LONESOME CREEK STATION
PHASE II PROJECT
McKenzie County, ND

Application to North Dakota Public Service Commission for Certificate of Site Compatibility

Case No: PU-12-790

October 2013

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

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McKenzie County, North Dakota

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prepared for

Basin Electric Power Cooperative

October 2013

prepared by

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TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

Page No.

1.0 INTRODUCTION

Basin Electric Power Cooperative (Basin Electric) submits this application for a Certificate of Site Compatibility for the Lonesome Creek Station Phase II Project (LCS Phase II) (PU 12-790) to the North Dakota Public Service Commission (NDPSC).

Basin Electric Power Cooperative is a regional wholesale electric generation and transmission cooperative owned and controlled by the 134 member cooperatives it serves. It was created in May 1961 as a result of regional efforts by electric distribution cooperatives and the Rural Electrification Administration, now the Rural Utilities Service (RUS). Basin Electric serves approximately 2.8 million customers in 540,000 square miles covering portions of nine states: Colorado, Iowa, Minnesota, Montana, Nebraska, New Mexico, North Dakota, South Dakota, and Wyoming.

Within the Basin Electric service area, northwestern North Dakota is experiencing a rapid increase in development as a result of the activities associated with the extraction of oil from the Bakken shale. In North Dakota, development of Bakken oil shale extraction activities is currently concentrated in McKenzie, Mountrail, and Williams Counties. The level of development that has occurred and is planned for the future will require numerous increases in infrastructure throughout the region, including an increase in electrical generation capacity and reliability. Through load forecast studies, it has been determined that two new 45-Megawatt (MW) simple-cycle natural gas-fired combustion turbines (CTs) are needed to serve the short-term needs of northwestern North Dakota by increasing the power generation capacity and enhancing the reliability of the electrical system.

Basin Electric proposes to construct, operate, and maintain the new simple-cycle natural gas-fired CTs at the existing Lonesome Creek Station (LCS) located at 2648 NW 140th Avenue, Alexander, McKenzie County, North Dakota, approximately 14 miles west of Watford City. LCS Phase I consists of a 45 MW simple-cycle CT with a clutch attached to isolate the CT from the generator. With the clutch engaged, the generator acts similar to a synchronous condenser, thereby providing much needed voltage support to the local transmission system during times that generation is not required. Basin Electric was not required to submit a Certificate of Site Compatibility application for the LCS Phase I, because the project fell below the permitting threshold of 50 MW. LCS Phase II includes developing LCS Units 2 and 3 with each unit identical to LCS Unit 1, with the exception that there will not be a clutch. LCS Phase II is expected to start construction in April 2014 after all the necessary permits have been acquired with an anticipated commercial operation date of end of December 2014.

In accordance with the North Dakota Energy Conversion and Transmission Facility Siting Act, Basin Electric has considered exclusion areas, avoidance areas, the selection criteria, and the policy criteria in the design of the LCS. In addition, sufficient generation design and technical information provided a thorough evaluation of the reasonableness of the site studied. Basin Electric located and designed the proposed Project to minimize environmental impacts by utilizing an existing generation station site.

Table 1-1 outlines the information required to fulfill the requirements to obtain a Certificate of Site Compatibility from the NDPSC using the NDPSC's Guidelines and identifying where these requirements are addressed in this application.

Table 1-1: Certificate of Site Compatibility Completion Checklist

State Authority	Description	Section
Chapter 49-22	**NDPSC Guidelines: Energy Conversion and Transmission Facility Siting**	**1.1**
Section A	**Description**	**1.2, 4.2**
1.	Type: Describe the type of facility addressed in this application. The description shall include the purpose of the facility and the technology to be employed	1.2
2.	Product: Describe the type, source, and final destination of the product to be transmitted by the proposed facility	1.2.2
3.	Size and Design	1.2.1
4.	Location of any new facility	1.0
4a.	Provide a description of the size and design of the pipeline facility including, but not limited to, the following:	NA
5.	Time Schedule: Provide the anticipated time schedule for the accomplishment of the following events:	1.3
5a.	Certificate of Site Compatibility	1.5
5b.	Site Application	1.6
5c.	Site Permit	1.6
5d.	Construction start date	1.3
5e.	Construction complete	1.3
5f.	In-service date	1.3
Section B	**Studies**	
	Provide a copy of any evaluative studies or assessments of the environmental impact of the proposed facility submitted to any federal, regional, state or local agency	Appendices—EA, Cultural Resources, Noise Studies, Wetlands
Section C	**Need for Facility**	**1.4**
1.	An analysis of the need for the proposed facility based on present and projected demand for the product to be transmitted by the facility, including the most recent system studies supporting the analysis of the need.	1.4
2.	A description of any feasible alternative methods of serving the need.	1.4.5

State Authority	Description	Section
3.	A statement justifying any deviations from the most recent Ten-Year Plan which the proposed facility may present.	1.4.6
Section D	**Location**	
1.	Identify and map the criteria that led to the proposed site location within the study area.	Figures
2.	Discuss the relative value of each criteria and how the proposed corridor location was selected giving consideration to all criteria.	2.3
3.	The criteria to be evaluated shall include at a minimum all of the following which are within the study area:	
3a.	Exclusion areas	2.1, Table 2-1
3b.	Avoidance areas	2.2, Table 2-2
3c.	Selection criteria	2.3, Table 2-3
3d.	Policy criteria	2.4, Table 2-4
3e.	Design and construction limitations	2.5
3f.	Economic considerations	2.6
5.	Discuss the general mitigative measures that will be taken to minimize adverse impacts	4.19
6.	List the qualifications of the people in the various disciplines that contributed to the corridor location study	9.0
7.	Maps	Figures
7a.	Map the criteria within the site area. Several different criteria may be shown on each map, depending on the map scale and the density and nature of the criteria. Minimum map scale shall be ½ inch = 1 mile. All maps shall be at the same scale unless otherwise specified.	
7b.	Furnish one set of Mylar maps, separate from the application, of the same scale as the criteria maps and showing the same basic features as the criteria maps, including the study area, but not the proposed facility location.	
Chapter 49-22-09	**Factors to be considered in evaluating applications and designation of sites, corridors, and routes.**	7.0
1.	Available research and investigations relating to the effects of the location, construction, and operation of the proposed facility on public health and welfare, natural resources, and the environment.	4.0, 7.1, & Appendix A
2.	The effects of new energy conversion and transmission technologies and systems designed to minimize adverse environmental effects.	7.2
3.	The potential for beneficial uses of waste energy from a proposed energy conversion facility	7.3
4.	Adverse direct and indirect environmental effects which cannot be avoided should the proposed site or route be designated.	7.4
5.	Alternatives to the proposed site, corridor, or route which are developed during the hearing process and which minimize adverse effects.	NA
6.	Irreversible and irretrievable commitments of natural resources should the proposed site.	7.5
7.	The direct and indirect economic impacts of the proposed facility	7.6

State Authority	Description	Section
8.	Existing plans of the state, local government, and private entities for other developments at or in the vicinity of the proposed site	7.7
9.	The effect of the proposed site on existing scenic areas, historic sites and structures, and paleontological or archaeological sites	7.8
10.	The effect of the proposed site on areas which are unique because of biological wealth or because they are habitats for rare and endangered species	7.9 , 7.10
11.	Problems raised by federal agencies, other state agencies, and local entities	7.11

Table 1-2 below outlines the information required in the NDPSC Guidelines dated November 1979 for a Site Compatibility Permit.

Table 1-2: Site Permit Completion Checklist

State Authority	Description	Section
Chapter 49-22-08	**NDPSC Guidelines: Energy Conversion and Transmission Facility Siting**	
Section A	**Description**	**1.0**
1.	Type: Describe the type of transmission facility proposed.	1.2.1
2.	Product: Describe the product or products to be transmitted.	1.2.2
3.	Size and Design: Provide a general description of the proposed size and design, and any alternate size or design, which was considered. Provide one (1) copy of the design data report, separate from the application, for the proposed facility and any associated facilities.	1.2.1
4.	Time Schedule: Provide the anticipated time schedule for the accomplishment of major events including, at a minimum, the following:	1.3
4a.	Site Permit	1.3
4b.	Construction start date	1.3
4c.	Construction complete	1.3
4d.	Test operations	1.3
4e.	In-service date	1.3
Section B	**Studies**	
	Provide a copy of any evaluative studies or assessments of the environmental impact of the proposed facility submitted to any federal, regional, state, or local agency.	Appendix A
Section C	**Need for Facility**	
1.	An analysis of the need for the proposed facility based on present and projected demand for the product to be transmitted by the facility, including the most recent system studies supporting the analysis of the need.	1.4
2.	A description of any feasible alternative methods of serving the need.	1.4.5

State Authority	Description	Section
3.	A statement justifying any deviations from the most recent Ten-Year Plan which the proposed facility may present.	1.4.6
Section D	**Location**	
1.	Discuss the utility's policies and commitments to limit the environmental impact of its facilities, including copies of board resolutions and management directives.	
2.	Discuss the factors listed in Section 49-22-09, NDCC to aid the NDPSC's evaluation of the proposed route.	7.0
3.	Discuss in detail the relative value of each criteria and how the location, construction, and operation of the facility will affect each criteria.	2.0
4.	The criteria to be evaluated shall include at a minimum all of the following which are within the designated site:	
4a.	Exclusion areas	2.1, Table 2-1
4b.	Avoidance areas	2.2, Table 2-2
4c.	Selection criteria	2.3, Table 2-3
4d.	Policy criteria	2.4, Table 2-4
4e.	Design and construction limitations	2.5
4f.	Economic considerations	2.6
6.	Discuss the mitigative measures that will be taken to minimize adverse impacts which result from the location, construction, and operation of the proposed facility.	4.19
7.	List the qualifications of the people in the various disciplines that contributed to the facility route location study.	9.0
8.	**Maps**	Figures
8a.	Map the criteria within the site. Several different criteria may be shown on each map, depending on the map scale and the density and nature of the criteria. Minimum map scale shall be ½ inch = 1 mile. All maps shall be at the same scale unless otherwise specified.	
8b.	Furnish one (1) set of Mylar maps, separate from the application, of the same scale as the criteria maps and showing the same basic features as the criteria maps, including the designated corridor, but not the proposed route or location of any new associated facilities.	
8c.	Furnish one (1) set of uncontrolled 9x9 inch stereo-pair aerial photographs, separate from the application, with acceptable resolution showing the designated corridor, proposed route and location of any new associated faculties, and Section, Township and Range numbers, at a scale of 1 inch = 2,000 feet, together with a flight map at a scale of ½ inch = 1 mile showing each flight line and the beginning and ending photo number of each flight line. Photo mosaic strip maps will also be acceptable. If the applicant can demonstrate that because of the limited size and scope of the project, aerial photographs would not be practical, this requirement may be waived.	
Chapter 49-22-09	**Factors to be considered in evaluating applications and designation of sites, corridors, and routes.**	**7.0**
1.	Available research and investigations relating to the effects of the location, construction, and operation of the proposed facility on public health and welfare, natural resources, and the environment.	4.0, 7.1, & Appendix A

State Authority	Description	Section
2.	The effects of new energy conversion and transmission technologies and systems designed to minimize adverse environmental effects.	7.2
3.	The potential for beneficial uses of waste energy from a proposed energy conversion facility	7.3
4.	Adverse direct and indirect environmental effects which cannot be avoided should the proposed site.	7.4
5.	Alternatives to the proposed site which are developed during the hearing process and which minimize adverse effects.	NA
6.	Irreversible and irretrievable commitments of natural resources should the proposed site be designated.	7.5
7.	The direct and indirect economic impacts of the proposed facility	7.6
8.	Existing plans of the state, local government, and private entities for other developments at or in the vicinity of the proposed site.	7.7
9.	The effect of the proposed site or route on existing scenic areas, historic sites and structures, and paleontological or archaeological sites.	7.8
10.	The effect of the proposed site or route on areas which are unique because of biological wealth or because they are habitats for rare and endangered species	7.9, 7.10
11.	Problems raised by federal agencies, other state agencies, and local entities	7.11

1.1 Project Description

1.1.1 Type, Size and Design

The proposed Project will use two GE LM6000 – PF Sprint turbines with an output rating of a nominal 45 MW and approximate heat rate of 9,300 British thermal units/ kilowatt-hour (Btu/kWh) higher heating value (HHV) for each unit. The units use dry low-nitrogen oxide (NO_x) burner technology along with an anhydrous ammonia-based selective catalytic reduction (SCR) system for NO_x control. Also, equipment will be provided for reduction of carbon monoxide (CO) emissions. The units' flue gas will be released to the atmosphere through an 80-foot tall stack. The proposed Project will utilize the existing operator and maintenance building which will be supported by two full-time employees and includes the water treatment area for the demineralizer trailers, service and demineralized water forwarding pumps. This facility is designed to be operated locally at the site or remotely from either Basin Electric's Culbertson Station located near Culbertson, Montana or Basin Electric's Headquarters located in Bismarck, North Dakota.

LCS Phase I consists of Unit 1, a 45-MW simple-cycle CT with a clutch attached to isolate the CT from the generator. With the clutch engaged, the generator acts similar to a synchronous condenser, thereby providing much-needed voltage support to the local transmission system during times that generation is not required. The proposed Project, LCS Phase II, includes developing Units 2 and 3, each of which would be identical to LCS Unit 1, with the exception that there would not be a clutch.

Natural gas is transported to the LCS site by the Northern Border Pipeline that runs immediately adjacent to the plant site. A ten-inch tap was installed on the Northern Border 42-inch pipeline for LCS Phase I and is large enough to provide for all three units.

Electrical interconnection for the new units will be to an on-site 115-kV transmission line that extends from LCS to McKenzie Electric Cooperative, Inc.'s (MEC's) Hay Butte Substation located approximately two miles to the southwest of LCS. The transmission line is already constructed and is large enough to provide for all three units.

All storm water runoff would be diverted to an on-site pond. The storm water runoff pond was designed to hold run-off from a 25-year, 24–hour rainfall event and is large enough to handle runoff from the entire site including the area for the two new units. In addition to storm water, the pond would receive spray mist water blowdown and overflow. The spray mist is demineralized water used to cool air inlet temperatures, which increases power output, especially during peak summer demand.

Potable water is supplied to the LCS from the local rural water distribution system and placed into the 125,000 gallon service water tank. Water requirements for the existing unit range from very little in the winter to approximately 25 gallons per minute (gpm) during the summer. To accommodate all three units, the maximum total water consumption for the LCS will increase from 25 gpm to 75 gpm (3 units at 25 gpm). The potable water is further treated through the utilization of a portable demineralization trailer and placed into the 220,000 gallon demineralized water storage tank. The demineralizer trailer is provided by an outside contractor. When required, the demineralizer trailer is regenerated off site. The water demineralizer operations and water storage tanks developed for the existing facility are sufficient for all three units. All process water will be evaporated on site or if required, hauled off site to a licensed waste facility.

All waste generated from construction of the project will be collected and placed in acceptable waste containers, to be hauled off site and properly disposed by a licensed contractor.

1.1.2 Product

Energy will be generated and distributed to the electrical grid system serving the rapidly increasing electrical load requirements in northwestern North Dakota. The LCS will improve the reliability of service into the area.

1.1.3 Location

The proposed site is located at 2648 NW 140th Avenue, Alexander, North Dakota, approximately 15 miles west of Watford City in T150N, R101W, Section 23, McKenzie County, North Dakota.

1.1.4 Geographical Service Area

The general area to be served by the energy conversion facility is Basin Electric's service territory, specifically the area in northwestern North Dakota.

1.2 Project Schedule

The anticipated schedule for the project is below:

- Obtain Site Compatibility permit by May 1, 2014
- Start construction on May 1, 2014
- Commence commercial operation December 15, 2014

Note: Should all approvals be received, the schedule will be advanced accordingly.

1.2.1 Future Plans

The LCS is capable of supporting additional generation from the electrical, water and fuel supply perspective. At the time of this application, Basin Electric does not have plans to increase the generation capacity at LCS at the current 48.4-acre site that is currently zoned industrial. However, as a result of recently completed load forecast studies, Basin Electric may consider the remainder of the 160-acre section for the location of additional energy conversion facility generation equipment to serve the need of the Williston Basin in northwestern North Dakota.

1.3 Determination of the Need for Facility

Basin Electric has identified the need for additional electric generation in northwestern North Dakota as a result of increased demand and to meet reliability and system stability requirements for the region. This need is determined through the load forecast process developed as a partnership effort between the distribution cooperatives (Class C cooperatives), generation and transmission (G&T) cooperatives, and Basin Electric for the entire service area. Both Class C cooperatives and G&T cooperatives are considered Basin Electric member cooperatives.

1.3.1 Load Forecast Process

Basin Electric's primary mission is to provide electrical power to its member-owners. In order to accomplish this objective, the cooperatives must understand how the consumers are presently using their electricity and must forecast the consumers' future electrical requirements. The projection of future requirements serves as one of the main planning tools in determining the cooperative's future operating strategy. Adequate resources and transmission facilities must be maintained and, where necessary, developed to deliver the required power to the members.

Two major studies are jointly prepared by the members and Basin Electric to address where the members are presently using their power (end use survey) and how much they will require in the future (load forecast). These studies are prepared in accordance with RUS general guidelines. Both the end use survey and the load forecast represent a joint effort by the distribution cooperatives, the G&T cooperatives, and Basin Electric. In order to assure all segments of the cooperative's structure are involved, a Load Forecast Technical Committee was established. This committee consists of representatives from the three-tier cooperative structure.

The Load Forecast Technical Committee approved the timetable and procedures used in preparing the 2012 Update of the 2011 Load Forecast (2012 Load Forecast). RUS attendance and participation at the committee meeting provided a forum for the cooperatives and RUS to exchange ideas and discuss problems. This committee establishes the project timetable and develops the general procedures used in the two projects. RUS requires the submittal of a board-approved load forecast work plan. The 2012 Load Forecast Work Plan was approved by the Basin Electric Board of Directors and by RUS.

End use surveys and load forecasts are prepared for all Basin Electric members, except Tri-State, which conducts its own studies. The other participating members represent cooperatives located in North Dakota, South Dakota, Minnesota, Montana, Iowa and Wyoming. Individual studies are prepared for each of the participating distribution cooperatives. The distribution cooperative studies are combined to obtain G&T studies and the G&T studies are combined to obtain a Basin Electric report.

The purpose of the load forecast is to provide the distribution cooperatives, the G&T's, and Basin Electric with a forecast of their power supply obligations to their consumer-owners. The load forecast, which is prepared on a distribution cooperative basis, is conducted in accordance with RUS criteria. The criteria define a load forecast as a thorough study of a cooperative's electric loads and the factors that affect those loads in order to determine as accurately and as practical the cooperative's future requirements for energy and capacity. The individual member's load forecast analyzed the cooperative's service area for historical and projected developments that have and will influence future load growth.

The 2012 Load Forecast is a weather-normalized forecast. As a result, temperature extremes and extended periods of hot, cold, wet, and/or dry weather conditions can cause deviations from weather-normalized demand and energy forecasts. Basin Electric has done analysis suggesting these weather deviations could amount to a 10 percent deviation in the demand forecasts and potentially lower variations in energy forecasts. Prudent planning for extreme weather events should be considered when using this forecast.

1.3.1.1 Econometric Models

The basis for econometric modeling is to identify factors in the economy that have historically affected electrical consumption. This is accomplished by using regression analysis software that establishes a mathematical relationship between the economic factors and power usage. The mathematical relationship, which is in the form of algebraic equations, represents the econometric model.

The econometric models are based on regression analysis. Regression analysis is a statistical technique used to identify a relationship between an observed event and other measured events that can be shown to be related. These are known as the dependent and the independent variables, respectively.

Independent variables must be applicable to the members' service territory and be of importance to the local economy. This is the first step to ensure the model will accurately explain the historical trends. This gives the confidence that the same factors that have influenced previous trends will accurately reflect future expectations.

The next step to determine if the model is acceptable is the combination of the statistical results of the model. The model statistics include the R-squared, adjusted R-squared, and basic statistical information. The R-squared indicates the amount of variation of the dependent variable explained by the independent variables. To show the impact of changes in the number of independent variables used in a model, an adjusted R-squared is used; therefore, the explained variation can be compared with the same dependent variable and different numbers of independent variables.

The statistical significance of the explanatory variables used in the model is measured by a t-statistic. A t-statistic (ignoring negative signs) of at least 2.0 would be required for a 95 percent level of confidence and 1.5 for a 90 percent level of confidence, depending upon the number of observations and variables used in the model.

The Durbin-Watson test examines the equation residuals that are the differences between the fitted and the actual historical values. In a good model the residuals are randomly distributed and are of approximately constant magnitude. This indicates the model has explained all of the patterns in the data. In general, a Durbin-Watson near 2.00 indicates the absence of autocorrelation.

When residuals are not randomly distributed, a Cochrane-Orcutt transformation (AR term) can be computed to develop an equation that does have randomly distributed residuals. After the variables are transformed by adjusting the equation according to the value of the AR term, a new equation is developed.

The combination of the variables selected, model statistics, and the forecasted results all are considered together to determine the validity of the forecast.

Econometric models are used for the majority of the member systems to forecast residential sales. In most instances, two residential econometric models are developed for each cooperative. The first model relates the number of historical residential consumers to factors that have been shown to influence their numbers in the past. The second model is developed for the average annual usage per residential consumer. Multiplying the forecasts of these two models developed the total residential energy forecast.

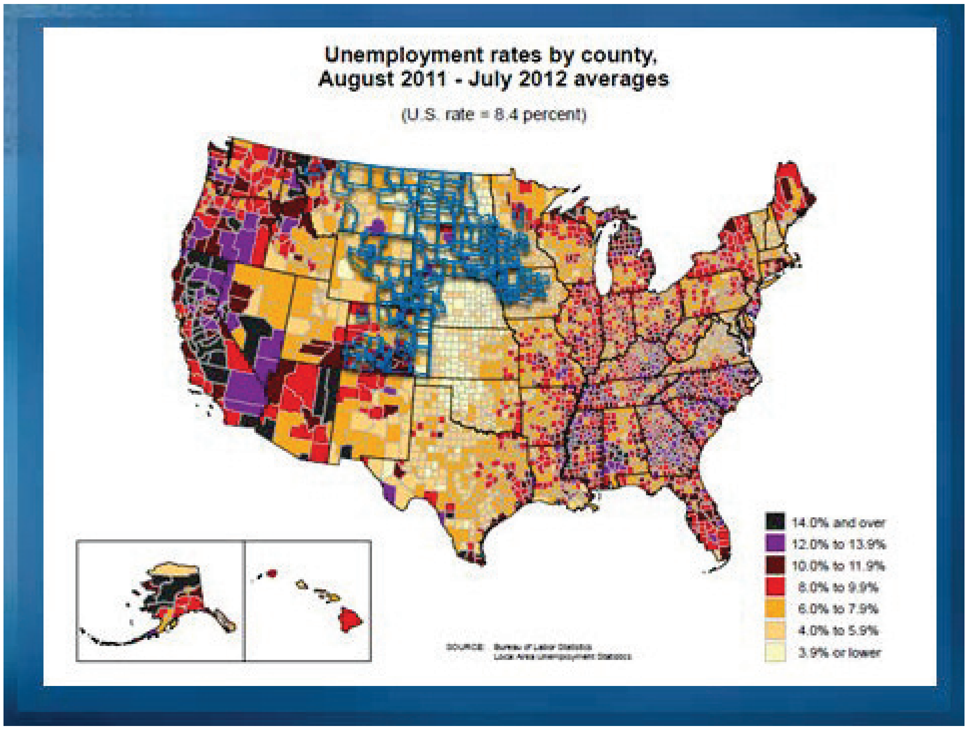
The small commercial modeling and other smaller consumer sectors are developed using econometric or trending models. In some cases they may also be judgmental forecasts or a combination of the three.

The distribution member forecasts are forecasts of annual energy requirements by category. To translate the annual energy requirements into monthly energy and demand needs, two econometric models were developed to distribute this correctly. The first model uses historical monthly energy purchases along with actual weather patterns to determine the monthly per unit purchase pattern. This purchase pattern is applied to the annual energy forecast to develop a monthly energy forecast. The second model was used to develop a monthly demand forecast where an econometric model is fitted through the historical load factors. The resultant load factor pattern is applied to the monthly energy forecast to determine the monthly demand forecast.

1.3.1.2 Explanatory Variables

The economy of the upper Midwest has faired the recent nationwide economic downturn quite well, due to the relative strength of the agricultural economy and energy exploration. Employment in the Basin Electric territory, for the most part, has not seen the major swings that other areas of the country have. Due to a diverse economy that is not centered in a singular industry these strong historical employment trends are expected to continue into the future. Figure 1-1 indicates the average unemployment rates for the last 12 months with the Basin Electric cooperative service territory overlaid, and shows the relative strength of the economy in the upper Midwest.

Figure 1-1: Unemployment Rates and Basin Electric Service Territory



The major sources of the explanatory variables are as follows:

Historical data for county and metropolitan statistical area (MSA) level employment, population, earnings and income is provided by the U.S. Department of Commerce Bureau of Economic Analysis (BEA) and the Census Bureau. The state and federal governments monitor the data closely as it serves as a measure of the state of the local economies.

Since the BEA implemented the North American Industrial Classification System (NAICS) to replace its previous Standard Industrial Classification System (SICS), and only 2001-2009 data are available on the new database, the entire set of historical and forecast employment data was used from Woods & Poole Economics, Inc. (W&P). W&P is an econometric forecasting firm that provides projections for employment, earnings, income, and population on a county and MSA basis. W&P used BEA data through year 2009. The exception to this is the population data, in which W&P data was updated to include the 2010 data available from the US Census Bureau.

W&P is the source for the economic and demographic historical and forecasted county data. IHS Global is used for county, metro, state and national economic data.

Historical agricultural production and price data was obtained from the United States Department of Agriculture (USDA) and forecasted data was obtained from the Food and Agricultural Policy Research

Institute (FAPRI) 2010 U.S. Baseline, as well as the USDA baseline agricultural projections. FAPRI specializes in agricultural research and forecasting.

FAPRI's primary responsibility is to analyze for Congress the effects of proposed agricultural legislation. In addition to that primary responsibility, it provides forecasts to many other external organizations which are heavily influenced by agricultural activities. FAPRI is recognized for its expertise in agriculture analysis and forecasting.

The FAPRI baseline projection used is a result of a three-step process. It begins with macroeconomic assumptions for the U.S. developed by Global Insight (formally DRI-WEFA). The assumptions are used to develop a FAPRI preliminary baseline, which is then distributed to a group of reviewers. The reviewers critique and comment on the validity of the assumptions and the baseline projection. After receiving comments, the baseline projection is revised and finalized.

The FAPRI baseline includes the assumptions that government laws or policies remain unchanged, that normal weather occurs, and that random events such as droughts, diseases, and floods do not occur. The FAPRI and the USDA historical and projected data are used for forecasting some of the residential service areas where farming and ranching have a big influence.

The majority of the members' consumers are engaged in farming/ranching and agriculture. In most of the states the members serve, farming/ranching and agriculture is first in new wealth creation. Since agriculture is the dominant industry in most of the areas our members serve, agricultural explanatory variables have been heavily incorporated into the econometric models. In the 2012 Load Forecast, agricultural explanatory variables included: national beef production and average prices, national corn production and average prices, national wheat production and average prices, national hog production and average prices, along with county level production of selected agricultural variables.

Other demographic and economic variables used in the 2012 Load Forecast included:

- Population
- Households
- Total Employment
- Farm Earnings
- Transfer Payments
- Total Personal Income
- Farm Employment

The forecasts for these variables, which are available on a county basis, were obtained from W&P.

Another major consideration in the load forecast econometric modeling is the competition between electricity and alternate fuels. This competition occurs in space heating, water heating, cooking, clothes drying, and grain drying. The future price of alternate fuels and how they compare with the distribution cooperative's electricity prices affects electric consumption.

Historical alternative fuel prices are obtained on a state level from the Department of Energy's (DOE's) State Energy Data 2009 Price, Consumption and Expenditures Data (SEDS). Basin Electric uses DOE projections of regional price forecasts to develop projections of alternative fuel prices. A further explanation can be found in the ratio variable narrative in the residential energy use per consumer section.

IHS CERA is used for natural gas and oil prices for the energy related loads. Wood Mackenzie, IHS, and DOE data are also used in the energy related sectors.

Projected electricity prices were obtained from the distribution cooperative's financial forecast. The econometric models address the competition between electricity and alternate fuels by including a ratio computed by dividing electricity costs by the predominant alternate fuel cost in each member's service territory. The ratio is a weighted average of alternate fuels used by the residential consumers for their primary heating system, as indicated by the cooperative's end use survey. In order to compare the energy alternatives on a uniform basis, the alternate fuel and electricity prices are converted to real dollars on a per million British thermal unit (Btu) basis.

Weather has a significant effect on the cooperative's energy requirements due to energy uses such as heating, grain drying, and air conditioning. In order to address these effects, the econometric models normally include either heating degree days, cooling degree days, or a combination of both.

Historical heating and cooling degree day's weather data was obtained from the National Oceanic and Atmospheric Administration (NOAA). This information is received for first-order stations, as well as all cooperative stations within the geographic region. Forecasts for weather data are assumed to be the simple average of 1996-2010 values.

1.3.1.3 Inflation Indexes

For the 2012 Load Forecast there are three inflation indexes used to deflate historical data and the same to project future inflation. These indexes or deflators use the base 2010 equals 100. Those three indexes include:

Producer Price Index (PPI) (all commodities): This index is used to deflate crude oil prices. Real 2010 dollar crude oil prices are used as a variable in the oil related models and forecasts and also in residential models in oil producing areas. The forecast for the PPI is obtained from the Energy Information Administration's 2011 Annual Energy Outlook (AEO).

Gross Domestic Product - Implicit Price Deflator (GDP-IPD): This index is used to deflate all agricultural monetary data from FAPRI to real 2010 dollars. The forecast is obtained from the Congressional Budget Office.

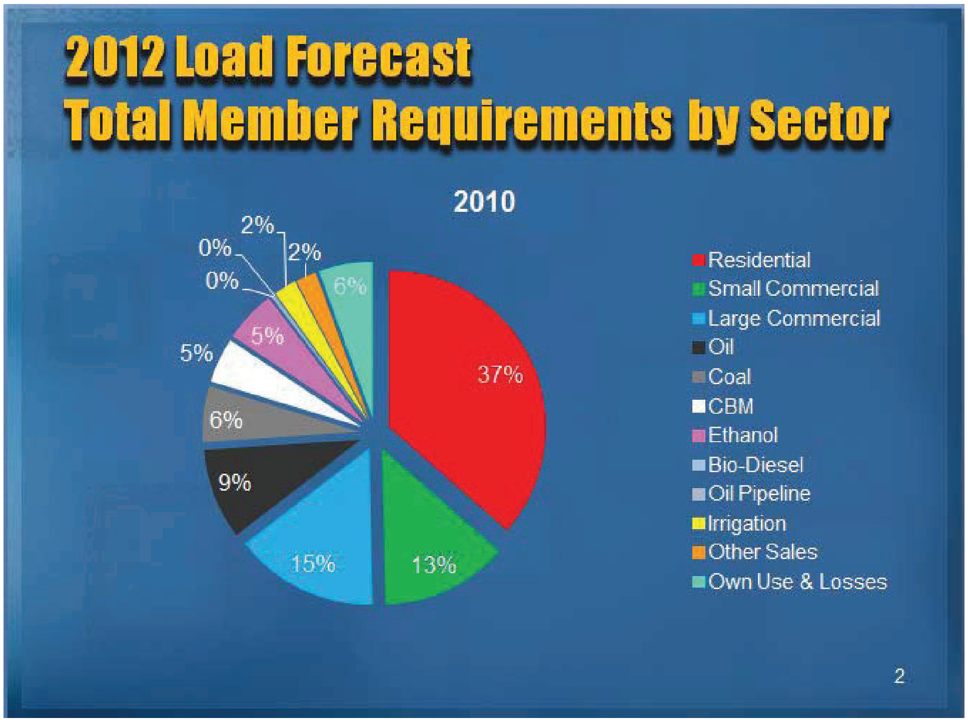
Personal Consumptions Expenditures - Implicit Price Deflator (PCE-IPD): This index is also obtained from the Congressional Budget Office. This implicit price deflator is used to deflate all non-FAPRI monetary data other than that covered by GDP-IPD and PPI to real 2010 dollars. This index is used to deflate such data as electricity prices, alternative fuels, personal income and earnings. Also, it is used to convert current prime interest rates to real prime interest rates.

In addition to the previously mentioned forecast variables, tremendous arrays of commercial projects are monitored for their impacts on Basin Electric's wholesale energy sales. These industries are oil, coal, coal bed methane (CBM), ethanol, and bio-diesel. Each of these categories is discussed in detail below.

1.3.2 Basin Electric Load Forecast Sectors

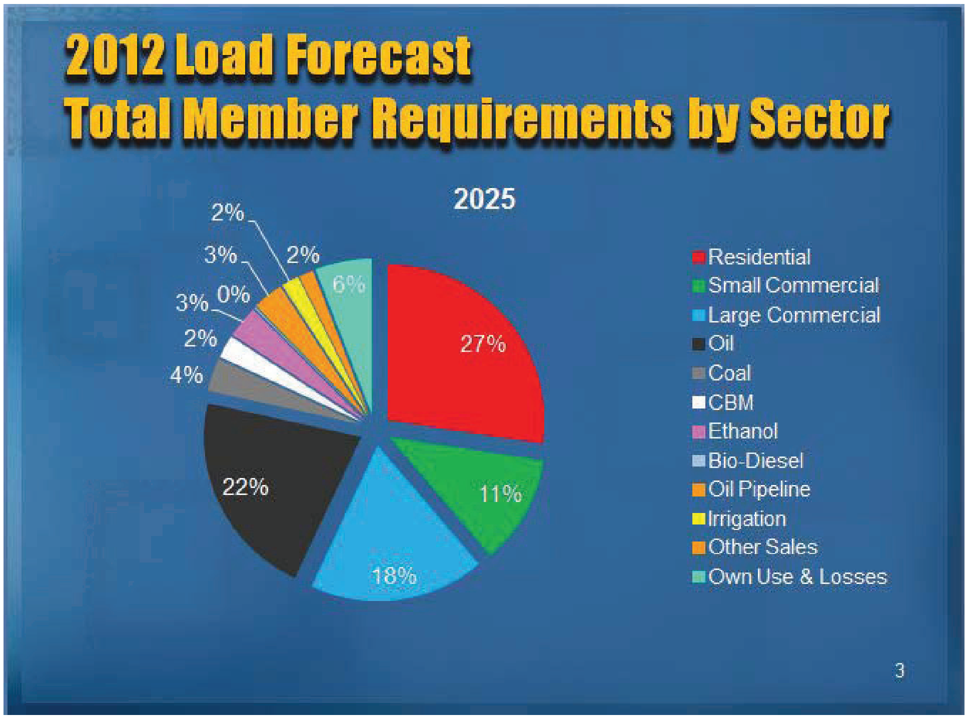
In 2010 Basin Electric's membership sold 37% of their energy to the residential sector (Figure 1-2). The large and small commercial represented 15% and 13% of sales respectively. The other 35% of sales were spread among the remaining sectors.

Figure 1-2: Basin Electric 2010 Load Requirements



At the end of the forecast period the growth in the oil-related sector is evident. Sales to this sector are forecasted to grow from 9% of sales in 2010 to 22% of member sales in 2025 (Figure 1-3). Other growth is overshadowed by the growth in this sector. In this section, we will discuss each sector in detail.

Figure 1-3: Basin Electric 2025 Load Forecast



1.3.2.1 Residential Forecasts

The load forecast continues to concentrate on the residential classification since it represents a large portion of the energy sales for Basin Electric. The residential energy forecasts are prepared by (i) forecasting the number of residential consumers; (ii) forecasting the average annual energy consumption per residential consumer; and (iii) multiplying the two forecasts together to obtain a total residential sector energy forecast. All load forecasts are net of demand side management.

The starting point in the forecasting process is to develop historical databases for each distribution cooperative. These databases contain information on the member's monthly energy sales by consumer classification. They also provide data on the cooperative's own use and losses, and data on their monthly demand and energy wholesale power purchases. The databases are developed annually from the information the members report to RUS on Form 7 or its equivalent. The data is updated and modified to reflect reclassifications that occasionally occur between consumer categories at the distribution cooperative. These reclassifications may result from changes in the cooperative's rate structure or the size criteria of different rate categories.

Subsequent to the completion of the historical database development, regression analysis software is used to identify economic, demographic, and meteorological factors that have affected the member's power requirements. These factors are called explanatory variables as they explain why the electric requirements change. While the explanatory variables are first used to develop the econometric models based on historic relationships, the variables are also used to develop the forecasts that require historical and forecasted values.

1.3.2.2 Small Commercial Forecasts

The small commercial classification consists of commercial accounts that are generally 1,000 kVA or less. This section addresses the econometric models that forecast the small commercial consumers and energy use. The models developed took into consideration the historical factors that statistically, demographically, and economically influenced each members number of small commercial consumers and small commercial energy use.

The make-up of the small commercial accounts is generally larger farms, small retail and wholesale establishments and other types of accounts that do not qualify for residential status. It has been observed that the small commercial sector closely mirrors the cooperatives local and regional economy. Therefore, the small commercial sector is generally modeled using the same type of variables that are used in the residential modeling.

1.3.2.3 Large Commercial Forecasts

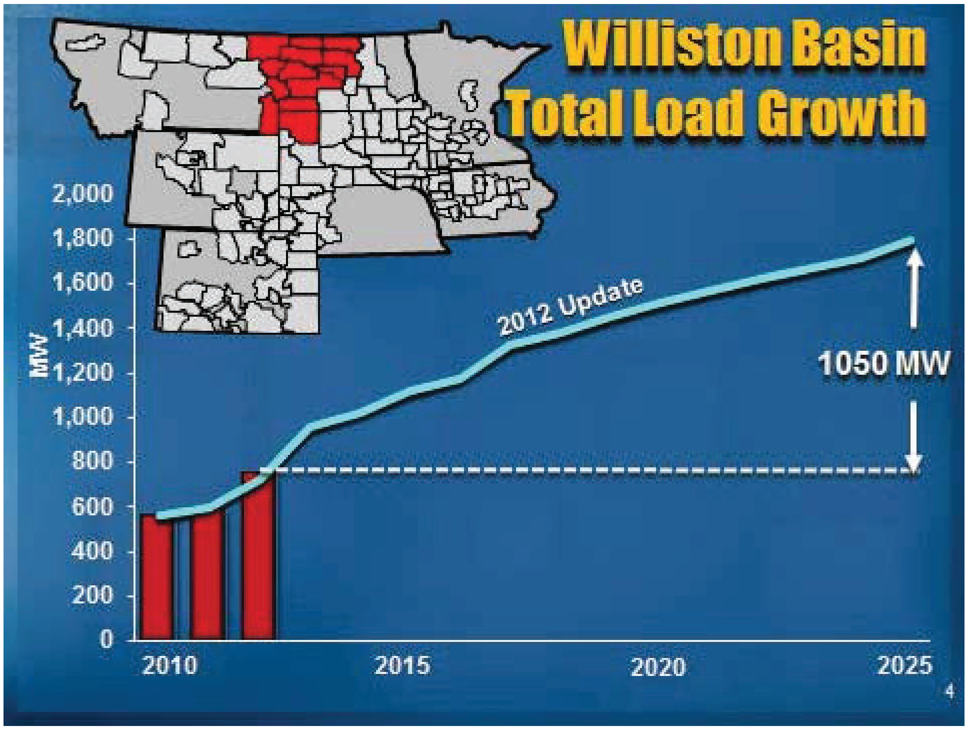
The large commercial classification consists of commercial accounts that are generally 1,000 kVA or larger. The types of businesses that are included in this classification are generally manufacturing, large retail, and processing facilities. These types of businesses do not necessarily mirror the local economy. The factors that drive these accounts usually have national impacts. Therefore, we use national macroeconomic variables to determine annual energy usage.

1.3.2.4 Oil-Related Commercial Forecast

The service territory of Basin Electric's members in Western North Dakota, Eastern Montana, and Northwest South Dakota lies within a geological formation known as the Williston Basin. In addition to the Williston Basin, Basin Electric also provides wholesale electricity to the Powder River Basin (PRB) in Northeastern Wyoming, which also produces a considerable amount of oil. Significant oil-related commercial load growth is not anticipated in the PRB, therefore, the rest of this section deals with the Williston Basin.

Figure 1-4 depicts the growth of the oil related load within the Williston Basin. A tremendous amount of growth is expected in the next 15 years.

Figure 1-4: Williston Basin Load Forecast



The small and large commercial loads of those members that serve in the heavy oil production areas of the basin are heavily influenced by oil and gas exploration, production and distribution activities. Direct loads, such as oil pumps, pipelines, compressors and processing plants contribute directly to the amount of commercial load. Other commercial loads, such as support services, are indirectly related to oil activity as they would not exist without the oil exploration, development and extraction activities.

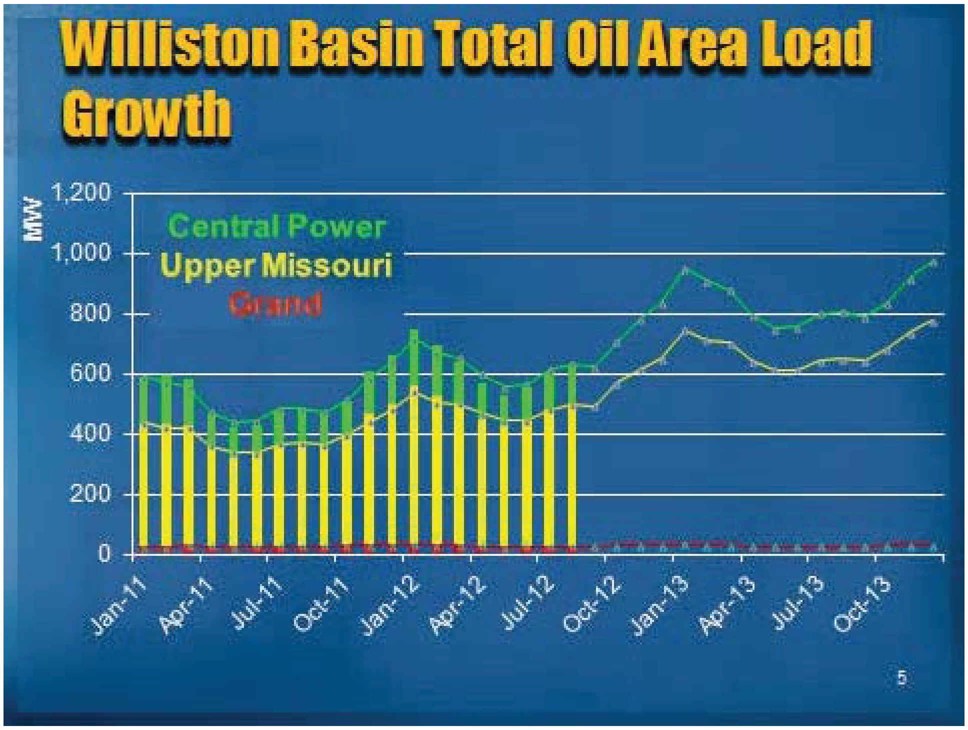
For those members whose commercial loads are heavily influenced by oil activities, three tier econometric models were developed to project their commercial loads.

The econometric models generally consist of three models for each distribution cooperative. They generally address new oil production, oil prices, and number of commercial consumers, total commercial energy, and other factors. New upcoming oil projects and services are also included.

The most important variable in the determination of oil production and related loads is crude oil prices. The crude oil price used in the models is the domestic refiner’s acquisition cost of crude oil, which represents an average cost the domestic refiners pay for their crude oil.

Figure 1-5 depicts the monthly performance of the 2012 Load Forecast for the members located within the Williston Basin. Winter 2011-2012 load levels were experienced by November 2012, before the heavy onset of the heating season.

Figure 1-5: Seasonality of Williston Basin Load



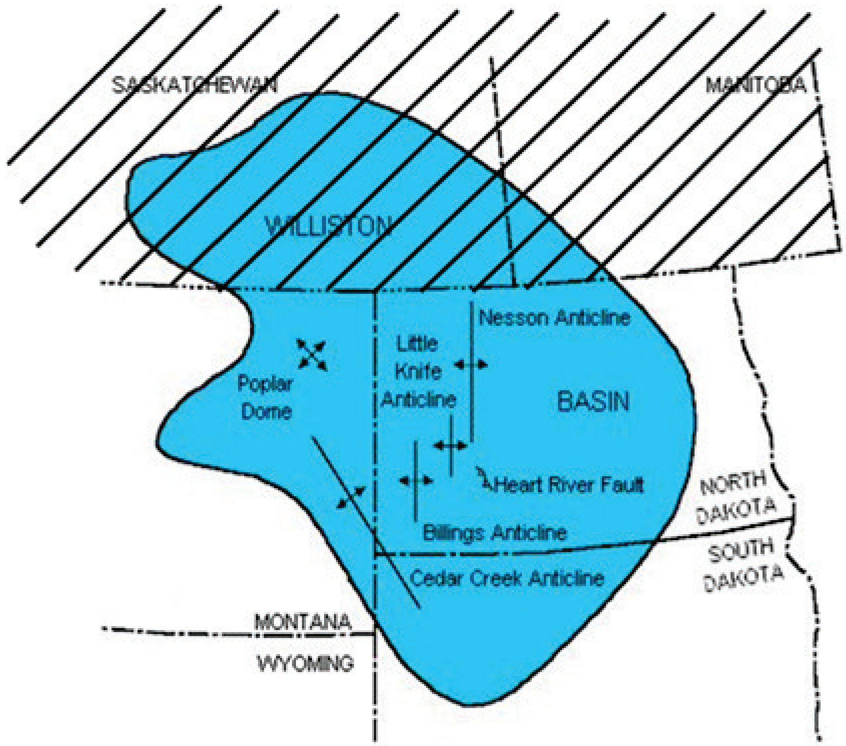
Oil loads have been somewhat cyclical in the past. This was mainly due to oil price volatility. Domestic oil prices are largely influenced by international oil markets, which are influenced by sometimes radical conditions and unstable situations. Oil prices are also significantly influenced by radical weather conditions such as the hurricanes occurring in the Gulf of Mexico. Oil prices are also influenced by national and international demand, the value of natural gas, and the value of the U.S. dollar. In recent years, developing India and China economies have been identified as very significant users of oil, hence putting upward pressure on oil prices.

Due to the magnitude of the forecasted oil loads, a decision was made to get an independent forecast of the regional loads for the Williston Basin.

Williston Basin Oil- and Gas-Related Independent Load Forecast

Due to the unprecedented electric growth expected in the forecast period, a decision was made to get another opinion of the growth potential for the Williston Basin. This forecast not only looked at the oil industry, but includes the electrical load with the ancillary services that go along with this type of economic activity such as housing, consumer service businesses, retail, oil and gas service companies, etc. Growth in Williston Basin communities is impacting Montana Dakota Utilities Co. (MDU) and the electric cooperatives in North Dakota, Montana, and South Dakota. The scope of this study focused on the electric utilities' service areas, encompassing all of the Williston Basin within the United States. Figure 1-6 details the area covered by the study.

Figure 1-6: Area Covered by Independent Load Forecast



The North Dakota Transmission Authority (NDTA) was the lead agency for procuring a consultant to perform the study. Due to the impact and breadth of this growth, four parties were involved in this contract, the North Dakota Transmission Authority, Basin Electric Power Cooperative, MDU, and the oil industry through the North Dakota Petroleum Council.

Kadrmas, Lee & Jackson (KLJ) were the consultants selected to perform the forecast. The 2012 Power Forecast – Williston Basin Oil and Gas Related Electrical Load Growth Forecast (PF12) was completed in October 2012 (KLJ 2012). Public results were presented to the North Dakota Industrial Commission in October. Basin Electric results were presented to the Basin Electric Power Cooperative Board of Directors in November 2012.

Load Forecast Model and Inputs

The consultant performed an assessment of Williston Basin oil and gas activity and developed an econometric model for the development of the oil plays within the service area. The independent input assumptions to this model included, but not be limited to, the following:

Required Infrastructure. The consultant evaluated the demand and energy needs of current and expected temporary and permanent housing, small industrial and commercial businesses required to service the oil and gas activity, and retail and lodging impacts. The consultant developed a correlation between well count and required infrastructure.

Drilling Activity. The consultant evaluated, assessed and forecasted the number of new oil wells to be drilled and completed in all of the formations in the Williston Basin for the twenty year period. The consultant determined the energy requirements of new wells in the Bakken/Three Forks, Tyler, and Spearfish formations. The consultant also determined well spacing and energy requirements per drill site to fully develop the oil play.

Power Requirements. The consultant developed qualitative oil and gas production curves and identified the pumping loads for a generic well in each of the identified formations. In addition, they will determined the total oil and gas production for the entire service area, including the number of salt water disposal injection wells needed to fully develop the oil and gas play and the associated power needs over the lifecycle.

Well Life-Cycle. The consultant identified the characteristic life-cycle operating well profile for each formation and recovery technique (primary, secondary, tertiary), as well as the amount of energy and demand required for each stage of the life-cycle, the number of wells (as a percentage) that are currently using secondary and tertiary recovery methods, and the length of time such methods can be used.

Oil Price Forecasts. The consultant provided an independent high, medium and low regional oil price forecast for the 20-year forecast period, along with a break even oil price range by formation for continued development.

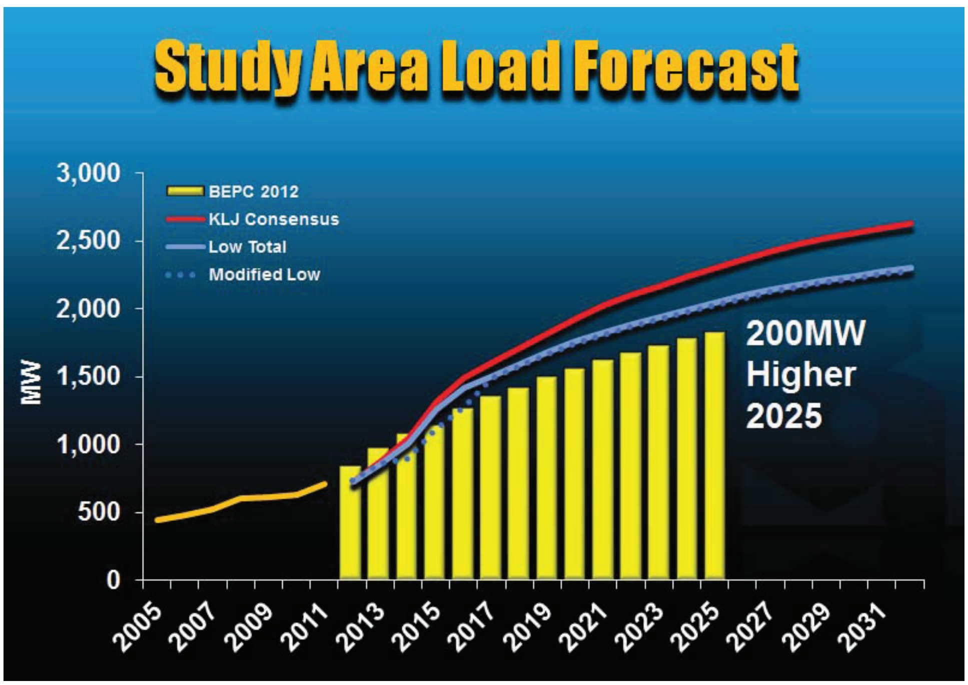
Pipeline and Refinery Capacity. The consultant determined the ability for the existing infrastructure to adequately move oil and gas to regional refineries and processing centers and other export market hubs, including obtaining information on new projects and identifying their potential power load requirements.

Opinions. The consultant included opinions regarding: The future of hydraulic fracturing, water availability, air quality impacts, flaring restrictions, and salt water disposal well needs as it could impact oil development. Also included were opinions on limiting factors, including availability of drilling rigs, equipment, materials, labor, housing and service companies.

Independent Oil Load Forecast Model Results

The results of the independent assessment of the energy needs for the Williston Basin were similar to the Basin Electric forecast. Due to timing issues, some of the projects included in the PF12 were cancelled or delayed. To reflect these changes, the PF12 was modified to reflect these changes. Figure 1-7 compares the forecasts. Due to the similar expectations of future load growth in the intermediate term, a decision was made to continue using 2012 Load Forecast for planning for future power supply needs.

Figure 1-7: Comparison of Study Area Load Forecasts



1.3.2.5 Coal-Related Commercial Forecast

The service territory for the coal production of Basin Electric members is located in Wyoming, Montana, and western North Dakota. Generally, this region is considered by the Energy Information Administration as Western coal production in the United States, which has grown steadily since 1970 and continues to increase. Most of the increase in output originates from mines located in Wyoming, Montana, and North Dakota. The majority of this Western coal production occurs in Wyoming and Montana in the coal fields referred to as the Powder River Basin (PRB), which includes the Northern PRB (in Montana) and the Southern PRB (in Wyoming).

According to the Energy Information Agency (EIA), Wyoming has been the largest coal-producing state for many years. In 2010, Wyoming produced 442 million short tons of coal.

Econometric forecasts are developed for the coal-related portion of the small and large commercial sector for the PRB in Wyoming. These forecasts are derived by the use of econometric models, as well as upcoming coal projects and services.

The coal production and energy forecasts for western North Dakota's coal fields are judgmental forecasts based on the estimated production of the mines located in Mercer County that supply Basin Electric's Antelope Valley Station, the Leland Olds Station, and the Dakota Gasification Company.

1.3.2.6 Coal Bed Methane Load

A major load development is also occurring in northeastern Wyoming. This load is related to the extraction of methane gas that is contained in the sub-bituminous coal reserves located within Basin Electric's member service territory.

CBM loads were first considered in the 1998 Power Requirements Study. At that time only limited activity was taking place and the forecast was not particularly significant. By 2000, the CBM play was more active and therefore a more comprehensive forecast was conducted in-house by Basin Electric staff and was included in the January 1, 2001, Powder River Energy Corporation (PRECorp) Load Forecast.

After the 2001 PRECorp Load Forecast was completed, the Bureau of Land Management (BLM) was required to prepare an environmental impact statement (EIS), which essentially put a freeze on further drilling on federal leases until the record of decision (ROD) was finalized. It was also felt a more thorough, comprehensive, and independent forecast should be conducted. Therefore, PACE Global Energy Services (PACE) was retained after a careful review of many consultants, to develop the next PRECorp CBM forecast. PACE completed four consecutive CBM load forecasts for Basin Electric. Basin Electric also participated with other companies in a Pace Global Energy Services Wyoming Pipeline Study in 2003.

Since the CBM load had been thoroughly researched and developed by external consultants for four consecutive load forecasts, when there was not as much CBM development and little historical data, it was decided the 2009 CBM load forecast could be developed internally. Basin Electric continues to develop the CBM load forecast internally. The use of the IHS Global Database and forecasting software was necessary to create econometric models based on historical data for use in forecasting. This is the same software and databases that were used in the oil load forecasting process.

One of the main drivers of such a forecasting process was to develop a CBM well drilling forecast, as well as the company plans for the larger CBM loads such as water pumping and large gas compressors. Therefore, Basin Electric and PRECorp held joint conference calls with the major CBM producers to get their opinions and outlook for their companies and the industry as a whole.

After the development of 12 regional econometric equations based on PRECorp historical CBM energy data, IHS Global data, projected company drilling plans and other factors, such as water and gas production (from IHS Global), were applied to the equations to develop forecasts of existing and new CBM loads. All existing loads were included in the historical load data for model development; therefore, any projected loads will include the same ratio of smaller water gathering or treatment, as well as any field gas gathering type of loads. New large loads, such as water pipelines (>1000 HP) and large gas compressors obtained from the company plans were added judgmentally to these modeled and projected forecasts to produce a total CBM load forecast for PRECorp. Also data were obtained from the Wyoming Oil and Gas Commission website, which tracks and posts a variety of monthly CBM data.

Due to the increase in shale drilling in the United States, higher cost CBM natural gas has been relegated to a niche play, and growth is not expected in this sector.

1.3.2.7 Ethanol- and Bio-Diesel Related Commercial Load

The ethanol sector loads were judgmentally projected by the distribution members that have had contact with the companies planning new plants or expansion of existing facilities. No new facilities are expected during the forecast period.

Other retail sectors that are considered when compiling the distribution forecasts follow.

1.3.2.8 Other Commercial Load Forecasts

Those commercial loads that are not oil- or coal-related are generally prepared using trending and sometimes judgmental forecasts. These forecasts that consider past trends and expected future developments reflect the knowledge and expertise the local cooperatives have of their service territories.

1.3.2.9 Irrigation

Irrigation sales fluctuate during the historical periods due to the weather, the state of the farm economy, and government programs. Trending models were used to forecast consumers and energy.

1.3.2.10 Other Sales

These represent sales to categories such as public street and highway, public authorities, and other RUS borrowers. These sales, which are usually quite small, are forecasted using trending models.

1.3.2.11 Losses

The forecasted sales for each of the previous consumer categories are on an at-load basis, meaning the sales represent the amount of power delivered to the retail consumers. One of the objectives of the load forecast process is to obtain a forecast of the distribution cooperative's wholesale power requirements at its substations. These requirements, which correspond to their purchases, are obtained by increasing the distribution cooperative sales to reflect their own use, as well as system losses occurring on its transmission and substation facilities. Own use and losses are represented together as a percent of purchases. An estimate is derived by considering historical percentages and planned improvements to the cooperative's distribution system that would affect the amount of future losses.

1.3.3 Basin Electric Load Forecast Results

The Basin Electric load forecasts are prepared for the three levels of membership. At each level of membership the total energy and demand needed is totaled and is required to be approved by the board of directors of that particular cooperative. Each of the three levels of load forecasts is discussed as follows;

Distribution Cooperative Load Forecasts

The previous forecasting process is employed, with the exception of Tri-State, for each Basin Electric distribution cooperative. The resultant load forecast provides the member with a detailed document outlining the derivations and assumptions utilized in the preparation of its forecast. Member involvement is an integral part of this process as the members provide retail rate projections, judgmental forecasts, and review the econometric models for forecast reasonability and explanatory variable appropriateness. The final product provides each distribution cooperative with a forecast of its annual energy sales by consumer category and monthly forecasts of its wholesale power demand and energy requirements.

G&T Cooperative Load Forecasts

The G&T's Load Forecasts are prepared by adding together the projected purchases of their distribution members. Transmission losses and member diversity within G&T's are also considered where applicable. The G&T Load Forecasts provide a forecast of the total sales of the G&T distribution member categorized according to consumer classifications. It also contains a forecast of the total wholesale power requirements of the G&T. These power requirements are separated into Western and Basin Electric, along with any other power suppliers' components in accordance with the member's contracts with the power supply organizations.

Basin Electric's Load Forecast

Basin Electric's Load Forecast is prepared by adding together the projected power requirements of its 19 Class A Members and the three Class D Members. The resultant forecast reflects the combined power requirements of Basin Electric member cooperatives.

These results are then translated into a model that represents the Basin Electric system on a delivery point basis. This allows the planning of infrastructure improvements to be made where needed.

The Load Forecast is then monitored on a monthly basis to ensure that the forecast is performing as expected. Also, due to the detailed information available from the large commercial sector, individual projects can be monitored to ensure that they are proceeding as planned. If the load deviates significantly from the forecast, modifications can be made for future load forecasts.

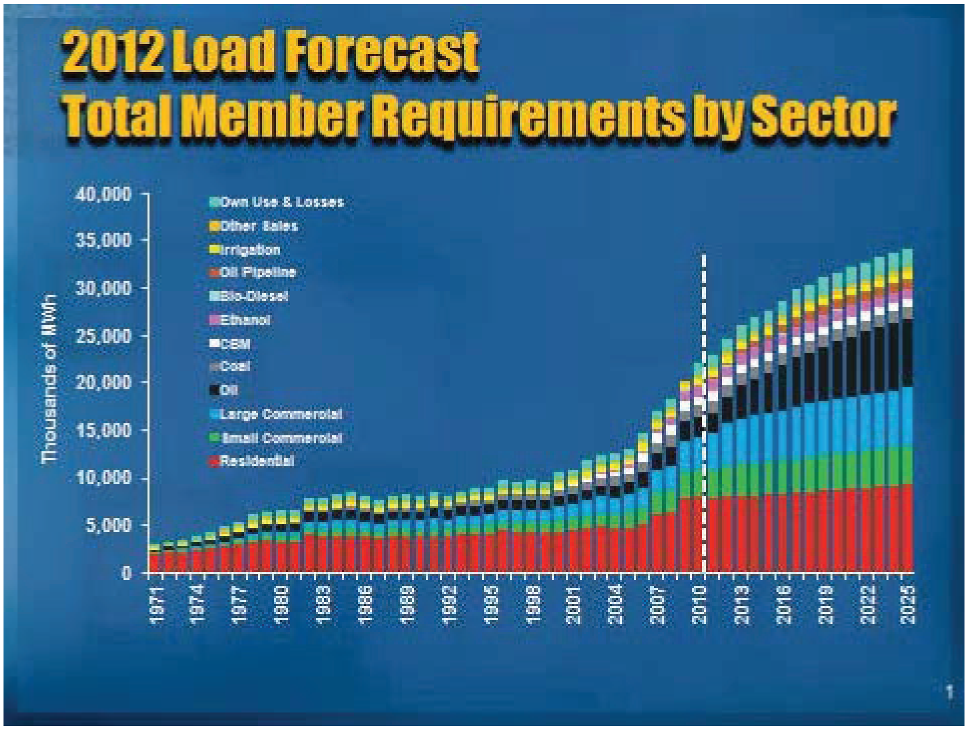
1.3.4 Summary of the Latest Load Forecast

The latest load forecast that Basin Electric has completed is the 2013 Load Forecast Update, which was approved by the Basin Electric Board of Directors on April 10, 2013, and approved by the Rural Utilities Service on May 22, 2013. The 2013 Load Forecast Update confirms the need for LCS Phase II; however, the justification for LCS Phase II was based on the 2012 Load Forecast and integrated resource plan which is described in detail within this application.

Figure 1-8 shows actual total member sales by class such as residential, commercial, etc., from 1971 to 2010 and projected member sales by class from 2011 to 2025 based on the 2012 Load Forecast. The need for additional generating capacity is driven by the increasing use of electricity and the resulting load growth including industrial growth, energy sector (coal, oil, gas and ethanol bio-diesel) development and new rural development. Between actual 2010 and forecasted 2025, Basin Electric's portion of this load growth is expected to grow 12.3 million MWh in total energy sales which is approximately 820,387 MWh per year.

Strong growth in the Williston Basin Oil sector is underpinned by historically strong residential and non-energy related commercial sectors.

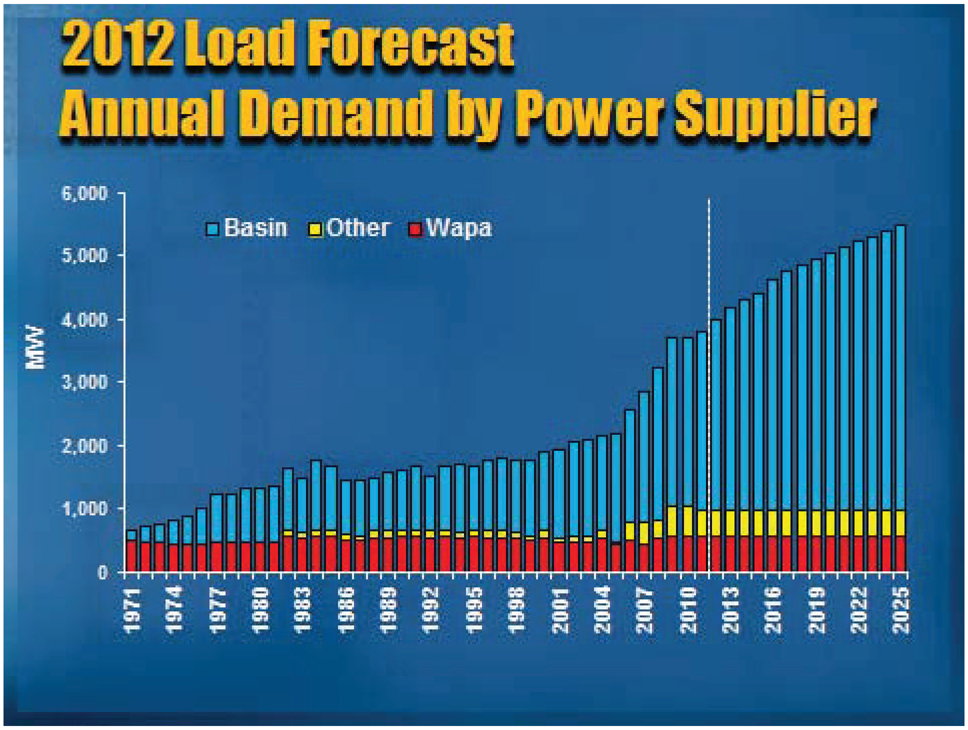
Figure 1-8: Total Member Requirements by Sector



Basin Electric's 2012 Load Forecast was approved by the Basin Electric Board of Directors and was sent on to the RUS for approval in April 2012. Basin Electric received approval of the 2012 Load Forecast from RUS in June 2012.

Basin Electric's supplemental power supply responsibility to its member systems is, in most cases, computed by subtracting the members' direct Western allocation from their total power requirements (Figure 1-9). In instances where other power supply sources are applicable, contractual arrangements are considered.

Figure 1-9: Annual Demand by Power Supplier



After other power suppliers obligations are considered, the remainders of the loads are Basin Electric's responsibility. Figure 1-10 depicts the expected annual demands for Basin Electric.

Table 1-3 shows Basin Electric's member energy sales and member peak demand from 2004 through 2010. System peak demand increased on average by 186 MW annually from 2004 to 2010. System energy sales have been increasing on average by 1,158,173 MWh annually from 2004 to 2010. The total system experienced annual average percent load factors in the high 60's during this same time period.

Table 1-3: Historical Member Sales (Billing Load Levels)

Year	Peak MW	Annual MWh
2004	1,542	9,559,319
2005	1,709	10,291,152
2006	1,933	11,759,408
2007	2,053	12,912,847
2008	2,421	14,073,369
2009	2,672	14,947,627
2010	2,658	16,508,356
Average Annual Increase	**186**	**1,158,173**

Figure 1-10: Basin Electric Annual Demand

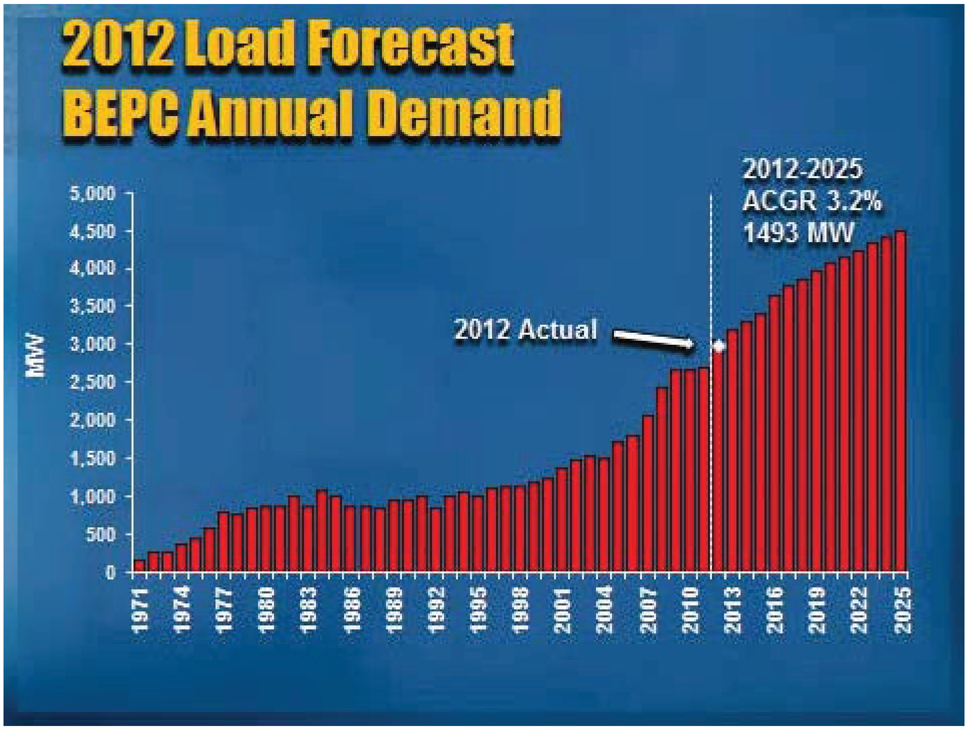
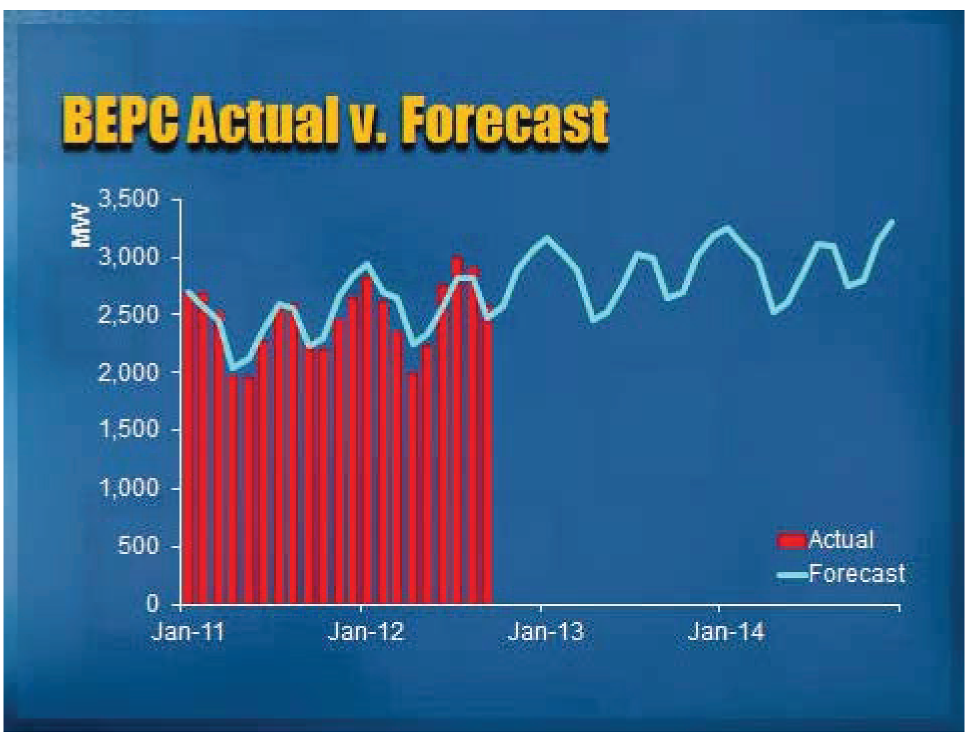


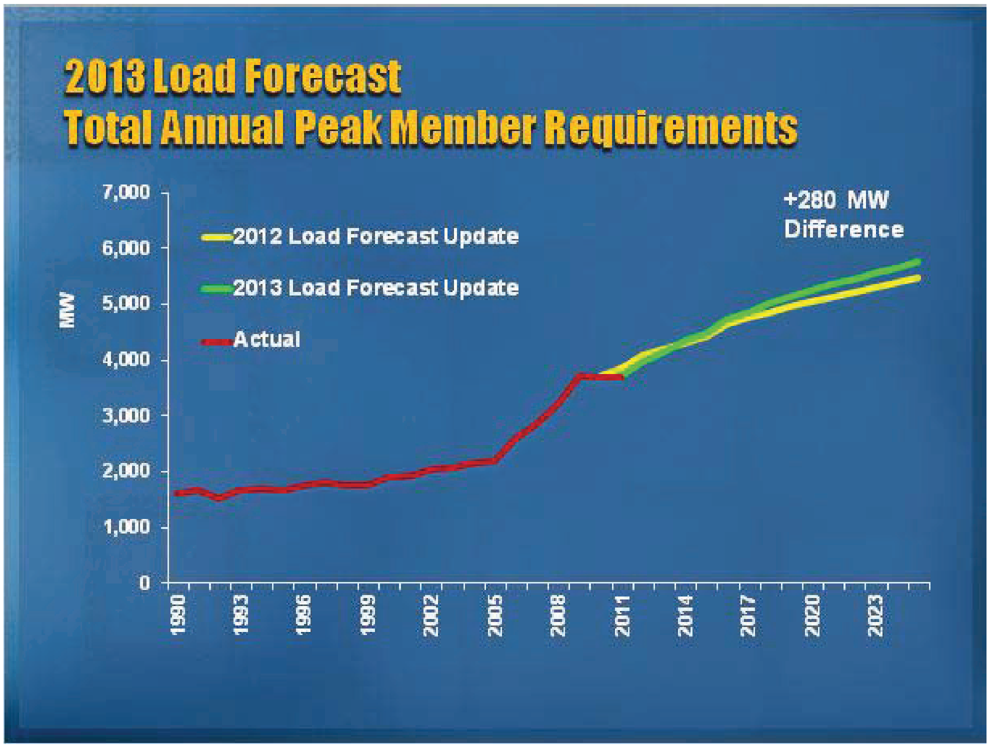
Figure 1-11 depicts the performance of the 2012 Load Forecast. Significant growth is expected to continue in the future. Summer 2012 actual peak load was 167 MW or 5.9% above the weather normalized forecast.

Figure 1-11: Performance of the 2012 Forecast



Basin Electric continues to update the forecast load within the member service territory. Since the justification and need for LCS Phase II, Basin Electric completed the 2013 Load Forecast Update and is well into development of the 2014 Load Forecast. The outcome of the 2013 Load Forecast Update was substantially similar to the 2012 Load Forecast, reaffirming the need for LCS Phase II. The comparison of the load forecast updates can be seen in Figure 1-12 below.

Figure 1-12: Load Forecast Update Comparison



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1.3.5 Existing Resources

1.3.5.1 Supply Side Resources

1. Leland Olds Station: Leland Olds Unit 1 was placed in-service on January 9, 1966, and is a baseload coal-fueled unit located near Stanton, North Dakota, with a net capacity of 221 MW. Leland Olds Unit 2 is a coal-fueled unit that was placed in-service on December 15, 1975, and its net capacity is rated at 445 MW. Basin Electric installed emission control equipment at the Leland Olds Station which requires an increase to the station service. This equipment was put in service after the 2012 fall outage on Unit 2, reducing the net capacity from 448 MW to 445 MW due to additional station service required. The Unit 1 emissions control equipment was placed into service in June 2013 after

the spring maintenance outage, reducing the net capacity from 222 MW to 221 MW. Leland Olds Station Unit 1 is the oldest baseload generating unit in Basin Electric's fleet and its current depreciable life is listed as 2030 while Unit 2 is 2040. While this seems relatively close, Basin Electric has verified the useable life of the equipment and successfully been granted depreciable life extensions from the Rural Utilities Service in the past.

2. Laramie River Station (LRS): Basin Electric, together with five other consumer-owned power supply entities, began construction of the three coal-fired baseload units at LRS near Wheatland in southeast Wyoming in July, 1976. LRS has three steam turbine generators supplied by General Electric (GE) Company and three steam boilers supplied by Babcock and Wilcox Company. The station's three units became fully operational on November 1, 1982, with Unit 1 at a net capacity of 570 MW; Unit 2 at a net capacity of 570 MW; and Unit 3 at a net capacity of 570 MW. The current rating of the units is due to turbine upgrades that occurred in 2007, 2008 and 2009. Basin Electric owns 42.27 percent of the entire project, which results in 723 MW available. Basin Electric, as Project Manager and Operating Agent for the Missouri Basin Power Project, was assigned overall responsibility for the design, construction and operation of the power plant and related transmission. Units 2 and 3 of the Laramie River Station are electrically connected to the western system; Unit 1 is electrically connected to the eastern system. The amount of power Basin Electric receives from the eastern unit is 48 MW and the amount of power Basin Electric receives from the western units is 675 MW. LRS was financed through the RUS for all but 19.8 percent. The 19.8 percent financed elsewhere pertains to pollution control bonds and Tax Benefit Transfers. Tax Benefit Transfers were a financing mechanism allowed by the IRS several years ago where an entity that was unable to use tax credits was able to sell those to an entity who could use the credits against the income taxes to be paid. Currently Laramie River Station Units 1, 2, and 3 have a depreciable life to 2032, 2033, and 2034 respectively for financial purposes.

3. Antelope Valley Station (AVS) is a two-unit lignite-fired steam electric generating station located in Mercer County, North Dakota. AVS Unit 1 went into commercial operation on July 1, 1984, and AVS Unit 2 went into commercial operation June 1, 1986. AVS is equipped with two steam turbine generators supplied by Westinghouse Electric Corporation and two steam boilers supplied by Combustion Engineering. The most recent Uniforms Rating of Generating Equipment (URGE) is 450 MW for AVS Unit 1 and 450 MW for AVS Unit 2. AVS provides approximately 135 MW of electric power for the neighboring Dakota Gasification Company's Great Plains Synfuels Plant. Designed to be environmentally sound, over $319 million has been invested in capital pollution control asset investments for AVS, to date. Dry scrubbers use lime to capture and remove up to 90 percent of

sulfur dioxide emissions from stack gases. Fabric filter bag houses capture and remove up to 99 percent of particulate matter. Each bag house contains more than 8,000, 35-foot-tall bags. AVS is a "zero-discharge" facility. Water is used efficiently, only leaving the plant site through evaporation. Basin Electric is 100 percent owner of AVS. A portion (45.3%) of AVS Unit 1 was financed through RUS while the other portion (54.7%) was financed through pollution control financing and a loan from CoBank that subsequently replaced a leveraged lease financing. AVS Unit 2 was not financed by the RUS but rather by pollution control financing and a leveraged lease. For financial purposes, AVS Units 1 and 2 have a depreciable life to the years 2036 and 2038, respectively.

4. Spirit Mound Station: Basin Electric placed in service a two-unit, 60-MW nameplate No. 2 fuel oil combustion turbine facility on June 30, 1978, to provide power as a peaking resource. The combined winter rating of the two units is 120 MW and the summer rating is 100 MW. The capacity is intended to be used primarily as reserves or replacement during initial outages of baseload units or during peak load periods when existing baseload units cannot meet the demand. The site can store in containers up to 8 million gallons of fuel. When the station is in use it consumes 100 gallons of fuel per minute. The Spirit Mound Station is located near Vermillion, South Dakota, and has a depreciable life lasting through 2025 for financial purposes.

5. Earl F. Wisdom Unit 1: Earl F. Wisdom Generating Station Unit 1 is a 38-MW coal-based unit located near Spencer, Iowa. Basin Electric and Corn Belt Power Cooperative (Corn Belt), one of Basin Electric's member cooperatives, negotiated a power supply contract which provides that Corn Belt will sell to Basin Electric Corn Belt's 38 MW of uncommitted capacity and associated energy from the Earl F. Wisdom Unit 1. In return, Corn Belt entered into a wholesale power contract with Basin Electric whereby Basin Electric will sell and deliver to Corn Belt all of Corn Belt's capacity and energy requirements in excess of the power and energy available to Corn Belt from the Western Area Power Administration (Western). In February 2015, Wisdom Unit 1 will be forced to stop burning coal in accordance with the Utility Mercury and Air Toxics Standards (ATS) rules. Corn Belt retained Burns and McDonnell to perform a technology assessment for Wisdom which resulted in the decision to convert Wisdom Unit 1 to burn natural gas rather than coal to maintain environmental compliance and extend its useful life. Wisdom Unit 1 is scheduled to complete this fuel conversion in 2014.

6. Earl F. Wisdom Unit 2: Basin Electric partnered with Corn Belt Power Cooperative to build the 80-MW GE model 7EA natural gas peaking unit near Spencer, Iowa. Although the combustion turbine uses natural gas as a primary fuel, it can also burn fuel oil as a contingency. Basin Electric owns one

half of the unit, which was placed in service in April 2004. Basin Electric purchases 87.5 % of Corn Belt's-owned half in response to Corn Belt entering into a Wholesale Power Contract. Therefore Basin Electric has 93.75% or 75 MW from the 80 MW combustion turbine. Wisdom Unit 2 has a depreciable life lasting to 2037.

7. Wyoming Distributed Generation: The Wyoming Distributed Generation turbines consists of nine peaking resource units located at three sites (Arvada, Hartzog, and Barber Creek) released for commercial operation in 2002. These units are natural gas-fired simple-cycle turbines manufactured by Solar and consisting of a total net output of 45 MW summer and 54 MW winter. The turbines are used to hold a portion of the necessary reserves for Basin Electric's west side electrical requirements. Financially, the Wyoming Distributed Generation turbines have a depreciable life ending in 2035.

8. Groton Generation Station: The Groton Generation Station near Groton, South Dakota consists of two GE LMS 100 simple-cycle gas turbines which provide about 98 MW for Unit 1 and 97 MW for Unit 2 (winter rating) as peaking resources. Basin Electric commissioned Groton Unit 1 in 2006 which was the first commercial application of GE's LMS 100. Unit 2 began providing power as a peaking resource in 2008. The two gas turbines get their natural gas from the Northern Border Pipeline. Through Dakota Gasification Company's Great Plains Synfuels Plant, the units have firm gas transport which gives them fuel security without requiring a backup or alternative fuel supply. A unique aspect of the station is the ability that Unit 1 has to disconnect the generator from the gas turbine through a synchronous clutch allowing the generator rotor to spin independent from the gas turbine to provide voltage stability to the electrical grid.

9. Culbertson Generation Station: The Culbertson Generation Station, near Culbertson, Montana is a single LMS 100 simple-cycle gas turbine providing 95 MW (winter rating) of peaking power. Operating since 2010, Culbertson Unit 1 is Basin Electric's first resource located in Montana. Similar to the Groton Generation Station, Culbertson Unit 1 has no need for an alternative fuel source as it receives its fuel from the Northern Border Pipeline and has firm gas transport via the Great Plains Synfuels Plant.

10. Deer Creek Station: The Deer Creek Station combined-cycle natural gas facility is a 300 MW intermediate resource located near White, South Dakota. This is the newest unit in Basin Electric's fleet, achieving commercial operation in August of 2012. The combined-cycle plant electrical generators are powered by a GE model 7FA gas turbine and an Alstom steam turbine. The natural gas fuel used by the station comes from the Northern Border Pipeline where firm gas transport is

possible through Dakota Gasification Company's Great Plains Synfuels Plant. The exhaust gases from the gas turbine pass through a heat recovery steam generator where they boil water into steam and provide steam to the Alstom steam turbine. When the combustion turbine has reached full load, duct burners can burn additional fuel within the heat recovery steam generator to produce more steam and reach the full station output ability of 300 MW.

11. Dry Fork Station: The Dry Fork Station is a 405-MW coal-fired power plant located 10 miles north of Gillette, Wyoming which was released for commercial operation in 2011. Basin Electric owns 92.9% of the station or 376 MW of the baseload resource. The station utilizes Powder River Basin coal from the next door Dry Fork Mine to ensure an uninterrupted, stable-priced fuel supply. The latest generation of pollution control technology was implemented resulting in very low emission rates.

12. Pioneer Generation Station: Basin Electric completed construction in 2013 of Pioneer Generation Station Unit 1, which consists of a 45-MW GE LM6000 natural gas-fired simple-cycle combustion turbine located near Williston, North Dakota. This is a new peaking resource fueled by natural gas from the Northern Border Pipeline. Unit 1 has a synchronous clutch located between the combustion turbine and generator allowing the generator rotor to rotate independent of the turbine to provide voltage stability to the electrical grid. Pioneer Generation Station Units 2 and 3 are currently under construction and are similar to Unit 1 with the exception of not having a synchronous clutch to provide voltage stability. These two units would provide a total of 90 MW of additional capacity and are scheduled to begin commercial operation in early January 2014.

13. Lonesome Creek Station: Lonesome Creek Station Unit 1 is anticipated to be commercial by the end of 2013. It is a 45-MW GE LM6000 natural gas-fired combustion turbine located near Watford City, North Dakota. It is a peaking resource fueled by natural gas from the Northern Border Pipeline. Unit 1 also has a synchronous clutch located between the combustion turbine and the generator allowing the generator rotor to spin independent of the turbine, providing voltage stability to the electrical grid. Lonesome Creek Station Units 2 and 3 are scheduled to begin commercial operation in 2015 and are similar to Unit 1 with the exception of not having a synchronous clutch to provide voltage stability.

14. Chamberlain Wind Project: Basin Electric, in partnership with East River Power Cooperative, has constructed a wind energy project near Chamberlain, South Dakota. The 2.6-MW capacity project was placed into commercial service in January 2002. Chamberlain Wind Project is owned by Basin Electric Power Cooperative and the energy is delivered to members as part of Basin Electric's overall

power supply. The Chamberlain wind turbines have a depreciable life lasting to 2022 for financial purposes.

15. Minot Wind Project: Basin Electric, in partnership with Central Power Electric Cooperative, constructed a wind energy project 14 miles south of Minot, North Dakota. The 2.6-MW capacity wind project was placed into commercial service in February 2002. Three additional turbines were added in December 2009 for a total output of 7.1 MW. The facility is owned by Basin Electric's subsidiary PrairieWinds ND 1 Inc. and energy is purchased by Basin Electric and delivered to members through a long term power purchase agreement (PPA) with PrairieWinds ND1 Inc. The Minot Wind turbines have a 20-year depreciable life showing their financial end of life in 2023 and 2029 per their installation dates.

16. PrairieWinds 1: Basin Electric, in partnership with PrairieWinds ND 1 Inc., constructed a wind energy project of 77 turbines near Minot, North Dakota which is owned by Basin Electric's subsidiary PrairieWinds ND 1 Inc. Basin Electric purchases the output of the 115.5-MW capacity wind project via a long term PPA. PrairieWinds 1 was placed into commercial service in December 2009. With a 20-year depreciable life allowed, the wind turbines are shown with an end of service to 2029 from a financial perspective.

17. Crow Lake Wind Project: Basin Electric, in partnership with PrairieWinds SD1 Inc., South Dakota Wind Partners and Mitchell Technical Institute, constructed a wind energy project of 108 turbines near White Lake, South Dakota. The 162-MW-capacity wind project was placed into commercial service in 2011. Basin Electric's subsidiary, PrairieWinds SD1, owns 100 turbines or 150 MW. Basin Electric has a purchase power contract for the output from all 108 turbines or 162 MW from the Crow Lake Wind Project. The 20-year depreciable life is shown from 2011 to 2031.

1.3.5.2 Power Supply Contracts

1. George Neal Station Unit 4: Unit 4 is a 644-MW coal-fired electric generation facility located south of Sioux City, Iowa that has been providing baseload power since 1979. Basin Electric and Northwest Iowa Power Cooperative (NIPCO), one of Basin Electric's member cooperatives, negotiated a power supply contract which provides that NIPCO will sell to Basin Electric NIPCO's 31 MW of uncommitted capacity and associated energy from Unit 4 of the George Neal Generating Station. In return NIPCO entered into a wholesale power contract with Basin Electric whereby Basin Electric will sell and deliver to NIPCO all of NIPCO's capacity and energy requirements in excess of the power and energy available to NIPCO from Western.

Basin Electric and Corn Belt Power Cooperative (Corn Belt), one of Basin Electric's member cooperatives, negotiated a power supply contract which provides that Corn Belt will sell to Basin Electric its 73 MW of uncommitted capacity and associated energy from Unit 4 of the George Neal Station. In return, Corn Belt entered into a wholesale power contract with Basin Electric whereby Basin Electric will sell and deliver to Corn Belt all of Corn Belt's capacity and energy requirements in excess of the power and energy available to Corn Belt from Western. Unit 4 is connected to MidAmerican Energy Company (MEC) where NIPCO and Corn Belt have rights to bring this energy to the IS or the Midwest Independent Transmission System Operator (MISO) via MEC.

2. Walter Scott 3 and 4: The Walter Scott Energy Center, located near Council Bluffs, Iowa, provides baseload power through the 690-MW Unit 3 and the 790-MW Unit 4. While both of the units are coal-based, Unit 3 has been operating since 1979 and Unit 4 began operation in 2007. Basin Electric and Corn Belt Power Cooperative (Corn Belt), one of Basin Electric's member cooperatives, negotiated a power supply contract which provides that Corn Belt will sell to Basin Electric its 26 MW of uncommitted capacity and associated energy from Unit 3 and 45 MW of uncommitted capacity and associated energy from Unit 4 of the Walter Scott Energy Center. In return, Corn Belt entered into a wholesale power contract with Basin Electric whereby Basin Electric will sell and deliver to Corn Belt all of Corn Belt's capacity and energy requirements in excess of the power and energy available to Corn Belt from Western. Walter Scott 3 and 4 are connected to MidAmerican Energy Company (MEC) where Corn Belt has rights to bring this energy into the IS or MISO via MEC.

3. Duane Arnold Energy Center: The Duane Arnold Energy Center consists of a 615-MW nuclear-powered unit located near Cedar Rapids, Iowa, that has been providing baseload power since 1975. Basin Electric and Corn Belt Power Cooperative (Corn Belt), one of Basin Electric's member cooperatives, negotiated a power supply contract which provides that Corn Belt will sell to Basin Electric Corn Belt's 10% share which is about 62 MW of uncommitted capacity and associated energy from the Duane Arnold Energy Center. In return, Corn Belt entered into a wholesale power contract with Basin Electric whereby Basin Electric will sell and deliver to Corn Belt all of Corn Belt's capacity and energy requirements in excess of the power and energy available to Corn Belt from Western. Interconnected to the Alliant West (ALTW) system, Corn Belt has the rights to bring the power to Corn Belt's transmission system which is within the WAUE balancing area.

4. Western Area Power Administration Peaking Capacity: In 1968 Basin Electric executed a long-term contract with the federal government for US Bureau of Reclamation (now Western) hydro peaking from the dams in the Missouri River Basin. This contract currently provides Basin Electric with 268.2 MW of winter peaking capacity at load and for Basin Electric to return a like amount of energy to Western during off-peak periods. This contract has been extended through the year 2039.

5. Western Native American Purchase: Basin Electric receives a Native American Allocation of 37 MW in the winter and 38 MW in the summer season. This allocation is a result of congressional action that made federal power available to Native Americans.

6. Madison Diesel: Basin Electric purchases capacity and energy output (when scheduled) from diesel generators owned by the City of Madison, South Dakota. The purchase is for five, 2-MW Caterpillar diesel generators that went commercial in April 2005. The agreement goes through December 2025.

7. Northern Border Waste Heat: Basin Electric purchases the energy from eight Recovered Energy Generation (REG) power plants fueled by hot exhaust off the Northern Border Pipeline compression stations with three units in North Dakota, three units in South Dakota, and one in both Montana and Minnesota for a total generating capacity of 44 MW; 22 MW went commercial in 2006, 22 MW went commercial by the end of 2009. The generation is environmentally benign, using virtually no additional fuel and producing virtually zero emissions. Basin Electric has signed a 25-year contract with the developer for the output of the REGs.

8. NextEra Wind: Basin Electric purchases all of the energy from six wind projects owned and operated by NextEra. The wind projects include:

    a. Edgeley Wind Project: 40-MW wind facility near Edgeley, North Dakota, which went commercial in 2003. Basin Electric entered into a 25-year PPA for the power from this facility.

    b. Hyde County Wind Project: 40-MW wind facility near Highmore, South Dakota, which went commercial in 2003. Basin Electric entered into a 25-year PPA for the power from this facility.

c. Wilton 1 Wind Project: 49.5-MW wind facility near Wilton, North Dakota, which went commercial in early 2006. Basin Electric entered into a 25-year PPA for the power from this facility.

d. Wilton 2 Wind Project: 49.5-MW wind facilities near Wilton, North Dakota, which went commercial November 2009. Basin Electric entered into a 25-year PPA for the power from this facility.

e. Day County Wind Project: 99 MW wind facility near Aberdeen, South Dakota, which went commercial in 2010. Basin Electric entered into a 30-year PPA for the power from this facility.

f. Baldwin Wind Project: 100 MW wind facility near Baldwin, North Dakota, which went commercial in 2011. Basin Electric entered into a 30-year PPA for the power from this facility.

9. Tri-State Sheridan-Johnson: Basin Electric has a power purchase arrangement with Tri-State to serve a portion of its member obligations in northeast Wyoming's Sheridan and Johnson counties. Under this agreement Basin Electric receives 11 MW to 13 MW varying on a monthly basis. The agreement extends through December 31, 2025 and may be extended for up to two successive terms of five consecutive years.

10. Tri-State Nebraska Allocation: The Tri-State Nebraska Allocation is a power allocation from the Western Area Power Administration – Rocky Mountain Region. This allocation provides for fixed monthly capacity and energy deliveries that correspond to the monthly resource capability of the Federal hydro systems. The load for Tri-State Nebraska members is split between the east and the west electrical interconnections. For planning purposes, Basin Electric and Western have agreed to split the amount of Contracted Rates of Delivery (CROD) between the east and west electrical interconnections. As a result, the planned power program shows the minimum Tri-State Nebraska CROD delivered west of the electrical separation, and the balance between the maximum CROD as delivered east of the electrical separation. The CROD under the federal power deliveries for Tri-State Nebraska reaches the maximum CROD of 83 MW for the summer season in July. However, as a system, Basin Electric's maximum west side member load obligations may occur in either July or August. For prudent planning, Basin Electric assumes the maximum member load as indicated by the Load Forecast as occurring in July, but uses the August CROD of 73 MW. The winter CROD at the point of delivery is 49 MW. The Basin

Electric west side planning numbers are a summer value of 27 MW and a winter value of 10 MW. Basin Electric uses these allocations to the extent possible as peaking resources due to the limited amount of energy that can be scheduled to maximize the value of these allocations. Effective October 1, 2014, the seasonal energy and CROD for future winter and summer seasons may be reduced by up to 1 percent from the then-current seasonal energy and CROD.

11. PRECorp Allocation: The PRECorp Allocation is a power allocation from the Western Area Power Administration – Rocky Mountain Region (RMR). The RMR allocation provides for fixed monthly capacity and energy deliveries that correspond to the monthly resource capability of the Federal hydro systems. The PRECorp Allocation uses 24 MW in the winter season and 21 MW in the summer season for planning purposes. Basin Electric uses these allocations to the extent possible as peaking resources due to the limited amount of energy that can be scheduled to maximize the value of these allocations. Effective October 1, 2014, the seasonal energy and CROD for future winter and summer seasons may be reduced by up to 1 percent from the then-current seasonal energy and CROD.

12. Municipal Energy Agency of Nebraska: Basin Electric has signed a contract with Municipal Energy Agency of Nebraska (MEAN) to purchase 30 MW of Mid-Continent Energy Marketers Association Schedule Q, Mid-Continent Area Power Pool Product K: System Participation Power Interchange Service. The purchase began May 1, 2007, and the contract goes through April 30, 2014. All capacity and energy from MEAN is deemed delivered at the Cooper Nuclear Station bus.

13. Webster City CT: Basin Electric has signed a contract with Corn Belt Power Cooperative, a member of Basin Electric, to purchase the output of the Webster City CT peaking plant (20.8 MW) that is fueled by fuel oil. The purchase begins September 1, 2009, and continues through the term of the Wholesale Power Contract between Basin Electric and Corn Belt.

14. Estherville Diesel Generators: Basin Electric has signed a contract with Corn Belt Power Cooperative, a member of Basin Electric, to purchase the output from the City of Estherville's six diesel generators (13.0 MW). The purchase begins September 1, 2009, and will remain in effect so long as Corn Belt continues to purchase the output of the diesel generators pursuant to the Wholesale Agreement between Iowa Lakes Electric Cooperative and the City of Estherville, provided that this will not extend through the term of the Wholesale Power Contract between Basin Electric and Corn Belt.

15. Pocahontas Diesel Generators: Basin Electric has signed a contract with Corn Belt Power Cooperative, a member of Basin Electric, to purchase the output from the City of Pocahontas's two diesel generators (3.8 MW). The purchase begins September 1, 2009, and will remain in effect so long as Corn Belt continues to purchase the output of the diesel generators pursuant to the Wholesale Agreement between Iowa Lakes Electric Cooperative and the City of Pocahontas, Iowa, provided that this will not extend through the term of the Wholesale Power Contract between Basin Electric and Corn Belt.

16. Spencer Combustion Turbine (CT) Generator: Basin Electric has signed a contract with Corn Belt Power Cooperative, a member of Basin Electric, to purchase 10 MW from the City of Spencer 20 MW combustion turbine. The purchase begins September 1, 2009, and will remain in effect so long as Corn Belt continues to purchase the output of the combustion turbine pursuant to Corn Belt being a party to the Spencer PPA with Spencer Municipal Utilities of the City of Spencer, Iowa, provided that this will not extend through the term of the Wholesale Power Contract between Basin Electric and Corn Belt.

17. Corn Belt Wind: Basin Electric has signed a contract with Corn Belt Power Cooperative, a member of Basin Electric, to purchase the output of Corn Belt's wind projects. The purchase begins September 1, 2009, and continues through the term of the Wholesale Power Contract between Basin Electric and Corn Belt. The wind projects include: 7.3 MW from the Hancock County Wind Project, 16.8 MW from the Crosswind Generators, 10.5 MW from the Lakota Wind Project, and 10.5 MW from the Superior Wind Project.

18. Minnesota Power Purchase: Basin Electric has signed a contract with Minnesota Power to purchase 100 MW from the Clay Boswell Energy Center. This facility is a four-unit coal-fired power station with a nameplate capacity of 1,025 MW. It is owned and operated by ALLETE and is located near Cohasset, Minnesota. The PPA ends on April 30, 2020.

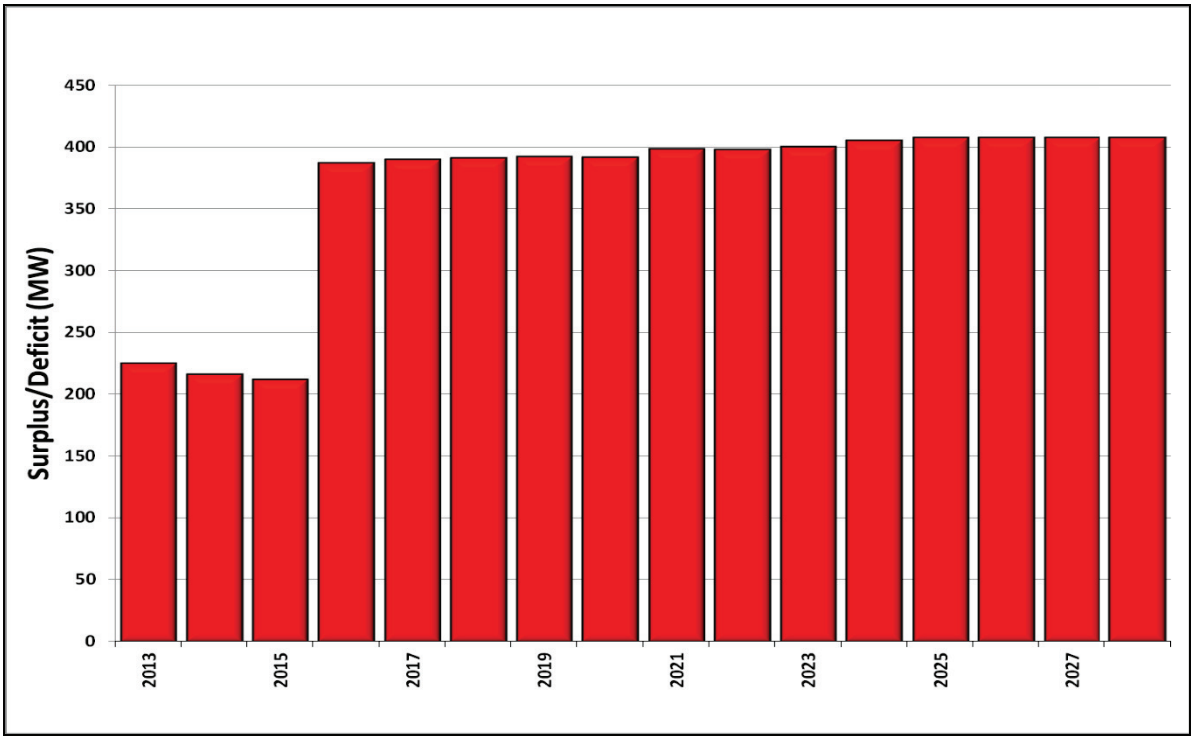
1.3.6 Project Justification and Support

Basin Electric identified the need for Lonesome Creek Phase II during the integrated resource plan process based on the 2012 Load Forecast compared to the existing generation fleet and purchase agreements in early 2012. The difference in the load forecast plus other obligations (such as non-member sales, losses, and reserves, less Basin Electric's system-wide load management) and existing and committed generating resources along with purchases, define the load and capability of the Basin Electric system which shows the amount of surplus capacity on Basin Electric's system.

Since Basin Electric's member systems reside on both the eastern and western interconnection and there is limited capability in moving power between the systems, Basin Electric further narrows its view on load and capability to the eastern and western systems.

Figure 1-13 shows Basin Electric's western system summer season surplus capacity. The western system is not in a capacity deficit throughout the study period.

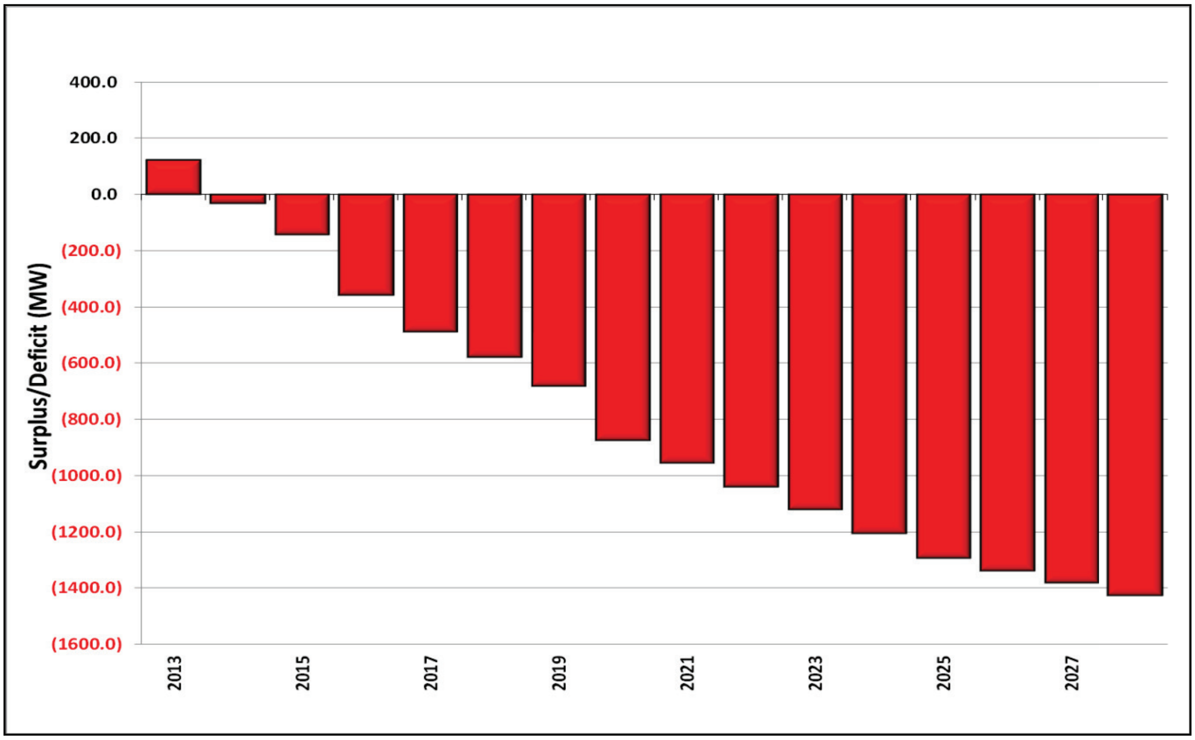
Figure 1-13: West System Surplus Capacity



Basin Electric has access to alternating current (AC) to direct current (DC) ties to move power between the eastern and western systems. Transfers utilizing these DC ties are not incorporated into the graph and would allow Basin Electric to move surplus west-side generation to the east up to the capability and rights to the ties, which is currently 240 MW in a west-to-east direction.

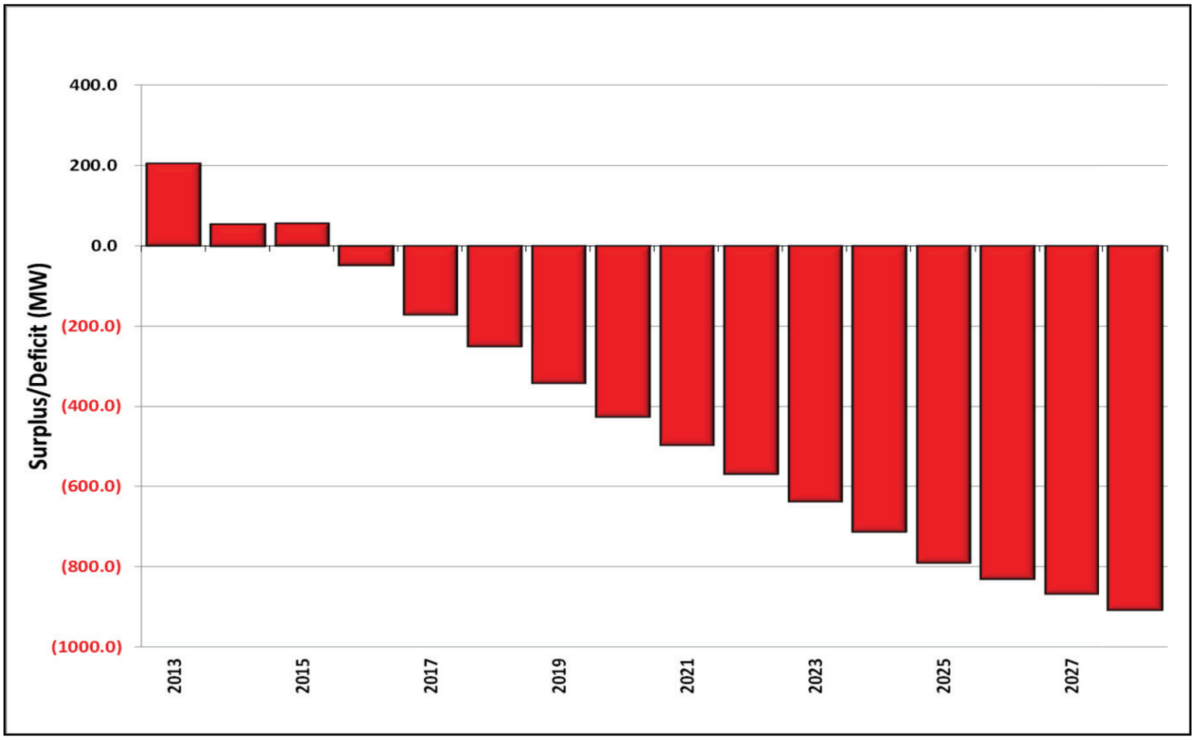
Figure 1-14 shows Basin Electric's eastern system summer season surplus capacity. Basin Electric's eastern system is shown to be in a deficit of 28 MW in 2014. This deficit is forecasted to grow greater year over year. This graph does not include potential transfers across available DC ties - the Rapid City DC Tie or the Stegall DC Tie - to transfer power in either direction.

Figure 1-14: East System Surplus Capacity



Basin Electric's eastern system can be broken into three areas, the Integrated System (IS), the Southwest Power Pool (SPP) and the Midwest Independent Transmission System Operator (MISO). Figure 1-15 shows Basin Electric's IS (WAUE) system. The IS is a transmission partnership between Western, Basin Electric, and Heartland Consumer Power District. This is the portion of the eastern system showing the greatest growth over the forecasted period. This area encompasses the oil developing region known as the Williston Basin. This graph does include anticipated transfers across the Rapid City DC Tie and the Stegall DC Tie to transfer power from the west to the east. The graph shows the IS (WAUE) to be in a deficit of 48 MW in 2016. This deficit is forecasted to grow year over year, to 172 MW by 2017 and 905 MW at the end of the forecast period.

Figure 1-15: WAUE System Surplus Capacity



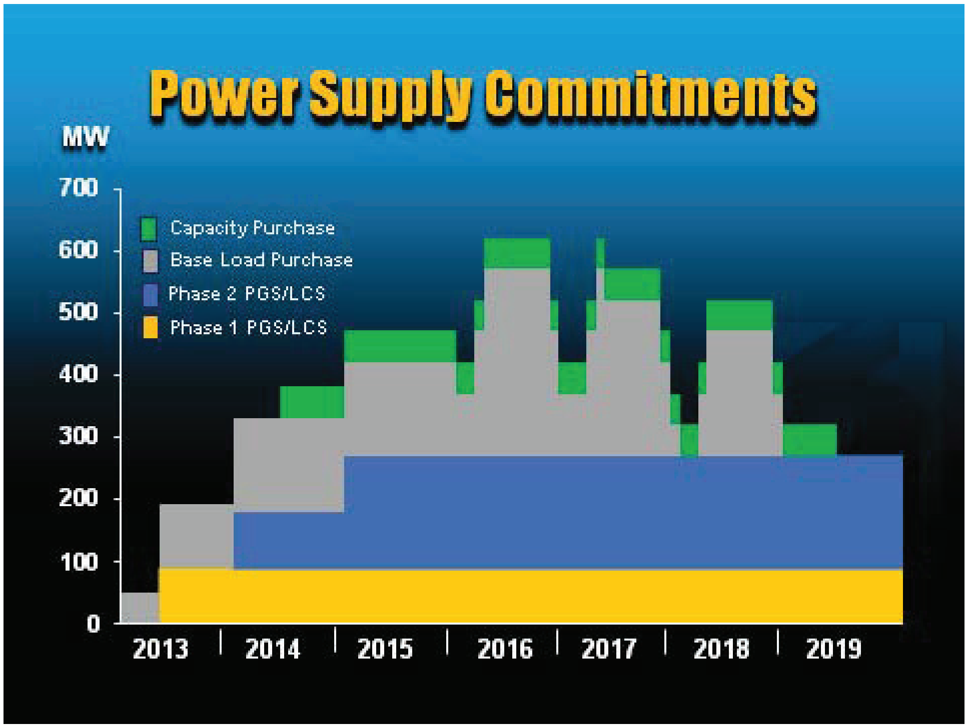
If the DC Tie transfers are unavailable, or there is no surplus on the west to move east, the IS (WAUE) would show a deficit of 166 MW in 2014 and this deficit would continue to grow year over year.

The high voltage transmission system into the Williston Basin area is very close to its maximum load-serving capacity, in that the load-serving ability of the area may be impacted until additional transmission facilities are built to bring power into the region or Basin Electric has the ability to start generation located within the area. Currently Basin Electric is in the process of building a 345-kV high voltage transmission line from Antelope Valley Station to Williston to Tioga, scheduled to be complete in 2016. Until that line is completed, the growing load in this area will be constrained by transmission limitations and will limit the amount of load that can be served in the area without the support of local generation.

Basin Electric will need some portion of local generation in 2014 and 2015 to help with transmission reliability issues in the Williston Basin area until the 345-kV high voltage transmission line from Antelope Valley Station to Williston to Tioga will be completed. The local generation will also provide for support during transmission outages with the line in place as well as support if the load within the area grows faster than is currently forecasted.

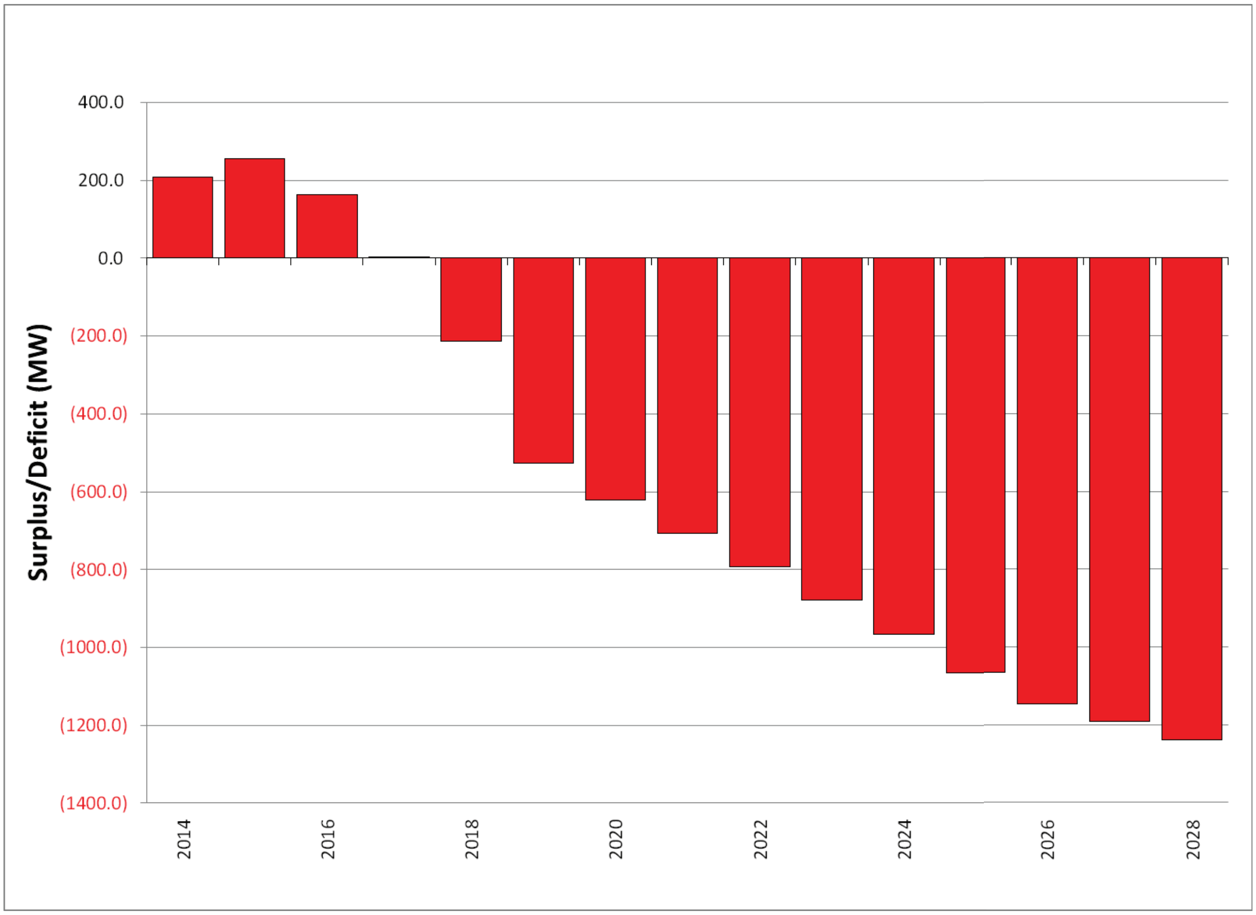
As a result of the integrated resource plan finalized in early 2013, commitments to power purchases and commitments to build new resources were made, including Lonesome Creek Phase II. Figure 1-16 displays the magnitude of commitments that Basin Electric has made to meet the growing demand and ensure an adequate supply of electrical power for the membership.

Figure 1-16: Power Supply Commitments



These commitments to power supply and the 2013 Load Forecast Update were used to create the updated system graph indicating the capacity position in Figure 1-17 below. The purchases and generation fleet expansion pushed the previous first deficit of 48 MW in 2016 (Figure 1-15) to a first deficit of 213 MW in 2018 (Figure 1-17). Basin Electric continues to evaluate the best alternatives in resource planning to meet the substantial demand growth that is projected. As the load forecast materializes, additions to the purchases or generation fleet will be made to meet the quickly developing demand for electricity within Basin Electric's membership.

Figure 1-17: WAUE System Surplus Capacity



1.3.7 Cost

The cost of construction for the LCS Phase II is estimated to be approximately $102 million.

1.3.8 Alternatives

A number of demand-side and supply-side resource alternatives were considered as a means of meeting the forecasted electrical needs for Basin Electric. The alternatives evaluated included:

- Demand Side Management
- Baseload Capacity
- Intermediate Capacity
- Peaking Capacity
- Purchased Power / Request for Proposal

1.3.8.1 Demand Side Management

Demand-side Management (DSM) is the process of managing the consumption of energy, generally to optimize available and planned generation resources. DSM refers to actions taken on the customer's side of the meter to change the amount or timing of energy consumption. DSM programs offer a variety of measures that can reduce energy consumption and consumer energy expenses. DSM strategies have the goal of maximizing end-use efficiency to avoid or postpone the construction of new generating plants.

DSM programs aim to achieve three broad objectives: energy conservation, energy efficiency and load management. Energy conservation can reduce the overall consumption of electricity by reducing the need for heating, lighting, cooling, cooking and other functions. Energy efficiency encourages consumers to use energy more efficiently, thus more effectively. Load management allows generation companies to better manage the timing of their consumers' energy use and helps reduce the large discrepancy between on-peak and off-peak demand.

Basin Electric and its members are engaged in a variety of conservation and energy efficiency programs. The programs and activities were developed to promote, support and market such technologies as efficient dual heat, water heaters, heat pumps, air conditioning, storage heating, grain drying, and irrigation. Other examples are photovoltaic generation and energy audits. A number of Basin Electric's members have developed DSM programs. These vary depending on the cooperative; some elect to utilize rebates, others use energy resource conservation loans, others use variable rates, some use all three and some elect not to adopt any of the programs.

Prior to 2011, Basin Electric surveyed its membership directly on all DSM activities and reported the information. Starting in 2011 Basin Electric adopted the new RUS and National Rural Utilities Cooperative Finance Corporation (CFC) energy efficiency information reported by Basin Electric's members on RUS Form 7 part P or CFC Form part S documents.

Energy conservation and efficiency programs can lessen the demand for electricity, therefore reducing the capacity needed from additional future generation facilities. However, energy savings through DSM are not enough to alleviate the need for additional peaking capacity resources.

1.3.8.2 Baseload Capacity

The most economical means of supplying power to a load that varies every hour on an electric power system is to have three basic types of generating assets available for use. These generation assets are commonly referred to as baseload, intermediate, and peaking capacity.

Baseload capacity runs at its full capacity continuously throughout the day and night, all year round. The output of baseload-type plants cannot be rapidly decreased or increased to "follow load." Baseload units are designed to optimize the balance between high capital/installation cost and low fuel cost that will give the lowest overall production cost under the assumption that the unit will be heavily loaded for most of its life. Typically, baseload capacity units are operated at an 80 percent capacity factor or more. Coal-fired steam–cycle power plants, nuclear plants, and hydroelectric plants are examples of baseload generation capacity; however, hydro plants that follow load are not baseload units. Some renewable forms of energy, such as geothermal, biomass power, biogas power, and municipal solid waste, are typically used in a baseload generation mode and are most cost effective in this mode of operation. While baseload capacity units are being contemplated for inclusion in Basin Electric's resource expansion plan, because of the locality of the load area and the timing required for the new generation to be operational, baseload capacity units were not considered responsive to the immediate need for power in McKenzie County and the Bakken oil field.

1.3.8.3 Intermediate Capacity

Intermediate capacity units are designed to be "cycled" at low load periods, such as evening and weekends. The units are loaded up and down rapidly to handle the load swings of the system while the unit is online. Typically, intermediate capacity units are operated between a 20 and 80 percent capacity factor, or between baseload and peaking. Technologies for intermediate load plants include oil- or gas-fired steam cycle plants, combined cycle plants, some hydroelectric plants, and internal combustion engine generators. Renewable generation types such as wind, solar, and hydroelectric are intermediate resources. Wind and solar are intermittent resources whose operation cannot be scheduled. Their capacity factor is between 20 and 50 percent. Hydroelectric power generally operates between 40 and 50 percent capacity factor; however, it is very dependent on annual rainfall and therefore can go through some long periods of low generation.

While intermediate capacity units are being contemplated for inclusion in Basin Electric's resource expansion plan, because of the locality of the load area and the timing required for the new generation to be operational, intermediate capacity units were not considered responsive to the immediate need for power in McKenzie County and the Bakken oil field.

1.3.8.4 Peaking Capacity

Peaking capacity is only operated during peak load periods and during emergencies. Very low capital/installation costs are important due to the fact these units are typically not operated for long periods. The production costs are relatively high due to the high cost and volatility in the price of fuel; this is why operation of these resources is limited. Types of peaking capacity power plants include combustion turbines, internal combustion engine plants, and pumped storage hydroelectric facilities. Typically, peaking capacity is operated at a capacity factor of 20 percent capacity or less.

Simple cycle is a type of natural gas-fired combustion turbine generator application. In simple-cycle combustion turbine (SCCT) operation, gas turbines are operated alone, without any recovery of the energy in the hot exhaust gases. SCCTs in the power industry require smaller capital investment than coal, nuclear or even combined cycle natural gas plants, and SCCT can be designed to generate small or large amounts of power. Also, the actual construction process can take as little as several weeks to a few months, compared to years for baseload power plants. Another main advantage of SCCT is that they can be turned on and off within minutes, supplying power during peak demand or during transmission outages. Since they are less efficient than combined cycle plants, they are usually operated as peaking power plants, which primarily are used during the peak months and less than a total of 2,000 hours per year. A typical large SCCT may produce 45 to 150 MW of power and have 35 to 40 percent thermal efficiency. SCCTs are rarely used in baseload capacity units because of the lower heat rate efficiencies. Figure 1-18 shows a typical SCCT process flow diagram.

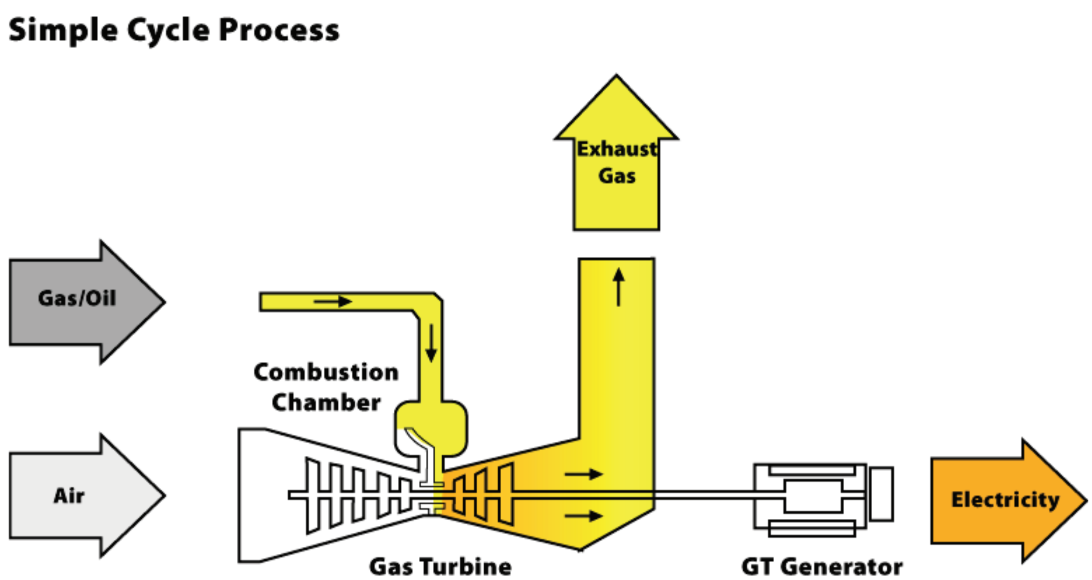


Figure 1-18: Simple-Cycle Unit Process Flow Diagram

There are two types of combustion gas turbines: heavy industrial “frame” machines and aero-derivative machines. Gas turbine power plants are pre-assembled at the factory, skid or baseplate mounted, and then shipped to the site along with other major components including the generator, cooling, lube oil, and electrical modules. Because they are pre-assembled and modular, field erection hours are significantly reduced, particularly as compared to a coal-fired plant.

The capital cost component of the levelized cost of SCCT power is approximately $47 per Megawatt-hour (MWh) for a plant that runs about 20 percent annual capacity factor. The total levelized cost of SCCT power is projected to be relatively high at approximately $103/MWh for about 1,750 hours of operation in a year or about 20 percent annual capacity factor. If a SCCT were operated at 80 percent annual capacity factor, the levelized cost of power would be about $67/MWh. Most of the power-generation cost for SCCT is from the variable/fuel cost of approximately $48/MWh, assuming the cost of fuel is about $4.00 per million British thermal units (MMBtu). Natural gas costs are highly variable and strongly affected by the economy, production and supply, demand, weather, and storage levels. Weather and demand are large factors that affect gas prices and are very unpredictable. Traditionally, demand for natural gas has peaked in the coldest months, but with the nation's power increasingly being generated by natural gas, demand now also spikes in summer when utilities fire up peaking plants to provide more power for cooling needs.

Permitting of SCCTs has an average timeframe of two to three years. This permitting timeframe is dependent on the type of machine selected and the area where it is constructed. The construction time for a simple-cycle unit is relatively short, ranging from 1 to 1.5 years. This is of course dependent on availability of units, transmission and construction resources.

SCCT could easily fulfill Basin Electric's peaking power need or local generation need for the Williston Basin area. Natural gas prices are currently low and are projected to remain low for the foreseeable future. With the increased oil (and as a result natural gas) production in North Dakota and Montana, natural gas-fired generation is considered in Basin Electric's future resource portfolios.

Capacity additions could be in one 80- to 100-MW simple-cycle unit or in two smaller units, such as in 45-MW simple-cycle units. The footprint and impacts of these two capacity options would be similar. However, the 45-MW size would allow for better adjustments to variable loads and would operate more efficiently at reduced loads, should that be required. A larger 80 to 100 MW SCCT has an increased likelihood of being operated at half load and, thus, a less efficient operating level. For this reason, Basin chose two 45-MW turbines for its capacity addition.

1.3.8.5 Purchase Power/Request for Proposals

Basin Electric developed and issued a Request for Proposals in early 2012 for short- and long-term power supply on its eastern system. The long-term proposals were evaluated against Basin Electric's self-build options. The short-term proposals could be utilized to meet some of Basin Electric's need in the next couple of years. Basin Electric received 5,706 MW of power supply bids. Basin Electric evaluated the short- and long-term proposals and short-listed the total number of qualifying bids to 15, which totaled 1,276 MW.

These short-listed projects were moved forward into Basin Electric's power supply modeling software, along with Basin Electric's self-build options, and were included in the future resource portfolio modeling runs. If the model indicates one of these options is justified to move forward, Basin Electric would further evaluate that option. However, these short-term proposals would not provide the reliability benefits of a location in the McKenzie County-Williston Basin area.

1.3.8.6 Summary of Alternatives

Basin Electric will need some quick start and local generation resources in 2014 and 2015 to help with transmission load-serving issues in the Williston Basin area until the 345-kV high voltage transmission line from Antelope Valley Station to Williston to Tioga is completed. The generation types that are capable of meeting Basin Electric's local generation need should be constructed in the area and in the time frame required to service the increased load. Based on these parameters, a two-unit SCCT at the existing LCS site is the best alternative and is carried forward as the proposed Project.

1.3.9 Ten-Year Plan

Basin Electric filed a Ten-Year Plan with the Commission on June 21, 2013. LCS Phase II is consistent with the Ten-Year Plan on file with the NDPSC.

2.0 SITE COMPATIBILITY CRITERIA

The site selection included an inventory and suitability analysis of criteria listed in NDAC Section 69-06-08-02, including exclusion and avoidance area criteria; selection criteria that relate to minimizing potential land use and environmental impacts; policy criteria that relate to maximizing public benefits; and design and construction limitations. Basin Electric also included economic considerations as part of the analysis.

2.1 Exclusion Areas

Per Section 69-06-08-02(1), the geographical areas listed in Table 2-1 shall be excluded in the consideration for an energy conversion facility, and shall include a buffer zone of reasonable width to protect the integrity of the area.

Table 2-1: Exclusion Areas

Geographic Area	Present within Project Site	Section Addressed
Designated or registered national: parks; memorial parks; historic sites and landmarks; natural landmarks; monuments; and wilderness areas	Not Present	4.10
Designated or registered state: parks; historic sites; monuments; historical markers; archaeological sites; and nature preserves	Not Present	4.10
County parks and recreational areas; municipal parks; and parks owned or administered by other governmental subdivisions	Not Present	4.4.1.1, 4.10
Areas critical to the life stages of threatened or endangered animal or plant species	Not Present	4.18
Areas where animal or plant species that are unique or rare to this state would be irreversibly damaged	Not Present	4.18

2.2 Avoidance Areas

Per Section 69-06-08-02(2), the geographical areas listed in Table 2-2 shall not be considered in the siting of an energy conversion facility unless the applicant shows that under the circumstances there is no reasonable alternative. In determining whether an avoidance area should be designated for a facility, the NDPSC may consider, among other things, the proposed management of adverse impacts, the orderly siting of facilities, system reliability and integrity, the efficient use of resources, and alternative routes. Economic considerations alone shall not justify approval of these areas. A buffer zone of a reasonable width to protect the integrity of the area shall be included unless a distance is specified in the criteria. Natural screening may be considered in determining the width of the buffer zone.

Table 2-2: Avoidance Areas

Avoidance Area	Present within Project Site	Section Addressed
Designated or registered national: historic districts; wildlife areas; wild, scenic or recreational rivers; wildlife refuges; and grasslands	Not Present	4.9, 4.10
Designated or registered state: wild, scenic, or recreational rivers; game refuges; game management areas; management areas; forests; forest management lands; and grasslands	Not Present	4.10
Historical resources which are not specifically designated as exclusion or avoidance areas	Not Present	4.9
Areas which are geologically unstable	Not Present	4.13
Within 500 feet of a residence, school, or place of business	Not Present	4.3
Reservoirs and municipal water supplies	Not Present	4.4, 4.14
Water sources for organized rural water districts	Not Present	4.4.1.5
Irrigated land. This criterion shall not apply to an underground transmission facility.	Not Present	4.11
Areas of recreational significance which are not designated as exclusion areas	Not Present	4.10

2.3 Selection Criteria

Per Section 69-06-08-02(3), a site shall be designated only when it is demonstrated to the NDPSC by the applicant that any significant adverse effects resulting from the location, construction, and maintenance of the facility as they relate to the following, will be at an acceptable minimum, or that those effects will be managed and maintained at an acceptable minimum (Table 2-3).

Table 2-3: Selection Criteria

Selection Criteria	Potential Adverse Effects	Section Addressed
Agricultural production	None	4.3, 4.11
Family farms and ranches	None	4.11
Land which the owner can demonstrate has soil, topography, drainage, and an available water supply that cause the land to be economically suitable for irrigation	None	4.11, 4.12
Surface drainage patterns and ground water flow patterns	None	4.12, 4.13, 4.14
Noise-sensitive land uses	None	4.7
The visual effect on the adjacent area	None	4.8
Extractive and storage resources	None	4.11
Wetlands, woodlands, and wooded areas	None	4.11, 4.15
Radio and television reception, and other communication or electronic control facilities	None	4.4
Human health and safety	None	4.5
Animal health and safety	None	4.11, 4.17, 4.18
Plant life	None	4.15, 4.16

2.4 Policy Criteria

Per Section 69-06-08-02(4), the Commission may give preference to an applicant that will maximize benefits that result from the adoption of the following policies and practices, and in a proper case may require the adoption of such policies and practices (Table 2-4). The NDPSC may also give preference to an applicant that will maximize interstate benefits.

Table 2-4: Policy Criteria

Policy Criteria	Suitable Policy or Practice of Applicant	Section Addressed
Location and design	Basin Electric's policy is to locate and design to minimize environmental impacts and utilize existing corridors.	1.0, 3.0
Training and utilization of available labor in this state for the general and specialized skills required	Basin Electric will use local labor to the extent practicable.	4.2.2
Economies of construction and operation	The Project creates economies of construction and operation by constructing the facility in a location with existing infrastructure such as the highways, transmission line, and gas line.	4.2.2
Use of citizen coordinating committees	The use of citizen coordinating committees is not expected for this Project.	NA
A commitment of a portion of the transmitted product for use in this state	The Project will meet the need for additional electric generation capacity in northwestern North Dakota as a result of increased demand and will meet reliability and system stability requirements for the region.	1.4
Labor relations	No labor relations will be negatively affected by the Project.	4.2.2
The coordination of facilities	New right of way corridors will not be needed for Phase II construction or operation	1.2.1
Monitoring of impacts	Basin Electric will utilize Best Management Practices (BMPs) during construction to minimize environmental impacts and will monitor construction compliance with the commitments made in this application and applicable permit conditions, including the NDPSC's Order.	4.6, 4.14.3
Utilization of existing and proposed rights of way and corridors	The Phase II facility will not use any new right of way corridors.	1.2.1
Other existing or proposed transmission facilities	No new transmission facilities are proposed for Phase II.	1.2.1

2.5 Design and Construction Limitations

Project construction and design would meet the requirements of the National Electrical Safety Code (NESC) and Basin Electric design criteria, and other applicable local or national building codes.

2.6 Economic Considerations

There are many economic considerations in the design and siting of a power generation facility and transmission line. Basin Electric has designed the LCS to take advantage of the proximity to existing energy supplies (natural gas from adjacent the Northern Border Pipeline) and MEC's Hay Butte substation for energy delivery in an area with existing roadways. In general, siting LCS Phase II on a previously disturbed industrial site (LCS Phase I) minimizes impacts to the surrounding community. Additionally, the close proximity to complementary facilities (energy acquisition and energy distribution) creates efficiency and condenses the development into a compact area.

3.0 LOCATION, PROPOSED FACILITY PROCESS DESCRIPTION, AND RESTORATION PROCEDURES

3.1 Location

The proposed facility would be located at 2648 NW 140th Avenue, Alexander, which is approximately 14 miles west of Watford City in T150N, R101W, Section 23 in McKenzie County, North Dakota (see Figure 1 in Appendix C). The plant site, which has room for both Phase I and Phase II, will take up approximately 7 acres of the larger 48.4-acre energy conversion facility property (see Figure 2 in Appendix C). Basin Electric owns the entire 160-acre section containing the Project area.

3.2 Facility Process Description

LCS Phase II will consist of two GE LM6000 natural gas-fired simple-cycle CT electrical generator packages. The LM6000 – PF Sprint turbine output rating is a nominal 45 MW with an approximate heat rate of 9,300 Btu/kWh. The units use dry low-NO_x burner technology along with an anhydrous ammonia-based selective catalytic reduction (SCR) system for NO_x control. Also, equipment will be provided to achieve reduction of carbon monoxide (CO) emissions. The units' flue gas will be released to the atmosphere through an 80-foot tall stack. The proposed Project will utilize the existing operator and maintenance building which will be supported by two full-time employees and includes the water treatment area for the demineralizer trailers, service and demineralized water forwarding pumps. This facility is designed to be operated locally at the site or remotely from either Basin Electric's Culbertson Station located near Culbertson, Montana or Basin Electric's Headquarters located in Bismarck, North Dakota.

Each CT generator package configuration will consist of a GE LM6000 CT driving an electrical generator. The LM6000 is a two-shaft aeroderivative gas turbine. A low pressure compressor and low pressure turbine are assembled on one shaft, forming the low pressure rotor. A high pressure compressor and high pressure turbine are assembled on the other shaft, forming the high pressure rotor. The low pressure turbine powers the output shaft and the electrical generator is driven using a flexible dry-type coupling connected to the front end of the low pressure compressor shaft. A site layout diagram has been included in Appendix C.

Natural gas is transported to the LCS site by the immediately adjacent Northern Border Pipeline. A 10-inch tap was installed on the Northern Border 42-inch pipeline for the existing facility and is large enough to provide for all three units.

Electrical interconnection for the new units will be to an on-site 115-kV transmission line that extends from LCS Phase I to MEC's Hay Butte Substation located approximately two miles southwest of the LCS. This transmission line is large enough to provide for all three units.

3.3 Restoration Procedures

During construction, crews would limit ground disturbance wherever possible. Temporary disturbance areas would be restored to their original condition to the extent practicable. Reclamation activities include removing and disposing debris, dismantling all temporary facilities (including staging and temporary material storage areas), and leveling or filling tire ruts. Erosion control measures will be implemented to minimize runoff during construction into the LCS storm water pond. Erosion control measures such as silt fence, rock checks, flow diverters, mulching, seeding, or mesh fabric overlay would be installed when and where appropriate.

4.0 ENVIRONMENTAL ANALYSIS

4.1 Overview

This section describes the environmental setting that exists within the area of land disturbed, including the seven-acre plant site, and discusses potential impacts associated with the construction and operation of the proposed Project. Where applicable to a specific resource, the larger 48.4-acre energy conversion facility property and surrounding vicinity are also discussed. For each resource, a general description on each resource is provided, followed by a discussion of potential impacts and potential mitigation measures.

The existing plant site has been previously disturbed to construct LCS Phase I; construction began in June 2012, with commercial operation by the end of 2013. LCS Phase I was non-jurisdictional with regard to the NDPSC Siting Act because the generation capacity and the associated 115-kV transmission line of LCS Phase I are both below jurisdictional levels. Basin Electric obtained a conditional use permit for the 48.4-acre energy conversion facility property from Alex Township to construct the LCS.

The description of resources subsections describe the resources and environmental settings found in the vicinity of the Project. The impact discussion subsections describe the potential effects on each resource from the Project. The mitigation discussion subsections provide potential measures to reduce or eliminate anticipated impacts identified for each resource. Mitigation measures are not discussed for identified potential effects that are either not anticipated to occur under construction or operation of the Project or are anticipated to result in a positive effect.

Standard mitigation measures have been incorporated into the development and construction of the proposed Project. These mitigation measures are designed to reduce or eliminate anticipated impacts resulting from construction or operation. They include Best Management Practices (BMPs) such as the spanning of wetlands and use of silt fencing and other erosion-control measures.

4.2 Demographics & Socioeconomics

4.2.1 Description of Resources

The Project is located within an area considered to be lightly populated in northwestern North Dakota. Population data for this section was taken from the 2007-2011 American Community Survey 5-Year Estimates via the U.S. Census Bureau.

The population of McKenzie County is 6,262. The county seat of McKenzie County is Watford City, which is the closest town to the proposed facility and has a population of 1,996. The project is located at

2648 NW 140th Avenue, Alexander, North Dakota. This is approximately 14 miles west of Watford City in T150N, R101W, Section 23. Table 4-1 summarizes the population and economic characteristics. Population estimates for 2012 by the U.S. Census Bureau indicate that McKenzie County is experiencing rapid population growth, with a 2012 population estimate of 7,987, an increase of 28 percent from 2011 to 2012. While population growth estimates specific to Watford City are not available, such rapid growth is likely affecting the city as well.

Table 4-1: Population and Economic Characteristics

Location	Population	Per Capita Income	Poverty Level
McKenzie County	6,262	$29,890	12%
Alex Township	16	$14,481	31.3%
Watford City	1,996	$32,356	3.1%

Source: 2007-2011 American Community Survey 5-Year Estimates Data via U.S. Census Bureau.

According to the 2007-2011 ACS 5-Year Estimates, the largest industry employing residents of McKenzie County was agriculture, with education and healthcare being the second largest, and the third largest industry was art and entertainment.

4.2.2 Impacts

Construction of the proposed Project could temporarily stimulate additional jobs in the construction trades such as electricians, laborers, and carpenters. Basin Electric will use local labor to the extent practicable and no labor relations will be negatively affected by the Project. Peak construction labor force for LCS Phase II will be approximately 130 employees. With an estimated construction schedule of eight months, length of employment would range from a few weeks to several months dependent on skill and/or specialty. The majority of construction contractors and workers would temporarily relocate to the Project area as construction of the LCS would require specialized expertise and workforce. A small number of local construction workers could be utilized for more general activities. However, due to the tight labor market in the region and low unemployment rates, it is anticipated that the majority of the construction workforce would come from outside the region. Gas stations, convenience stores, and restaurants in communities such as Watford City may experience increases in business during the construction period in response to activity from construction workers.

The construction workforce required for the Project will have an impact on the availability of temporary housing in the Project area. Many of the construction workers will seek temporary housing for varying time periods based on their individual roles in the proposed Project. Arrangement for longer-term housing may be established by the construction contractor, with crews rotating in and out as their assignments begin and are completed. McKenzie County has a very limited supply of temporary housing units available for use by construction workers relocating to the area on a temporary basis. Short-term housing is likely to experience the largest increase in demand due to the transient nature of construction workers and their limited duration in the Project area. Generally, housing options for construction crews will consist of area hotels, existing crew camps, or RV camps.

Two permanent employees are anticipated to staff the LCS. Because of the low number of personnel required, operation of the proposed Project would not result in a large increase in the number of permanent residents in the communities near the site.

LCS Phase II would provide an estimated annual value to property taxes of $123,840. Expenditures made for equipment, fuel, operating supplies, and other products and services would benefit businesses in the counties and state. Industries near the site should not be impacted by LCS Phase II, but should support the continued reliability of the electrical system for the oil and gas development in the region.

4.2.3 Mitigation

Socioeconomic impacts associated with the LCS Phase II are expected to be positive, with an influx of wages and expenditures made at local businesses during the construction period. Therefore, no mitigation is proposed.

4.3 Land Use

4.3.1 Description of Resources

The current land use is industrial. To the northwest is commercial property between the proposed Project and U.S. Route 85. The surrounding area consists of rural agricultural land used for crops. Oil and gas wells and associated energy development infrastructure are becoming more predominant and are located throughout the county. The LCS is not within a city limits or an area of military installation and will not displace any residences or existing or planned industrial facilities.

Basin Electric applied for a conditional use permit to change the zoning from agricultural to industrial use with Alex Township, McKenzie County, North Dakota. A Conditional Use Application was submitted to Alex Township on January 23, 2012, requesting the zoning change. Alex Township approved the conditional use permit for 48.4 acres to construct and operate the LCS energy conversion facility on May 16, 2012, and a permit for the transmission line from LCS to Hay Butte Substation on July 18, 2012 (Appendix D). LCS Phase I will be commercial in late 2013.

Prior to conversion of the land for LCS Phase I, the site was cropland. Table 4-2 identifies current land cover within the LCS site.

Table 4-2: Land Cover

Major Habitats and Their Relative Abundance	LCS Units 2 and 3	
	Acreage	Percent of Site
Riparian	0	0
Developed	7	100
Roads	0	0
Grassland	0	0
Cropland	0	0
Wetland	0	0
Total	**7**	**100**

4.3.2 Impacts

Land use at the LCS is zoned industrial. Adjacent lands owned by Basin Electric that are not required to support LCS will continue to be used for agricultural purposes. The additional land cover impacts anticipated due to LCS Phase II construction are minimal. LCS Phase II will be constructed east of Unit 1 within the LCS site (Figure 2 in Appendix C). An additional 22 acres to the east of the plant site is available to be used for a laydown area during construction. This laydown area will be unavailable for agricultural purposes during construction. Following construction, this area will be restored to its original condition to the extent practicable and will be available for agricultural purposes.

4.3.3 Mitigation

Since the site has already been dedicated to LCS Phase I, no mitigation efforts are necessary.

4.4 Public Services

4.4.1 Description of Resources

4.4.1.1 Local Services – General Discussion

The LCS is located in a lightly populated, rural area in northwestern North Dakota with an established transportation and utility network that provides access and necessary services to light industry, homesteads, and farms existing in and near the LCS. The area to the northwest of the site has recently been converted from agricultural to commercial property with various commercial enterprises, including a truck stop, café, and sleeping quarters. Watford City, located 14 miles to the east, provides emergency services, a fire department, ambulance service, and a police department. The city also provides recreation and parks, a community recreation center, a golf course, community pool, and a community library. There are also local retail service facilities and institutions.

4.4.1.2 Electrical Service

The LCS site is located within the McKenzie Electric Cooperative, Inc. (MEC) service area. MEC is a not-for-profit, member-owned electric distribution cooperative that provides electrical services to residential and commercial customers in the surrounding area in North Dakota. Basin Electric, through the operation of the IS transmission system, also delivers electrical supply to the area.

Natural gas is supplied to LCS by the Northern Border Pipeline that runs immediately adjacent to the plant site. A 10-inch tap was installed on the Northern Border 42-inch pipeline for LCS Phase I.

4.4.1.3 Roads

County and township (section line) roads characterize the existing roadway infrastructure in and around the LCS. The LCS is located one-half mile south of U.S. Route 85 on 140th Avenue.

4.4.1.4 Traffic

The existing traffic volume on nearby U.S. Route 85 is documented in Table 4-3. Determining the specific capacity of any highway is a complex process; however, general estimates are used for planning purposes. For purposes of comparison, the functional capacity of a two-lane paved rural highway is approximately 5,000 vehicles per day, or Average Annual Daily Traffic (AADT). In general, the state highways in and near the LCS carry higher levels of traffic than what is average for rural North Dakota. NDDOT is conducting planning and environmental studies as part of the process to improve U.S. Route 85 to four lanes from Watford City to U.S. Route 2 in Williston, including the building of a new bridge across the Missouri River. Construction on the U.S. Route 85 segment between Watford City and Alexander began in 2013 with completion anticipated in 2014.

Table 4-3: Existing Daily Traffic Levels

Roadway Segment	2011 AADT	2011 Commercial Truck Traffic
U.S. Route 85 east of Watford City	6,335	2,235

Source: 2011 Traffic Volumes from NDDOT, Bismarck

Additional county and township roads are near the LCS, but have no count data available. In general, the North Dakota Department of Transportation (NDDOT) provides traffic counts for designated U.S. and state highways (NDDOT 2011). As per NDDOT, the routes with no counts are likely lower than those with count data. The nearest highway, U.S. Route 85, is located one-half mile north of the LCS. State Highway 68 is located approximately three miles to the west near Alexander.

4.4.1.5 Water Supply

Alex Township and the surrounding area have limited public infrastructure services, which is typical of most rural townships in western North Dakota. Homes typically utilize septic systems and water wells for their household needs. The LCS will have water supplied by the McKenzie County Water Resource District which has lines located in this area. The district obtains its water supply from the Watford City Reservoir and the Western Area Water Supply Project, which obtains its water from the Missouri River.

4.4.1.6 Telephone, Fiber Optic, Television and Radio Communications

The LCS will make use of existing underground fiber cable. LCS is interconnected with Basin Electric facilities thru Basin Electric’s microwave communication system

No radio or television signal interference directly from the transmission of electricity is anticipated because of the differences in frequency of the signals.

4.4.2 Impacts

4.4.2.1 Local Services

No negative impacts to local services are anticipated.

4.4.2.2 Electric Service

Basin Electric has identified the need for additional electric generation in northwestern North Dakota as a result of increased demand and to meet reliability and system stability requirements for the region. Investigations and analyses conducted for the overall power delivery systems found that without improvements, the flow of power along existing lines may result in local line overloads.

Energy will be generated and distributed to the electrical grid system serving the rapidly increasing electrical load requirements in northwestern North Dakota. LCS Phase II will improve the reliability of service into the area.

4.4.2.3 Roads

The access road to the site is from 140th Avenue. No major grading or filling is anticipated.

4.4.2.4 Traffic

The peak construction labor force for LCS Phase II will be approximately 130 employees. Two permanent employees are anticipated to staff LCS. This workforce and support services will generate an approximate maximum of 60 additional vehicle trips per day. The equipment and material deliveries will be approximately 260 truckloads. Using any combination of federal, state, and county highways and other township roads throughout the Project area, the traffic impacts are considered negligible. The traffic volume in and around Watford City has increased significantly with the oil and gas development occurring in the area. Additional vehicles in the area as a result of the LCS would be temporary in nature. The capacity of any route and level of service on existing roads would not be impacted.

Truck access to the LCS is served by U.S. Route 85. Additional operating permits will be issued by the state, county, and/or township for over-sized truck movements.

4.4.2.5 Water Supply

Water requirements will range from very little in the winter to 25 gallons per minute (gpm) per unit in the summer when in operation. The maximum total consumption for the Plant will then increase from the maximum usage of 25 gpm to 75 gpm. Potable water will be supplied to the plant site from the local rural water distribution system and placed into the existing 125,000 gallon service water tank. The potable water is further treated through the utilization of a portable demineralization trailer and transferred into the 220,000-gallon demineralization water storage tank. When required the demineralization trailer is regenerated offsite. Any excess process water will be evaporated on-site or if required, hauled off site to a licensed waste facility.

4.4.2.6 Telephone, Fiber Optic, Television and Radio Communications

No impacts to these communication resources are anticipated.

4.4.3 Mitigation

Construction and operation of LCS Phase II will be in accordance with all associated Federal, state and local permits and laws, as well as industry construction and operation standards. Due to the minor impacts expected on the existing infrastructure during project construction and operation, no mitigation is proposed.

4.4.3.1 Local Services

Construction, operation, and maintenance of LCS Phase II will not impact local services, and no mitigation is proposed.

4.4.3.2 Electrical Service

The construction of LCS Phase II will not negatively impact existing electrical service; therefore, no mitigation is proposed.

4.4.3.3 Roads

Construction, operation, and maintenance of LCS Phase II will not negatively impact existing roadways; therefore, no mitigation is proposed.

4.4.3.4 Traffic

Construction, operation, and maintenance of LCS Phase II will not negatively impact traffic; therefore, no mitigation is proposed.

4.4.3.5 Water Supply

Construction, operation, and maintenance of LCS Phase II will not negatively impact local water supply; therefore, no mitigation is proposed.

4.4.3.6 Telephone, Fiber Optic, Television, and Radio Communications

Construction, operation, and maintenance of LCS Phase II will not negatively impact telephone, fiber optic, television, and radio communications; therefore, no mitigation is proposed.

4.5 Human Health and Safety

4.5.1 Description of Resources

4.5.1.1 Human Health

The term electromagnetic field (EMF), as it relates to transmission lines, references two separate fields: electric fields and magnetic fields. Electric fields are produced by the line voltage, and magnetic fields are produced by the electric current in the lines. An electric field results from the voltage on an electrical wire as caused by electric charges, and electric fields can exert forces on other nearby charges. The intensity of the electric field is related to the voltage of the line and proximity to the conductor. Electric fields are measured in volts per meter (V/m) or kilovolts per meter (kV/m) where 1 kV = 1,000 V.

The National Institutes of Health (NIH 2002) indicates that for a 115-kV transmission line the typical electric field at 50 feet from the centerline is 0.5 kV/m and 6.5mG. Both values are far less than the International Commission on Non-Ionizing Radiation Protection (ICNIRP 1998) levels for members of the general public of 4.2 kV/m for electric fields and 833 mG for magnetic fields. The NIH document is included in Appendix A-1.

4.5.1.2 Human Safety

Proper safeguards will be implemented during construction and operation of the facility. The transmission line and associated facilities will be designed to meet local, state, National Electric Safety Code (NESC), and Basin Electric safety standards. Construction crews will comply with local, state, NESC, and Basin Electric standards regarding the installation of facilities.

The proposed transmission line will be equipped with protective devices such as relays at the substation to safeguard the public from the transmission line if an accident occurs or if a structure or conductor falls to the ground.

4.5.2 Impacts

4.5.2.1 Human Health

EMF will be strongest directly under the transmission line and decrease with increasing distance from the transmission line towards the ROW edge.

Based on NIH (2002), the EMF levels at the edge of the right of way for the 115-kV transmission segment under maximum operating conditions and normal operating conditions are below the published guidelines from the ICNIRP Guidelines. The nearest sensitive receptor from the LCS is a commercial area approximately ¼ mile to the northwest. EMF from the transmission line is predicted to be within the standards for protection of the general public. No adverse impacts are anticipated.

4.5.2.2 Human Safety

Construction and operation of the proposed Project would involve the use and storage of regulated and hazardous materials. During construction, diesel fuel, gasoline, and lubricating oils from heavy equipment and vehicles could be accidentally leaked or spilled. Hydraulic fluid, paints, and solvents would likely be used during the construction phase as well. All used oil generated at the proposed Project site and other potentially hazardous materials (automotive fluids, spray paint cans etc.) at the site would be collected by a licensed/permitted recycler. To reduce the potential for a release of regulated or hazardous materials during the construction phase of the proposed Project, work would be planned and performed in accordance with OSHA standards and protocols addressing the use of potentially hazardous materials and applicable Federal and State environmental regulations. If a hazardous release were to occur, cleanup, management, and disposal of contaminated soils would be conducted according to EPA and State standards. Conformance to these standards and procedures would reduce the potential for significant impacts resulting from the release of hazardous materials during the construction phase. During plant operation petroleum products would be stored in areas designed for liquid storage.

There would also be two 2,000-gallon tanks of anhydrous ammonia for the SCR system. The quantity of anhydrous ammonia stored on site would exceed the threshold planning quantity set forth in EPA's Clean Air Act Section 112(r) regulations (40 CFR Part 68.130), as well as the threshold in the Emergency Planning and Community Planning and Community Right-to-Know Act. This is further discussed below under Mitigation.

The major risk to the general public would be from increased traffic volume on the roadways near or adjacent to the proposed Project as a result of commuting construction workers and transportation of equipment and materials.

4.5.3 Mitigation

4.5.3.1 Human Health

No EMF-related impacts to humans or animals are anticipated; therefore, no additional mitigation is required.

4.5.3.2 Human Safety

Construction-related hazards would be effectively mitigated by complying with all applicable Federal and State occupational safety and health standards, applicable National Electrical Safety Code regulations, and utility design and safety standards.

In addition, Basin Electric would develop a Health and Safety Plan to address public and worker safety during the construction and operation of the proposed Project. The Health and Safety Plan would identify requirements for minimum construction or operation distances from residences or businesses, as well as requirements for temporary fencing around staging, excavation, and laydown areas during construction. It would also include provisions for worker protection as is required under OSHA with emphasis on CFR 1926 – *Safety and Health Regulations for Construction.* During construction, all employees, contractors, and sub-contractors would be required to conform to OSHA safety procedures. Adequate training would be mandatory for all construction workers on site. Heavy equipment would be in compliance with OSHA requirements for safety devices such as back-up warnings, seat belts, and rollover protection. Personal safety equipment such as hard hats, ear and eye protection, and safety boots would be required for all workers on site. Accidents and injuries would be reported to the designated safety officer at each site.

Risk of accidental fire during construction could occur from human activities such as refueling, cigarette smoking, and use of vehicles and construction equipment in dry, grassy areas. The Health and Safety plan would reduce fire-related risks to acceptable levels by imposing restrictions or procedures regarding these activities. A risk of fire would be present during operation of the proposed Project due to the use and storage of fuel and chemicals within the facility. The proposed Project would have a built-in fire suppression system. In addition, implementation of industry-approved design measures for all proposed Project components would ensure that fire-related risks would remain acceptably low.

Because of the presence of anhydrous ammonia tanks subject to the Clean Air Act Section 112(r) regulations, Basin Electric would develop a Risk Management Program, prepare a Risk Management Plan, submit the Risk Management Plan to EPA, and coordinate with the state and local emergency planning committees. All construction sites would be managed to prevent harm to the general public. The general public would not be allowed to enter any construction areas associated with the proposed Project.

4.6 Air Quality

4.6.1 Description of Resources

Air quality generally is determined by comparing monitored pollutant concentrations with prescribed standards. The maximum level of a pollutant considered to be acceptable is specified by the Environmental Protection Agency (EPA). The Clean Air Act (CAA) established two types of National Ambient Air Quality Standards (NAAQS), primary and secondary. The EPA has established NAAQS for six criteria air pollutants: sulfur dioxide (SO_2), CO, nitrogen dioxide (NO_2), ozone (O_3), respirable particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb). Primary standards set limits to protect human health, and secondary standards set limits to protect public welfare. For most criteria pollutants, the North Dakota Ambient Air Quality Standards (NDAAQS) are the same as the federal NAAQS; however, the North Dakota Department of Health (NDDH) has set more stringent standards for SO_2.

McKenzie County is currently not part of a designated Air Quality Control Region (AQCR). AQCR's were established by the EPA and local agencies in accordance with Section 107 of the CAA as a means to implement the CAA and comply with the NAAQS through state implementation plans. Additional AQCR’s may be designated by the EPA as necessary to protect the public health and welfare. McKenzie County is currently classified as attainment or unclassifiable (to be treated as attainment) for all NAAQS criteria pollutants.

Emissions from all phases of construction and operation of the LCS would be subject to applicable state and federal air regulations. Most air quality regulatory programs address emissions from stationary sources of air pollution; these programs will primarily affect ongoing operations of the LCS. Air quality regulations affecting construction are primarily concerned with reducing emissions associated with construction equipment and fugitive dust.

LCS Phase I currently consists of an identical CT as is being proposed for LCS Phase II. The total nominal generation capacity of the LCS will be 135 MW after implementation of LCS Phase II.

LCS Phase II air emission sources will be regulated at the federal level by the CAA, as amended, and at the state level by North Dakota Administrative Rules. Regulations that are applicable to the project include:

- North Dakota Construction and Operating Permit Rules
- Title V Operating Permits
- Prevention of Significant Deterioration (PSD) Review
- New Source Performance Standards

North Dakota air permitting requirements are codified in Article 33-15, Air Pollution Control. Chapter 33-15-14, Designated Air Contaminate Sources, Permit to Construct, Minor Source Permit to Operate, Title V Permit to Operate, establishes permit review procedures for all facilities that can emit pollutants to the ambient air. New facilities are required to obtain a Permit to Construct prior to initiating construction activities. Basin Electric applied for and received a Permit to Construct from the NDDH for LCS Phase I and LCS Phase II projects.

In addition to Chapter 33-15-14 requirements, North Dakota Rules Chapter 33-15-15 establishes Prevention of Significant Deterioration (PSD) of air quality requirements. The provisions of 40 CFR 52.21, paragraphs (a)(2) through (e), (h) through (r), (v), (w), (aa), and (bb) as they existed on July 2, 2010, are incorporated by reference into Chapter 33-15-15. This includes revisions to the federal rules that were published as a final rule in the Federal Register by July 2, 2010, but had not yet been published in the Code of Federal Regulations.

New Source Performance Standards (NSPS) regulations (40 CFR 60) establish pollutant emission limits and monitoring, reporting and recordkeeping requirements for various emission sources based on source type and size. The NSPS applies to new, modified or reconstructed sources. Subpart GG of 40 CFR 60, *Standards of Performance for Stationary Gas Turbines,* applies to stationary gas turbines with a heat input at peak load equal to or greater than 10 MMBtu/hr that commenced construction after October 3,

1977. In addition to Subpart GG, Subpart KKKK, *Standards of Performance for Stationary Combustion Turbines*, applies to stationary CTs that commenced construction after February 18, 2005.

The LCS Phase II will comply with all applicable state and federal air quality regulations and obtain applicable air quality permits prior to commencing construction.

4.6.2 Impacts

Construction of LCS Phase II would potentially have minor and temporary impacts on air quality due to fugitive dust emissions during ground-disturbing activities associated with construction and installation of the equipment and associated infrastructure of LCS Phase II. Construction emissions would result from combustion of fuel in construction equipment/vehicles, fugitive dust associated with site preparation/grading and travel on the access road.

Because of their temporary nature, construction emissions will not have a long-term impact on ambient air quality, and LCS Phase II's implementation of the proposed emission control measures as well as other measures specified by the NDDH are anticipated to reduce impacts associated with construction emissions to less than significant levels.

Operation of LCS Phase II would result in air emissions from stationary fuel burning equipment. There will be two simple-cycle natural gas-fired CTs. LCS Phase II will operate as allowed under applicable air permits obtained prior to construction and operation. Operation of LCS Phase II in compliance with the applicable permit limits will result in impacts that are protective of the environment and will not result in an adverse impact to public health and welfare.

Based on the LCS air permit for Phase II, emissions will not violate an air quality standard, but emissions of nitrogen oxides, particulate matter, and greenhouse gas emissions will potentially exceed PSD evaluation levels and will require use of BACT. These emissions are 108 tons per year (tpy) for nitrogen oxides, 64.8 tpy for $PM_{2.5}$, and 660,366 tpy for greenhouse gas emissions measured as carbon dioxide equivalent. Dry low-NO_x burners in combination with SCR will control NO_x emissions. For particulate matter, natural gas firing and combustion controls would be used to limit emissions to 5.0 lb/hr. BACT for GHG emissions would be the efficiencies achievable with a CT. Although CO emissions will be below PSD evaluation levels, the Project still included an oxidation catalyst system to control CO emissions. The two CTs will operate as allowed under applicable permits and regulations. Operation in compliance with the applicable permit limits will not result in an adverse impact to public health and welfare.

Air dispersion modeling was conducted to determine the impacts of operation of the proposed Project on the Class I national park and wilderness areas near the LCS site. These modeling impacts indicated that there would be insignificant air quality, plume visibility, sulfur and nitrogen deposition, soil and vegetation, air toxic, and carcinogen impacts in the Theodore Roosevelt National Park, Medicine Lake National Wildlife Refuge, and Lostwood National Wildlife Refuge Class I areas. Modeling indicated that the air quality impacts from LCS would not exceed the PSD significant impact levels, NAAQS, or PSD increments in northwestern North Dakota. Therefore, the LCS project will not cause or contribute to adverse ambient air quality impacts. The North Dakota Department of Health Air Pollution Control Permit to Construct for Lonesome Creek Station is included as Appendix A-2.

GHG emissions of 660,366 tpy (600,000 metric tonnes per year) from LCS would represent a small fraction of one percent of United States emissions of 6,708 Terragrams in 2011. Thus, construction and operation of the LCS would not contribute measurably to global GHG emissions. While global climate change in the 21st century is expected to affect northwestern North Dakota through higher temperatures and higher precipitation (Karl, Melillo, and Peterson 2009), this change is not expected to affect the LCS project or the demand for electricity in the near term, which is primarily driven by Bakken oil field development.

4.6.3 Mitigation

During construction it is proposed that standard dust control measures be employed to reduce generation of fugitive dust due to surface disturbance. Dust control measures will include, but are not limited to the following:

- Applications of water during grading
- Paving, chemical stabilization, or watering of internal roadways after completion of grading
- Reduction of speed on unpaved roadways to 15 miles per hour or less
- Use of sweepers or water trucks to remove "track-out" at any point of public street access
- Stabilization of dirt storage piles by chemical binders, tarps, fencing, or other erosion control

Construction of LCS Phase II will also result in tailpipe emissions from a variety of sources, including cranes, loaders, excavators, graders, generators, vibratory rollers, concrete emplacement trucks, and crew trucks. It is proposed that the following measures be employed to reduce emissions from vehicles and construction equipment during project construction:

- Properly maintain construction equipment in accordance with manufacturers' specifications or standard practices
- Limit truck idling to the extent practicable

The simple-cycle natural gas-fired CTs associated with LCS Phase II will be equipped with Dry Low Emissions (DLE) combustor and SCR to achieve a high level of NO_x control. Use of these control systems along with the primary fuel of natural gas and operating limits imposed by required air emissions operating permits are anticipated to mitigate impacts to ambient air quality and ensure compliance with applicable state and National Ambient Air Quality Standards (NAAQS).

4.7 Noise

4.7.1 Acoustic Background and Terminology

The term “sound level” is often used to describe two different sound characteristics called sound power and sound pressure. Every source that produces sound has a sound power level (Lw). The sound power level is the acoustical energy emitted by a sound source and is an absolute number that is not affected by the environment. The acoustical energy produced by a source propagates through a media as pressure fluctuations. These pressure fluctuations, also called sound pressure (Lp), are what human ears hear and microphones measure.

Sound energy is physically characterized by amplitude and frequency. Sound amplitude is measured in decibels (dB) as the logarithmic ratio of a sound pressure to a reference sound pressure (20 microPascals). The reference sound pressure corresponds to the typical threshold of human hearing. A 3 dB change in a continuous broadband sound is generally considered “just barely perceptible” to the average listener. A 5 dB change is generally considered “clearly noticeable” and a 10 dB change is generally considered a doubling (or halving) of the apparent loudness.

Frequency is measured in hertz (Hz), which is the number of cycles per second. The typical human ear can hear frequencies ranging from approximately 20 to 20,000 Hz. Normally, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the low and high frequencies. As such, the A-weighting scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. Any sound level to which the A- weighting scale has been applied is expressed in A-weighted decibels or dBA. For reference, the A-weighted sound pressure level and subjective loudness associated with some common sound sources are listed in Table 4-4.

Sound in the environment is constantly fluctuating; examples could be when a car drives by, a dog barks, or an aircraft passes overhead. Therefore, sound metrics have been developed to quantify fluctuating environmental sound levels. These metrics include the exceedance sound levels. The exceedance sound level, Lx, is the sound level exceeded “x” percent of the sampling period and is referred to as a statistical sound level. The most common Lx value is Leq. Leq is the average sound level for a given time period. Another common sound metric is Ldn. Ldn is a 24-hour average sound level that is often used to represent community sound levels. A 10-dB nighttime penalty is added to the nighttime hours to account for added sensitivity to noise during the night. Leq and Ldn are presented in this analysis.

Table 4-4: Sound Pressure Level, Subjective Evaluation, and Environment

Sound Pressure Level (dBA)	Subjective Evaluation	Environment	
		Outdoor	Indoor
140	Deafening	Jet aircraft at 75 ft	
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 ft	
120	Threshold of feeling	Elevated train	Hard rock band
110		Jet flyover at 1,000 ft	Inside propeller plane
100	Very loud	Power mower, motorcycle at 25 ft, auto horn at 10 ft, crowd sound at football game	
90		Propeller plane flyover at 1,000 ft, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately loud	Diesel truck (40 mph) at 50 ft	Inside auto at high speed, garbage disposal, dishwasher
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner
60	Moderate	Air-conditioner condenser at 15 ft, near highway traffic	General office
50	Quiet		Private office
40		Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Inside average residence (without TV and stereo)
20		Rustling leaves	Quiet theater, whisper
10	Just audible		Human breathing
0	Threshold of hearing		

Source: Adapted from Egan (1988) and Ramsey and Sleeper (1994)

Burns & McDonnell analyzed the sound levels of the proposed LCS using a predictive, three-dimensional noise model (CadnaA) based on the methodologies presented in the ISO-9613 standards. The model analyzed the sound levels expected at the nearest residences to the LCS for two scenarios: 1) one CT unit, and 2) three CT units. Additionally, the model analyzed sound levels over a gridded area to produce sound contours that covered the area that could possibly be impacted from the sound levels of the LCS.

4.7.2 Description of Resources

There are few nearby houses or businesses in the vicinity of LCS. Most houses are located to the north along U.S. Route 85and a commercial area that has developed to the northwest of the LSC site. Currently, there is community noise from the operation of one unit at the LCS. Based on modeling of the proposed Project in 2012, the sound level at the closest nearby receptor is expected to be 38.0 dBA or a 24-hour average sound level (Ldn) of 44.4 dBA, noticeably lower than the HUD guideline of 65 dBA. This is considered the quiet sound level at the exterior of a residence, and standard housing construction will reduce outside noise levels by 10 to 20 dB relative to outside noise levels.

4.7.3 Impacts

4.7.3.1 Facility Noise

Nearby residences are mostly located to the north of the proposed Project and the commercial area is to the northwest of the proposed Project. The modeled L_{eq} and L_{dn} sound pressure levels for each of the nearest structures are shown in Table 4-5. The closest structure is one-half mile from LCS. The single unit and three unit scenarios were analyzed. Figure 4-1 provides a graphic illustration of the sound levels expected with three-unit operation. Additional details are included in the noise analysis memo in Appendix A-3.

Table 4-5: Expected Worst-Case L_{eq} and L_{dn} Sound Levels

Receiver	Sound Pressure Level			
	One Unit Leq (dBA)	One Unit Ldn (dBA)	Three Units Leq (dBA)	Three Units Ldn (dBA)
Residential (Res) 1	26.5	32.9	29.8	36.3
Res2	28.0	34.5	32.0	38.4
Res3	31.8	38.2	35.2	41.6
Res4	23.5	29.9	28.4	34.8
Res5	25.0	31.4	28.9	35.3
Res6	21.9	28.3	25.9	32.3
Commercial (Com) 1	32.3	38.7	35.1	41.5
Com2	34.9	41.3	37.5	43.9
Com 3	36.3	42.7	39.4	45.8
Com 4	38.0	44.4	40.7	47.1

When Units 2 and 3 are placed into operation (Phase II), the maximum L_{eq} sound level would approach 40.7 dBA at receptor Com 4. This equates to an L_{dn} sound level of 47.1 dBA, which is lower than the HUD guideline of 65 dBA for site acceptability. The combined sound level from operation of Units 1, 2, and 3 (LCS Phases I and II) would still be considered a quiet sound level at the exterior of a residence, and standard housing construction will reduce outside noise levels by 10 to 20 dB to the inside of a house. Noise levels due to operation of three units are expected to have little or no impact on the closest residences or commercial areas.

4.7.3.2 Construction Noise

The project has the potential to elevate local noise levels due to traffic, construction of transmission lines and the electrical generation units. However, these noise levels are deemed to be relatively short and temporary in their nature over the life of the project and cannot therefore be considered a noise impact.

4.7.4 Mitigation

The modeled operational noise levels at the sensitive noise receptors varied slightly, but all of the sound levels were below the EPA's recommended noise guidelines. Therefore, noise levels due to the operation of three units are expected to have little impact on the closest sensitive noise receptors. With no impacts expected, no mitigation is proposed.

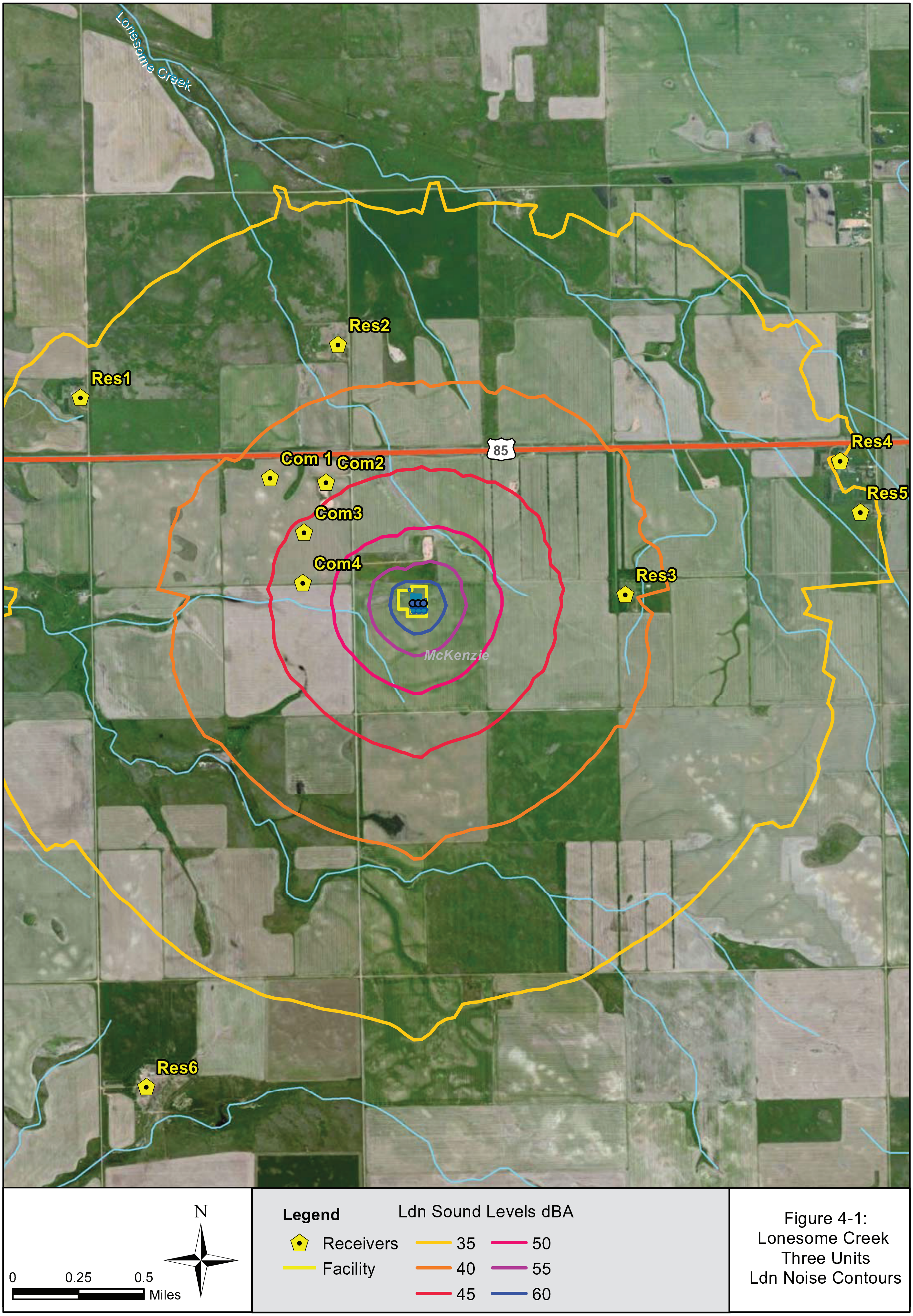


Figure 4-1:
Lonesome Creek
Three Units
Ldn Noise Contours

Path: R:\Basin\67626_LCNoise\GIS\DataFiles\ArcDocs\Figure C4-6.mxd jbell 9/30/2013

4.8 Visual Impacts

4.8.1 Description of Resources

The proposed Project site is surrounded by undeveloped areas. There are no designated natural areas in the surrounding area or adjacent to the proposed Project site. The topography is relatively rolling farm and grasslands, with riparian areas along the periphery of nearby streams. Man-made features include existing buildings, homes, commercial development, and state highways. Elevation of the LCS is approximately 2,300 feet above sea level, according to the Rawson 7.5-minute topographic map. The landscape is characterized by crop fields, and the area surrounding the LCS is used for crop production.

Existing electric infrastructure, such as transmission lines, distribution lines and substations, and oil and gas facilities, are scattered throughout the surrounding landscape. The settlements in the area are residences and farm buildings (inhabited and uninhabited) along the county and township roads. These structures are focal points in the dominant open space character of the vicinity. Typically, the farmsteads and residences are located at lower elevations or are surrounded by wind-breaks (often on the northern and/or western sides) to avoid the prevailing winds common to the area. Roads generally follow section lines.

4.8.2 Impacts

LCS Phase I has been constructed and is currently visible. The addition of LCS Phase II will be visible on the generation station site to landowners and community residents who live near the station. There will be two 80-foot stacks built as part of Phase II. The LCS Phase II Project would add additional visual elements to a power plant site that already exists.

4.8.3 Mitigation

Although the LCS Phase II will contrast with the historical surrounding land use, these areas have recently been impacted visually by the existing power plant, the newly constructed 115-kV transmission infrastructure that connects to the Hay Butte substation, and oil and gas facilities in the area. No mitigation is required.

4.9 Cultural Resources

4.9.1 Description of Resources

There are three properties in McKenzie County listed on the National Register of Historic Places, the Fairview Lift Bridge on Route 200 at the Yellowstone River, the Grassy Butte Post Office in the southern part of the county, and the Sandstone School in Keene. None of these properties are close to the proposed

Project. A Class III cultural resource inventory was conducted in 2012 by Metcalf Archaeological Consultants, Inc. (MAC) for the LCS property and transmission line corridor prior to construction of Phase I (Appendix A-4). No historic properties were found.

4.9.2 Impacts

Based on the results of the Class III cultural resource inventory conducted for the Project, MAC recommended a finding of no historic properties affected. By letter of December 4, 2012, the State Historic Preservation Officer (SHPO) concurred with this determination (Appendix B). There would be no impacts to cultural resources.

4.9.3 Mitigation

No mitigation is needed because no cultural resources would be affected. In the event of unanticipated discoveries, Basin has in place an Unanticipated Discoveries Plan (Appendix A-5).

4.10 Recreational Resources

4.10.1 Description of Resources

Recreational opportunities in McKenzie County include camping, hiking, biking, swimming, golfing, hunting, fishing and nature observation. Review of state and federal databases indicates that no national wildlife refuges, state wildlife management areas, state game refuges, game management areas, nature preserves, or county parks are present within the LCS area. The closest public land is school trust property (North Dakota State Land Department lands) with tracts located four miles to the north (T151N, R101W, Section 36), four miles to the northeast (T150N, R100W, Section 16), and four miles to the southwest (T150N, R102W, Section 36). These lands are open to walk-in hunting unless otherwise posted. The closest federal land is Little Missouri National Grassland property seven miles to the west. Theodore Roosevelt National Park is located 13 miles to the southeast. Lake Sakakawea, a federal reservoir used for water supply and recreation, is located 14 miles to the north.

No National Wild and Scenic Rivers or streams on the Nationwide Rivers Inventory (NRI) are located near the site. However, the Little Missouri River through the badlands in McKenzie County is on the NRI list, as is the Missouri River at its confluence with the Yellowstone near Fort Union Trading Post National Historic Site. The closest reach of the Little Missouri River is 15 miles to the southeast and the Yellowstone-Missouri confluence is 22 miles to the northwest.

4.10.2 Impacts

Recreational impacts would primarily be visual in nature and limited to individuals using private property in the area for hiking, hunting, fishing, or nature observation. No adverse effects to recreational resources are anticipated.

4.10.3 Mitigation

Recreational resources would not be impacted by LCS Phase II; therefore, no mitigation is proposed.

4.11 Effects on Land-based Economics

4.11.1 Description of Resources

4.11.1.1 Agriculture/Farming

McKenzie County is consistently one of the top ten counties in North Dakota for the production of durum wheat, lentils, sugar beets, and cattle (USDA 2012a). In 2007, McKenzie County had approximately 1,074,700 acres of farmland (roughly 59 percent of the total county area) classified as farmland from 585 farms (USDA 2012b). About 35 percent of the county is cropland or pasture, 30 percent is privately owned native rangeland, 30 percent is federal land, and 5 percent is other land (Aziz, Champa, and VanderBusch 2006). The current site is industrial; however, agriculture takes place on adjacent properties. There is no nearby irrigated land.

4.11.1.2 Woodlands

No forestry resources are located on the LCS site due to the previous land use as agricultural and present land use as industrial.

4.11.2 Impacts

4.11.2.1 Agriculture/Farming

Impacts to agriculture will be nominal. No impacts are anticipated to animal health and safety due to the construction or operation of LCS Phase II. The land surrounding the energy conversion facility will continue to be available for agriculture uses. Permanent impacts will occur in the area already disturbed for LCS Phase I. Any temporary impacts, such as soil disturbance, would have either already occurred on the plant site during the construction of LCS Phase I or will be incurred on the additional 22-acre laydown area required to support Phase II construction activity. No heavy equipment use of adjacent agricultural soils would occur. The approximately 22-acre laydown area to the east of the plant site will be temporarily unavailable for agricultural uses during construction. Following construction, this area will be restored to its original condition to the extent practicable and will be available for agricultural uses.

4.11.2.2 Woodlands

Because no forestry resources are located on the site, there would be no impacts to woodlands.

4.11.3 Mitigation

4.11.3.1 Agriculture/Farming

The site has been previously disrupted for LCS Phase I and no mitigation is proposed.

4.11.3.2 Woodlands

No woodlands are located within the LCS site and no mitigation is proposed.

4.12 Soils

4.12.1 Description of Resources

Soils of the Missouri Plateau are primarily Mollisols and Entisols which developed under grassland vegetation. The proposed Project site contains three soil groups. The Tally-Parshall fine sandy loams are Mollisols formed in glacial outwash. They are considered farmland of statewide importance. The county contains 10,946 acres of Talley-Parshall soils of statewide importance, or 0.6 percent of the county. The Dooley-Zahl complex includes Mollisols formed in uplands over glacial till, found on knolls or ridges. Neither soil series is prime farmland. The Vebar-Flasher complex, also found on uplands, consists of Mollisols and Entisols. Both soil series weathered from sandstone, and neither is prime farmland. The soils on the Project site are shown in Figure 3 (Appendix C). None of the soils on the LCS site are considered hydric (Aziz, Champa, and VanderBusch 2006).

4.12.2 Impacts

The project area is already occupied by LCS Phase I and no further permanent soil mpacts would occur. The approximately 22-acre laydown area to the east of the plant site would be temporarily disturbed during construction. Crews will limit ground disturbance wherever possible, and the laydown area will be restored to its original condition to the extent practicable.

4.12.3 Mitigation

Erosion control measures will be implemented as necessary for the construction of LCS Phase II.

4.13 Geologic and Groundwater Resources

4.13.1 Description of Resources

The Missouri Plateau was unglaciated during the late Pleistocene glaciations which affected the area of North Dakota north and east of the Missouri River. However, occasional erratic boulders from earlier glaciations are present. The landscape consists of level to rolling plains with isolated sandstone buttes. Formations are Tertiary in geologic age, with sandstone, shale and some coal. The geologic formation underlying the Missouri Plateau in McKenzie County is the Sentinel Butte formation (Bluemle 1977). Oil field development associated with the Bakken play is ongoing in the area. Lignite resources and salt beds are also present and range from near the surface to as much as 800 feet deep (Carlson 1985).

The proposed Project site is generally flat, with a ground elevation of 2,300 feet above mean sea level (MSL). A prominent hill, Hay Butte, is approximately two miles to the southeast, and Tub Butte and A Butte are approximately four miles to the northwest, near Alexander. The limit of glaciation was south of the proposed Project site, along a line formed by Bennie Peer Creek and the Little Missouri River (Carlson 1985). The closest identified paleontological sites are in the Theodore Roosevelt National Park (South Unit), which is located 50 miles to the south of the LCS.

According to the North Dakota Geological Survey (NDGS), North Dakota is located in an area of very low earthquake probability. There are no known active tectonic features in south-central North Dakota and the deep basement formations underlying North Dakota are expected to be geologically stable (Bluemle 1991). This information is supported by USGS seismic hazard maps, which show that the LCS would be located in an area with very low seismic risk (USGS 2008). Related hazards, such as soil liquefaction, are therefore also unlikely.

Aquifers underlying McKenzie County are found in rocks of Cretaceous and Tertiary age, from 140 to 1,800 feet deep. The Tertiary aquifers are in the Ludlow and Tongue River formations, while the deeper Cretaceous aquifers are in the basal Hell Creek and Fox Hills formations. There are also deeper aquifers in older rocks extending to 15,000 feet in depth, but they tend to be brackish and not an important resource. Shallow aquifers also exist in sediments along the major streams and rivers, including Charbonneau, Tobacco Garden, and Cherry Creeks as well as the Little Missouri, Yellowstone, and Missouri Rivers. Yields from the aquifers are 100 gallons per minute. Groundwater slowly flows northeast and is recharged from the south (Croft 1985). The McKenzie County Water Resource District in Watford City obtains water from Lake Sakakawea and the Watford City Reservoir and is the water supplier to the plant site.

4.13.2 Impacts

There are no anticipated impacts to geologic resources. However if an unanticipated spill occurs at the LCS site Basin Electric has a SPCC plan and mitigation in place.

4.13.3 Mitigation

The construction contractor would minimize the likelihood of spilling fuel, hydraulic fluid, or other regulated materials by ensuring that refueling takes place at secure areas. Spill kits would be maintained at these sites to contain and clean up any spills that may occur. Construction crew members would be trained in spill prevention and clean up.

4.14 Surface Water and Floodplain Resources

4.14.1 Description of Resources

The facility is located in the Lonesome Creek watershed. Lonesome Creek is an intermittent tributary to Charbonneau Creek, which in turn confluences with the Yellowstone River about eight miles south of the Missouri River. The average annual rainfall in Watford City is 15 inches. No surface water is found on the site. The National Hydrography Dataset (NHD) data indicates the presence of a stream on the western boundary of the LCS property. However, a field review conducted by Western EcoSystems Technology, Inc. (WEST) on January 27, 2012, found no streams on the property (Appendix A).

Flood Insurance Rate Maps (FIRM) have not been prepared for McKenzie County outside of Alexander and Watford City. However, the pattern of floodplain areas in these cities indicates that floodplains will occur along the major streams, such as Lonesome Creek. Because there are no major streams on the site, there are no 100-year floodplains near the proposed Project site.

4.14.2 Impacts

A rural water line currently supplies water to the site and has adequate capacity for the proposed Project. Storm water from the existing LCS facility is captured and retained in an on-site pond. The facility would not discharge storm water external to the site. All runoff and spray mist blowdown overflow would be diverted to the storm water pond. Sanitary wastewater would be generated as a result of staffing the facility and would be directed to a state-approved mound septic system. Therefore, construction and operation of the proposed Project would not result in any long-term or short-term impacts to water quality. Because storm water would be captured in an on-site pond and because of the distance from LCS to Lonesome Creek, there would be no impacts to surface water or floodplains.

4.14.3 Mitigation

The Phase II construction contractor will prepare, apply for, and obtain the necessary NPDES storm water permit and approved SWPPP for Phase II. Basin Electric will maintain an NPDES permit for the continued operation of the storm water pond. No impacts to surface water or floodplains are anticipated; therefore, no mitigation is being proposed.

4.15 Wetlands

4.15.1 Description of Resources

WEST reviewed National Wetland Inventory (NWI), NHD, and SSURGO soils data for the entire 160-acre property containing the energy conversion facility and conducted a field review of wetland features on the property on January 27, 2012 (Appendix A-6). Based on the data review and field survey, no wetlands, water bodies, or hydric soils were identified on the property. The NWI data indicates that the closest wetlands are in Section 22 about one mile to the northwest, along Lonesome Creek two miles to the north, or along Antelope Creek two miles to the southwest.

4.15.2 Impacts

There are no wetlands within the LCS property. No impacts to wetlands would occur.

4.15.3 Mitigation

Because no wetlands are present on the site, no mitigation is necessary.

4.16 Vegetation

4.16.1 Description of Resources

In McKenzie County, a mosaic of spring wheat, alfalfa, and grazing land covers land that was formerly short grass prairie. Spring wheat is a predominant crop with other acreage in barley, oats, and sunflowers. Native areas consist of mixed grasses including blue grama, wheatgrass, needlegrass, and little bluestem. Forbs include prairie sandreed. Lands adjacent to the proposed Project site have been used for cultivated crops in the past, and this use is likely to continue.

4.16.2 Impacts

No vegetation is present on the proposed construction site for LCS Phase II.

4.16.3 Mitigation

Because no vegetation is present, no mitigation is being proposed. However, Basin Electric will inspect and control noxious weeds immediately after construction and periodically for the life of the project.

4.17 Wildlife

4.17.1 Description of Resources

The proposed Project site is already converted to industrial use and does not provide good wildlife habitat. Wildlife found in the area surrounding the site would be species typical of the northwestern Great Plains. Typical big game species may include white-tailed deer, mule deer, pronghorn, and elk. Bighorn sheep occur in McKenzie County badlands areas to the south of the proposed Project. Typical other mammals include coyote, mountain lion, porcupine, badger, striped skunk, and bobcat. Game birds expected in the area are ring-necked pheasant, gray partridge, sharp-tailed grouse, and wild turkey. The prairie pothole region is north and east of the Missouri River, so waterfowl and shorebirds would not be expected to be common at the proposed Project site; however, species like killdeer often are attracted to graveled areas such as parking lots. Migratory birds would be those of the western prairies, including western meadowlark, yellow warbler, black-headed grosbeak, chipping sparrow, grasshopper sparrow, northern oriole, and loggerhead shrike. Resident birds may include horned lark, black-capped chickadee, white-breasted nuthatch, blue jay, and American crow. Raptors such as red-tailed hawk, American kestrel, prairie falcon, and turkey vulture are likely found in the area, but there are no raptor nests observed near the site.

4.17.2 Impacts

The proposed Project is not anticipated to result in any long-term or permanent impacts to wildlife species. Construction of the proposed Project would take place at the existing LCS site, which has already been disturbed to develop an operational power plant. Noise and human activity that are associated with construction would result in short-term, temporary displacement impacts to wildlife species foraging in the area. The noise and human activity would temporarily deter wildlife species from using the areas in the immediate vicinity of construction; however, following completion of construction, the wildlife species would be expected to return.

4.17.3 Mitigation

To ensure wildlife impacts are minimized during construction and operation, Basin Electric will maintain sound water and soil conservation practices during construction and operation of the LCS to protect topsoil and adjacent resources and to minimize soil erosion. To minimize erosion during and after construction, North Dakota BMPs for erosion and sediment control (SN 19389 9/99) will be utilized. These practices include temporary seeding, permanent seeding, mulching, filter strips, erosion blankets, grassed waterways, and sod stabilization. Basin Electric is committed to minimizing wildlife impacts.

4.18 Rare and Unique Natural Resources

4.18.1 Description of Resources

The Endangered Species Act (ESA) of 1973, as amended, provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. Federally threatened species are those species likely to become endangered within the foreseeable future throughout all or a significant portion of their range. Federally endangered species are those species already in danger of extinction throughout all, or a significant portion of, their range. According to the USFWS letter of February 1, 2013 (Appendix B), McKenzie County may contain suitable habitat for, or have known occurrences of, three federally listed endangered species and one federally-listed threatened species. Two of these species, the interior least tern and pallid sturgeon, are associated with large rivers such as the Yellowstone and Missouri and would not be found at the proposed Project site. Critical habitat for the piping plover in McKenzie County is along the Missouri and Yellowstone Rivers and does not include the project site. The LCS site is located in the migration corridor of the Aransas Wood Buffalo Population of the whooping crane. However, the proposed Project is not located near any wetlands or riparian areas that would be used for feeding or roosting.

Two candidate species are found in McKenzie County. Both the Sprague's pipit and Dakota skipper are associated with native prairie. Review of aerial photography and land cover maps of the LCS indicate that no suitable native prairie habitat is present within the area; therefore, Sprague's pipits and the Dakota skipper are unlikely to utilize this area. These species, along with their federal and state designations of possible occurrence, are shown in Table 4-6.

Table 4-6: McKenzie County Listed Species

Common Name	Scientific Name	Federal Status	Critical Habitat in McKenzie County
Whooping Crane	*Grus americana*	E	No
Piping Plover	*Charadrius melodus*	T	Yes[1]
Interior Least Tern	*Sterna antillarum*	E	No
Spragues Pipit	*Anthus spragueii*	C	n/a
Pallid Sturgeon	*Scaphirhynchus albus*	E	No
Dakota Skipper	*Hesperia dacotae*	C	n/a

Source: USFWS
[1]Critical habitat in McKenzie County is sparsely vegetated sandbars along the Missouri River.

The Bald and Golden Eagle Protection Act (BGEPA) provides for the protection of the bald eagle and golden eagle, both of which may occur within McKenzie County. Migratory bird habitats generally consist of breeding and foraging habitat. Many migratory waterfowl utilize wetland areas within McKenzie County during the breeding season, while additional species may use agricultural fields and wetland areas for foraging. Bald and golden eagles can occur throughout McKenzie County, but are found more often near food sources and nesting areas. Bald eagles are primarily found in forested areas near large bodies of water such as the Missouri River, Little Missouri River, and Lake Sakakawea. Golden eagles may be found in more rugged badland areas associated with these rivers.

4.18.2 Impacts

No impacts on rare and unique resources would occur as a result of the construction of LCS Phase II.

4.18.3 Mitigation

Because golden eagles are found in McKenzie County, USFWS recommended a field survey within one mile of the construction site. Basin Electric will implement this survey and will consult with USFWS should nesting golden eagles be observed.

Out of an abundance of caution, the USFWS has recommended that the proposed Project include a commitment to stop construction should the whooping crane be observed in the area. Basin Electric will implement this commitment.

4.19 Summary of Site Impacts

Table 4-7 summarizes the resources that will be impacted as a result of the construction of the project and the appropriate mitigation.

Table 4-7: Summary of Impacts and Mitigation

Resource	Impact	Mitigation
Demographics and Socioeconomics	Socioeconomic impacts are primarily positive due to increased expenditures during construction and the long-term benefits of an increased tax base of the county due to property taxes.	No mitigation measures are necessary.
Land Use	No impacts.	No mitigation measures are necessary.
Public Services	No impacts	No mitigation measures are necessary.

Resource	Impact	Mitigation
Human Health and Safety	No impacts	Basin Electric will develop a Risk Management Plan and will coordinate with Local Emergency Responders.
Air	Minor impacts would occur from natural gas combustion and fugitive dust during construction.	Fugitive dust would be controlled by standard dust control measures. The natural gas-fired CTs would be equipped with DLE combustor and SCR to achieve NOx control. Basin Electric has submitted a Permit to Construct from the NDDH for LCS Phase II.
Noise	The noise sensitive land uses are the residences near the LCS. Noise impacts are nominal. No impacts to noise sensitive land uses are anticipated.	No mitigation measures are proposed.
Visual	The LCS Phase II Project would add additional visual elements to a power plant site that already exists.	Because the area has already been impacted by LCS Phase I, transmission line construction, and oil field development, no additional mitigation is necessary.
Cultural and Archaeological	No impacts	No mitigation measures are necessary.
Recreational Resources	No impacts	No mitigation measures are necessary.
Land Based Economies	No impacts	No mitigation measures are necessary.
Soils	No impacts	Basin Electric will maintain sound water and soil conservation practices during construction and operation of the LCS to protect topsoil and adjacent resources and to minimize soil erosion.
Geologic and Groundwater Resources	No impacts	The construction contractor would minimize the likelihood of spilling fuel, hydraulic fluid, or other regulated materials by ensuring that refueling takes place at secure areas. Spill kits would be maintained at these sites to contain and clean up any spills that may occur. Construction crew members would be trained in spill prevention and clean up
Surface Water and Floodplain Resources	No impacts	An NPDES permit and SWPPP has been acquired from the North Dakota Department of Health.
Wetlands	No impacts	No mitigation measures are necessary
Vegetation	No impacts	Basin Electric will inspect and control noxious weeds immediately after construction and periodically for the life of the project.

Resource	Impact	Mitigation
Wildlife	No impacts	Basin Electric will maintain sound water and soil conservation practices during construction and operation of the LCS to protect topsoil and adjacent resources and to minimize soil erosion.
Rare and Unique Natural Resources	No impacts	Basin electric will implement a field survey within one mile of the construction site for the presence of golden eagles. Basin Electric will stop construction should Whooping Cranes be observed in the area and consult with the USFWS.

5.0 PUBLIC AND AGENCY COORDINATION

Keeping the public informed on the status of the LCS Phase II development is a key component to its success. Principal stakeholders in the LCS area are landowners in the area and other oil/gas and energy interests. The storage volume of anhydrous ammonia exceeds the threshold of planning quantities (TPQ) as set forth in the EPA's Clean Air Act Section 112(r) regulations of 10,000 pounds (40 CFR Part 68.130). This program requires any facility that has materials above the TPQ to develop a Risk Management Program, prepare a Risk Management Plan (RMP), submit the RMP to EPA, and coordinate with the local emergency planning committee.

Correspondence regarding LCS Phase II was sent to federal and state agencies for comment. Agency response letters for the LCS Phase II Project are included in Appendix B. Responses were received from the USACE, USDA-Forest Service, USDA-Natural Resources Conservation Service, US EPA, USDI-Bureau of Indian Affairs, USDI-Fish and Wildlife Service, North Dakota Department of Health, North Dakota Department of Transportation, North Dakota Forest Service, North Dakota Game and Fish Department, North Dakota State Water Commission, and State Historical Society of North Dakota.

6.0 IDENTIFICATION OF REQUIRED PERMITS/APPROVALS

6.1 Permits/Approvals

The Federal and state permits or approvals that have been identified as potentially being required for the construction and operation of the Project are shown in Table 6-1.

Table 6-1: Possible Permits and Approvals

Agency	Type of Approval	Status*	Need
Federal Approvals			
Rural Utilities Service	Financial assistance	Environmental Assessment public review and comment period ends October 11, 2013	RUS must complete National Environmental Policy Act compliance prior to providing financing
EPA	Risk Management Program	Pending	Required when the quantity of anhydrous ammonia on site exceeds 10,000 pounds
State of North Dakota			
Public Service Commission	Certificate of Site Compatibility	Subject of this Application	Included herein
	Site Permit	Subject of this Application	Included herein
North Dakota Department of Health	Air permit, Prevention of Significant Deterioration (PSD)	Permit to Construct issued September 16, 2013	New facilities are required to obtain a Permit to Construct prior to construction

Agency	Type of Approval	Status*	Need
	NPDES Permit: General Construction Storm Water	Permit acquired by Basin Electric's Contractor	Permits required if: • land disturbance (clearing, grading or excavating) is greater than or equal to one acre, or • land disturbance is less than one acre and the site is part of a larger common plan of development or sale with the total land area disturbed in the development being equal to or greater than one acre or, • there is potential for contribution to a violation of a water quality standard or potential for significant contribution of pollutants to waters of the state Permit application requires the preparation of a Storm Water Pollution Prevention Plan (SWPPP).
	NDPDES Industrial Storm Water Permit	Permit is being prepared	Permit required for storm water discharge at industrial facilities
North Dakota Highway Patrol	Overheight/ Overweight Permit	If required, applicant will apply once Certificate is received and prior to transporting equipment	Permit required for hauling construction equipment and materials on state highways. Contractors will obtain as necessary
County/Local			
Alex Township	Conditional Use Permit	Received	Rezoned from Agricultural to Industrial
McKenzie County	Building Permit	Application is being developed	Additional Construction
Local Emergency Planning Committee	File Emergency Response Plan	Plan is being developed	Emergency Management Plan

7.0 FACTORS CONSIDERED

NDCC Section 49-22-09 of the North Dakota Energy Conversion and Transmission Facility Siting Act lists 11 factors to guide the NDPSC in evaluation of the Site. The following sections address these factors where applicable to the LCS.

7.1 Public Health and Welfare, Natural Resources, and the Environment

The preceding sections discuss the research and investigations relating the effects of the proposed facility on public health and welfare, natural resources, and the environment. Chapter 4 details the research and investigations that were used to identify expected environmental impacts and mitigation in relation to the LCS Phase II. Chapter 3 discussed construction and operation techniques. All impacts evaluated in the LCS Phase II are minor.

7.2 Technologies to Minimize Adverse Environmental Effects

Basin Electric will utilize the most recent generation station technologies and systems that minimize impacts to the environment. Chapter 3 discusses the engineering and operational design of LCS Phase II, including the proposed unit type and construction techniques. These technologies and techniques are the most appropriate technologies to minimize adverse environmental effects. This is evident in the minimal environmental effects identified by the research and investigations discussed in this application.

7.3 Potential for Beneficial Uses of Waste Energy

This factor is not applicable to this project.

7.4 Unavoidable Adverse Environmental Effects

Chapter 4 details the research and investigations that were used to identify expected environmental impacts and mitigation in relation to LCS Phase II. The environmental effects of LCS Phase II are minor. Unavoidable adverse environmental effects include the visual impacts associated with the LCS Phase II facility and noise from operation of the facility. This is an area with other pre-existing visual and noise impacts including transmission lines and oil and gas development; the proposed facility would not significantly increase these impacts.

7.5 Irreversible and Irretrievable Commitment of Natural Resources for the Site

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action. There are few commitments of resources associated with this project that are irreversible and irretrievable, but include those resources primarily related to construction. Resources that will be used to construct the project include aggregate resources, concrete, steel, and hydrocarbon fuel.

7.6 Direct and Indirect Economic Impacts of the Proposed Facility

The direct and indirect economic impacts are positive. To the extent that local contractors are used for portions of the construction, total wages and salaries paid to contractors and workers will contribute to the total personal income of the region. Additional personal income will be generated for residents in the county and the state by circulation and recirculation of dollars paid out by Basin Electric as business expenditures and state and local taxes. Expenditures made for equipment, energy, fuel, operating supplies, and other products and services also benefit businesses in the county and the state.

7.7 Existing Development Plans of the State, Local Government, and Private Entities at or in the Vicinity of the Site

No conflicts with existing development plans were identified as part of this application. In recent years, oil and gas development has continued to expand in the McKenzie County area. It is reasonably foreseeable that areas near the LCS will be considered for gas and oil development. This is evidenced by the existing oil wells. The location of the LCS is not expected to inhibit the potential for future gas and oil development.

7.8 Effect on Scenic Areas, Cultural Resources, and Paleontological Sites

The LCS site is not located in a locally or nationally recognized scenic area or near any known paleontological sites. As indicated in Chapter 4, both of the archaeological surveys of the LCS property recommended a finding of no historic properties affected. By letter of December 4, 2012, the State Historic Preservation Officer (SHPO) concurred with this determination. There would be no impacts to cultural resources.

7.9 Effect on Biological Resources

Chapter 4 discusses potential impacts to biological resources such as wetlands, vegetation, wildlife, and rare and unique species. There would be no impacts to wetlands and rare or unique species and minor impacts to vegetation and wildlife.

7.10 Effects of Site on Sensitive Species and Habitats

Federally listed species are not known to occur within the LCS area and are not likely to be adversely impacted. Habitat for the other species listed is either completely lacking or is extremely limited in the LCS area.

7.11 Concerns Raised by Agencies

The area in the vicinity of the LCS was reviewed by state and federal agencies as part of this NDPSC permitting process. Agency comments varied according to agency function and jurisdiction, but agency comments generally emphasized a desire to minimize impacts to environmental resources such as wetlands, wildlife, and cultural resources. These environmental resources are addressed in Chapter 4 of this application. Agency response letters for the LCS Phase II project are included in Appendix B.

8.0 DEFINITIONS AND ACRONYMS

Term or Acronym	Definition
AADT	Average Annual Daily Traffic
AC	Alternating Current
ACS	American Community Survey
AQCR	Air Quality Control Region
AVS	Antelope Valley Station
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
Basin Electric	Basin Electric Power Cooperative
Btu	British thermal units
BEA	Bureau of Economic Analysis of U.S. Department of Commerce
CAA	Clean Air Act
CBM	Coal Bed Methane
CBO	Congressional Budget Office
Certificate	Certificate of Site Compatibility
CO	carbon monoxide
Corn Belt	Corn Belt Power Cooperative
Corridor Certificate	Certificate of Corridor Compatibility
CT	Combustion Turbine
dBA	A-weighted decibel
DC	Direct Current
dB	decibel
DOE	U.S. Department of Energy
EMF	Electromagnetic Field
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FIRM	Flood Insurance Rate Map
ft	foot/feet
G&T	Generation and Transmission
GDP-IPD	Gross Domestic Product-Implicit Price Deflator
GE	General Electric
GIS	Geographic Information System
gpm	gallons per minute
HHV	Higher Heating Value
Hz	Hertz
IS	Integrated System, also known as WAUE (see)

Term or Acronym	**Definition**
kV	kilovolt
kVA	kilovolt-Ampere
kWh	kilowatt-hour
L_{dn}	24-hour average sound level used to represent community sound levels
L_{eq}	average sound level for a given time period
L_p	sound pressure level
L_w	sound power level
L_x	exceedance sound level (statistical sound level)
LCS	Lonesome Creek Station
m	meter
mG	milligaus
MISO	Midwest Independent System Operator
MSL	mean sea level
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NDAAQS	North Dakota Ambient Air Quality Standards
NDAC	North Dakota Administrative Code
NDCC	North Dakota Century Code
NDDH	North Dakota Department of Health
NDDOT	North Dakota Department of Transportation
NDGS	North Dakota Geological Survey
NESC	National Electrical Safety Code
NIH	National Institutes of Health
NIPCO	Northwest Iowa Power Cooperative
NPDES	National Pollutant Discharge Elimination System
NO_2	Nitrogen dioxide
NOx	Nitrous oxides
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NSPS	New Source Performance Standards
O_3	Ozone
Pb	Lead
PCE-IPD	Personal Consumption Expenditures-Implicit Price Deflator
$PM_{2.5}$	Particulate matter less than 2.5 microns in size
PM_{10}	Particulate matter less than 10 microns in size
PPI	Producer Price Index

Term or Acronym	**Definition**
PRB	Powder River Basin
NDPSC	North Dakota Public Service Commission
RUS	Rural Utilities Service of U.S. Department of Agriculture
SCR	Selective Catalytic Reduction
SPP	Southwest Power Pool
SEDS	State Energy Data Price, Consumption, and Expenditures Data
SHPO	State Historic Preservation Officer
SO_2	Sulfur dioxide
SWPPP	Storm Water Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
V	Volt
W&P	Woods & Poole Economics, Inc.
WAUE	Western Area Power Administration Upper Great Plains Region East

9.0 QUALIFICATIONS OF CONTRIBUTORS

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APPENDIX A - STUDIES AND ASSESSMENTS

APPENDIX A-1 - ELECTRIC AND MAGNETIC FIELD QUESTIONS AND ANSWERS

June 2002

EMF

Electric and Magnetic Fields Associated with the Use of Electric Power

Questions & Answers

prepared by the

National Institute of Environmental Health Sciences
National Institutes of Health

EMF RAPID
Electric and Magnetic Fields Research and Public Information Dissemination Program

sponsored by the

NIEHS/DOE EMF RAPID Program

Contents

Introduction

Since the mid-twentieth century, electricity has been an essential part of our lives. Electricity powers our appliances, office equipment, and countless other devices that we use to make life safer, easier, and more interesting. Use of electric power is something we take for granted. However, some have wondered whether the electric and magnetic fields (EMF) produced through the generation, transmission, and use of electric power [power-frequency EMF, 50 or 60 hertz (Hz)] might adversely affect our health. Numerous research studies and scientific reviews have been conducted to address this question.

Unfortunately, initial studies of the health effects of EMF did not provide straightforward answers. The study of the possible health effects of EMF has been particularly complex and results have been reviewed by expert scientific panels in the United States and other countries. This booklet summarizes the results of these reviews. Although questions remain about the possibility of health effects related to EMF, recent reviews have substantially reduced the level of concern.

The largest evaluation to date was led by two U.S. government institutions, the National Institute of Environmental Health Sciences (NIEHS) of the National Institutes of Health and the Department of Energy (DOE), with input from a wide range of public and private agencies. This evaluation, known as the Electric and Magnetic Fields Research and Public Information Dissemination (EMF RAPID) Program, was a six-year project with the goal of providing scientific evidence to determine whether exposure to power-frequency EMF involves a potential risk to human health.

In 1999, at the conclusion of the EMF RAPID Program, the NIEHS reported to the U.S. Congress that the overall scientific evidence for human health risk from EMF exposure is weak. No consistent pattern of biological effects from exposure to EMF had emerged from laboratory studies with animals or with cells. However, epidemiological studies (studies of disease incidence in human populations) had shown a fairly consistent pattern that associated potential EMF exposure with a small increased risk for leukemia in children and chronic lymphocytic leukemia in adults. Since 1999, several other assessments have been completed that support an association between childhood leukemia and exposure to power-frequency EMF. These more recent reviews, however, do not support a link between EMF exposures and adult leukemias. For both childhood and adult leukemias, interpretation of the epidemiological findings has been difficult due to the absence of supporting laboratory evidence or a scientific explanation linking EMF exposures with leukemia.

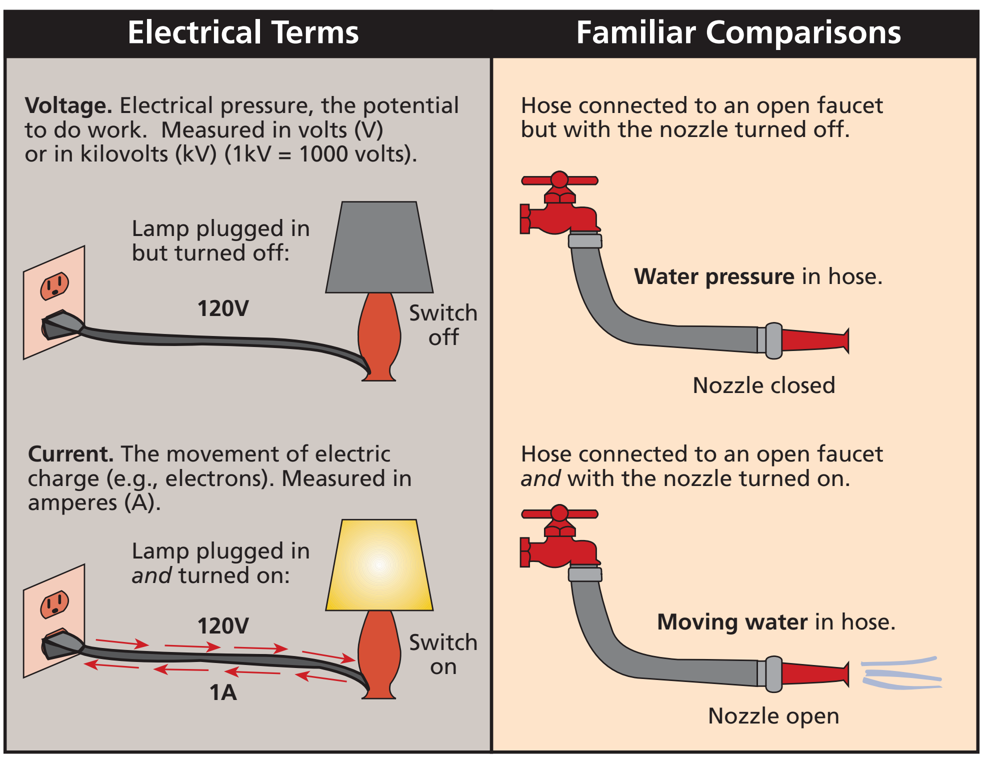
EMF exposures are complex and exist in the home and workplace as a result of all types of electrical equipment and building wiring as well as a result of nearby power lines. This booklet explains the basic principles of electric and magnetic fields, provides an overview of the results of major research studies, and summarizes conclusions of the expert review panels to help you reach your own conclusions about EMF-related health concerns.

1 EMF Basics

This chapter reviews terms you need to know to have a basic understanding of electric and magnetic fields (EMF), compares EMF with other forms of electromagnetic energy, and briefly discusses how such fields may affect us.

Q What are electric and magnetic fields?

A Electric and magnetic fields (EMF) are invisible lines of force that surround any electrical device. Power lines, electrical wiring, and electrical equipment all produce EMF. There are many other sources of EMF as well (see pages 33–35). The focus of this booklet is on power-frequency EMF—that is, EMF associated with the generation, transmission, and use of electric power.



Voltage produces an electric field and current produces a magnetic field.

Electric fields are produced by voltage and increase in strength as the voltage increases. The electric field strength is measured in units of volts per meter (V/m). Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as the current increases. Magnetic fields are measured in units of gauss (G) or tesla (T).

Most electrical equipment has to be turned on, i.e., current must be flowing, for a magnetic field to be produced. Electric fields are often present even when the equipment is switched off, as long as it remains connected to the source of electric power. Brief bursts of EMF (sometimes called "transients") can also occur when electrical devices are turned on or off.

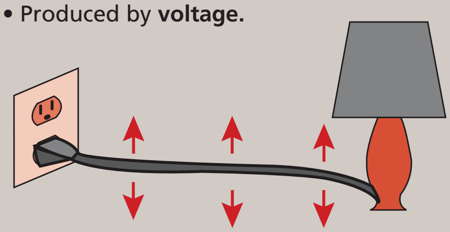
Electric fields are shielded or weakened by materials that conduct electricity—even materials that conduct poorly, including trees, buildings, and human skin. Magnetic fields, however, pass through most materials and are therefore more difficult to shield. Both electric fields and magnetic fields decrease rapidly as the distance from the source increases.

Even though electrical equipment, appliances, and power lines produce both electric and magnetic fields, most recent research has focused on potential health effects of magnetic field exposure. This is because some epidemiological studies have reported an increased cancer risk associated with estimates of magnetic field exposure (see pages 19 and 20 for a summary of these studies). No similar associations have been reported for electric fields; many of the studies examining biological effects of electric fields were essentially negative.

A Comparison of Electric and Magnetic Fields

Electric Fields

- Produced by **voltage.**

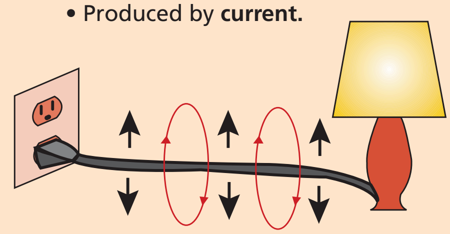


Lamp plugged in but turned off. Voltage produces an electric field.

- Measured in **volts per meter (V/m)** or in **kilovolts per meter (kV/m).**
- **Easily shielded** (weakened) by conducting objects such as trees and buildings.
- Strength decreases rapidly with increasing distance from the source.

Magnetic Fields

- Produced by **current.**

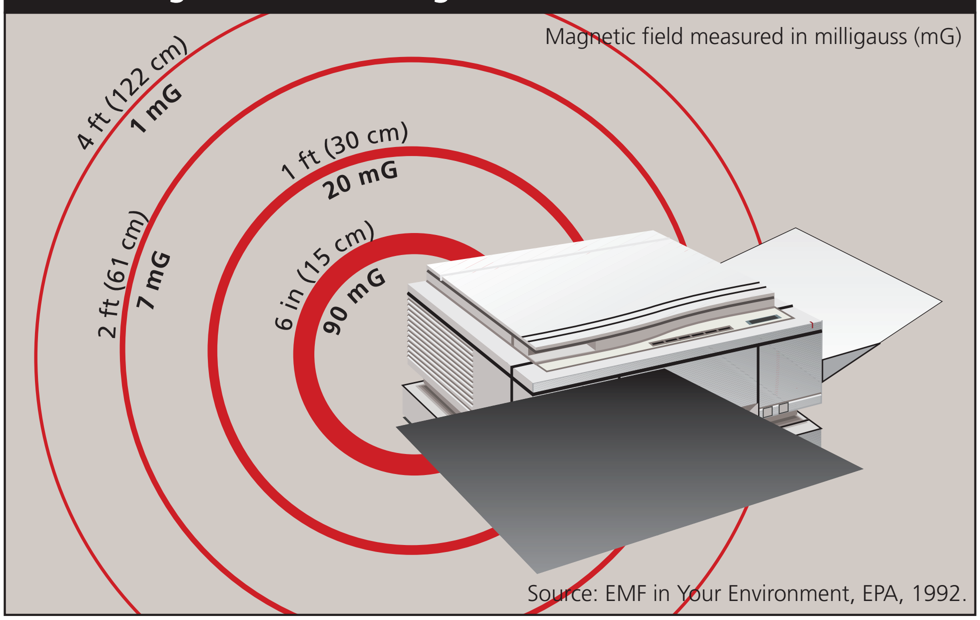


Lamp plugged in and turned on. Current now produces a magnetic field also.

- Measured in **gauss (G)** or **tesla (T).**
- **Not easily shielded** (weakened) by most material.
- Strength decreases rapidly with increasing distance from the source.

An appliance that is plugged in and therefore connected to a source of electricity has an electric field even when the appliance is turned off. To produce a magnetic field, the appliance must be plugged in and turned on so that the current is flowing.

Magnetic Field Strength Decreases with Distance



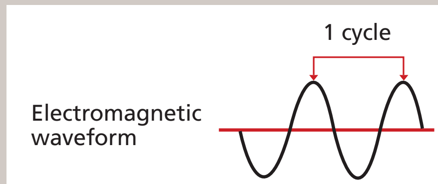
You cannot see a magnetic field, but this illustration represents how the strength of the magnetic field can diminish just 1–2 feet (30–61 centimeters) from the source. This magnetic field is a 60-Hz power-frequency field.

Characteristics of electric and magnetic fields

Electric fields and magnetic fields can be characterized by their wavelength, frequency, and amplitude (strength). The graphic below shows the waveform of an alternating electric or magnetic field. The direction of the field alternates from one polarity to the opposite and back to the first polarity in a period of time called one cycle. Wavelength describes the distance between a peak on the wave and the next peak of the same polarity. The frequency of the field, measured in hertz (Hz), describes the number of cycles that occur in one second. Electricity in North America alternates through 60 cycles per second, or 60 Hz. In many other parts of the world, the frequency of electric power is 50 Hz.

Frequency and Wavelength

Frequency is measured in hertz (Hz).
1 Hz = 1 cycle per second.



Examples:

Source	Frequency	Wavelength
Power line (North America)	60 Hz	3100 miles (5000 km)
Power line (Europe and most other locations)	50 Hz	3750 miles (6000 km)

Q How is the term EMF used in this booklet?

A The term “EMF” usually refers to electric and magnetic fields at extremely low frequencies such as those associated with the use of electric power. The term EMF can be used in a much broader sense as well, encompassing electromagnetic fields with low or high frequencies (see page 8).

Measuring EMF: Common Terms

Electric fields

Electric field strength is measured in volts per meter (V/m) or in kilovolts per meter (kV/m). 1 kV = 1000 V

Magnetic fields

Magnetic fields are measured in units of gauss (G) or tesla (T). Gauss is the unit most commonly used in the United States. Tesla is the internationally accepted scientific term. 1 T = 10,000 G

Since most environmental EMF exposures involve magnetic fields that are only a fraction of a tesla or a gauss, these are commonly measured in units of microtesla (μT) or milligauss (mG). A milligauss is 1/1,000 of a gauss. A microtesla is 1/1,000,000 of a tesla. 1 G = 1,000 mG; 1 T = 1,000,000 μT

To convert a measurement from microtesla (μT) to milligauss (mG), multiply by 10.
1 μT = 10 mG; 0.1 μT = 1 mG

When we use EMF in this booklet, we mean extremely low frequency (ELF) electric and magnetic fields, ranging from 3 to 3,000 Hz (see page 8). This range includes power-frequency (50 or 60 Hz) fields. In the ELF range, electric and magnetic fields are not coupled or interrelated in the same way that they are at higher frequencies. So, it is more useful to refer to them as "electric and magnetic fields" rather than "electromagnetic fields." In the popular press, however, you will see both terms used, abbreviated as EMF.

This booklet focuses on extremely low frequency EMF, primarily power-frequency fields of 50 or 60 Hz, produced by the generation, transmission, and use of electricity.

Q How are power-frequency EMF different from other types of electromagnetic energy?

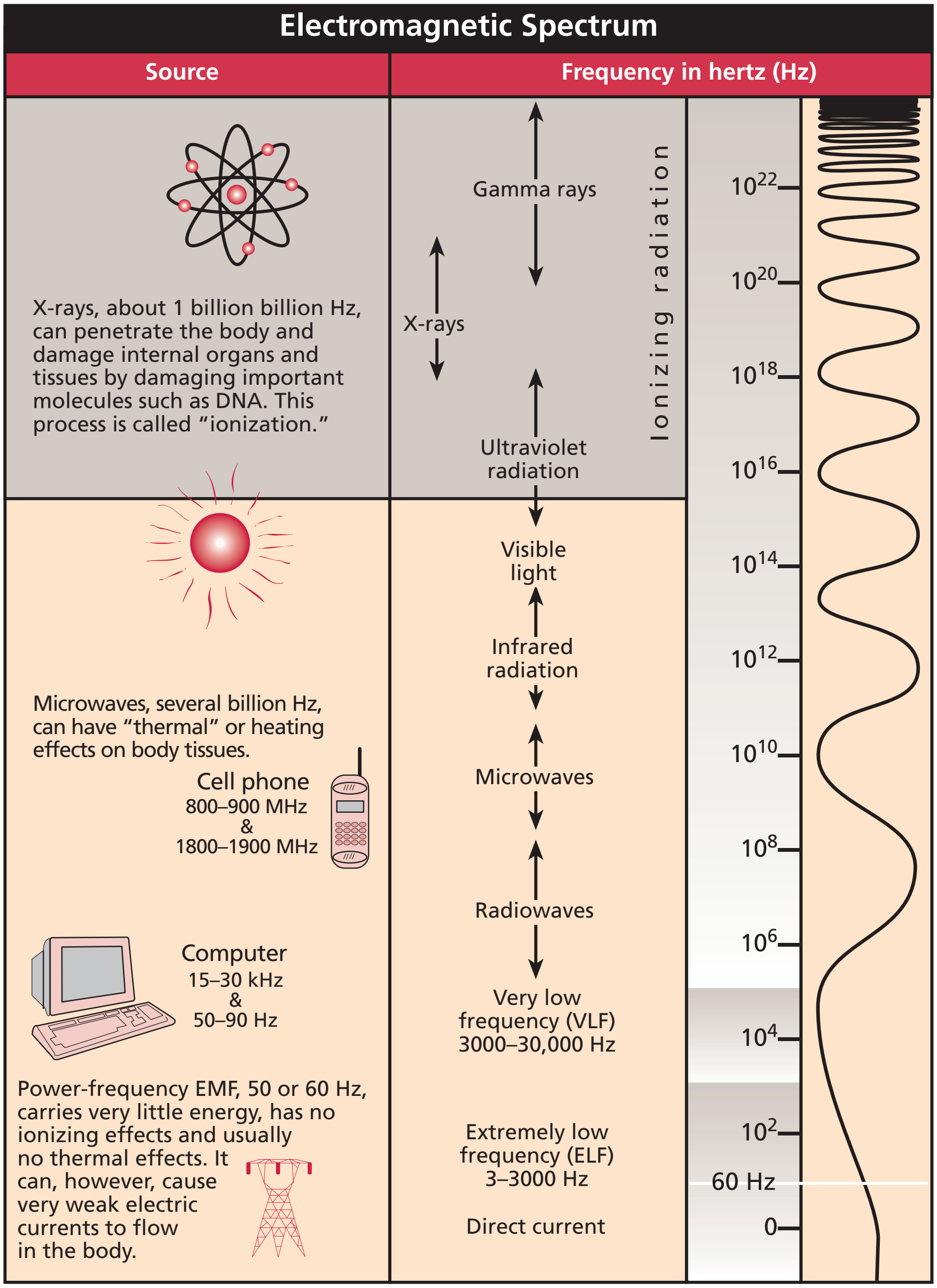
A X-rays, visible light, microwaves, radio waves, and EMF are all forms of electromagnetic energy. One property that distinguishes different forms of electromagnetic energy is the frequency, expressed in hertz (Hz). Power-frequency EMF, 50 or 60 Hz, carries very little energy, has no ionizing effects, and usually has no thermal effects (see page 8). Just as various chemicals affect our bodies in different ways, various forms of electromagnetic energy can have very different biological effects (see "Results of EMF Research" on page 16).

Some types of equipment or operations simultaneously produce electromagnetic energy of different frequencies. Welding operations, for example, can produce electromagnetic energy in the ultraviolet, visible, infrared, and radio-frequency ranges, in addition to power-frequency EMF. Microwave ovens produce 60-Hz fields of several hundred milligauss, but they also create microwave energy inside the oven that is at a much higher frequency (about 2.45 billion Hz). We are shielded from the higher frequency fields inside the oven by its casing, but we are not shielded from the 60-Hz fields.

Cellular telephones communicate by emitting high-frequency electric and magnetic fields similar to those used for radio and television broadcasts. These radio-frequency and microwave fields are quite different from the extremely low frequency EMF produced by power lines and most appliances.

Q How are alternating current sources of EMF different from direct current sources?

A Some equipment can run on either alternating current (AC) or direct current (DC). In most parts of the United States, if the equipment is plugged into a household wall socket, it is using AC electric current that reverses direction in the electrical wiring—or alternates—60 times per second, or at 60 hertz (Hz). If the equipment uses batteries, then electric current flows in one direction only. This



The wavy line at the right illustrates the concept that the higher the frequency, the more rapidly the field varies. The fields do not vary at 0 Hz (direct current) and vary trillions of times per second near the top of the spectrum. Note that 10^4 means 10 x 10 x 10 x 10 or 10,000 Hz. 1 kilohertz (kHz) = 1,000 Hz. 1 megahertz (MHz) = 1,000,000 Hz.

produces a "static" or stationary magnetic field, also called a direct current field. Some battery-operated equipment can produce time-varying magnetic fields as part of its normal operation.

Q What happens when I am exposed to EMF?

A In most practical situations, DC electric power does not induce electric currents in humans. Strong DC magnetic fields are present in some industrial environments, can induce significant currents when a person moves, and may be of concern for other reasons, such as potential effects on implanted medical devices (see page 47 for more information on pacemakers and other medical devices).

AC electric power produces electric and magnetic fields that create weak electric currents in humans. These are called "induced currents." Much of the research on how EMF may affect human health has focused on AC-induced currents.

Electric fields

A person standing directly under a high-voltage transmission line may feel a mild shock when touching something that conducts electricity. These sensations are caused by the strong electric fields from the high-voltage electricity in the lines. They occur only at close range because the electric fields rapidly become weaker as the distance from the line increases. Electric fields may be shielded and further weakened by buildings, trees, and other objects that conduct electricity.

Magnetic fields

Alternating magnetic fields produced by AC electricity can induce the flow of weak electric currents in the body. However, such currents are estimated to be smaller than the measured electric currents produced naturally by the brain, nerves, and heart.

Q Doesn't the earth produce EMF?

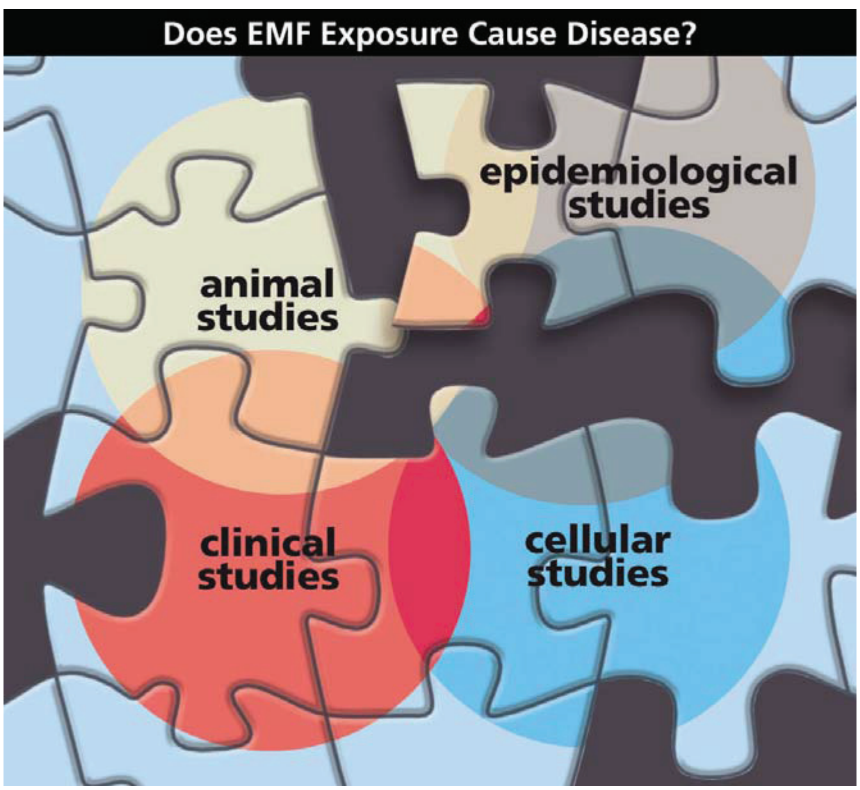
A Yes. The earth produces EMF, mainly in the form of static fields, similar to the fields generated by DC electricity. Electric fields are produced by air turbulence and other atmospheric activity. The earth's magnetic field of about 500 mG is thought to be produced by electric currents flowing deep within the earth's core. Because these fields are static rather than alternating, they do not induce currents in stationary objects as do fields associated with alternating current. Such static fields can induce currents in moving and rotating objects.

2 Evaluating Potential Health Effects

This chapter explains how scientific studies are conducted and evaluated to assess potential health effects.

Q How do we evaluate whether EMF exposures cause health effects?

A Animal experiments, laboratory studies of cells, clinical studies, computer simulations, and human population (epidemiological) studies all provide valuable information. When evaluating evidence that certain exposures cause disease, scientists consider results from studies in various disciplines. No single study or type of study is definitive.



Laboratory studies and human studies provide pieces of the puzzle, but no single study can give us the whole picture.

Laboratory studies

Laboratory studies with cells and animals can provide evidence to help determine if an agent such as EMF causes disease. Cellular studies can increase our understanding of the biological mechanisms by which disease occurs. Experiments with animals provide a means to observe effects of specific agents under carefully controlled conditions. Neither cellular nor animal studies, however, can recreate the complex nature of the whole human organism and its environment. Therefore, we must use caution in applying the results of cellular or animal studies directly to humans or concluding that a lack of an effect in laboratory studies proves that an agent is safe. Even with these limitations, cellular and animal studies have proven very useful over the years for identifying and understanding the toxicity of numerous chemicals and physical agents.

Very specific laboratory conditions are needed for researchers to be able to detect EMF effects, and experimental exposures are not easily comparable to human exposures. In most cases, it is not clear how EMF actually produces the effects observed in some experiments. Without understanding how the effects occur, it is difficult to evaluate how laboratory results relate to human health effects.

Some laboratory studies have reported that EMF exposure can produce biological effects, including changes in functions of cells and tissues and subtle changes in hormone levels in animals. It is important to distinguish between a biological effect and a health effect. Many biological effects are within the normal range of variation and are not necessarily harmful. For example, bright light has a biological effect on our eyes, causing the pupils to constrict, which is a normal response.

Clinical studies

In clinical studies, researchers use sensitive instruments to monitor human physiology during controlled exposure to environmental agents. In EMF studies, volunteers are exposed to electric or magnetic fields at higher levels than those commonly encountered in everyday life. Researchers measure heart rate, brain activity, hormonal levels, and other factors in exposed and unexposed groups to look for differences resulting from EMF exposure.

Epidemiology

A valuable tool to identify human health risks is to study a human population that has experienced the exposure. This type of research is called epidemiology.

The epidemiologist observes and compares groups of people who have had or have not had certain diseases and exposures to see if the risk of disease is different between the exposed and unexposed groups. The epidemiologist does not control the exposure and cannot experimentally control all the factors that might affect the risk of disease.

Most researchers agree that epidemiology—the study of patterns and possible causes of diseases—is one of the most valuable tools to identify human health risks.

Q How do we evaluate the results of epidemiological studies of EMF?

A Many factors need to be considered when determining whether an agent causes disease. An exposure that an epidemiological study associates with increased risk of a certain disease is not always the actual cause of the disease. To judge whether an agent actually causes a health effect, several issues are considered.

Strength of association

The stronger the association between an exposure and disease, the more confident we can be that the disease is due to the exposure being studied. With cigarette smoking and lung cancer, the association is very strong—20 times the normal risk. In the studies that suggest a relationship between EMF and certain rare cancers, the association is much weaker (see page 19).

Dose-response

Epidemiological data are more convincing if disease rates increase as exposure levels increase. Such dose-response relationships have appeared in only a few EMF studies.

Consistency

Consistency requires that an association found in one study appears in other studies involving different study populations and methods. Associations found consistently are more likely to be causal. With regard to EMF, results from different studies sometimes disagree in important ways, such as what type of cancer is associated with EMF exposure. Because of this inconsistency, scientists cannot be sure whether the increased risks are due to EMF or other factors.

Biological plausibility

When associations are weak in an epidemiological study, results of laboratory studies are even more important to support the association. Many scientists remain skeptical about an association between EMF exposure and cancer because laboratory studies thus far have not shown any consistent evidence of adverse health effects, nor have results of experimental studies revealed a plausible biological explanation for such an association.

Reliability of exposure information

Another important consideration with EMF epidemiological studies is how the exposure information was obtained. Did the researchers simply estimate people's EMF exposures based on their job titles or how their houses were wired, or did they actually conduct EMF measurements? What did they measure (electric fields, magnetic fields, or both)? How often were the EMF measurements made and at what time? In how many different places were the fields measured? More recent studies have included measurements of magnetic field exposure. Magnetic fields measured at the time a study is conducted can only estimate exposures that occurred in previous years (at the time a disease process may have begun). Lack of comprehensive exposure information makes it more difficult to interpret the results of a study, particularly considering that everyone in the industrialized world has been exposed to EMF.

Confounding

Epidemiological studies show relationships or correlations between disease and other factors such as diet, environmental conditions, and heredity. When a disease is correlated with some factor, it does not necessarily mean that the correlated factor causes the disease. It could mean that the factor occurs together with some other factor, not measured in the study, that actually causes the disease. This is called confounding.

For example, a study might show that alcohol consumption is correlated with lung cancer. This could occur if the study group consists of people who drink and also smoke tobacco, as often happens. In this example, alcohol use is correlated with lung cancer, but cigarette smoking is a confounding factor and the true cause of the disease.

Statistical significance

Researchers use statistical methods to determine the likelihood that the association between exposure and disease is due simply to chance. For a result to be considered "statistically significant," the association must be stronger than would be expected to occur by chance alone.

Meta-analysis

One way researchers try to get more information from epidemiological studies is to conduct a meta-analysis. A meta-analysis combines the summary statistics of many studies to explore their differences and, if appropriate, calculates an overall summary risk estimate. The main challenge faced by researchers performing meta-analyses is that populations, measurements, evaluation techniques, participation rates, and potential confounding factors vary in the original studies. These differences in the studies make it difficult to combine the results in a meaningful way.

Pooled analysis

Pooled analysis combines the original data from several studies and conducts a new analysis on the primary data. It requires access to the original data from individual studies and can only include diseases or factors included in all the studies, but it has the advantage that the same parameters can be applied to all studies. As with meta-analysis, pooled analysis is still subject to the limitations of the experimental design of the original studies (for example, evaluation techniques, participation rates, etc.). Pooled analysis differs from meta-analysis, which combines the summary statistics from different studies, not their original data.

Q How do we characterize EMF exposure?

A No one knows which aspect of EMF exposure, if any, affects human health. Because of this uncertainty, in addition to the field strength, we must ask how long an exposure lasts, how it varies, and at what time of day or night it occurs. House wiring, for example, is often a significant source of EMF exposure for an individual, but the magnetic fields produced by the wiring depend on the amount of current flowing. As heating, lighting, and appliance use varies during the day, magnetic field exposure will also vary.

For many studies, researchers describe EMF exposures by estimating the average field strength. Some scientists believe that average exposure may not be the best measurement of EMF exposure and that other parameters, such as peak exposure or time of exposure, may be important.

Q What is the average field strength?

A In EMF studies, the information reported most often has been a person's EMF exposure averaged over time (average field strength). With cancer-causing chemicals, a person's average exposure over many years can be a good way to predict his or her chances of getting the disease.

There are different ways to calculate average magnetic field exposures. One method involves having a person wear a small monitor that takes many measurements over a work shift, a day, or longer. Then the average of those measurements is calculated. Another method involves placing a monitor that takes many measurements in a residence over a 24-hour or 48-hour period. Sometimes averages are calculated for people with the same occupation, people working in similar environments, or people using several brands of the same type or similar types of equipment.

Q How is EMF exposure measured in epidemiological studies?

A Epidemiologists study patterns and possible causes of diseases in human populations. These studies are usually observational rather than experimental. This means that the researcher observes and compares groups of people who have had certain diseases and exposures and looks for possible "associations." The epidemiologist must find a way to estimate the exposure that people had at an earlier time.

Association

In epidemiology, a positive association between an exposure (such as EMF) and a disease is not necessarily proof that the exposure *caused* the disease. However, the more often the exposure and disease occur together, the stronger the association, and the stronger is the possibility that the exposure may increase the risk of the disease.

Some exposure estimates for residential studies have been based on designation of households in terms of "wire codes." In other studies, measurements have been made in homes, assuming that EMF levels at the time of the measurement are similar to levels at some time in the past. Some studies involved "spot measurements." Exposure levels change as a person moves around in his or her environment, so spot measurements taken at specific locations only approximate the complex variations in exposure a person experiences. Other studies measured magnetic fields over a 24-hour or 48-hour period. Exposure levels for some occupational studies are measured by having certain employees wear personal monitors. The data taken from these monitors are sometimes used to estimate typical exposure levels for employees with certain job titles. Researchers can then estimate exposures using only an employee's job title and avoid measuring exposures of all employees.

Methods to Estimate EMF Exposure

Wire Codes

A classification of homes based on characteristics of power lines outside the home (thickness of the wires, wire configuration, etc.) and their distance from the home. This information is used to code the homes into groups with higher and lower predicted magnetic field levels.

Spot Measurement

An instantaneous or very short-term (e.g., 30-second) measurement taken at a designated location.

Time-Weighted Average

A weighted average of exposure measurements taken over a period of time that takes into account the time interval between measurements. When the measurements are taken with a monitor at a fixed sampling rate, the time-weighted average equals the arithmetic mean of the measurements.

Personal Monitor

An instrument that can be worn on the body for measuring exposure over time.

Calculated Historical Fields

An estimate based on a theoretical calculation of the magnetic field emitted by power lines using historical electrical loads on those lines.

3 Results of EMF Research

This chapter summarizes the results of EMF research worldwide, including epidemiological studies of children and adults, clinical studies of how humans react to typical EMF exposures, and laboratory research with animals and cells.

Q Is there a link between EMF exposure and childhood leukemia?

A Despite more than two decades of research to determine whether elevated EMF exposure, principally to magnetic fields, is related to an increased risk of childhood leukemia, there is still no definitive answer. Much progress has been made, however, with some lines of research leading to reasonably clear answers and others remaining unresolved. The best available evidence at this time leads to the following answers to specific questions about the link between EMF exposure and childhood leukemia:

> *Is there an association between power line configurations (wire codes) and childhood leukemia?* No.
>
> *Is there an association between measured fields and childhood leukemia?* Yes, but the association is weak, and it is not clear whether it represents a cause-and-effect relationship.

Q What is the epidemiological evidence for evaluating a link between EMF exposure and childhood leukemia?

A The initial studies, starting with the pioneering research of Dr. Nancy Wertheimer and Ed Leeper in 1979 in Denver, Colorado, focused on power line configurations near homes. Power lines were systematically evaluated and coded for their presumed ability to produce elevated magnetic fields in homes and classified into groups with higher and lower predicted magnetic field levels (see discussion of wire codes on page 15). Although the first study and two that followed in Denver and Los Angeles showed an association between wire codes indicative of elevated magnetic fields and childhood leukemia, larger, more recent studies in the central part of the United States and in several provinces of Canada did not find such an association. In fact, combining the evidence from all the studies, we can conclude with some confidence that wire codes are not associated with a measurable increase in the risk of childhood leukemia.

The other approach to assessing EMF exposure in homes focused on the measurements of magnetic fields. Unlike wire codes, which are only applicable in North America due to the nature of the electric power distribution system, measured fields have been studied in relation to childhood leukemia in research conducted around the world, including Sweden, England, Germany, New Zealand, and Taiwan. Large, detailed studies have recently been completed in the United States, Canada, and the United Kingdom that provide the most evidence for making an evaluation. These studies have produced variable findings, some reporting small associations, others finding no associations.

National Cancer Institute Study

In 1997, after eight years of work, Dr. Martha Linet and colleagues at the National Cancer Institute (NCI) reported the results of their study of childhood acute lymphoblastic leukemia (ALL). The case-control study involved more than 1,000 children living in 9 eastern and midwestern U.S. states and is the largest epidemiological study of childhood leukemia to date in the United States. To help resolve the question of wire code versus measured magnetic fields, the NCI researchers carried out both types of exposure assessment. Overall, Linet reported little evidence that living in homes with higher measured magnetic-field levels was a disease risk and found no evidence that living in a home with a high wire code configuration increased the risk of ALL in children.

United Kingdom Childhood Cancer Study

In December 1999, Sir Richard Doll and colleagues in the United Kingdom announced that the largest study of childhood cancer ever undertaken—involving nearly 4,000 children with cancer in England, Wales, and Scotland—found no evidence of excess risk of childhood leukemia or other cancers from exposure to power-frequency magnetic fields. It should be noted, however, that because most power lines in the United Kingdom are underground, the EMF exposures of these children were mostly lower than 0.2 microtesla or 2 milligauss.

After reviewing all the data, the U.S. National Institute of Environmental Health Sciences (NIEHS) concluded in 1999 that the evidence was weak, but that it was still sufficient to warrant limited concern. The NIEHS rationale was that no individual epidemiological study provided convincing evidence linking magnetic field exposure with childhood leukemia, but the overall pattern of results for some methods of measuring exposure suggested a weak association between increasing exposure to EMF and increasing risk of childhood leukemia. The small number of cases in these studies made it impossible to firmly demonstrate this association. However, the fact that similar results had been observed in studies of different populations using a variety of study designs supported this observation.

A major challenge has been to determine whether the most highly elevated, but rarely encountered, levels of magnetic fields are associated with an increased risk of leukemia. Early reports focused on the risk associated with exposures above 2 or 3 milligauss, but the more recent studies have been large enough to also provide some information on levels above 3 or 4 milligauss. It is estimated that 4.5% of homes in the United States have magnetic fields above 3 milligauss, and 2.5% of homes have levels above 4 milligauss.

What is Cancer?

Cancer

"Cancer" is a term used to describe at least 200 different diseases, all involving uncontrolled cell growth. The frequency of cancer is measured by the incidence—the number of new cases diagnosed each year. Incidence is usually described as the number of new cases diagnosed per 100,000 people per year.

The incidence of cancer in adults in the United States is 382 per 100,000 per year, and childhood cancers account for about 1% of all cancers. The factors that influence risk differ among the forms of cancer. Known risk factors such as smoking, diet, and alcohol contribute to specific types of cancer. (For example, smoking is a known risk factor for lung cancer, bladder cancer, and oral cancer.) For many other cancers, the causes are unknown.

Leukemia

Leukemia describes a variety of cancers that arise in the bone marrow where blood cells are formed. The leukemias represent less than 4% of all cancer cases in adults but are the most common form of cancer in children. For children age 4 and under, the incidence of childhood leukemia is approximately 6 per 100,000 per year, and it decreases with age to about 2 per 100,000 per year for children 10 and older. In the United States, the incidence of adult leukemia is about 10 cases per 100,000 people per year. Little is known about what causes leukemia, although genetic factors play a role. The only known causes are ionizing radiation, benzene, and other chemicals and drugs that suppress bone marrow function, and a human T-cell leukemia virus.

Brain Cancer

Cancer of the central nervous system (the brain and spinal cord) is uncommon, with incidence in the United States now at about 6 cases in 100,000 people per year. The causes of the disease are largely unknown, although a number of studies have reported an association with certain occupational chemical exposures. Ionizing radiation to the scalp is a known risk factor for brain cancer. Factors associated with an increased risk for other types of cancer—such as smoking, diet, and excessive alcohol use—have not been found to be associated with brain cancer.

To determine what the integrated information from all the studies says about magnetic fields and childhood leukemia, two groups have conducted pooled analyses in which the original data from relevant studies were integrated and analyzed. One report (Greenland et al., 2000) combined 12 relevant studies with magnetic field measurements, and the other considered 9 such studies (Ahlbom et al., 2000). The details of the two pooled analyses are different, but their findings are similar. There is weak evidence for an association (relative risk of approximately 2) at exposures above 3 mG. However, few individuals had high exposures in these studies; therefore, even combining all studies, there is uncertainty about the strength of the association.

The following table summarizes the results for the epidemiological studies of EMF exposure and childhood leukemia analyzed in the pooled analysis by Greenland et al. (2000). The focus of the summary review was the magnetic fields that occurred three months prior to diagnosis. The results were derived from either calculated historical fields or multiple measurements of magnetic fields. The North American

Residential Exposure to Magnetic Fields and Childhood Leukemia

	Magnetic field category (mG)					
	>1 – ≤2 mG		>2 – ≤3 mG		>3 mG	
First author	Estimate	95% CL	Estimate	95% CL	Estimate	95% CL
Coghill	0.54	0.17, 1.74	No controls		No controls	
Dockerty	0.65	0.26, 1.63	2.83	0.29, 27.9	No controls	
Feychting	0.63	0.08, 4.77	0.90	0.12, 7.00	4.44	1.67, 11.7
Linet	1.07	0.82, 1.39	1.01	0.64, 1.59	1.51	0.92, 2.49
London	0.96	0.54, 1.73	0.75	0.22, 2.53	1.53	0.67, 3.50
McBride	0.89	0.62, 1.29	1.27	0.74, 2.20	1.42	0.63, 3.21
Michaelis	1.45	0.78, 2.72	1.06	0.27, 4.16	2.48	0.79, 7.81
Olsen	0.67	0.07, 6.42	No cases		2.00	0.40, 9.93
Savitz	1.61	0.64, 4.11	1.29	0.27, 6.26	3.87	0.87, 17.3
Tomenius	0.57	0.33, 0.99	0.88	0.33, 2.36	1.41	0.38, 5.29
Tynes	1.06	0.25, 4.53	No cases		No cases	
Verkasalo	1.11	0.14, 9.07	No cases		2.00	0.23, 17.7
Study summary	0.95	0.80, 1.12	1.06	0.79, 1.42	1.69*	1.25, 2.29
	1 – <2 mG		2 – <4 mG		≥4 mG	
**United Kingdom	0.84	0.57, 1.24	0.98	0.50, 1.93	1.00	0.30, 3.37

95% CL = 95% confidence limits.
Source: Greenland et al., 2000.
* Mantel-Haenszel analysis (p = 0.01). Maximum-likelihood summaries differed by less than 1% from these summaries; based on 2,656 cases and 7,084 controls. Adjusting for age, sex, and other variables had little effect on summary results.
** These data are from a recent United Kingdom study not included in the Greenland analysis but included in another pooled analysis (Ahlbom et al. 2000). The United Kingdom study included 1,073 cases and 2,224 controls.
For this table, the column headed "estimate" describes the relative risk. Relative risk is the ratio of the risk of childhood leukemia for those in a magnetic field exposure group compared to persons with exposure levels of 1.0 mG or less. For example, Coghill estimated that children with exposures between 1 and 2 mG have 0.54 times the risk of children whose exposures were less than 1 mG. London's study estimates that children whose exposures were greater than 3 mG have 1.53 times the risk of children whose exposures were less than 1 mG. The column headed "95% CL" (confidence limits) describes how much random variation is in the estimate of relative risk. The estimate may be off by some amount due to random variation, and the width of the confidence limits gives some notion of that variation. For example, in Coghill's estimate of 0.54 for the relative risk, values as low as 0.17 or as high as 1.74 would not be statistically significantly different from the value of 0.54. Note there is a wide range of estimates of relative risk across the studies and wide confidence limits for many studies. In light of these findings, the pooling of results can be extremely helpful to calculate an overall estimate, much better than can be obtained from any study taken alone.

studies (Linet, London, McBride, Savitz) were 60 Hz; all other studies were 50 Hz. Results from the recent study from the United Kingdom (see page 17) are also included in the table. This study was included in the analysis by Ahlbom et al. (2000). The relative risk estimates from the individual studies show little or no association of magnetic fields with childhood leukemia. The study summary for the pooled analysis by Greenland et al. (2000) shows a weak association between childhood leukemia and magnetic field exposures greater 3 mG.

Q Is there a link between EMF exposure and childhood brain cancer or other forms of cancer in children?

A Although the earliest studies suggested an association between EMF exposure and all forms of childhood cancer, those initial findings have not been confirmed by other studies. At present, the available series of studies indicates no association between EMF exposure and childhood cancers other than leukemia. Far fewer of these studies have been conducted than studies of childhood leukemia.

Q Is there a link between residential EMF exposure and cancer in adults?

A The few studies that have been conducted to address EMF and adult cancer do not provide strong evidence for an association. Thus, a link has not been established between residential EMF exposure and adult cancers, including leukemia, brain cancer, and breast cancer (see table below).

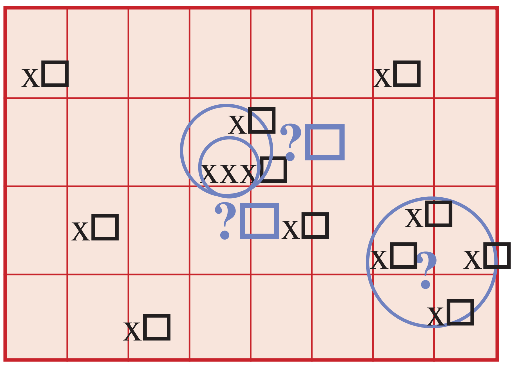
Residential Exposure to Magnetic Fields and Adult Cancer

			Results (odds ratios)		
First author	Location	Type of exposure data	Leukemia	CNS tumors	All cancers
Coleman	United Kingdom	Calculated historical fields	0.92	NA	NA
Feychting and Ahlbom	Sweden	Calculated & spot measurements	1.5*	0.7	NA
Li	Taiwan	Calculated historical fields	1.4*	1.1	NA
Li	Taiwan	Calculated historical fields		1.1 (breast cancer)	
McDowall	United Kingdom	Calculated historical fields	1.43	NA	1.03
Severson	Seattle	Wire codes & spot measurements	0.75	NA	NA
Wrensch	San Francisco	Wire codes & spot measurements	NA	0.9	NA
Youngson	United Kingdom	Calculated historical fields	1.88	NA	NA

CNS = central nervous system.
*The number is statistically significant (greater than expected by chance).
Study results are listed as "odds ratios" (OR). An odds ratio of 1.00 means there was no increase or decrease in risk. In other words, the odds that the people in the study who had the disease (in this case, cancer) and were exposed to a particular agent (in this case, EMF) are the same as for the people in the study who did not have the disease. An odds ratio greater than 1 may occur simply by chance, unless it is statistically significant.

Q Have clusters of cancer or other adverse health effects been linked to EMF exposure?

A An unusually large number of cancers, miscarriages, or other adverse health effects that occur in one area or over one period of time is called a “cluster.” Sometimes clusters provide an early warning of a health hazard. But most of the time the reason for the cluster is not known. There have been no proven instances of cancer clusters linked with EMF exposure.



The definition of a “cluster” depends on how large an area is included. Cancer cases (x’s in illustration) in a city, neighborhood, or workplace may occur in ways that suggest a cluster due to a common environmental cause. Often these patterns turn out to be due to chance. Delineation of a cluster is subjective—where do you draw the circles?

Q If EMF does cause or promote cancer, shouldn’t cancer rates have increased along with the increased use of electricity?

A Not necessarily. Although the use of electricity has increased greatly over the years, EMF exposures may not have increased. Changes in building wiring codes and in the design of electrical appliances have in some cases resulted in lower magnetic field levels. Rates for various types of cancer have shown both increases and decreases through the years, due in part to improved prevention, diagnosis, reporting, and treatment.

Q Is there a link between EMF exposure in electrical occupations and cancer?

A For almost as long as we have been concerned with residential exposure to EMF and childhood cancers, researchers have been studying workplace exposure to EMF and adult cancers, focusing on leukemia and brain cancer. This research began with surveys of job titles and cancer risks, but has progressed to include very large, detailed studies of the health of workers, especially electric utility workers, in the United States, Canada, France, England, and several Northern European countries. Some studies have found evidence that suggests a link between EMF exposure and both leukemia and brain cancer, whereas other studies of similar size and quality have not found such associations.

California
A 1993 study of 36,000 California electric utility workers reported no strong, consistent evidence of an association between magnetic fields and any type of cancer.

Canada/France
A 1994 study of more than 200,000 utility workers in 3 utility companies in Canada and France reported no significant association between all leukemias combined and cumulative exposure to magnetic fields. There was a slight, but not statistically significant, increase in brain cancer. The researchers concluded that the study did not provide clear-cut evidence that magnetic field exposures caused leukemia or brain cancer.

North Carolina
Results of a 1995 study involving more than 138,000 utility workers at 5 electric utilities in the United States did not support an association between occupational magnetic field exposure and leukemia, but suggested a link to brain cancer.

Denmark
In 1997 a study of workers employed in all Danish utility companies reported a small, but statistically significant, excess risk for all cancers combined and for lung cancer. No excess risk was observed for leukemia, brain cancers, or breast cancer.

United Kingdom
A 1997 study among electrical workers in the United Kingdom did not find an excess risk for brain cancer. An extension of this work reported in 2001 also found no increased risk for brain cancer.

Efforts have also been made to pool the findings across several of the above studies to produce more accurate estimates of the association between EMF and cancer (Kheifets et al., 1999). The combined summary statistics across studies provide insufficient evidence for an association between EMF exposure in the workplace and either leukemia or brain cancer.

Q Have studies of workers in other industries suggested a link between EMF exposure and cancer?

A One of the largest studies to report an association between cancer and magnetic field exposure in a broad range of industries was conducted in Sweden (1993). The study included an assessment of EMF exposure in 1,015 different workplaces and involved more than 1,600 people in 169 different occupations. An association was reported between estimated EMF exposure and increased risk for chronic lymphocytic leukemia. An association was also reported between exposure to magnetic fields and brain cancer, but there was no dose-response relationship.

Another Swedish study (1994) found an excess risk of lymphocytic leukemia among railway engine drivers and conductors. However, the total cancer incidence (all tumors included) for this group of workers was lower than in the general Swedish population. A study of Norwegian railway workers found no evidence for an association between EMF exposure and leukemia or brain cancer. Although both positive and negative effects of EMF exposure have been reported, the majority of studies show no effects.

Q Is there a link between EMF exposure and breast cancer?

A Researchers have been interested in the possibility that EMF exposure might cause breast cancer, in part because breast cancer is such a common disease in adult women. Early studies identified a few electrical workers with male breast cancer, a very rare disease. A link between EMF exposure and alterations in the hormone melatonin was considered a possible hypothesis (see page 24). This idea provided motivation to conduct research addressing a possible link between EMF exposure and breast cancer. Overall, the published epidemiological studies have not shown such an association.

Q What have we learned from clinical studies?

A Laboratory studies with human volunteers have attempted to answer questions such as,

Does EMF exposure alter normal brain and heart function?
Does EMF exposure at night affect sleep patterns?
Does EMF exposure affect the immune system?
Does EMF exposure affect hormones?

The following kinds of biological effects have been reported. Keep in mind that a biological effect is simply a measurable change in some biological response. It may or may not have any bearing on health.

Heart rate

An inconsistent effect on heart rate by EMF exposure has been reported. When observed, the biological response is small (on average, a slowing of about three to five beats per minute), and the response does not persist once exposure has ended.

Two laboratories, one in the United States and one in Australia, have reported effects of EMF on heart rate variability. Exposures used in these experiments were relatively high (about 300 mG), and lower exposures failed to produce the effect. Effects have not been observed consistently in repeated experiments.

Sleep electrophysiology

A laboratory report suggested that overnight exposure to 60-Hz magnetic fields may disrupt brain electrical activity (EEG) during night sleep. In this study subjects were exposed to either continuous or intermittent magnetic fields of 283 mG. Individuals exposed to the intermittent magnetic fields showed alterations in traditional EEG sleep parameters indicative of a pattern of poor and disrupted sleep. Several studies have reported no effect with continuous exposure.

Hormones, immune system, and blood chemistry

Several clinical studies with human volunteers have evaluated the effects of power-frequency EMF exposure on hormones, the immune system, and blood chemistry. These studies provide little evidence for any consistent effect.

Melatonin

The hormone melatonin is secreted mainly at night and primarily by the pineal gland, a small gland attached to the brain. Some laboratory experiments with cells and animals have shown that melatonin can slow the growth of cancer cells, including breast cancer cells. Suppressed nocturnal melatonin levels have been observed in some studies of laboratory animals exposed to both electric and magnetic fields. These observations led to the hypothesis that EMF exposure might reduce melatonin and thereby weaken one of the body's defenses against cancer.

Many clinical studies with human volunteers have now examined whether various levels and types of magnetic field exposure affect blood levels of melatonin. Exposure of human volunteers at night to power-frequency EMF under controlled laboratory conditions has no apparent effect on melatonin. Some studies of people exposed to EMF at work or at home do report evidence for a small suppression of melatonin. It is not clear whether the decreases in melatonin reported under environmental conditions are related to the presence of EMF exposure or to other factors.

Q What effects of EMF have been reported in laboratory studies of cells?

A Over the years, scientists have conducted more than 1,000 laboratory studies to investigate potential biological effects of EMF exposure. Most have been *in vitro* studies; that is, studies carried out on cells isolated from animals and plants, or on cell components such as cell membranes. Other studies involved animals, mainly rats and mice. In general, these studies do not demonstrate a consistent effect of EMF exposure.

Most *in vitro* studies have used magnetic fields of 1,000 mG (100 µT) or higher, exposures that far exceed daily human exposures. In most incidences, when one laboratory has reported effects of EMF exposure on cells, other laboratories have not been able to reproduce the findings. For such research results to be widely accepted by scientists as valid, they must be replicated—that is, scientists in other laboratories should be able to repeat the experiment and get similar results. Cellular studies have investigated potential EMF effects on cell proliferation and differentiation, gene expression, enzyme activity, melatonin, and DNA. Scientists reviewing the EMF research literature find overall that the cellular studies provide little convincing evidence of EMF effects at environmental levels.

Q Have effects of EMF been reported in laboratory studies in animals?

A Researchers have published more than 30 detailed reports on both long-term and short-term studies of EMF exposures in laboratory animals (bioassays). Long-term animal bioassays constitute an important group of studies in EMF research. Such studies have a proven record for predicting the carcinogenicity of chemicals, physical agents, and other suspected cancer-causing agents. In the EMF studies, large groups of mice or rats were continuously exposed to EMF for two years or longer and were then evaluated for cancer. The U.S. National Toxicology Program (http://ntp-server.niehs.nih.gov/) has an extensive historical database for hundreds of different chemical and physical agents evaluated using this model. EMF long-term bioassays examined leukemia, brain cancer, and breast cancer—the diseases some epidemiological studies have associated with EMF exposure (see pages 16–23).

Several different approaches have been used to evaluate effects of EMF exposure in animal bioassays. To investigate whether EMF could promote cancer after genetic damage had occurred, some long-term studies used cancer initiators such as ultraviolet light, radiation, or certain chemicals that are known to cause genetic damage. Researchers compared groups of animals treated with cancer initiators to groups treated with cancer initiators and then exposed to EMF, to see if EMF exposure promoted the cancer growth (initiation-promotion model). Other studies tested the cancer promotion potential of EMF using mice that were predisposed to cancer because they had defects in the genes that control cancer.

Animal Leukemia Studies: Long-Term, Continuous Exposure Studies, Two or More Years in Length			
First author	Sex/species	Exposure/animal numbers	Results
Babbitt (U.S.)	Female mice	14,000 mG, 190 or 380 mice per group. Some groups treated with ionizing radiation.	No effect
Boorman (U.S.)	Male and female rats	20 to 10,000 mG, 100 per group	No effect
McCormick (U.S.)	Male and female mice	20 to 10,000 mG, 100 per group	No effect
Mandeville (Canada)	Female rats	20 to 20,000 mG, 50 per group *In utero* exposure	No effect
Yasui (Japan)	Male and female rats	5,000 to 50,000 mG, 50 per group	No effect

10 milligauss (mG) = 1 microtesla (μT) = 0.001 millitesla (mT)

Leukemia

Fifteen animal leukemia studies have been completed and reported. Most tested for effects of exposure to power-frequency (60-Hz) magnetic fields using rodents. Results of these studies were largely negative. The Babbitt study evaluated the subtypes of leukemia. The data provide no support for the reported epidemiology findings of leukemia from EMF exposure. Many scientists feel that the lack of effects seen in these laboratory leukemia studies significantly weakens the case for EMF as a cause of leukemia.

Breast cancer

Researchers in the Ukraine, Germany, Sweden, and the United States have used initiation-promotion models to investigate whether EMF exposure promotes breast cancer in rats.

The results of these studies are mixed; while the German studies showed some effects, the Swedish and U.S. studies showed none. Studies in Germany reported effects on the numbers of tumors and tumor volume. A National Toxicology Program long-term bioassay performed without the use of other cancer-initiating substances showed no effects of EMF exposure on the development of mammary tumors in rats and mice.

The explanation for the observed difference among these studies is not readily apparent. Within the limits of the experimental rodent model of mammary carcinogenesis, no conclusions are possible regarding a promoting effect of EMF on chemically induced mammary cancer.

Other cancers

Tests of EMF effects on skin cancer, liver cancer, and brain cancer have been conducted using both initiation-promotion models and non-initiated long-term bioassays. All are negative.

Three positive studies were reported for a co-promotion model of skin cancer in mice. The mice were exposed to EMF plus cancer-causing chemicals after cancers had already been initiated. The same research team as well as an independent laboratory were unable to reproduce these results in subsequent experiments.

Non-cancer effects

Many animal studies have investigated whether EMF can cause health problems other than cancer. Researchers have examined many endpoints, including birth defects, immune system function, reproduction, behavior, and learning. Overall, animal studies do not support EMF effects on non-cancer endpoints.

Q Can EMF exposure damage DNA?

A Studies have attempted to determine whether EMF has genotoxic potential; that is, whether EMF exposure can alter the genetic material of living organisms. This question is important because genotoxic agents often also cause cancer or birth defects. Studies of genotoxicity have included tests on bacteria, fruit flies, and some tests on rats and mice. Nearly 100 studies on EMF genotoxicity have been reported. Most evidence suggests that EMF exposure is not genotoxic. Based on experiments with cells, some researchers have suggested that EMF exposure may inhibit the cell's ability to repair normal DNA damage, but this idea remains speculative because of the lack of genotoxicity observed in EMF animal studies.

4 Your EMF Environment

This chapter discusses typical magnetic field exposures in home and work environments and identifies common EMF sources and field intensities associated with these sources.

Q How do we define EMF exposure?

A Scientists are still uncertain about the best way to define “exposure” because experiments have yet to show which aspect of the field, if any, may be relevant to reported biological effects. Important aspects of exposure could be the highest intensity, the average intensity, or the amount of time spent above a certain baseline level. The most widely used measure of EMF exposure has been the time-weighted average magnetic field level (see discussion on page 15).

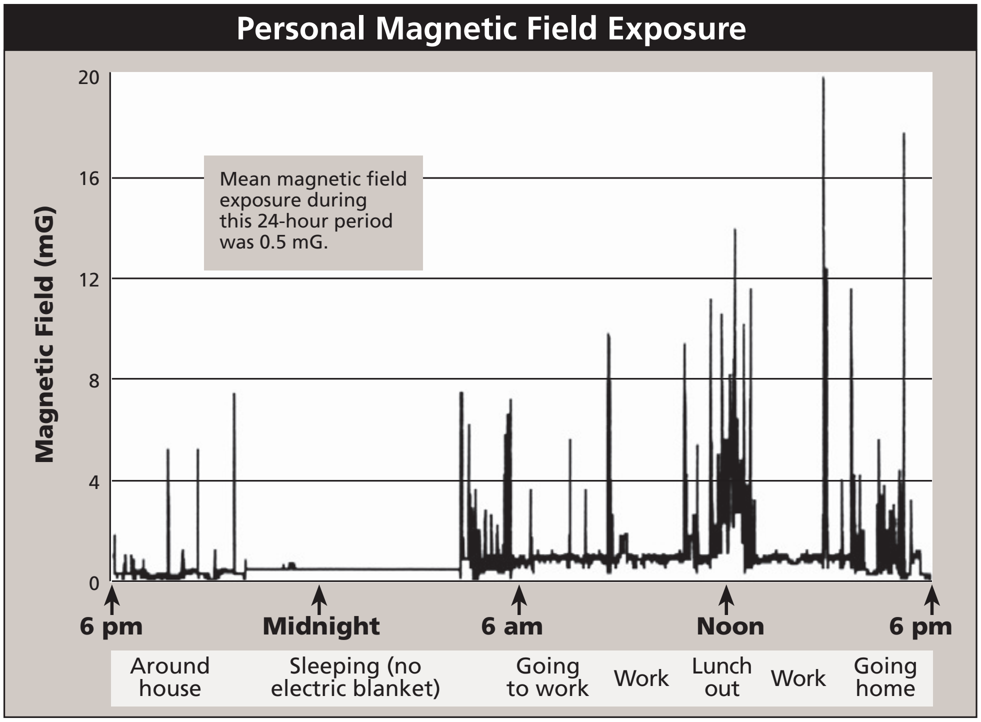
Q How is EMF exposure measured?

A Several kinds of personal exposure meters are now available. These automatically record the magnetic field as it varies over time. To determine a person’s EMF exposure, the personal exposure meter is usually worn at the waist or is placed as close as possible to the person during the course of a work shift or day.

EMF can also be measured using survey meters, sometimes called “gaussmeters.” These measure the EMF levels in a given location at a given time. Such measurements do not necessarily reflect personal EMF exposure because they are not always taken at the distance from the EMF source that the person would typically be from the source. Measurements are not always made in a location for the same amount of time that a person spends there. Such “spot measurements” also fail to capture variations of the field over time, which can be significant.

Q What are some typical EMF exposures?

A The figure below is an example of data collected with a personal exposure meter.



In the above example, the magnetic field was measured every 1.5 seconds over a period of 24 hours. For this person, exposure at home was very low. The occasional spikes (short exposure to high fields) occurred when the person drove or walked under power lines or over underground power lines or was close to appliances in the home or office.

Several studies have used personal exposure meters to measure field exposure in different environments. These studies tend to show that appliances and building wiring contribute to the magnetic field exposure that most people receive while at home. People living close to high voltage power lines that carry a lot of current tend to have higher overall field exposures. As shown on page 32, there is considerable variation among houses.

Q What are typical EMF exposures for people living in the United States?

A Most people in the United States are exposed to magnetic fields that average less than 2 milligauss (mG), although individual exposures vary.

The following table shows the estimated average magnetic field exposure of the U.S. population, according to a study commissioned by the U.S. government as part of the EMF Research and Public Information Dissemination (EMF RAPID) Program (see page 50). This study measured magnetic field exposure of about 1,000 people of all ages randomly selected among the U.S. population. Participants wore or carried with them a small personal exposure meter and kept a diary of their activities both at home and away from home. Magnetic field values were automatically recorded twice a second for 24 hours. The study reported that exposure to magnetic fields is similar in different regions of the country and similar for both men and women.

Estimated Average Magnetic Field Exposure of the U.S. Population

Average 24-hour field (mG)	Population exposed (%)	95% confidence interval (%)	People exposed* (millions)
> 0.5	76.3	73.8–78.9	197–211
> 1	43.6	40.9–46.5	109–124
> 2	14.3	11.8–17.3	31.5–46.2
> 3	6.3	4.7–8.5	12.5–22.7
> 4	3.6	2.5–5.2	6.7–13.9
> 5	2.42	1.65–3.55	4.4–9.5
> 7.5	0.58	0.29–1.16	0.77–3.1
> 10	0.46	0.20–1.05	0.53–2.8
> 15	0.17	0.035–0.83	0.09–2.2

*Based on a population of 267 million. This table summarizes some of the results of a study that sampled about 1,000 people in the United States. In the first row, for example, we find that 76.3% of the sample population had a 24-hour average exposure of greater than 0.5 mG. Assuming that the sample was random, we can use statistics to say that we are 95% confident that the percentage of the overall U.S. population exposed to greater than 0.5 mG is between 73.8% and 78.9%. Source: Zaffanella, 1993.

The following table shows average magnetic fields experienced during different types of activities. In general, magnetic fields are greater at work than at home.

Estimated Average Magnetic Field Exposure of the U.S. Population for Various Activities

Average field (mG)	Population exposed (%)				
	Home	Bed	Work	School	Travel
> 0.5	69	48	81	63	87
> 1	38	30	49	25	48
> 2	14	14	20	3.5	13
> 3	7.8	7.2	13	1.6	4.1
> 4	4.7	4.7	8.0	< 1	1.5
> 5	3.5	3.7	4.6		1.0
> 7.5	1.2	1.6	2.5		0.5
> 10	0.9	0.8	1.3		< 0.2
> 15	0.1	0.1	0.9		

Source: Zaffanella, 1993.

Q What levels of EMF are found in common environments?

A Magnetic field exposures can vary greatly from site to site for any type of environment. The data shown in the following table are median measurements taken at four different sites for each environment category.

EMF Exposures in Common Environments
Magnetic fields measured in milligauss (mG)

Environment	Median* exposure	Top 5th percentile	Environment	Median* exposure	Top 5th percentile
OFFICE BUILDING			MACHINE SHOP		
Support staff	0.6	3.7	Machinist	0.4	6.0
Professional	0.5	2.6	Welder	1.1	24.6
Maintenance	0.6	3.8	Engineer	1.0	5.1
Visitor	0.6	2.1	Assembler	0.5	6.4
SCHOOL			Office staff	0.7	4.7
Teacher	0.6	3.3	GROCERY STORE		
Student	0.5	2.9	Cashier	2.7	11.9
Custodian	1.0	4.9	Butcher	2.4	12.8
Administrative staff	1.3	6.9	Office staff	2.1	7.1
HOSPITAL			Customer	1.1	7.7
Patient	0.6	3.6			
Medical staff	0.8	5.6			
Visitor	0.6	2.4			
Maintenance	0.6	5.9			

*The median of four measurements. For this table, the median is the average of the two middle measurements. Source: National Institute for Occupational Safety and Health.

Q What EMF field levels are encountered in the home?

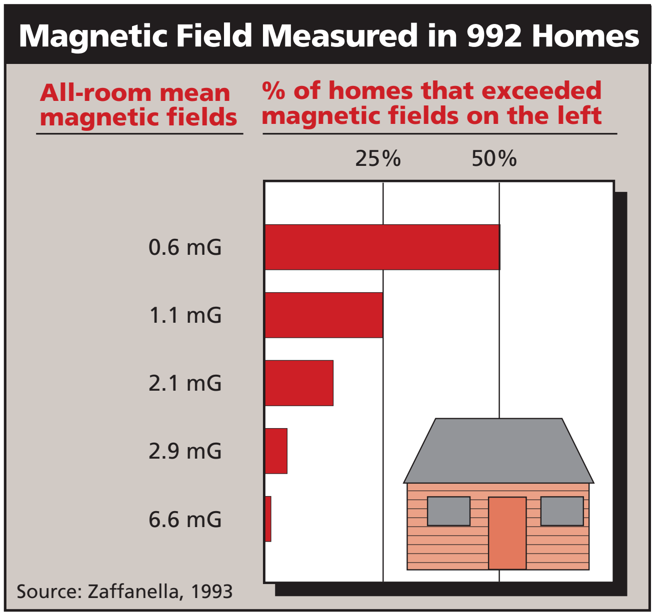
A

Electric fields

Electric fields in the home, on average, range from 0 to 10 volts per meter. They can be hundreds, thousands, or even millions of times weaker than those encountered outdoors near power lines. Electric fields directly beneath power lines may vary from a few volts per meter for some overhead distribution lines to several thousands of volts per meter for extra high voltage power lines. Electric fields from power lines rapidly become weaker with distance and can be greatly reduced by walls and roofs of buildings.

Magnetic fields

Magnetic fields are not blocked by most materials. Magnetic fields encountered in homes vary greatly. Magnetic fields rapidly become weaker with distance from the source.



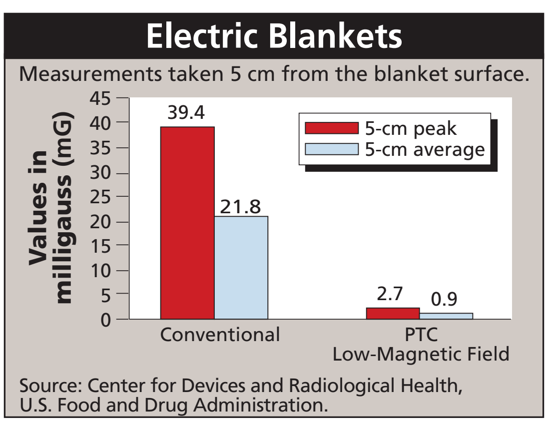
The chart on the left summarizes data from a study by the Electric Power Research Institute (EPRI) in which spot measurements of magnetic fields were made in the center of rooms in 992 homes throughout the United States. Half of the houses studied had magnetic field measurements of 0.6 mG or less, when the average of measurements from all the rooms in the house was calculated (the all-room mean magnetic field). The all-room mean magnetic field for all houses studied was 0.9 mG. The measurements were made away from electrical appliances and reflect primarily the fields from household wiring and outside power lines.

If you are comparing the information in this chart with measurements in your own home, keep in mind that this chart shows averages of measurements taken throughout the homes, not the single highest measurement found in the home.

Q What are EMF levels close to electrical appliances?

A Magnetic fields close to electrical appliances are often much stronger than those from other sources, including magnetic fields directly under power lines. Appliance fields decrease in strength with distance more quickly than do power line fields.

The following table, based on data gathered in 1992, lists the EMF levels generated by common electrical appliances. Magnetic field strength (magnitude) does not depend on how large, complex, powerful, or noisy the appliance is. Magnetic fields near large appliances are often weaker than those near small devices. Appliances in your home may have been redesigned since the data in the table were collected, and the EMF they produce may differ considerably from the levels shown here.



The graph shows magnetic fields produced by electric blankets, including conventional 110-V electric blankets as well as the PTC (positive temperature coefficient) low-magnetic-field blankets. The fields were measured at a distance of about 2 inches from the blanket's surface, roughly the distance from the blanket to the user's internal organs. Because of the wiring, magnetic field strengths vary from point to point on the blanket. The graph reflects this and gives both the peak and the average measurement.

Sources of Magnetic Fields (mG)*

	Distance from source 6″	1′	2′	4′
Office Sources				
AIR CLEANERS				
Lowest	110	20	3	–
Median	180	35	5	1
Highest	250	50	8	2
COPY MACHINES				
Lowest	4	2	1	–
Median	90	20	7	1
Highest	200	40	13	4
FAX MACHINES				
Lowest	4	–	–	–
Median	6	–	–	–
Highest	9	2	–	–
FLUORESCENT LIGHTS				
Lowest	20	–	–	–
Median	40	6	2	–
Highest	100	30	8	4
ELECTRIC PENCIL SHARPENERS				
Lowest	20	8	5	–
Median	200	70	20	2
Highest	300	90	30	30
VIDEO DISPLAY TERMINALS (see page 48) (PCs with color monitors)**				
Lowest	7	2	1	–
Median	14	5	2	–
Highest	20	6	3	–
Bathroom Sources				
HAIR DRYERS				
Lowest	1	–	–	–
Median	300	1	–	–
Highest	700	70	10	1
ELECTRIC SHAVERS				
Lowest	4	–	–	–
Median	100	20	–	–
Highest	600	100	10	1

	Distance from source 6″	1′	2′	4′
Workshop Sources				
BATTERY CHARGERS				
Lowest	3	2	–	–
Median	30	3	–	–
Highest	50	4	–	–
DRILLS				
Lowest	100	20	3	–
Median	150	30	4	–
Highest	200	40	6	–
POWER SAWS				
Lowest	50	9	1	–
Median	200	40	5	–
Highest	1000	300	40	4
ELECTRIC SCREWDRIVERS (while charging)				
Lowest	–	–	–	–
Median	–	–	–	–
Highest	–	–	–	–

	Distance from source 1′	2′	4′
Living/Family Room Sources			
CEILING FANS			
Lowest	–	–	–
Median	3	–	–
Highest	50	6	1
WINDOW AIR CONDITIONERS			
Lowest	–	–	–
Median	3	1	–
Highest	20	6	4
COLOR TELEVISIONS**			
Lowest	–	–	–
Median	7	2	–
Highest	20	8	4

Continued

Sources of Magnetic Fields (mG)*

Kitchen Sources	Distance from source 6″	1′	2′	4′
BLENDERS				
Lowest	30	5	–	–
Median	70	10	2	–
Highest	100	20	3	–
CAN OPENERS				
Lowest	500	40	3	–
Median	600	150	20	2
Highest	1500	300	30	4
COFFEE MAKERS				
Lowest	4	–	–	–
Median	7	–	–	–
Highest	10	1	–	–
DISHWASHERS				
Lowest	10	6	2	–
Median	20	10	4	–
Highest	100	30	7	1
FOOD PROCESSORS				
Lowest	20	5	–	–
Median	30	6	2	–
Highest	130	20	3	–
GARBAGE DISPOSALS				
Lowest	60	8	1	–
Median	80	10	2	–
Highest	100	20	3	–
MICROWAVE OVENS***				
Lowest	100	1	1	–
Median	200	4	10	2
Highest	300	200	30	20
MIXERS				
Lowest	30	5	–	–
Median	100	10	1	–
Highest	600	100	10	–

Kitchen Sources	Distance from source 6″	1′	2′	4′
ELECTRIC OVENS				
Lowest	4	1	–	–
Median	9	4	–	–
Highest	20	5	1	–
ELECTRIC RANGES				
Lowest	20	–	–	–
Median	30	8	2	–
Highest	200	30	9	6
REFRIGERATORS				
Lowest	–	–	–	–
Median	2	2	1	–
Highest	40	20	10	10
TOASTERS				
Lowest	5	–	–	–
Median	10	3	–	–
Highest	20	7	–	–

Bedroom Sources	6″	1′	2′	4′
DIGITAL CLOCK******				
Lowest		–	–	–
Median		1	–	–
High		8	2	1
ANALOG CLOCKS (conventional clockface)******				
Lowest		1	–	–
Median		15	2	–
Highest		30	5	3
BABY MONITOR (unit nearest child)				
Lowest	4	–	–	–
Median	6	1	–	–
Highest	15	2	–	–

Continued

Sources of Magnetic Fields (mG)*

	Distance from source 6″	1′	2′	4′
Laundry/Utility Sources				
ELECTRIC CLOTHES DRYERS				
Lowest	2	–	–	–
Median	3	2	–	–
Highest	10	3	–	–
WASHING MACHINES				
Lowest	4	1	–	–
Median	20	7	1	–
Highest	100	30	6	–
IRONS				
Lowest	6	1	–	–
Median	8	1	–	–
Highest	20	3	–	–

	Distance from source 6″	1′	2′	4′
Laundry/Utility Sources				
PORTABLE HEATERS				
Lowest	5	1	–	–
Median	100	20	4	–
Highest	150	40	8	1
VACUUM CLEANERS				
Lowest	100	20	4	–
Median	300	60	10	1
Highest	700	200	50	10

SEWING MACHINES

Home sewing machines can produce magnetic fields of 12 mG at chest level and 5 mG at head level. Magnetic fields as high as 35 mG at chest level and 215 mG at knee level have been measured from industrial sewing machine models (Sobel, 1994).

Source: EMF In Your Environment, U.S. Environmental Protection Agency, 1992.

* Dash (–) means that the magnetic field at this distance from the operating appliance could not be distinguished from background measurements taken before the appliance had been turned on.

** Some appliances produce both 60-Hz and higher frequency fields. For example, televisions and computer screens produce fields at 10,000-30,000 Hz (10-30 kHz) as well as 60-Hz fields.

*** Microwave ovens produce 60-Hz fields of several hundred milligauss, but they also create microwave energy inside the appliance that is at a much higher frequency (about 2.45 billion hertz). We are shielded from the higher frequency fields but not from the 60-Hz fields.

**** Most digital clocks have low magnetic fields. In some analog clocks, however, higher magnetic fields are produced by the motor that drives the hands. In the above table, the clocks are electrically powered using alternating current, as are all the appliances described in these tables.

Q What EMF levels are found near power lines?

A Power transmission lines bring power from a generating station to an electrical substation. Power distribution lines bring power from the substation to your home. Transmission and distribution lines can be either overhead or underground. Overhead lines produce both electric fields and magnetic fields. Underground lines do not produce electric fields above ground but may produce magnetic fields above ground.

Power transmission lines

Typical EMF levels for transmission lines are shown in the chart on page 37. At a distance of 300 feet and at times of average electricity demand, the magnetic fields from many lines can be similar to typical background levels found in most homes. The distance at which the magnetic field from the line becomes indistinguishable from typical background levels differs for different types of lines.

Power distribution lines

Typical voltage for power distribution lines in North America ranges from 4 to 24 kilovolts (kV). Electric field levels directly beneath overhead distribution lines may vary from a few volts per meter to 100 or 200 volts per meter. Magnetic fields directly beneath overhead distribution lines typically range from 10 to 20 mG for main feeders and less than 10 mG for laterals. Such levels are also typical directly above underground lines. Peak EMF levels, however, can vary considerably depending on the amount of current carried by the line. Peak magnetic field levels as high as 70 mG have been measured directly below overhead distribution lines and as high as 40 mG above underground lines.

Q How strong is the EMF from electric power substations?

A In general, the strongest EMF around the outside of a substation comes from the power lines entering and leaving the substation. The strength of the EMF from equipment within the substations, such as transformers, reactors, and capacitor banks, decreases rapidly with increasing distance. Beyond the substation fence or wall, the EMF produced by the substation equipment is typically indistinguishable from background levels.

Q Do electrical workers have higher EMF exposure than other workers?

A Most of the information we have about occupational EMF exposure comes from studies of electric utility workers. It is therefore difficult to compare electrical workers' EMF exposures with those of other workers because there is less information about EMF exposures in work environments other than electric utilities. Early studies did not include actual measurements of EMF exposure on the job but used job titles as an estimate of EMF exposure among electrical workers. Recent studies, however, have included extensive EMF exposure assessments.

A report published in 1994 provides some information about estimated EMF exposures of workers in Los Angeles in a number of electrical jobs in electric utilities and other industries. Electrical workers had higher average EMF exposures (9.6 mG) than did workers in other jobs (1.7 mG). For this study, the category "electrical workers" included electrical engineering technicians, electrical engineers, electricians, power line workers, power station operators, telephone line workers, TV repairers, and welders.

Typical EMF Levels for Power Transmission Lines*

115 kV

		Approx. Edge of Right-of-Way 15 m (50 ft)	30 m (100 ft)	61 m (200 ft)	91 m (300 ft)
Electric Field (kV/m)	1.0	0.5	0.07	0.01	0.003
Mean Magnetic Field (mG)	29.7	6.5	1.7	0.4	0.2

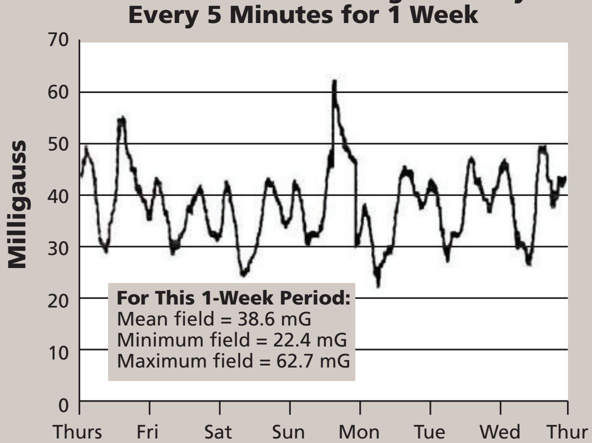
230 kV

		Approx. Edge of Right-of-Way 15 m (50 ft)	30 m (100 ft)	61 m (200 ft)	91 m (300 ft)
Electric Field (kV/m)	2.0	1.5	0.3	0.05	0.01
Mean Magnetic Field (mG)	57.5	19.5	7.1	1.8	0.8

500 kV

		Approx. Edge of Right-of-Way 20 m (65 ft)	30 m (100 ft)	61 m (200 ft)	91 m (300 ft)
Electric Field (kV/m)	7.0	3.0	1.0	0.3	0.1
Mean Magnetic Field (mG)	86.7	29.4	12.6	3.2	1.4

Magnetic Field from a 500-kV Transmission Line Measured on the Right-of-Way Every 5 Minutes for 1 Week



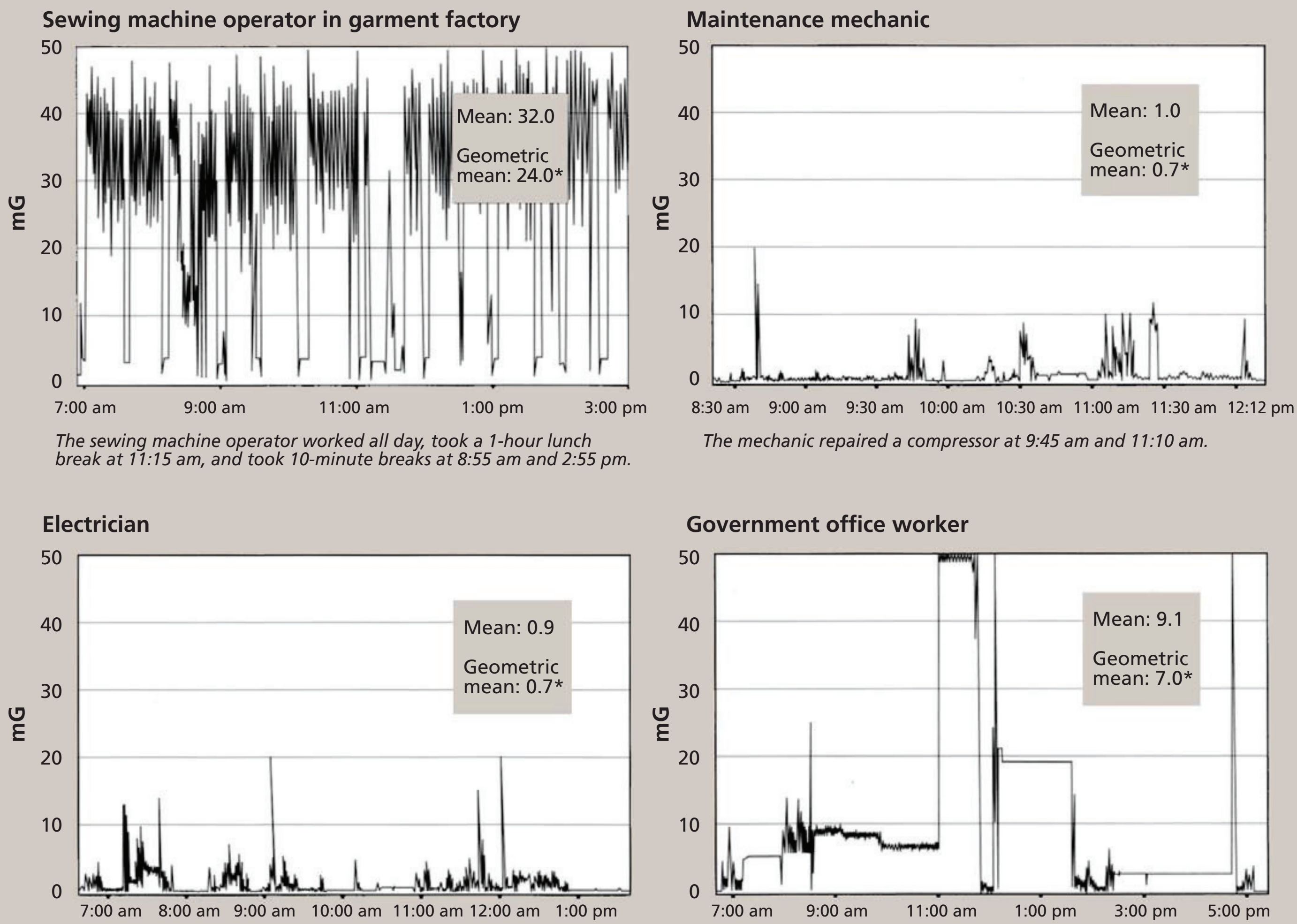
Electric fields from power lines are relatively stable because line voltage doesn't change very much. Magnetic fields on most lines fluctuate greatly as current changes in response to changing loads. Magnetic fields must be described statistically in terms of averages, maximums, etc. The magnetic fields above are means calculated for 321 power lines for 1990 annual mean loads. During peak loads (about 1% of the time), magnetic fields are about twice as strong as the mean levels above. The graph on the left is an example of how the magnetic field varied during one week for one 500-kV transmission line.

*These are typical EMFs at 1 m (3.3 ft) above ground for various distances from power lines in the Pacific Northwest. They are for general information. For information about a specific line, contact the utility that operates the line.
Source: Bonneville Power Administration, 1994.

Q What are possible EMF exposures in the workplace?

A The figures below are examples of magnetic field exposures determined with exposure meters worn by four workers in different occupations. These measurements demonstrate how EMF exposures vary among individual workers. They do not necessarily represent typical EMF exposures for workers in these occupations.

Magnetic Field Exposures of Workers (mG)



The sewing machine operator worked all day, took a 1-hour lunch break at 11:15 am, and took 10-minute breaks at 8:55 am and 2:55 pm.

The mechanic repaired a compressor at 9:45 am and 11:10 am.

The electrician repaired a large air-conditioning motor at 9:10 am and at 11:45 am.

The government worker was at the copy machine at 8:00 am, at the computer from 11:00 am to 1:00 pm and also from 2:30 pm to 4:30 pm.

*The geometric mean is calculated by squaring the values, adding the squares, and then taking the square root of the sum.
Source: National Institute for Occupational Safety and Health and U.S. Department of Energy.

The tables below and on page 41 can give you a general idea about magnetic field levels for different jobs and around various kinds of electrical equipment. It is important to remember that EMF levels depend on the actual equipment used in

EMF Measurements During a Workday

Industry and occupation	ELF magnetic fields measured in mG: Median for occupation*	ELF magnetic fields measured in mG: Range for 90% of workers**
ELECTRICAL WORKERS IN VARIOUS INDUSTRIES		
Electrical engineers	1.7	0.5–12.0
Construction electricians	3.1	1.6–12.1
TV repairers	4.3	0.6–8.6
Welders	9.5	1.4–66.1
ELECTRIC UTILITIES		
Clerical workers without computers	0.5	0.2–2.0
Clerical workers with computers	1.2	0.5–4.5
Line workers	2.5	0.5–34.8
Electricians	5.4	0.8–34.0
Distribution substation operators	7.2	1.1–36.2
Workers off the job (home, travel, etc.)	0.9	0.3–3.7
TELECOMMUNICATIONS		
Install, maintenance, & repair technicians	1.5	0.7–3.2
Central office technicians	2.1	0.5–8.2
Cable splicers	3.2	0.7–15.0
AUTO TRANSMISSION MANUFACTURE		
Assemblers	0.7	0.2–4.9
Machinists	1.9	0.6–27.6
HOSPITALS		
Nurses	1.1	0.5–2.1
X-ray technicians	1.5	1.0–2.2
SELECTED OCCUPATIONS FROM ALL ECONOMIC SECTORS		
Construction machine operators	0.5	0.1–1.2
Motor vehicle drivers	1.1	0.4–2.7
School teachers	1.3	0.6–3.2
Auto mechanics	2.3	0.6–8.7
Retail sales	2.3	1.0–5.5
Sheet metal workers	3.9	0.3–48.4
Sewing machine operators	6.8	0.9–32.0
Forestry and logging jobs	7.6	0.6–95.5***

Source: National Institute for Occupational Safety and Health.
ELF (extremely low frequency)—frequencies 3–3,000 Hz.

* The median is the middle measurement in a sample arranged by size. These personal exposure measurements reflect the median magnitude of the magnetic field produced by the various EMF sources and the amount of time the worker spent in the fields.

** This range is between the 5th and 95th percentiles of the workday averages for an occupation.

*** Chain saw engines produce strong magnetic fields that are not pure 60-Hz fields.

the workplace. Different brands or models of the same type of equipment can have different magnetic field strengths. It is also important to keep in mind that the strength of a magnetic field decreases quickly with distance.

If you have questions or want more information about your EMF exposure at work, your plant safety officer, industrial hygienist, or other local safety official can be a good source of information. The National Institute for Occupational Safety and Health (NIOSH) is asked occasionally to conduct health hazard evaluations in workplaces where EMF is a suspected cause for concern. For further technical assistance contact NIOSH at 800-356-4674.

Q What are some typical sources of EMF in the workplace?

A Exposure assessment studies so far have shown that most people's EMF exposure at work comes from electrical appliances and tools and from the building's power supply. People who work near transformers, electrical closets, circuit boxes, or other high-current electrical equipment may have 60-Hz magnetic field exposures of hundreds of milligauss or more. In offices, magnetic field levels are often similar to those found at home, typically 0.5 to 4.0 mG. However, these levels can increase dramatically near certain types of equipment.

EMF Spot Measurements

Industry and sources	ELF magnetic fields (mG)	Other frequencies	Comments
ELECTRICAL EQUIPMENT USED IN MACHINE MANUFACTURING			
Electric resistance heater	6,000–14,000	VLF	
Induction heater	10–460	High VLF	
Hand-held grinder	3,000	–	Tool exposures measured at operator's chest.
Grinder	110	–	Tool exposures measured at operator's chest.
Lathe, drill press, etc.	1–4	–	Tool exposures measured at operator's chest.
ALUMINUM REFINING			
Aluminum pot rooms	3.4–30	Very high static field	Highly-rectified DC current (with an ELF ripple) refines aluminum.
Rectification room	300–3,300	High static field	
STEEL FOUNDRY			
Ladle refinery			
Furnace active	170–1,300	High ULF from the ladle's big magnetic stirrer	Highest ELF field was at the chair of control room operator.
Furnace inactive	0.6–3.7	High ULF from the ladle's big magnetic stirrer	Highest ELF field was at the chair of control room operator.
Electrogalvanizing unit	2–1,100	High VLF	
TELEVISION BROADCASTING			
Video cameras (studio and minicams)	7.2–24.0	VLF	
Video tape degaussers	160–3,300	–	Measured 1 ft away.
Light control centers	10–300	–	Walk-through survey.
Studio and newsrooms	2–5	–	Walk-through survey.
HOSPITALS			
Intensive care unit	0.1–220	VLF	Measured at nurse’s chest.
Post-anesthesia care unit	0.1–24	VLF	
Magnetic resonance imaging (MRI)	0.5–280	Very high static field, VLF and RF	Measured at technician's work locations.
TRANSPORTATION			
Cars, minivans, and trucks	0.1–125	Most frequencies less than 60 Hz	Steel-belted tires are the principal ELF source for gas/diesel vehicles.
Bus (diesel powered)	0.5–146	Most frequencies less than 60 Hz	
Electric cars	0.1–81	Some elevated static fields	
Chargers for electric cars	4–63	–	Measured 2 ft from charger.
Electric buses	0.1–88	–	Measured at waist. Fields at ankles 2-5 times higher.
Electric train passenger cars	0.1–330	25 & 60 Hz power on U.S. trains	Measured at waist. Fields at ankles 2-5 times higher.
Airliner	0.8–24.2	400 Hz power on airliners	Measured at waist.
GOVERNMENT OFFICES			
Desk work locations	0.1–7	–	Peaks due to laser printers.
Desks near power center	18–50	–	
Power cables in floor	15–170	–	
Building power supplies	25–1,800	–	
Can opener	3,000	–	Appliance fields measured 6 in. away.
Desktop cooling fan	1,000	–	Appliance fields measured 6 in. away.
Other office appliances	10–200	–	

Source: National Institute for Occupational Safety and Health, 2001.
ULF (ultra low frequency)—frequencies above 0, below 3 Hz.
ELF (extremely low frequency)—frequencies 3–3,000 Hz.
VLF (very low frequency)—frequencies 3,000–30,000 Hz (3–30 kilohertz).

Q What EMF exposure occurs during travel?

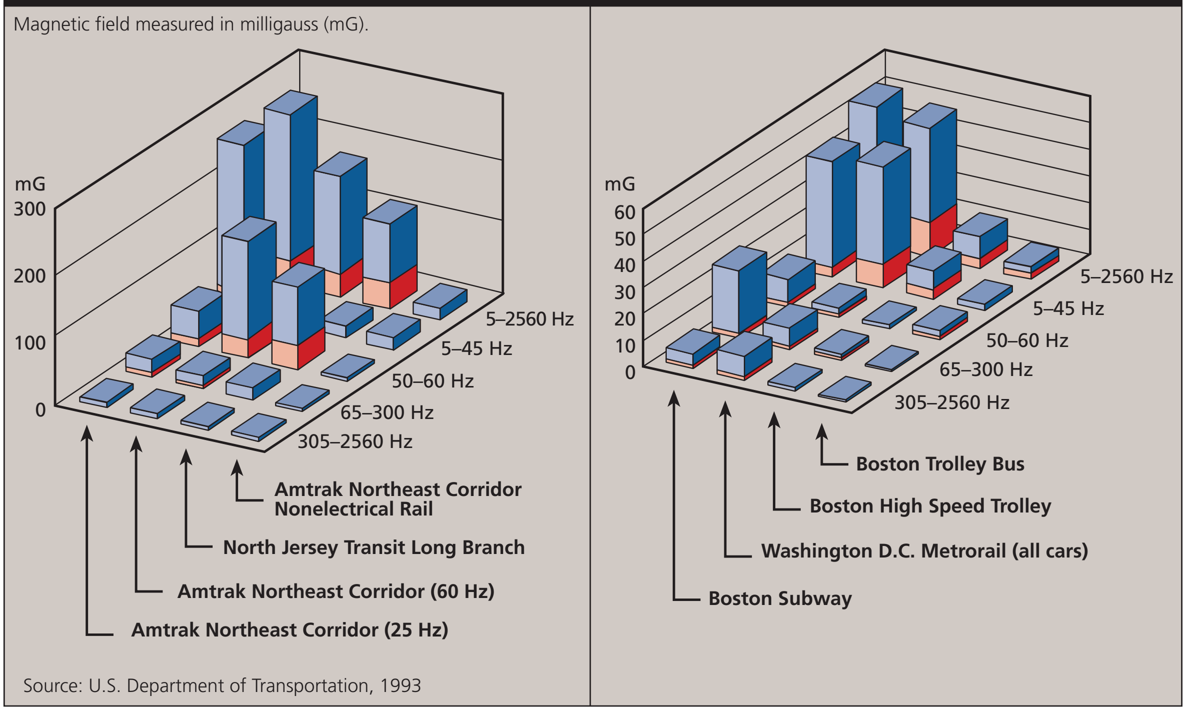
A Inside a car or bus, the main sources of magnetic field exposure are those you pass by (or under) as you drive, such as power lines. Car batteries involve direct current (DC) rather than alternating current (AC). Alternators can create EMF, but at frequencies other than 60 Hz. The rotation of steel-belted tires is also a source of EMF.

Most trains in the United States are diesel powered. Some electrically powered trains operate on AC, such as the passenger trains between Washington, D.C. and New Haven, Connecticut. Measurements taken on these trains using personal exposure monitors have suggested that average 60-Hz magnetic field exposures for passengers and conductors may exceed 50 mG. A U.S. government-sponsored exposure assessment study of electric rail systems found average 60-Hz magnetic field levels in train operator compartments that ranged from 0.4 mG (Boston high speed trolley) to 31.1 mG (North Jersey transit). The graph on the next page shows average and maximum magnetic field measurements in operator compartments of several electric rail systems. It illustrates that 60 Hz is one of several electromagnetic frequencies to which train operators are exposed.

Workers who maintain the tracks on electric rail lines, primarily in the northeastern United States, also have elevated magnetic field exposures at both 25 Hz and 60 Hz. Measurements taken by the National Institute for Occupational Safety and Health show that typical average daily exposures range from 3 to 18 mG, depending on how often trains pass the work site.

Rapid transit and light rail systems in the United States, such as the Washington D.C. Metro and the San Francisco Bay Area Rapid Transit, run on DC electricity. These DC-powered trains contain equipment that produces AC fields. For example, areas of strong AC magnetic fields have been measured on the Washington Metro close to the floor, during braking and acceleration, presumably near equipment located underneath the subway cars.

Magnetic Field Measurements in Train Operators' Compartments



These graphs illustrate that 60 Hz is one of several electromagnetic frequencies to which train operators are exposed. The maximum exposure is the top of the blue (upper) portion of the bar; the average exposure is the top of the red (lower) portion.

Q How can I find out how strong the EMF is where I live and work?

A The tables throughout this chapter can give you a general idea about magnetic field levels at home, for different jobs, and around various kinds of electrical equipment. For specific information about EMF from a particular power line, contact the utility that operates the line. Some will perform home EMF measurements.

You can take your own EMF measurements with a magnetic field meter. For a spot measurement to provide a useful estimate of your EMF exposure, it should be taken at a time of day and location when and where you are typically near the equipment. Keep in mind that the strength of a magnetic field drops off quickly with distance.

Independent technicians will conduct EMF measurements for a fee. Search the Internet under "EMF meters" or "EMF measurement." You should investigate the experience and qualifications of commercial firms, since governments do not standardize EMF measurements or certify measurement contractors.

At work, your plant safety officer, industrial hygienist, or other local safety official can be a good source of information. The National Institute for Occupational Safety and Health (NIOSH) sometimes conducts health hazard evaluations in workplaces where EMF is a suspected cause for concern. For further technical assistance, contact NIOSH at 800-356-4674.

Q How much do computers contribute to my EMF exposure?

A Personal computers themselves produce very little EMF. However, the video display terminal (VDT) or monitor provides some magnetic field exposure unless it is of the new flat-panel design. Conventional VDTs containing cathode ray tubes use magnetic fields to produce the image on the screen, and some emission of those magnetic fields is unavoidable. Unlike most other appliances which produce predominantly 60-Hz magnetic fields, VDTs emit magnetic fields in both the extremely low frequency (ELF) and very low frequency (VLF) frequency ranges (see page 8). Many newer VDTs have been designed to minimize magnetic field emissions, and those identified as "TCO'99 compliant" meet a standard for low emissions (see page 48).

Q What can be done to limit EMF exposure?

A Personal exposure to EMF depends on three things: the strength of the magnetic field sources in your environment, your distance from those sources, and the time you spend in the field.

If you are concerned about EMF exposure, your first step should be to find out where the major EMF sources are and move away from them or limit the time you spend near them. Magnetic fields from appliances decrease dramatically about an arm's length away from the source. In many cases, rearranging a bed, a chair, or a work area to increase your distance from an electrical panel or some other EMF source can reduce your EMF exposure.

Another way to reduce EMF exposure is to use equipment designed to have relatively low EMF emissions. Sometimes electrical wiring in a house or a building can be the source of strong magnetic field exposure. Incorrect wiring is a common source of higher-than-usual magnetic fields. Wiring problems are also worth correcting for safety reasons.

In its 1999 report to Congress, the National Institute of Environmental Health Sciences suggested that the power industry continue its current practice of siting power lines to reduce EMF exposures.

There are more costly actions, such as burying power lines, moving out of a home, or restricting the use of office space that may reduce exposures. Because scientists are still debating whether EMF is a hazard to health, it is not clear that the costs of such measures are warranted. Some EMF reduction measures may create other problems. For instance, compacting power lines reduces EMF but increases the danger of accidental electrocution for line workers.

We are not sure which aspects of the magnetic field exposure, if any, to reduce. Future research may reveal that EMF reduction measures based on today's limited understanding are inadequate or irrelevant. No action should be taken to reduce EMF exposure if it increases the risk of a known safety hazard.

5 EMF Exposure Standards

This chapter describes standards and guidelines established by state, national, and international safety organizations for some EMF sources and exposures.

Q Are there exposure standards for 60-Hz EMF?

A In the United States, there are no federal standards limiting occupational or residential exposure to 60-Hz EMF.

At least six states have set standards for transmission line electric fields; two of these also have standards for magnetic fields (see table below). In most cases, the maximum fields permitted by each state are the maximum fields that existing lines produce at maximum load-carrying conditions. Some states further limit electric field strength at road crossings to ensure that electric current induced into large metal objects such as trucks and buses does not represent an electric shock hazard.

State Transmission Line Standards and Guidelines

	Electric Field		Magnetic Field	
State	On R.O.W.*	Edge R.O.W.	On R.O.W.	Edge R.O.W.
Florida	8 kV/m[a] 10 kV/m[b]	2 kV/m	—	150 mG[a] (max. load) 200 mG[b] (max. load) 250 mG[c] (max. load)
Minnesota	8 kV/m	—	—	—
Montana	7 kV/m[d]	1 kV/m[e]		
New Jersey	—	3 kV/m		
New York	11.8 kV/m 11.0 kV/m[f] 7.0 kV/m[d]	1.6 kV/m	—	200 mG (max. load)
Oregon	9 kV/m	—	—	—

*R.O.W. = right-of-way (or in the Florida standard, certain additional areas adjoining the right-of-way). kV/m = kilovolt per meter. One kilovolt = 1,000 volts. [a]For lines of 69-230 kV. [b]For 500 kV lines. [c]For 500 kV lines on certain existing R.O.W. [d]Maximum for highway crossings. [e]May be waived by the landowner. [f]Maximum for private road crossings.

Two organizations have developed voluntary occupational exposure guidelines for EMF exposure. These guidelines are intended to prevent effects, such as induced currents in cells or nerve stimulation, which are known to occur at high magnitudes, much higher (more than 1,000 times higher) than EMF levels found typically in occupational and residential environments. These guidelines are summarized in the tables on the right.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) concluded that available data regarding potential long-term effects, such as increased risk of cancer, are insufficient to provide a basis for setting exposure restrictions.

The American Conference of Governmental Industrial Hygienists (ACGIH) publishes "Threshold Limit Values" (TLVs) for various physical agents. The TLVs for 60-Hz EMF shown in the table are identified as guides to control exposure; they are not intended to demarcate safe and dangerous levels.

ICNIRP Guidelines for EMF Exposure

Exposure (60 Hz)	Electric field	Magnetic field
Occupational	8.3 kV/m	4.2 G (4,200 mG)
General Public	4.2 kV/m	0.833 G (833 mG)

International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an organization of 15,000 scientists from 40 nations who specialize in radiation protection.
Source: ICNIRP, 1998.

ACGIH Occupational Threshold Limit Values for 60-Hz EMF

	Electric field	Magnetic field
Occupational exposure should not exceed	25 kV/m	10 G (10,000 mG)
Prudence dictates the use of protective clothing above	15 kV/m	–
Exposure of workers with cardiac pacemakers should not exceed	1 kV/m	1 G (1,000 mG)

American Conference of Governmental Industrial Hygienists (ACGIH) is a professional organization that facilitates the exchange of technical information about worker health protection. It is not a government regulatory agency.
Source: ACGIH, 2001.

Q Does EMF affect people with pacemakers or other medical devices?

A According to the U.S. Food and Drug Administration (FDA), interference from EMF can affect various medical devices including cardiac pacemakers and implantable defibrillators. Most current research in this area focuses on higher frequency sources such as cellular phones, citizens band radios, wireless computer links, microwave signals, radio and television transmitters, and paging transmitters.

Sources such as welding equipment, power lines at electric generating plants, and rail transportation equipment can produce lower frequency EMF strong enough to interfere with some models of pacemakers and defibrillators. The occupational exposure guidelines developed by ACGIH state that workers with cardiac pacemakers should not be exposed to a 60-Hz magnetic field greater than 1 gauss (1,000 mG) or a 60-Hz electric field greater than 1 kilovolt per meter (1,000 V/m) (see ACGIH guidelines above). Workers who are concerned about EMF exposure effects on pacemakers, implantable defibrillators, or other implanted electronic medical devices should consult their doctors or industrial hygienists.

Nonelectronic metallic medical implants (such as artificial joints, pins, nails, screws, and plates) can be affected by high magnetic fields such as those from magnetic resonance imaging (MRI) devices and aluminum refining equipment, but are generally unaffected by the lower fields from most other sources.

The FDA MedWatch program is collecting information about medical device problems thought to be associated with exposure to or interference from EMF. Anyone experiencing a problem that might be due to such interference is encouraged to call and report it (800-332-1088).

Q What about products advertised as producing low or reduced magnetic fields?

A Virtually all electrical appliances and devices emit electric and magnetic fields. The strengths of the fields vary appreciably both between types of devices and among manufacturers and models of the same type of device. Some appliance manufacturers are designing new models that, in general, have lower EMF than older models. As a result, the words "low field" or "reduced field" may be relative to older models and not necessarily relative to other manufacturers or devices. At this time, there are no domestic or international standards or guidelines limiting the EMF emissions of appliances.

The U.S. government has set no standards for magnetic fields from computer monitors or video display terminals (VDTs). The Swedish Confederation of Professional Employees (TCO) established in 1992 a standard recommending strict limits on the EMF emissions of computer monitors. The VDTs should produce magnetic fields of no more than 2 mG at a distance of 30 cm (about 1 ft) from the front surface of the monitor and 50 cm (about 1 ft 8 in) from the sides and back of the monitor. The TCO'92 standard has become a *de facto* standard in the VDT industry worldwide. A 1999 standard, promulgated by the Swedish TCO (known as the TCO'99 standard), provides for international and environmental labeling of personal computers. Many computer monitors marketed in the U.S. are certified as compliant with TCO'99 and are thereby assured to produce low magnetic fields.

Beware of advertisements claiming that the federal government has certified that the advertised equipment produces little or no EMF. The federal government has no such general certification program for the emissions of low-frequency EMF. The U.S. Food and Drug Administration's Center for Devices and Radiological Health (CDRH) does certify medical equipment and equipment producing high levels of ionizing radiation or microwave radiation. Information about certain devices as well as general information about EMF is available from the CDRH at 888-463-6332.

Q Are cellular telephones and towers sources of EMF exposure?

A Cellular telephones and towers involve radio-frequency and microwave-frequency electromagnetic fields (see page 8). These are in a much higher frequency range than are the power-frequency electric and magnetic fields associated with the transmission and use of electricity.

The U.S. Federal Communications Commission (FCC) licenses communications systems that use radio-frequency and microwave electromagnetic fields and ensures that licensed facilities comply with exposure standards. Public information on this topic is published on two FCC Internet sites: http://www.fcc.gov/oet/info/documents/bulletins/#56 and http://www.fcc.gov/oet/rfsafety/

The U.S. Food and Drug Administration also provides information about cellular telephones on its web site (http://www.fda.gov/cdrh/ocd/mobilphone.html).

6 National and International EMF Reviews

This chapter presents the findings and recommendations of major EMF research reviews, including the U.S. government's EMF RAPID Program.

Q What have national and international agencies concluded about the impact of EMF exposure on human health?

A Since 1995, two major U.S. reports have concluded that limited evidence exists for an association between EMF exposure and increased leukemia risk, but that when all the scientific evidence is considered, the link between EMF exposure and cancer is weak. The World Health Organization in 1997 reached a similar conclusion.

The two reports were the U.S. National Academy of Sciences report in 1996 and, in 1999, the National Institute of Environmental Health Sciences report to the U.S. Congress at the end of the U.S. EMF Research and Public Information Dissemination (RAPID) Program.

The U.S. EMF RAPID Program

Initiated by the U.S. Congress and established by law in 1992, the U.S. EMF Research and Public Information Dissemination (EMF RAPID) Program set out to study whether exposure to electric and magnetic fields produced by the generation, transmission, or use of electric power posed a risk to human health. For more information about the EMF RAPID Program, visit the web site (http://www.niehs.nih.gov/emfrapid).

The U.S. Department of Energy (DOE) administered the overall EMF RAPID Program, but health effects research and risk assessment were supervised by the National Institute of Environmental Health Sciences (NIEHS), a branch of the U.S. National Institutes of Health (NIH). Together, DOE and NIEHS oversaw more than 100 cellular and animal studies, as well as engineering and exposure assessment studies. Although the EMF RAPID Program did not fund any additional epidemiological studies, an analysis of the many studies already conducted was an important part of its final report.

The electric power industry contributed about half, or $22.5 million, of the $45 million eventually spent on EMF research over the course of the EMF RAPID Program. The NIEHS received $30.1 million from this program for research, public outreach, administration, and the health assessment evaluation of extremely low frequency (ELF) EMF. The DOE received approximately $15 million from this program for engineering and EMF mitigation research. The NIEHS contributed an additional $14.5 million for support of extramural and intramural research including long-term toxicity and carcinogenicity studies conducted by the National Toxicology Program.

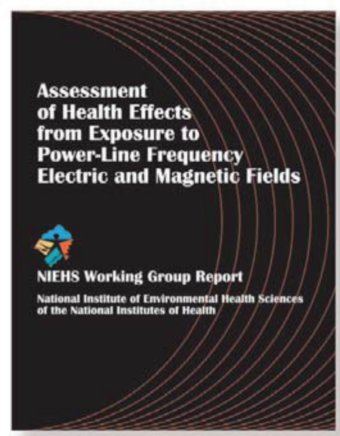
EMF RAPID Program Interagency Committee

- National Institute of Environmental Health Sciences
- Department of Energy
- Department of Defense
- Department of Transportation
- Environmental Protection Agency
- Federal Energy Regulatory Commission
- National Institute of Standards and Technology
- Occupational Safety and Health Administration
- Rural Electrification Administration

An interagency committee was established by the President of the United States to provide oversight and program management support for the EMF RAPID Program. The interagency committee included representatives from NIEHS, DOE, and seven other federal agencies with EMF-related responsibilities.

The EMF RAPID Program also received advice from a National EMF Advisory Committee (NEMFAC), which included representatives from citizen groups, labor, utilities, the National Academy of Sciences, and other groups. They met regularly with DOE and NIEHS staff to express their views. NEMFAC meetings were open to the public. The EMF RAPID Program sponsored citizen participation in some scientific meetings as well. A broad group of citizens reviewed all major public information materials produced for the program.

NIEHS Working Group Report 1998

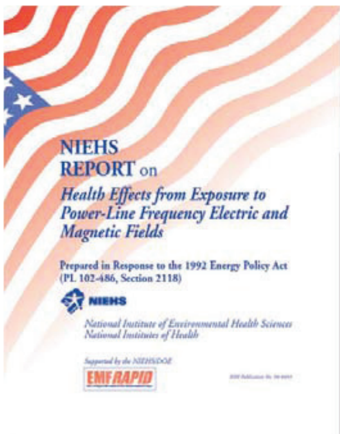


In preparation for the EMF RAPID Program's goal of reporting to the U.S. Congress on possible health effects from exposure to EMF from power lines, the NIEHS convened an expert working group in June 1998. Over 9 days, about 30 scientists conducted a complete review of EMF studies, including those sponsored by the EMF RAPID Program and others. Their conclusions offered guidance to the NIEHS as it prepared its report to Congress.

Using criteria developed by the International Agency for Research on Cancer, a majority of the members of the working group concluded that exposure to power-frequency EMF is a possible human carcinogen.

The majority called their opinion "a conservative public health decision based on limited evidence for an increased occurrence of childhood leukemias and an increased occurrence of chronic lymphocytic leukemia (CLL) in occupational settings." For these diseases, the working group reported that animal and cellular studies neither confirm nor deny the epidemiological studies' suggestion of a disease risk. This report is available on the NIEHS EMF RAPID web site (http://www.niehs.nih.gov/emfrapid).

NIEHS Report to Congress at Conclusion of EMF RAPID Program



In June 1999, the NIEHS reported to the U.S. Congress that scientific evidence for an EMF-cancer link is weak.

The following are excerpts from the 1999 NIEHS report:

> The NIEHS believes that the probability that ELF-EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal, scientific support that exposure to this agent is causing any degree of harm.
>
> The scientific evidence suggesting that extremely low frequency EMF exposures pose any health risk is weak. The strongest evidence for health effects comes from associations observed in human populations with two forms of cancer: childhood leukemia and chronic lymphocytic leukemia in occupationally exposed adults. While the support from individual studies is weak, the epidemiological studies demonstrate, for some methods of measuring exposure, a fairly consistent pattern of a small, increased risk with increasing exposure that is somewhat weaker for chronic lymphocytic leukemia than for childhood leukemia. In contrast, the mechanistic studies and the animal toxicology literature fail to demonstrate any consistent pattern across studies, although sporadic findings of biological effects (including increased cancers in animals) have been reported. No indication of increased leukemias in experimental animals has been observed.

The full report is available on the NIEHS EMF RAPID web site (http://www.niehs.nih.gov/emfrapid).

No regulatory action was recommended or taken based on the NIEHS report. The NIEHS director, Dr. Kenneth Olden, told the Congress that, in his opinion, the conclusion of the NIEHS report was not sufficient to warrant aggressive regulatory action.

The NIEHS did not recommend adopting EMF standards for electric appliances or burying electric power lines. Instead, it recommended providing public information about practical ways to reduce EMF exposure. The NIEHS also suggested that power companies and utilities "continue siting power lines to reduce exposures and . . . explore ways to reduce the creation of magnetic fields around transmission and distribution lines without creating new hazards." The NIEHS encouraged manufacturers to reduce magnetic fields at a minimal cost, but noted that the risks do not warrant expensive redesign of electrical appliances.

The NIEHS also encouraged individuals who are concerned about EMF in their homes to check to see if their homes are properly wired and grounded, since incorrect wiring or other code violations are a common source of higher-than-usual magnetic fields.

National Academy of Sciences Report

In October 1996, a National Research Council committee of the National Academy of Sciences (NAS) released its evaluation of research on potential associations between EMF exposure and cancer, reproduction, development, learning, and behavior. The report concluded:

> Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects.

The NAS report focused primarily on the association of childhood leukemia with the proximity of the child's home to power lines. The NAS panel found that although a link between EMF exposure and increased risk for childhood leukemia was observed in studies that had estimated EMF exposure using the wire code method (distance of home from power line), such a link was not found in studies that had included actual measurements of magnetic fields at the time of the study. The panel called for more research to pinpoint the unexplained factors causing small increases in childhood leukemia in houses close to power lines.

World Health Organization International EMF Project

The World Health Organization (WHO) International EMF Project, with headquarters in Geneva, Switzerland, was launched at a 1996 meeting with representatives of 23 countries attending. It was intended to respond to growing concerns in many member states over possible EMF health effects and to address the conflict between such concerns and technological and economic progress. In its advisory role, the WHO International EMF Project is now reviewing laboratory and epidemiological evidence, identifying gaps in scientific knowledge, developing an agenda for future research, and developing risk communication booklets and other public information. The WHO International EMF Project is funded with contributions from governments and institutions and is expected to provide an overall EMF health risk assessment. Additional information about this program can be found on the WHO EMF web site (http://www.who.int/peh-emf).

As part of this project, in 1997 a working group of 45 scientists from around the world surveyed the evidence for adverse

EMF health effects. They reported that, "taken together, the findings of all published studies are suggestive of an association between childhood leukemia and estimates of ELF (extremely low frequency or power-frequency) magnetic fields."

Much like the 1996 U.S. NAS report, the WHO report noted that living in homes near power lines was associated with an approximate 1.5-fold excess risk of childhood leukemia. But unlike the NAS panel, WHO scientists had seen the results of the 1997 U.S. National Cancer Institute study of EMF and childhood leukemia (see page 17). This work showed even more strongly the inconsistency between results of studies that used a wire code to estimate EMF exposure and studies that actually measured magnetic fields.

Regarding health effects other than cancer, the WHO scientists reported that the epidemiological studies "do not provide sufficient evidence to support an association between extremely-low-frequency magnetic-field exposure and adult cancers, pregnancy outcome, or neurobehavioural disorders."

World Health Organization International Agency for Research on Cancer

The WHO International Agency for Research on Cancer (IARC) produces a monograph series that reviews the scientific evidence regarding potential carcinogenicity associated with exposure to environmental agents. An international scientific panel of 21 experts from 10 countries met in June 2001 to review the scientific evidence regarding the potential carcinogenicity of static and ELF (extremely low frequency or power-frequency) EMF. The panel categorized its conclusions for carcinogenicity based on the IARC classification system—a system that evaluates the strength of evidence from epidemiological, laboratory (human and cellular), and mechanistic studies. The panel classified power-frequency EMF as "possibly carcinogenic to humans" based on a fairly consistent statistical association between a doubling of risk of childhood leukemia and magnetic field exposure above 0.4 microtesla (0.4 µT, 4 milligauss or 4 mG).

In contrast, they found no consistent evidence that childhood EMF exposures are associated with other types of cancer or that adult EMF exposures are associated with increased risk for any kind of cancer. The IARC panel reported that no consistent carcinogenic effects of EMF exposure have been observed in experimental animals and that there is currently no scientific explanation for the observed association between childhood leukemia and EMF exposure. Further information can be obtained at the IARC web sites (http://www.iarc.fr and http://monographs.iarc.fr).

International Commission on Non-Ionizing Radiation Protection

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) issued exposure guidelines to guard against known adverse effects such as stimulation of nerves and muscles at very high EMF levels, as well as shocks and burns caused by touching objects that conduct electricity (see page 47). In April 1998, ICNIRP revised its exposure guidelines and characterized as "unconvincing" the evidence for an association between everyday power-frequency EMF and cancer.

European Union

In 1996, a European Union (EU) advisory panel provided an overview of the state of science and standards among EU countries. With respect to power-frequency EMF, the panel members said that there is no clear evidence that exposure to EMF results in an increased risk of cancer.

Australia—Radiation Advisory Committee Report to Parliament

In 1997, Australia's Radiation Advisory Committee briefly reviewed the EMF scientific literature and advised the Australian Parliament that, overall, there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power-frequency magnetic fields.

The committee also reported that "the weight of opinion as expressed in the U.S. National Academy of Sciences report, and the negative results from the National Cancer Institute study (Linet et al., 1997) would seem to shift the balance of probability more towards there being no identifiable health effects" (see pages 17 and 53).

Canada—Health Canada Report

In December 1998, a working group of public health officers at Health Canada, the federal agency that manages Canada's health care system, issued a review of the scientific literature regarding power-frequency EMF health effects. They found the evidence to be insufficient to conclude that EMF causes a risk of cancer.

The report concluded that while EMF effects may be observed in biological systems in a laboratory, no adverse health effects have been demonstrated at the levels to which humans and animals are typically exposed.

As for epidemiology, 25 years of study results are inconsistent and inconclusive, the panel said, and a plausible EMF-cancer mechanism is missing. Health Canada pledged to continue monitoring EMF research and to reassess this position as new information becomes available.

Germany—Ordinance 26

On January 1, 1997, Germany became the first nation to adopt a national rule on EMF exposure for the general public. Ordinance 26 applies only to facilities such as overhead and underground transmission and distribution lines, transformers, switchgear and overhead lines for electric-powered trains. Both electric (5 kV/m) and magnetic field exposure limits (1 Gauss) are high enough that they are unlikely to be encountered in ordinary daily life. The ordinance also requires that precautionary measures be taken on a case-by-case basis when electric facilities are sited or upgraded near homes, hospital, schools, day care centers, and playgrounds.

Great Britain—National Radiological Protection Board Report

The National Radiological Protection Board (NRPB) in Great Britain advises the government of the United Kingdom regarding standards of protection for exposure to non-ionizing radiation. The NRPB's advisory group on non-ionizing radiation periodically reviews new developments in EMF research and reports its findings. Results of the advisory group's latest review were published in 2001. The report reviewed residential and occupational epidemiological studies, as well as cellular, animal, and human volunteer studies that had been published.

The advisory group noted that there is "some epidemiological evidence that prolonged exposure to higher levels of power frequency magnetic fields is associated with a small risk of leukaemia in children." Specifically, the NRPB advisory group's analysis suggests "that relatively heavy average exposures of 0.4 µT [4 mG] or more are associated with a doubling of the risk of leukaemia in children under 15 years of age." The group pointed out, however, that laboratory experiments have provided "no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer."

Scandinavia—EMF Developments

In October 1995, a group of Swedish researchers and government officials published a report about EMF exposure in the workplace. This "Criteria Group" reviewed EMF scientific literature and, using the IARC classification system, ranked occupational EMF exposure as "possibly carcinogenic to humans." They also endorsed the Swedish government's 1994 policy statement that public exposure limits to EMFs were not needed, but that people might simply want to use caution with EMFs.

In 1996, five Swedish government agencies further explained their precautionary advice about EMF. EMF exposure should be reduced, they said, but only when practical, without great inconvenience or cost.

Health experts in Norway, Denmark, and Finland generally agreed in reviews published in the 1990s that if an EMF health risk exists, it is small. They acknowledged that a link between residential magnetic fields and childhood leukemia cannot be confirmed or denied. In 1994, several Norwegian government ministries also recommended increasing the distance between residences and electrical facilities, if it could be done at low cost and with little inconvenience.

Q What other U.S. organizations have reported on EMF?

A

American Medical Association

In 1995, the American Medical Association advised physicians that no scientifically documented health risk had been associated with "usually occurring" EMF, based on a review of EMF epidemiological, laboratory studies, and major literature reviews.

American Cancer Society

In 1996, the American Cancer Society released a review of 20 years of EMF epidemiological research including occupational studies and residential studies of adult and childhood cancer. The society noted that some data support a possible relationship of magnetic field exposure with leukemia and brain cancer, but further research may not be justified if studies continue to find uncertain results. Of particular interest is the summary of results from eight studies of risk from use of household appliances with relatively high magnetic fields, such as electric blankets and electric razors. The summary suggested that there is no persuasive evidence for increased risk with more frequent or longer use of these appliances.

American Physical Society

The American Physical Society (APS) represents thousands of U.S. physicists. Responding to the NIEHS Working Group's conclusion that EMF is a possible human carcinogen, the APS executive board voted in 1998 to reaffirm its 1995 opinion that there is "no consistent, significant link between cancer and power line fields."

California's Department of Health Services

In 1996, California's Department of Health Services (DHS) began an ambitious five-year effort to assess possible EMF public health risk and offer guidance to school administrators and other decision-makers. The California Electric and Magnetic Fields (EMF) Program is a research, education, and technical assistance program concerned with the possible health effects of EMF from power lines, appliances, and other uses of electricity. The program's goal is to find a rational and fair approach to dealing with the potential risks, if any, of exposure to EMF. This is done through research, policy analysis, and education. The web site has educational materials on EMF and related health issues for individuals, schools, government agencies, and professional organizations (http://www.dhs.ca.gov/ps/deodc/ehib/emf).

Q What can we conclude about EMF at this time?

A Electricity is a beneficial part of our daily lives, but whenever electricity is generated, transmitted, or used, electric and magnetic fields are created. Over the past 25 years, research has addressed the question of whether exposure to power-frequency EMF might adversely affect human health. For most health outcomes, there is no evidence that EMF exposures have adverse effects. There is some evidence from epidemiology studies that exposure to power-frequency EMF is associated with an increased risk for childhood leukemia. This association is difficult to interpret in the absence of reproducible laboratory evidence or a scientific explanation that links magnetic fields with childhood leukemia.

EMF exposures are complex and come from multiple sources in the home and workplace in addition to power lines. Although scientists are still debating whether EMF is a hazard to health, the NIEHS recommends continued education on ways of reducing exposures. This booklet has identified some EMF sources and some simple steps you can take to limit your exposure. For your own safety, it is important that any steps you take to reduce your exposures do not increase other obvious hazards such as those from electrocution or fire. At the current time in the United States, there are no federal standards for occupational or residential exposure to 60-Hz EMF.

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APPENDIX A-2 - AIR POLLUTION CONTROL PERMIT TO CONSTRUCT

NORTH DAKOTA
DEPARTMENT of HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

AIR POLLUTION CONTROL
PERMIT TO CONSTRUCT

Permittee: **Name:** Basin Electric Power Cooperative	**Permit Number:** PTC 13049
Address: 1717 E Interstate Avenue Bismarck, ND 58503-0564	**Source Name:** Lonesome Creek Generating Station
Source Location: Sec. 23, T150N, R101W McKenzie County	**Source Type:** Combustion Turbines

Expiration Date:

See Condition 6.D.2

Pursuant to Chapter 23-25 of the North Dakota Century Code, and the Air Pollution Control Rules of the State of North Dakota, Article 33-15 of the North Dakota Administrative Code (NDAC), and in reliance on statements and representations heretofore made by the permittee designated above, a Permit to Construct is hereby issued authorizing such permittee to construct and initially operate the emissions unit(s) at the location designated above. This Permit to Construct is subject to all applicable rules and orders now or hereafter in effect of the North Dakota Department of Health and to any conditions specified on the following pages. All conditions are enforceable by EPA and citizens under the Clean Air Act unless otherwise noted.

Issued: 9/16/13

Terry O'Clair

Terry L. O'Clair, P.E.
Director
Division of Air Quality

Lonesome Creek Generating Station
Permit to Construct
Table of Contents

Abbreviations and Acronyms

acfm	-	Actual Cubic Feet Per Minute
ASTM	-	American Society for Testing and Materials
avg.	-	Average
BACT	-	Best Available Control Technology
BEPC	-	Basin Electric Power Cooperative
BMP	-	Best Management Practices
CatOx	-	Catalytic Oxidation
CEMS	-	Continuous Emissions Monitoring System
CO	-	Carbon Monoxide
CO_2	-	Carbon Dioxide
CO_2e	-	Carbon Dioxide Equivalent
CPM	-	Condensible Particulate Matter
CT	-	Combustion Turbine
dscf	-	Dry Standard Cubic Feet
EP	-	Emission Point
EU	-	Emission Unit
Fug.	-	Fugitive
GHG	-	Greenhouse Gases
gr	-	Grains
HAP	-	Hazardous Air Pollutant
HHV	-	Higher Heating Value
hr	-	Hour
lb/hr	-	Pounds Per Hour

$lb/10^6$ Btu	-	Pounds Per Million British Thermal Units
lb/MWe-hr	-	Pounds Per Megawatt Hour
LDAR	-	Leak Detection and Repair
MWe	-	Megawatts of Electricity
NO_x	-	Nitrogen Oxides
N/A	-	Not Applicable
NSPS	-	New Source Performance Standards (40 CFR 60)
PM	-	Particulate Matter
PM_{10}	-	Particulate Matter with an Aerodynamic Diameter Equal to or Less Than 10 Micrometers in Diameter
$PM_{2.5}$	-	Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 2.5 Micrometers
ppmvd	-	Parts per Million by Volume on a Dry Basis
PSD	-	Prevention of Significant Deterioration
r.a.	-	Rolling average
scf	-	Standard Cubic Feet
SCR	-	Selective Catalytic Reduction
SO_2	-	Sulfur Dioxide
TBD	-	To Be Determined
VOC	-	Volatile Organic Compounds
4 h.r.a.	-	4-hour Rolling Average
8 h.r.a.	-	8-hour Rolling Average
12 m.r.t.	-	12 Month Rolling Total

1. **General Information:**

   A. Facility Name: Lonesome Creek Generating Station

   B. Existing Source Classification: PSD Major Source, HAP Area Source

   C. Process Description: BEPC has proposed to construct an electrical generating station consisting of three natural gas-fired combustion turbines. All three turbines are GE Model LM6000 PF SPRINT with a nominal maximum rating of 46.0 MWe and a nominal maximum heat input of 412 x 10^6 Btu/hr each.

   D. Existing Permit to Construct: On April 25, 2012, BEPC was issued Permit to Construct No. PTC12011 for Unit 1 at the Lonesome Creek Generating Station. Once this Permit to Construct is issued, Permit to Construct No. PTC12011 is rescinded.

2. **Emission Unit(s) Identification:**

The emission units regulated by this permit are as follows:

Table 1
Emission Units

Emission Unit Description	Emission Unit (EU)	Emission Point (EP)	Air Pollution Control Equipment
Unit 1 - Combustion Turbine	1	1	SCR + CatOx
Unit 2 - Combustion Turbine	2	2	SCR + CatOx
Unit 3 - Combustion Turbine	3	3	SCR + CatOx
Fugitive - Methane Emissions	Fug.	Fug.	N/A
Fugitive - SF_6 Emissions	Fug.	Fug.	N/A

3. **Construction Restrictions:**

   A. This Permit to Construct allows the construction and initial operation of the above-mentioned emission units. The source units may be operated under this Permit to Construct until a Title V Permit to Operate for the Lonesome Creek Generating Station is issued unless this permit is suspended or revoked. The source is subject to all applicable rules, regulations, and orders now or hereafter in effect of the North Dakota Department of Health (hereafter referred to as the Department) and to the conditions specified herein.

   B. This Permit to Construct is issued in reliance upon the accuracy and completeness of the information set forth in the application. Notwithstanding the tentative nature of this information, the conditions of this permit herein become, upon the effective date of this permit, enforceable by the Department pursuant to any remedies it now has or may in the future have, under the North Dakota Air Pollution Control Law, NDCC Chapter 23-25. Each and every condition of this permit is a material part thereof, and is not severable.

Applicable Requirement: NDAC 33-15-14-02

4. **Fuel Restrictions**:

A. Pipeline Quality Natural Gas: EU 1, 2 and 3 shall be operated using only pipeline quality natural gas as defined in NDAC 33-15-01. The sulfur content of the gas shall not exceed 2 gr/100 scf.

Applicable Requirement: NDAC 33-15-14-02.9.f

5. **Emission Unit(s) Limits:**

A. Combustion Turbine NO_x:

For purposes of determining compliance with the NO_x limits on a ppm basis specified in Condition 5.D, the procedures specified in 40 CFR 60, Subpart KKKK shall be used. The permittee shall calculate a rolling average if a valid NO_x emission rate is obtained for at least 3 of the 4 hours. For 4-hour rolling periods during which the two different limits apply, the allowable emission rate is the average of the applicable limit during each hour. The higher limit applies for the hour if at any point in the hour, the unit was subject to the higher limit.

Applicable Requirements: NDAC 33-15-12-02, Subpart KKKK and NDAC 33-15-14-02.9

B. Combustion Turbine CO:

For purposes of determining compliance with the ppmvd emission limit in Condition 5.D, the permittee shall calculate a 8-hour rolling average (ppm basis) if a valid CO emission rate is obtained for at least 6 of the 8 hours in which each unit is operating (excludes startup).

Applicable Requirement: NDAC 33-15-14-02.9

C. Combustion Turbine GHG Emissions:

The permittee shall determine compliance with the GHG limit (CO_2e) specified in Condition 5.D using one of the methods in 40 CFR 75.10(a)(3) to determine CO_2 emissions and adding emissions of nitrous oxide (N_2O) and methane (CH_4) which are calculated on a CO_2e basis. The methane and nitrous oxide emissions (CO_2e basis) shall be determined using emission factors and global warming potentials in 40 CFR 98, along with the heat input to the turbine. The heat input to the turbine shall be calculated from the amount of natural gas burned (as measured in accordance with Condition 8.G.) and the higher heating value of the natural gas. All emission rates shall be converted to short tons. Other site specific emission factors for the N_2O and CH_4 emission rates and methods for calculating the heat input to the turbine may be used provided they are approved by the Department in advance.

Applicable Requirement: NDAC 33-15-14-02.9

D. Emission Limits:

Table 2
Emission Limits

Emission Unit Description	EU	EP	Parameter	Emission Limit	Applicable Requirement
Combustion Turbine	1-3	1-3	NO_x[1]	5.0 ppmvd @ 15% O_2 (4 h.r.a.)	NDAC 33-15-15-01.2 BACT
			NO_x (startup)[2]	18.5 lb per startup (each CT)	NDAC 33-15-15-01.2 BACT
			NO_x[3]	42.9 lb/hr (total) (1-hr block avg.)	NDAC 33-15-15-01.2 BACT
			CO[1]	6.0 ppmvd @ 15% O_2 (8 h.r.a.)	NDAC 33-15-15-01.2 BACT
			CO (startup)[2]	31.5 lb per startup (each CT)	NDAC 33-15-15-01.2 BACT
			CO[3]	54.2 lb/hr (total) (1-hr block avg.)	NDAC 33-15-15-01.2 BACT
			$PM_{10}/PM_{2.5}$[4] (filterable and condensable)	5.0 lb/hr (each CT)	NDAC 33-15-15-01.2 BACT
			SO_2	See Condition 4	NDAC 33-15-15-01.2 BACT
			Visible Emissions	20% Opacity (see Condition 5.E.1)	NDAC 33-15-15-01.2 BACT
			GHG (CO_2e)	220,122 tons (each) (12-m.r.t.)	NDAC 33-15-15-01.2 BACT
Fugitive Methane Emissi	Fug.	Fug.	Methane	LDAR (see Condition 6.A)	NDAC 33-15-15-01.2 BACT
Fugitive SF_6 Emissions	Fug.	Fug.	SF_6	(see Condition 6.B)	NDAC 33-15-15-01.2 BACT

[1] Does not apply during startup.
[2] Startup is defined to begin at initial firing of the combustion turbine and includes the time necessary to reach the oxidation catalyst and SCR temperatures needed for effective CO and NO_x control. For purposes of this condition, the limit applies only for the 30-minute period which begins when startup commences.
[3] Applies at all times including startup and shutdown. Total for three turbines calculated as the sum of the 1-hour block average emission rates for each unit.
[4] Average of three test runs.

E. Visible Emissions Limits:

The emission units listed above shall not exceed the following opacity limits:

1) Point Sources: Twenty percent, except that a maximum of 40% is permissible for not more than one six-minute period per hour. This limit applies at all times. Compliance with this visible emissions limit shall be determined by conducting observations in accordance with NDAC 33-15-03-05 (Method 9 of 40 CFR 60, Appendix A as incorporated by reference into NDAC 33-15-12).

Applicable Requirement: NDAC 33-15-03-02

2) Fugitive Emissions: The permittee shall not discharge into the ambient air any air contaminant which exhibits an opacity greater than 40% for more than one six-minute period per hour. Such visible emissions shall have been visibly transported off the property of emission origination and remains visible to an observer positioned off said property when sighting along a line which does not cross the property of emission origination.

Applicable Requirement: NDAC 33-15-03-03

F. Stack Height:

Stacks for the combustion turbines (EP 1-3) shall extend at least 80 feet above ground level.

Applicable Requirements: NDAC 33-15-02 and NDAC 33-15-15-01.2

6. **Other Conditions**:

A. Fugitive Methane LDAR: The permittee shall implement an instrumental leak detection and repair program to minimize emissions of methane from the facility. The program shall include quarterly leak inspections. A leak is detected when the instrument measures a concentration of 500 ppm or more above background. Repairs must be made as soon as practicable. Records shall be kept of all inspections and repairs. The records shall be available upon request.

Applicable Requirement: NDAC 33-15-15-01.2 - BACT

B. Circuit Breakers Containing SF_6: Circuit breakers containing SF_6 shall be guaranteed by the manufacturer to have an SF_6 leakage rate of 0.5% per year or less. The permittee shall implement a program for tracking SF_6 to help identify leaks. The permittee shall also educate its employees regarding SF_6 leaks and the necessity of minimizing those leaks. All leaks that are detected shall be repaired as soon as practicable. Records shall be kept of the manufacturer's guarantee , SF_6 tracking, employee training and repairs to the breakers containing SF_6. The records shall be available upon request.

Applicable Requirement: NDAC 33-15-15-01.2-BACT

C. Compliance: The permittee shall comply with all State and Federal environmental laws and rules. In addition, the permittee shall comply with all local building, fire, zoning, and other applicable ordinances, codes, rules and regulations.

Applicable Requirement: NDAC 33-15-14-02.9

D. Construction: Construction of the facility shall be in accordance with information provided in the Permit to Construct application as well as any plans, specifications and supporting data submitted to the Department.

1) Deviations:

a) The Department shall be notified at least ten days in advance of any significant deviations from the Permit to Construct application as well as any plans, specifications or supporting data furnished. The issuance of this Permit to Construct may be suspended or revoked if the Department determines that a significant deviation from the plans, permit application, specifications, and supporting data furnished has been or is to be made.

b) Any violation of a condition issued as part of this Permit to Construct as well as any construction which proceeds in variance with any information submitted in the application, is regarded as a violation of construction authority and is subject to enforcement action.

Applicable Requirement: NDAC 33-15-14-02.9

2) Construction Commencement: This Permit to Construct shall become invalid if construction is not commenced within eighteen months after receipt of such permit, if construction is discontinued for a period of eighteen months or more; or if construction is not completed within a reasonable time. The Department may extend the 18-month period upon a satisfactory showing that an extension is justified.

Applicable Requirement: NDAC 33-15-14-02.10

3) Initial Startup: A notification of the anticipated date of initial startup of the facility must be submitted to the Department not more than 60 days nor less than 15 days prior to such date. A notification of the actual date of initial startup shall be submitted within 15 days after such date.

Applicable Requirements: NDAC 33-15-14-02.9.d and NDAC 33-15-12-02, Subpart A

4) Permit Application Processing: The permittee shall pay permit application processing fees in accordance with NDAC 33-15-23-02.2.

Applicable Requirement: NDAC 33-15-23-02.2

E. Best Management Practices:

General: At all times, including periods of startup, shutdown and malfunction, the permittee shall, to the extent practicable, maintain and operate any affected emission unit including associated air pollution control equipment in a manner consistent with good air pollution control and good combustion practice for minimizing emissions.

Applicable Requirement: NDAC 33-15-14-02.9

F. New Source Performance Standards (NSPS): The permittee shall comply with the applicable requirements of NDAC 33-15-12-02 including:

Subpart A	-	General Provisions
Subpart KKKK	-	Standards of Performance for Stationary Gas Turbines

Applicable Requirement: NDAC 33-15-12

G. Acid Rain Program:

The permittee shall comply with the applicable requirements of 40 CFR 72, 75 and 76. The permittee shall hold sulfur dioxide allowances, as of the allowance transfer deadline, in the unit's subaccount not less than the total annual emissions of sulfur dioxide for the previous calendar year from the unit.

Applicable Requirement: NDAC 33-15-21

H. Title V Permit to Operate Application:

Within 12 months after commencing operation of the first turbine, the permittee shall submit an application for a Title V Permit to Operate for the Lonesome Creek Generating Station.

Applicable Requirement: NDAC 33-15-14-06

7. Emissions Testing:

A. Initial Testing: Within 60 days after achieving the maximum production rate at the plant, but not later than 180 days after startup, the permittee shall conduct emissions tests using an independent testing firm, to determine the compliance status of the facility with respect to the emission limits specified in Table 2. The continuous emissions monitors required under the Acid Rain Program and this permit for the combustion turbine shall be certified (performance evaluations completed and requirements met) within the time frames specified above and prior to the emissions test for the pollutant the CEMS is measuring. The testing of the emissions unit shall be accomplished in accordance with the requirements listed below:

Table 3
Emissions Testing

Emission Unit Description	EU	EP	Contaminant	Number of Runs	Length of Runs (min.)	Test Method(s)
Combustion Turbine	1-3	1-3	PM10/PM2.5 (filterable)	3	120 (minimum)	1-4, 201a
			PM10/PM2.5 (CPM)	3	120 (minimum)	202
			NO_x	N/A	N/A	CEMS
			CO	N/A	N/A	CEMS
			CO_2	N/A	N/A	Methods in 40 CFR 75.10(a)(3)
			Opacity	1	18	9

NOTE: Test methods and sampling times different from those listed in Table 3 may be used if approved in advance by the Department.

Applicable Requirements: NDAC 33-15-12 and NDAC 33-15-14-02.9.b

B. Notification: The permittee shall notify the Department using the form in the Emission Testing Guideline, or its equivalent, at least 30 calendar days in advance of any tests of emissions of air contaminants required by the Department. If the permittee is unable to conduct the performance test on the scheduled date, the permittee shall notify the Department at least five days prior to the scheduled test date and coordinate a new test date with the Department.

Applicable Requirement: NDAC 33-15-01-12.1

C. Sampling Ports/Access:

1) Sampling ports shall be provided downstream of all emission control devices and in a flue, conduit, duct, stack or chimney arranged to conduct emissions to the ambient air.

2) The ports shall be located to allow for reliable sampling and shall be adequate for test methods applicable to the facility. Safe sampling platforms and safe access to the platforms shall be provided. Plans and specifications showing the size and location of the ports, platform and utilities shall be submitted to the Department for review and approval.

3) Where the emission point is not a stack (e.g. blower) the permittee shall construct the appropriate temporary ducting or stack as necessary to assure an accurate test, when directed to do so by the Department.

Applicable Requirement: NDAC 33-15-14-02.14

8. **Monitoring Requirements and Conditions:**

A. Requirements: Monitoring shall be in accordance with the requirements of all applicable regulations and directives including those in 40 CFR 60, Subpart KKKK and 40 CFR 75.

B. Carbon Monoxide CEMS: The permittee shall install, calibrate, operate and maintain equipment for continuously monitoring the carbon monoxide emission rate from the stack. The systems shall report carbon monoxide emissions in units of ppmvd and lb/hr. The monitoring systems shall comply with the requirements of 40 CFR 60, Appendix B, Performance Specification 4. Quality assurance shall be in accordance with 40 CFR 60, Appendix F.

C. Other CEMs: The permittee shall install, calibrate, operate and maintain continuous emission monitors for nitrogen oxides and oxygen in accordance with the requirements of 40 CFR 75 and 40 CFR 60, Subpart KKKK.

D. The permittee shall install, calibrate, operate and maintain equipment for measuring and recording the gross energy output (MWe) on a hourly basis in accordance with 40 CFR 60, Subpart KKKK.

E. The permittee shall install, calibrate, operate, and maintain equipment to measure and record the ambient temperature at the site on an hourly basis in accordance with 40 CFR 60, Subpart KKKK.

F. The permittee shall install, calibrate, operate and maintain equipment to measure and record the quantity of natural gas combusted in each combustion turbine (EU 1, 2 and 3) in accordance with 40 CFR 60, Subpart KKKK.

G. The permittee shall determine the gross calorific value of the fuel monthly using the procedures in 40 CFR 75, Appendix F, Section 5.5.2.

H. The permittee shall determine the fuel sulfur content in accordance with 40 CFR 60, Subpart KKKK.

Applicable Requirements: NDAC 33-15-14-02.9, NDAC 33-15-12 and NDAC 33-15-21

9. **Recordkeeping**: All records required by this permit shall be kept on file for a period of five years. The records shall be available for inspection by Department personnel and shall be submitted to the Department upon request. In addition to maintaining the records required by any of the applicable regulations as listed in Condition 10 below, the following records shall be maintained:

A. All stack tests results including field data, laboratory analysis data, and quality assurance data.

B. All continuous emission monitoring data required by this permit, 40 CFR 60 and 40 CFR 75.

C. The results of all visible emissions observations and any corrective actions taken.

D. Quarterly inspection results for methane leaks and any repairs completed.

E. The occurrence of any startup or shutdown.

F. Ambient temperatures on an hourly basis.

G. Generator gross energy output (MWe).

H. Amount of natural gas combusted in EU 1, 2 and 3.

I. Fuel gross calorific values.

Applicable Requirements: NDAC 33-15-12 and NDAC 33-15-14-02.9.d

10. **Reporting:**

A. Reporting shall be in accordance with the following applicable requirements of Chapter 33-15-12, Chapter 33-15-14 and Chapter 33-15-21 of the North Dakota Air Pollution Control Rules.

1) 40 CFR 60, Subpart A, Section 60.7, Notification and Recordkeeping.

2) 40 CFR 60, Subpart KKKK, Section 60.4375, Reporting Requirements.

3) Subdivision 33-15-21-01.6.f of the North Dakota Air Pollution Control Rules, Reporting and Recordkeeping Requirements.

4) Quarterly excess emissions reports for EUs 1-3 shall be submitted by the 30th day following the end of each 3-month period. Excess emissions are defined as emission rates which exceed the emission limits outlined in Condition 5. Excess emissions shall be reported for the following:

Emission Unit	Parameter	Averaging Period
Combustion Turbine	NO_x (ppmvd)	4-h.r.a.
	NO_x (lb/hr)	1-hr block avg.
	NO_x (lb)	Per startup or shutdown event
	CO (ppmvd)	8-h.r.a.
	CO (lb/hr)	1-hr block avg.
	CO (lb)	Per startup or shutdown event
	CO_2e (tons)	12 m.r.t.

Applicable Requirements: NDAC 33-15-12 and NDAC 33-15-14

B. Semi-Annual Report:

The permittee shall submit to the Department a semi-annual report on the operation of the facility. The report shall include any deviations from the requirements of this permit.

The report shall be submitted within 45 days after June 30 and December 31 of each year. The report shall be signed by the responsible official and shall state that "based on information and belief formed after reasonable inquiry, the statements and information contained in this report are true, accurate and complete."

Applicable Requirement: NDAC 33-15-14-06

C. Annual Compliance Certification Report:

The permittee shall submit an annual compliance certification report on forms supplied by the Department, or approved alternate forms, within 45 days after December 31 of each year. The annual report shall include all of the following (the identification of applicable information pertaining to compliance may cross-reference the permit or previous reports, as applicable):

1) The identification of each term or condition of the permit that is the basis of the certification.

2) The identification of the method(s) or other means used by the permittee for determining the compliance status with each term and condition during the certification period, and whether compliance was continuous or intermittent. Such methods and other means shall include, at a minimum, the methods and means required under this permit. If necessary, the owner or operator also shall identify any other material information that is the basis for the certification.

3) The status of compliance with the terms and conditions of the permit for the period covered by the certification, based on the method or means designated in the permit.

4) Such other facts as the Department may require to determine the compliance status of the source.

Applicable Requirement: NDAC 33-15-14-06

D. Annual Emission Inventory Reports:

The permittee shall submit an annual emission inventory report on forms supplied or approved by the Department. This report shall be submitted by March 15 of each calendar year. Insignificant units/activities listed in this permit do not need to be included in the report.

Applicable Requirements: NDAC 33-15-14-06.5.a(7) and NDAC 33-15-23-04

11. **Facility Wide Operating Conditions:**

A. Ambient Air Quality Standards:

1) Particulate and gases: The permittee shall not emit air contaminants in such a manner or amount that would violate the standards of ambient air quality listed in Table 1 of NDAC 33-15-02 at any place beyond the premises on which the source is located.

2) Radioactive substances: The permittee shall not release into the ambient air any radioactive substances exceeding the concentrations specified in NDAC 33-10.

3) Other air contaminants: The permittee shall not emit any other air contaminants in concentrations that would be injurious to human health or well-being or unreasonably interfere with the enjoyment of property or that would injure plant or animal life.

4) Disclaimer: Nothing in any other part or section of this permit may in any manner be construed as authorizing or legalizing the emission of air contaminants in such manner that would violate the standards in Paragraphs 1, 2 and 3 of this condition.

Applicable Requirement: NDAC 33-15-02-04

B. Fugitive Emissions: The release of fugitive emissions shall comply with the applicable requirements in NDAC 33-15-17.

Applicable Requirement: NDAC 33-15-17

C. Open Burning: The permittee shall comply with open burning restrictions in NDAC 33-15-04.

Applicable Requirement: NDAC 33-15-04

D. Asbestos Renovation or Demolition: Any asbestos renovation or demolition at the facility shall comply with emission standard for asbestos in NDAC 33-15-13.

Applicable Requirement: NDAC 33-15-13-02

E. Requirements for Organic Compounds Gas Disposal:

1) The owner/operator shall incinerate, flare or treat in an equally effective manner any organic compounds, gases and vapors which are generated as wastes as the result of storage, refining, or process operations and which contain hydrogen sulfide before being released to the ambient air.

2) Each flare must be equipped and operated with an automatic ignitor or a continuous burning pilot.

Applicable Requirement: NDAC 33-15-07-02

F. Rotating Pumps and Compressors: All rotating pumps and compressors handling volatile organic compounds must be equipped and operated with properly maintained seals designed for their specific product service and operating conditions.

Applicable Requirement: NDAC 33-15-07-01.5

G. Shutdown/Malfunctions/Deviation from Permit Requirements:

1) In the case of shutdown of air pollution control equipment for necessary scheduled maintenance, the intent to shutdown equipment shall be reported to the Department at least 24 hours prior to the planned shutdown provided that the air contaminating source will be

operated while the control equipment is not in service. Such prior notice shall include the following:

a) Identification of the specific emission unit to be taken out of service as well as its location and permit number.

b) The expected length of time that the air pollution control equipment will be out of service.

c) The nature and estimated quantity of emissions of air pollutants likely to be emitted during the shutdown period.

d) Measures such as the use of off-shift labor and equipment that will be taken to minimize the length of the shutdown period.

e) The reasons that it would be impossible or impractical to shutdown the source operating during the maintenance period.

Applicable Requirement: NDAC 33-15-01-13.1

2) When a malfunction in any installation or deviation from permit requirements occurs that can be expected to last longer than 24-hours and cause the emission of air contaminants in violation of this permit or any other applicable rules and regulations, the person responsible for such installation or deviation from permit requirements shall notify the Department of such malfunction or deviation from permit requirements as soon as possible during normal working hours. The notification must contain a statement giving all pertinent facts, including the estimated duration of the breakdown, if applicable. On receipt of this notification, the Department may permit the continuance of the operation for a period not to exceed ten days provided that written application is made to the Department. Such application shall be made within 24-hours of the malfunction or deviation from permit requirements. In cases of major equipment failure, additional time period may be granted by the Department provided a corrective program has been submitted by the permittee and approved by the Department. The Department shall be notified when the condition causing the malfunction has been corrected.

3) Immediate notification to the Department is required for any malfunction that would threaten health or welfare, or pose an imminent danger. During normal working hours the Department can be contacted at (701)328-5188. After hours the Department can be contacted through the 24-hour State radio emergency number 1-800-472-2121. If calling from out-of-state, the 24-hour number is (701)328-2121.

Applicable Requirements: NDAC 33-15-01-13.1, NDAC 33-15-01-13.2.a and b

H. Vehicles and Internal Combustion Engines: No person shall operate, or cause to be operated, any internal combustion engine which emits from any source any unreasonable and excessive smoke, obnoxious or noxious gases, fumes or vapor.

Applicable Requirement: NDAC 33-15-08-01

I. Prohibition of Air Pollution:

1) The permittee shall not permit or cause air pollution, as defined in NDAC 33-15-01-04.

2) Nothing in any other part of this permit or any other regulation relating to air pollution shall in any manner be construed as authorizing or legalizing the creation or maintenance of air pollution.

Applicable Requirement: NDAC 33-15-01-15

J. Performance Tests:

1) The Department may reasonably require the permittee to make or have made tests, at a reasonable time or interval, to determine the emission of air contaminants from any source, for the purpose of determining whether the permittee is in violation of any standard or to satisfy other requirements of NDCC 23-25. All tests shall be made and the results calculated in accordance with test procedures approved or specified by the Department including the North Dakota Department of Health Emission Testing Guideline. All tests shall be conducted by reputable, qualified personnel. The Department shall be given a copy of the test results in writing and signed by the person responsible for the tests.

2) The Department may conduct tests of emissions of air contaminants from any source. Upon request of the Department, the permittee shall provide necessary holes in stacks or ducts and such other safe and proper sampling and testing facilities, exclusive of instruments and sensing devices, as may be necessary for proper determination of the emission of air contaminants.

Applicable Requirement: NDAC 33-15-01-12

3) Except for sources subject to 40 CFR 63, the permittee shall notify the Department by submitting a Proposed Test Plan, or its equivalent, at least 30 calendar days in advance of any tests of emissions of air contaminants required by the Department. The permittee shall notify the Department at least 60 calendar days in advance of any performance testing required under 40 CFR 63. If the permittee is unable to conduct the performance test on the scheduled date, the permittee shall notify the Department as soon as practicable when conditions warrant, and shall coordinate a new test date with the Department.

Failure to give the proper notification may prevent the Department from observing the test. If the Department is unable to observe the test because of improper notification, the test results may be rejected.

Applicable Requirements: NDAC 33-15-01-12, NDAC 33-15-14-02.9 and NDAC 33-15-12-02 Subpart A (40 CFR 60.8)

K. Pesticide Use and Disposal: Any use of a pesticide or disposal of surplus pesticides and empty pesticide containers shall comply with the requirements in NDAC 33-15-10.

Applicable Requirements: NDAC 33-15-10-01 and NDAC 33-15-10-02

L. Air Pollution Emergency Episodes: When an air pollution emergency episode is declared by the Department, the permittee shall comply with the requirements in NDAC 33-15-11.

Applicable Requirements: NDAC 33-15-11-01 through NDAC 33-15-11-04

M. Stratospheric Ozone Protection: The permittee shall comply with any applicable standards for recycling and emissions reduction pursuant to 40 CFR 82, Subpart F, except as provided for MVACs in Subpart B:

1) Persons opening appliances for maintenance, service, repair, or disposal must comply with the required practices pursuant to Section 82.156.

2) Equipment used during the maintenance, service, repair, or disposal of appliances must comply with the standards for recycling and recovery equipment pursuant to Section 82.158.

3) Persons performing maintenance, service, repair, or disposal of appliances must be certified by an approved technician certification program pursuant to Section 82.161.

4) Persons owning commercial or industrial process refrigeration equipment must comply with the leak repair requirements pursuant to Section 82.156.

Applicable Requirement: 40 CFR 82

N. Chemical Accident Prevention: The permittee shall comply with all applicable requirements of Chemical Accident Prevention pursuant to 40 CFR 68. The permittee shall comply with the requirements of this part no later than the latest of the following dates:

1) Three years after the date on which a regulated substance is first listed under this part; or

2) The date on which a regulated substance is first present above a threshold quantity in a process.

Applicable Requirement: 40 CFR 68

12. **General Conditions:**

A. Annual Fee Payment: The permittee shall pay an annual fee, for administering and monitoring compliance, which is determined by the actual annual emissions of regulated contaminants from the previous calendar year. The Department will send a notice, identifying the amount of the annual permit fee, to the permittee of each affected installation. The fee is due within sixty days following the date of such notice. Any source that qualifies as a "small business" may petition the Department to reduce or exempt any fee required under this section. Failure to pay the fee in a timely manner or submit a certification for exemption may cause this Department to initiate action to revoke the permit.

Applicable Requirements: NDAC 33-15-23-04

B. Transfer of Ownership or Operation: This permit may not be transferred except by procedures allowed in Chapter 33-15-14 and is to be returned to the Department upon the destruction or change of ownership of the source unit(s), or upon expiration, suspension or revocation of this permit. A change in ownership or operational control of a source is treated as an administrative permit amendment if no other change in the permit is necessary and provided that a written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittee has been submitted to the Department.

Applicable Requirement: NDAC 33-15-14-02.11

C. Submissions:

1) Reports, test data, monitoring data, notifications, and requests for renewal shall be submitted to:

North Dakota Department of Health
Division of Air Quality
918 E Divide Avenue, 2nd Floor
Bismarck, ND 58501-1947

2) Any document submitted shall be certified as being true, accurate, and complete by a responsible official.

Applicable Requirement: NDAC 33-15-14-02.9

D. Right of Entry: Any duly authorized officer, employee or agent of the North Dakota Department of Health may enter and inspect any property, premise or place listed on this permit or where records are kept concerning this permit at any reasonable time for the purpose of ascertaining the state of compliance with this permit and the North Dakota Air Pollution Control Rules. The Department may conduct tests and take samples of air contaminants, fuel, processing material, and other materials which affect or may affect emissions of air contaminants from any source, The Department shall have the right to access and copy any records required by the Department's rules and to inspect monitoring equipment located on the premises.

Applicable Requirement: NDAC 33-15-01-06

E. Compliance: The permittee must comply with all conditions of this permit. Any noncompliance with a federally-enforceable permit condition constitutes a violation of the Federal Clean Air Act. Any noncompliance with any State enforceable condition of this permit constitutes a violation of NDCC 23-25 and NDAC 33-15. Violation of any condition of this permit is grounds for enforcement action, for permit termination, revocation and reissuance or modification, or for denial of a permit renewal application. Noncompliance may also be grounds for assessment of penalties under the NDCC Chapter 23-25. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

Applicable Requirement: NDAC 33-15-14-02.15

F. Nuisance or Danger: This permit shall in no way authorize the maintenance of a nuisance or a danger to public health or safety.

Applicable Requirement: NDAC 33-15-02-03

13. **State Enforceable Only Conditions (not Federally enforceable):**

General Odor Restriction: The permittee shall not discharge into the ambient air any objectionable odorous air contaminant which exceeds the limits established in NDAC 33-15-16.

Applicable Requirement: NDAC 33-15-16

14. **Acid Rain Provisions:**

Affected Source Unit: Lonesome Creek Generating Station
ORIS Plant Code: 57943
Unit ID: CT-1, CT-2, CT-3

This section incorporates the definition of terms in NDAC Chapter 33-15-21 by reference.

A. Permit Requirements:

1) The designated representative of each affected source and each affected unit at the source shall:

a) Submit a complete Acid Rain permit application (including a compliance plan) under 40 CFR 72 in accordance with the deadlines specified in NDAC 33-15-21-08.1 and 40 CFR 72.30, including application for permit renewal; and

b) Submit in a timely manner any supplemental information that the North Dakota Department of Health, Division of Air Quality, Air Pollution Control Program determines is necessary in order to review an Acid Rain permit application and issue or deny an Acid Rain permit.

2) The owners and operators of each affected source and each affected unit at the source shall:

a) Operate the unit in compliance with a complete Acid Rain permit application including any application for permit renewal or a superseding Acid Rain permit issued by the North Dakota Department of Health, Division of Air Quality, Air Pollution Control Program and

b) Have an Acid Rain permit.

Applicable Requirement: NDAC 33-15-21-08.1

B. Monitoring Requirements:

1) The owners and operators and, to the extent applicable, designated representative of each affected source and each affected unit at the source shall comply with the monitoring requirements as provided in 40 CFR 75.

2) The emissions measurements recorded and reported in accordance with 40 CFR 75 shall be used to determine compliance by the unit with the Acid Rain emissions limitations and emissions reduction requirements for sulfur dioxide under the Acid Rain Program.

3) The requirements of 40 CFR 75 shall not affect the responsibility of the owners and operators to monitor emissions of other pollutants or other emissions characteristics at the unit under other applicable requirements of the Federal Clean Air Act and other provisions of the operating permit for the source.

Applicable Requirements: NDAC 33-15-21-09, NDAC 33-15-21-10 and 40 CFR 75

C. Sulfur Dioxide Requirements:

1) The owners and operators of each source and each affected unit at the source shall:

a) Hold allowances, as of the allowance transfer deadline, in the units compliance subaccount (after deductions under 40 CFR 73.34(c)) not less than the total annual emissions of sulfur dioxide for the previous calendar year from the unit; and

b) Comply with the applicable Acid Rain emissions limitations for sulfur dioxide.

2) Each ton of sulfur dioxide emitted in excess of the Acid Rain emissions limitations for sulfur dioxide shall constitute a separate violation of the Federal Clean Air Act.

3) An affected unit shall be subject to the requirements under paragraph (1) of the sulfur dioxide requirements as follows:

a) Starting January 1, 2000, an affected unit under 40 CFR 72.6(a)(2); or

b) Starting on the later of January 1, 2000 or the deadline for monitor certification under 40 CFR 75, an affected unit under 40 CFR 72.6(a)(3).

4) Allowances shall be held in, deducted from, or transferred among Allowance Tracking System accounts in accordance with the Acid Rain Program.

5) An allowance shall not be deducted in order to comply with the requirements under Condition 14.C.(1)(a) of this permit prior to the calendar year for which the allowance was allocated.

6) An allowance allocated by the Administrator under the Acid Rain Program is a limited authorization to emit sulfur dioxide in accordance with the Acid Rain Program. No provision of the Acid Rain Program, the Acid Rain permit application, this permit, or the written

exemption under 40 CFR 72.7 and 72.8 and no provision of law shall be construed to limit the authority of the United States to terminate or limit such authorization.

7) An allowance allocated by the Administrator under the Acid Rain Program does not constitute a property right.

Applicable Requirements: NDAC 33-15-21-08.1 and 40 CFR 72 and 73

D. Excess Emissions Requirements:

1) The designated representative of an affected unit that has excess emissions of SO_2 in any calendar year shall submit a proposed offset plan, to the Administrator as required under 40 CFR 77, with a copy to the North Dakota Department of Health, Division of Air Quality, Air Pollution Control Program.

2) The owners and operators of an affected unit that has excess emissions of SO_2 in any calendar year shall:

a) Pay to the Administrator without demand the penalty required, and pay upon demand the interest on that penalty, as required by 40 CFR 77; and

b) Comply with the terms of an approved offset plan for SO_2, as required by 40 CFR 77.

Applicable Requirements: NDAC 33-15-21-08.1 and 40 CFR 77

E. Recordkeeping and Reporting Requirements:

1) Unless otherwise provided, the owners and operators of the source and each affected unit at the source shall keep on-site at the source each of the following documents for a period of 5 years from the date the document is created. This period may be extended for cause, at any time prior to the end of 5 years, in writing by the Administrator of the U.S. EPA or the North Dakota Department of Health, Division of Air Quality, Air Pollution Control Program:

a) The certificate of representation for the designated representative for the source and each affected unit at the source and all documents that demonstrate the truth of the statements in the certificate of representation, in accordance with 40 CFR 72.24; provided that the certificate and documents shall be retained on-site at the source beyond such 5-year period until such documents are superseded because of the submission of a new certificate of representation changing the designated representative;

b) All emissions monitoring information, in accordance with 40 CFR 75, provided that to the extent that 40 CFR 75 provides for a 3-year period for recordkeeping, the 3-year period shall apply.

c) Copies of all reports, compliance certifications, and other submissions and all records made or required under the Acid Rain Program; and,

d) Copies of all documents used to complete an Acid Rain permit application and any other submission under the Acid Rain Program or to demonstrate compliance with the requirements of the Acid Rain Program.

2) The designated representative of an affected source and each affected unit at the source shall submit the reports and compliance certifications required under the Acid Rain Program, including those under 40 CFR 72, Subpart I and 40 CFR 75.

Applicable Requirements: NDAC 33-15-21-08.1 and NDAC 33-15-21-09

F. Liability:

1) Any person who knowingly violates any requirement or prohibition of the Acid Rain Program, a complete Acid Rain permit application, this Acid Rain Permit, or a written exemption under 40 CFR 72.7 or 72.8, including any requirement for the payment of any penalty owed to the United States, shall be subject to enforcement pursuant to Section 113(c) of the Federal Clean Air Act.

2) Any person who knowingly makes a false, material statement in any record, submission, or report under the Acid Rain Program shall be subject to criminal enforcement pursuant to Section 113(c) of the Federal Clean Air Act and 18 U.S.C. 1001.

3) No permit revision shall excuse any violation of the requirements of the Acid Rain Program that occurs prior to the date that the revision takes effect.

4) Each affected source and each affected unit shall meet the requirements of the Acid Rain Program.

5) Any provision of the Acid Rain Program that applies to an affected source (including a provision applicable to the designated represented of an affected source) shall also apply to the owners and operators of such source and of the affected units at the source.

6) Any provision of the Acid Rain Program that applies to an affected unit (including a provision applicable to the designated representative of an affected unit) shall also apply to the owners and operators of such unit.

7) Each violation of a provision of NDAC 33-15-21-08.1 and NDAC 33-15-21-09 and 40 CFR 73, 74, 77, and 78 by an affected source or affected unit, or by an owner or operator or designated representative of such source or unit, shall be a separate violation of the Federal Clean Air Act.

Applicable Requirements: NDAC 33-15-21-08.1, NDAC 33-15-21-09 and 40 CFR 73, 74, 77 and 78

G. Effect on Other Authorities:

No provision of the Acid Rain Program, an Acid Rain permit application, this Acid Rain permit condition, or a written exemption under 40 CFR 72.7 or 72.8 shall be construed as:

1) Except as expressly provided in Title IV of the Federal Clean Air Act, exempting or excluding the owners and operators and, to the extent applicable, the designated representative of an affected source or affected unit from compliance with any other provision of the Federal Clean Air Act, including the provisions of Title I of the Federal Clean Air Act relating to applicable National Ambient Air Quality Standards or State Implementation Plans;

2) Limiting the number of allowances a unit can hold; provided, that the number of allowances held by the unit shall not affect the source's obligation to comply with any other provisions of the Federal Clean Air Act,

3) Requiring a change of any kind in any State law regulating electric utility rates and charges, affecting any State law regarding such State regulation, or limiting such State regulation, including any prudence review requirements under such State law;

4) Modifying the Federal Power Act or affecting the authority of the Federal Energy Regulatory Commission under the Federal Power Act; or,

5) Interfering with or impairing any program for competitive bidding for power supply in a State in which such program is established.

Applicable Requirement: NDAC 33-15-21-08.1

H. Permit Shield:

Each affected unit operating in accordance with this permit which is issued in compliance with Title IV of the Federal Clean Air Act, as provided in NDAC 33-15-21-08.1, NDAC 33-15-21-09 and 40 CFR 73, 77 and 78, and the regulations implementing Section 407 of the Federal Clean Air Act, shall be deemed operating in compliance with the Acid Rain Program, except as provided in 40 CFR 72.9(g)(6). The permit shield does not take effect until the effective date of the acid rain permit.

Applicable Requirements: NDAC 33-15-21-08.1, NDAC 33-15-21-09 and 40 CFR 73, 77 and 78

I. Reopening for Cause:

In addition to any reasons for reopening for cause previously stated in this permit, the Department will reopen and revise this permit as necessary to remedy deficiencies in the following circumstance: If additional requirements, including excess emissions requirements, become applicable to an affected source under Title IV of the Federal Clean Air Act or the regulations promulgated there under. Upon approval by the administrator of the United States Environmental Protection Agency, excess emissions offset plans shall be deemed to be incorporated into the permit.

Applicable Requirement: NDAC 33-15-14-06.6.f.(1)(b)

Lonesome Creek Generating Station
Response to Public Comments

Written Comments

Commenter: National Park Service (NPS)

Comment 1: The NPS stated "BEPC has now proposed to add two identical turbines to LCGS. We note that a plot plan submitted by BEPC dated 2/22/2012 shows Unit #1 would be located on a pad with ample space left for two additional units. The current application shows that units #2 and #3 would be located in the previously-vacant space on that pad. It appears that BEPC intended to construct all three SCCTs as early as the 2/22/2012 application, but did not submit a proper PSD application for all three units until it could no longer claim synthetic minor status."

Response: The load growth for electricity in the Williston Basin has been unprecedented in North Dakota and is continuously changing. Basin Electric has met with the Department on several occasions to update the Department on their load growth projections. Even though the pad may have been designed to accommodate two additional turbines, there was no indication at the time the original Permit to Construct was issued that two additional turbines would be needed in a relatively short time. The Department is aware of projections regarding the number of wells that will be drilled in the Williston Basin. These projections have increased from as low as 1000 wells per year to projections now as high as 5000 wells per year. The electric load growth is directly related to the number of wells drilled. The Department believes Basin Electric made a valid attempt to project its load growth; however, the development of the Bakken formation is proceeding much more rapidly than anticipated. The Department believes there was no attempt to circumvent the PSD rules.

In addition, when Unit 1 is started up, the SCR and catalytic oxidation systems will be operating. Therefore, the amount of emissions will be the same as if PSD permitting was completed before construction of Unit 1 began.

Comment 2: The NPS agrees with the Department's BACT determination for NO_x.

Response: No response required.

Comment 3: The NPS agrees with the Department's BACT determination for GHGs.

Response: No response required.

Comment 4: The NPS recommended that the NDDH address the issue of cumulative impacts of energy development near Theodore Roosevelt National Park (TRNP).

Response: See response to NPCA comment below.

Commenter: National Parks Conservation Association (NPCA)

Comment: The NPCA asked that the NDDH undertake a comprehensive evaluation that accounts for emissions from oil and gas development as well as emissions from the Lonesome Creek Station. NPCA has concerns about cumulative visibility impairment, deposition as well as cumulative effects on ambient air quality standards.

Response: The NPS and NPCA have not identified to the NDDH any specific air quality problems. The NDDH included in the Air Quality Effects Analysis ambient air monitoring data from four sites located in the oil and gas development area (see Table 5-1). The data clearly indicate the ambient concentrations of NO_2, PM_{10}, $PM_{2.5}$ and ozone are well below the NAAQS and have not changed appreciably in the last three years. The dispersion modeling for the Lonesome Creek Station indicated that emissions from the facility will not significantly contribute to these concentrations. The NAAQS are not threatened by the oil and gas development or the Lonesome Creek Station. With respect to greenhouse gases (GHG), no ambient air quality standard has been established for this contaminant. Best Available Control Technology (BACT) was required for the control of GHG from the Lonesome Creek Station. Additional control of GHG or mitigation of the emissions of GHG is not required by the Prevention of Significant Deterioration (PSD) rules.

The NDDH conducted dispersion modeling to predict the amount of visibility impact and deposition in TRNP – NU from the emissions at Lonesome Creek Station (see sections 3.3.3 and 3.3.4 of the Air Quality Effects Analysis). The impact was insignificant. The Federal Land Managers have not indicated that deposition is a problem in the Class I areas. The commenter has indicated that visibility in TRNP is not improving significantly from the 2000-2004 baseline. IMPROVE data for 2005-2009 indicates a 3% improvement at TRNP and no change in the average visibility at Lostwood Wilderness Area for all days monitored (See WRAP RHRPR, Appendix J, North Dakota). While the commenter is correct, it can also be noted that visibility is not degrading in the Class I areas. Improvement in regional haze is handled under the Regional Haze SIP and not under the PSD rules.

The tremendous amount of oil and gas development in western North Dakota has not changed the average ambient concentrations in the western North Dakota significantly. A cumulative analysis of the emissions from oil and gas development is not required under the PSD rules for the Lonesome Creek Station. Since specific air quality problems have not been identified, the NDDH sees no reason to conduct a cumulative analysis at this time. Until the NPS or NPCA identify specific problems that would preclude the permitting of the Lonesome Creek Station, the NDDH cannot deny Basin Electric Power Cooperative's application for a Permit to Construct.

Oral Comments

Commenter: Myron Steckler; BEPC

Comment: The commenter provided information on Basin Electric Power Cooperative and details about the Lonesome Creek Generating Station.

Response: No response required.

Commenter: Erwin Prater; Sargent & Lundy, LLC

Comment: The commenter provided comments on behalf of BEPC. The comments addressed the application including the applicable requirements, the BACT analysis, the air quality modeling analyses and the air quality related values analysis. The commenter encouraged the Department to issue a Permit to Construct for the Lonesome Creek Generating Station.

Response: No response required.

Table J.2-1

Theodore Roosevelt NP, ND (THRO1 Site)

Annual Averages, 5-Year Period Averages and Trends

Group	Baseline Period 2000	2001	2002	2003	Progress Period 2004	2005	2006	2007	2008	2009	2010	2011	Trend 2000-2009 Statistics* Slope (change/yr.)	p-value	Period Averages** Baseline (B)	Progress (P)	2005-2011 (EP)	Difference (P-B)	2004-2009 Percent Change	Difference (EP-B)	2004-2011 Percent Change
Deciview (dv)																					
Best 20% Days	8.2	7.8	7.8	7.5	7.5	6.8	6.5	—	6.6	7.0	6.3	5.7	-0.2	0.0	7.8	6.7	6.5	-1.1	-14	-1.3	-17
Worst 20% Days	18.1	18.0	17.0	18.4	17.5	17.6	17.9	—	17.6	17.2	18.8	16.4	-0.1	0.1	17.8	17.6	17.8	-0.2	-1	-0.2	-1
All Days	12.8	12.5	11.9	12.5	11.9	11.9	12.1	—	12.0	11.6	12.1	10.9	-0.1	0.0	12.3	11.9	11.8	-0.4	-3	-0.5	-4
Total Extinction (Mm-1)																					
Best 20% Days	23.0	21.9	21.9	21.3	21.2	19.9	19.3	—	19.4	20.3	18.9	8.6	-0.4	0.0	21.9	19.7	17.4	-2.2	-10	-4.5	-20
Worst 20% Days	62.4	62.4	57.1	65.2	61.1	60.1	62.3	—	63.4	57.3	67.7	41.3	-0.2	0.3	61.6	60.8	58.7	-0.8	-1	-2.9	-5
All Days	38.3	37.7	35.3	37.9	35.5	35.5	36.6	—	36.7	34.4	37.3	20.9	-0.2	0.1	36.9	35.8	33.6	-1.1	-3	-3.3	-9
Ammonium Sulfate Extinction (Mm-1)																					
Best 20% Days	4.9	3.6	3.8	3.5	3.2	3.8	2.5	—	3.3	4.1	3.2	2.4	-0.1	0.1	3.8	3.4	3.2	-0.4	-11	-0.6	-16
Worst 20% Days	16.4	18.8	20.8	17.7	14.0	17.7	17.3	—	16.6	22.0	21.1	16.1	0.0	0.5	17.6	18.4	18.5	0.9	5	1.0	6
All Days	9.7	9.9	9.8	9.1	8.0	9.4	9.5	—	9.3	10.7	9.8	7.9	0.0	0.5	9.3	9.7	9.4	0.4	4	0.1	1
Ammonium Nitrate Extinction (Mm-1)																					
Best 20% Days	1.6	1.4	1.9	1.6	1.2	1.0	0.9	—	0.7	1.0	0.6	0.9	-0.1	0.0	1.5	0.9	0.9	-0.6	-40	-0.7	-43
Worst 20% Days	13.6	17.7	10.7	10.3	16.4	16.1	9.5	—	11.8	11.9	18.7	10.0	-0.3	0.2	13.7	12.3	13.0	-1.4	-10	-0.7	-5
All Days	5.3	6.1	5.1	5.3	5.6	4.9	4.2	—	4.9	4.8	6.4	3.6	-0.1	0.0	5.6	4.7	4.9	-0.8	-15	-0.7	-13
Particulate Organic Mass Extinction (Mm-1)																					
Best 20% Days	1.9	1.8	2.2	1.6	2.1	1.6	1.4	—	1.5	1.5	1.4	1.3	-0.1	0.0	2.0	1.5	1.5	-0.5	-25	-0.6	-28
Worst 20% Days	11.8	6.7	5.9	16.4	13.4	6.3	14.7	—	14.7	5.4	6.1	5.9	0.0	0.5	10.6	10.3	8.9	-0.5	-5	-2.0	-18
All Days	5.6	4.1	3.8	6.5	5.2	4.0	5.6	—	5.4	3.3	3.9	3.4	-0.1	0.3	5.0	4.6	4.3	-0.4	-9	-0.7	-15
Elemental Carbon Extinction (Mm-1)																					
Best 20% Days	1.2	0.8	0.8	0.9	0.9	1.0	1.1	—	0.7	0.6	0.7	0.6	0.0	0.2	0.9	0.9	0.8	0.0	0	-0.1	-13
Worst 20% Days	3.3	2.7	1.9	3.4	2.5	2.8	3.3	—	2.5	1.9	2.3	2.2	-0.1	0.2	2.7	2.6	2.5	-0.1	-4	-0.2	-7
All Days	2.1	1.7	1.4	1.9	1.5	1.9	1.9	—	1.6	1.2	1.5	1.4	-0.1	0.1	1.7	1.6	1.6	-0.1	-6	-0.1	-8
Soil Extinction (Mm-1)																					
Best 20% Days	0.3	0.5	0.4	0.3	0.4	0.3	0.3	—	0.3	0.3	0.3	0.1	0.0	0.0	0.4	0.3	0.3	-0.1	-25	-0.1	-33
Worst 20% Days	0.8	1.0	1.2	1.0	0.5	0.9	1.0	—	0.8	0.7	1.1	1.0	0.0	0.1	0.9	0.8	0.9	-0.1	-11	0.0	0
All Days	0.6	0.8	0.6	0.6	0.7	0.7	0.7	—	0.6	0.5	0.7	0.5	0.0	0.2	0.7	0.6	0.6	-0.1	-14	-0.1	-12
Coarse Mass Extinction (Mm-1)																					
Best 20% Days	2.1	2.7	1.7	2.1	2.4	1.3	1.9	—	1.8	1.8	1.7	1.4	0.0	0.1	2.2	1.7	1.7	-0.5	-23	-0.6	-25
Worst 20% Days	5.6	4.5	5.6	5.4	3.0	5.1	5.3	—	4.1	4.4	7.3	5.9	-0.1	0.1	4.8	4.7	5.4	-0.1	-2	0.6	11
All Days	4.0	4.0	3.3	3.4	3.4	3.5	3.6	—	3.4	3.0	3.9	3.7	-0.1	0.2	3.6	3.4	3.5	-0.2	-6	-0.1	-2
Sea Salt Extinction (Mm-1)																					
Best 20% Days	0.0	0.0	0.0	0.1	0.1	0.1	0.1	—	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1		0.1	
Worst 20% Days	0.0	0.0	0.0	0.0	0.3	0.2	0.1	—	2.0	0.1	0.1	0.2	0.0	0.0	0.1	0.6	0.5	0.5	500	0.4	350
All Days	0.0	0.2	0.0	0.0	0.1	0.1	0.1	—	0.5	0.1	0.0	0.2	0.0	0.1	0.1	0.2	0.2	0.1	100	0.1	67

*Values highlighted in blue (red) indicate statistically significant decreasing (increasing) annual trend. Significance is measured at the 85% confidence level (p-value ≤0.15).

**Values highlighted in blue indicate a decrease in the 5-year average, values highlighted in red indicate an increase.

"—" indicates a missing year that did not meet RHR data completeness criteria.

							Table J.1-1													
						Lostwood WA, ND (LOST1 Site)														
					Annual Averages, 5-Year Period Averages and Trends															
		Baseline Period					Progress Period						Trend 2000-2009 Statistics*		Period Averages**			2005-2009		2005-2011	
Group	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Slope		Baseline	Progress	2005-2011	Difference	Percent	Difference	Percent
													(change/yr.)	p-value	(B)	(P)	(EP)	(P - B)	Change	(EP - B)	Change
Deciview (dv)																					
Best 20% Days	9.1	8.2	7.9	7.9	7.9	7.6	7.8	8.8	8.2	8.4	7.4	7.9	0.0	0.5	8.2	8.1	8.0	-0.1	-1	-0.2	-2
Worst 20% Days	19.7	20.6	18.8	18.6	20.2	20.5	18.6	19.1	19.7	18.9	21.3	18.7	-0.1	0.3	19.6	19.6	19.7	0.0	0	0.1	0
All Days	14.1	14.0	13.0	13.1	13.0	13.2	13.3	13.3	13.9	13.3	13.8	13.0	0.0	0.4	13.4	13.4	13.4	0.0	0	0.0	0
Total Extinction (Mm-1)																					
Best 20% Days	25.0	22.8	22.2	22.2	22.2	21.6	22.2	24.3	23.0	23.4	21.2	11.3	0.0	0.5	22.9	22.9	21.0	0.0	0	-1.9	-8
Worst 20% Days	75.3	80.2	67.8	65.8	81.7	78.9	74.8	69.3	74.5	70.0	86.3	55.0	-0.8	0.2	74.0	73.5	72.7	-0.5	-1	-1.3	-2
All Days	44.5	44.9	39.9	40.0	41.7	42.0	41.8	40.6	43.9	41.2	45.2	28.4	-0.1	0.4	42.2	41.9	40.4	-0.3	-1	-1.8	-4
Ammonium Sulfate Extinction (Mm-1)																					
Best 20% Days	5.3	4.7	3.8	3.8	4.3	4.7	4.0	5.4	4.4	5.2	4.4	4.2	0.1	0.3	4.4	4.8	4.6	0.4	9	0.2	5
Worst 20% Days	20.0	21.5	20.1	18.6	26.8	29.9	20.2	22.9	20.3	21.3	34.0	19.7	0.1	0.2	21.4	22.9	24.0	1.5	7	2.6	12
All Days	11.4	11.5	10.8	9.7	11.4	13.3	11.3	11.7	12.0	11.9	13.8	9.6	0.1	0.1	10.9	12.1	11.9	1.2	11	1.0	10
Ammonium Nitrate Extinction (Mm-1)																					
Best 20% Days	2.4	1.8	1.8	1.7	1.8	1.7	1.8	1.5	1.1	1.7	1.1	2.1	0.0	0.1	1.9	1.5	1.6	-0.4	-21	-0.3	-17
Worst 20% Days	18.0	29.3	23.3	19.4	26.7	18.0	21.4	20.0	21.9	28.3	23.7	19.3	0.4	0.4	22.9	21.7	21.7	-1.2	-5	-1.2	-5
All Days	6.7	9.8	8.4	7.8	8.6	7.1	7.8	7.4	8.6	9.1	8.8	7.3	0.1	0.4	8.3	7.9	8.0	-0.4	-5	-0.3	-4
Particulate Organic Mass Extinction (Mm-1)																					
Best 20% Days	2.8	1.9	2.0	2.5	2.0	1.6	2.0	2.1	2.2	1.8	1.3	1.6	0.0	0.2	2.3	1.9	1.8	-0.4	-17	-0.5	-22
Worst 20% Days	17.8	9.2	7.6	9.1	11.6	11.0	14.5	8.0	12.2	5.0	9.1	5.7	-0.4	0.3	11.1	10.1	9.4	-1.0	-9	-1.7	-16
All Days	8.7	5.5	4.7	5.9	5.3	5.1	6.1	4.8	5.7	3.6	5.1	3.8	-0.2	0.1	6.0	5.0	4.9	-1.0	-17	-1.1	-19
Elemental Carbon Extinction (Mm-1)																					
Best 20% Days	0.8	0.7	0.7	0.7	0.5	0.7	0.9	0.7	0.7	0.7	0.7	1.1	0.0	0.3	0.7	0.7	0.8	0.0	0	0.1	12
Worst 20% Days	4.5	2.8	2.3	2.4	2.2	3.2	2.8	2.1	2.5	2.0	2.8	2.9	-0.1	0.0	2.8	2.5	2.6	-0.3	-11	-0.2	-7
All Days	2.1	1.6	1.4	1.6	1.2	1.7	1.7	1.3	1.4	1.4	2.0	2.0	-0.1	0.1	1.6	1.5	1.6	-0.1	-6	0.0	3
Soil Extinction (Mm-1)																					
Best 20% Days	0.3	0.4	0.4	0.3	0.3	0.2	0.3	0.4	0.3	0.4	0.3	0.2	0.0	0.3	0.3	0.3	0.3	0.0	0	0.0	0
Worst 20% Days	0.9	0.7	0.5	0.6	0.4	0.5	0.6	0.6	0.7	0.7	1.1	0.8	0.0	0.4	0.6	0.6	0.7	0.0	0	0.1	19
All Days	0.6	0.7	0.5	0.5	0.5	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.0	0.5	0.6	0.5	0.6	-0.1	-17	0.0	-7
Coarse Mass Extinction (Mm-1)																					
Best 20% Days	2.2	2.5	2.4	2.2	2.2	1.6	2.1	3.1	3.1	2.5	2.2	1.8	0.0	0.2	2.3	2.5	2.3	0.2	9	0.0	2
Worst 20% Days	5.2	4.7	2.6	4.3	2.7	4.1	4.2	4.4	3.9	3.5	4.6	8.3	-0.1	0.2	3.9	4.0	4.4	0.1	3	0.5	14
All Days	3.9	4.5	3.0	3.4	3.6	3.2	3.5	3.7	3.8	3.4	3.8	4.6	0.0	0.4	3.7	3.5	3.7	-0.2	-5	0.0	0
Sea Salt Extinction (Mm-1)																					
Best 20% Days	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.1	0.1	0.1		0.1	
Worst 20% Days	0.0	0.9	0.1	0.0	0.3	0.2	0.2	0.2	2.1	0.1	0.0	0.3	0.0	0.2	0.3	0.6	0.4	0.3	100	0.1	48
All Days	0.2	0.3	0.1	0.0	0.2	0.2	0.2	0.2	0.7	0.3	0.1	0.5	0.8	0.0	0.1	0.3	0.3	0.2	200	0.2	214

*Values highlighted in blue (red) indicate statistically significant decreasing (increasing) annual trend. Significance is measured at the 85% confidence level (p-value ≤0.15).

**Values highlighted in blue indicate a decrease in the 5-year average, values highlighted in red indicate an increase.

"—" indicates a missing year that did not meet RHR data completeness criteria.

Attachment A
Written Comments

United States Department of the Interior

NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225-0287

IN REPLY REFER T

N3615 (2350)

August 29, 2013

Terry L. O'Clair, P.E., Director
Division of Air Quality
North Dakota Department of Health
Environmental Health Section
918 E. Divide Ave., 2nd Floor
Bismarck, North Dakota 58501-1947

Dear Mr. O'Clair:

As requested in your July 24, 2013 letter, the National Park Service (NPS) is submitting the enclosed comments regarding the proposed permit for the Lonesome Creek Generating Station (LCGS) simple-cycle combustion turbines in McKenzie County, North Dakota. LCGS is located 22 km from Theodore Roosevelt National Park, a Class I area administered by the NPS. Our technical comments are enclosed and, while we agree with the proposal, we are concerned about the cumulative impacts of development occurring in the area and note that it appears the initial permitting of the facility circumvented the Prevention of Significant Deterioration process.

We believe that it is becoming increasingly necessary to take all reasonable measures to mitigate the environmental impact of the rapid and substantial energy development taking place in western North Dakota, especially in the vicinity of Theodore Roosevelt National Park. It will be far more efficient and cost-effective to take pro-active pollution abatement measures now than retroactively. We are also concerned about the additional 660,000 tons of greenhouse gases that would be emitted yearly from this project—a discussion of the effects of climate change on prairie ecosystems can be found at this link: http://www.nature.nps.gov/climatechange/prairiegrasslands.cfm

We look forward to working with the North Dakota Department of Health as this process advances. We believe that good communication and sharing of information will help expedite this process, and suggest that you contact Don Shepherd of my staff (don_shepherd@nps.gov, 303-969-2075) if you have any questions or comments.

Sincerely,

Susan Johnson
Chief, Policy, Planning and Permit Review Branch

NPS Comments on the Proposed Permit
for the
Lonesome Creek Generating Station
August 30, 2013

Basin Electric Power Cooperative (BEPC) has proposed to construct and operate the Lonesome Creek Generating Station (LCGS), located in McKenzie County, North Dakota. Theodore Roosevelt National Park (TRNP) is a Class I area administered by the National Park Service (NPS), and its north unit is approximately 22 km south-southeast of the proposed site. The nearest NPS Class II area is the Fort Union Trading Post National Historic Site approximately 60 km northwest of the proposed site.

LCGS will consist of three natural gas-fired simple-cycle combustion turbines (SCCTs). The SCCTs will be used for peak power demand and will each be rated at 45 MWe gross output. The units will each have a maximum rated heat input of 412 x 10^6 Btu/hr and will be fired exclusively on pipeline quality natural gas. The facility will emit 660,366 tons per year (tpy) of CO_2e and will emit 65 tpy of particulate matter (PM10 and PM2.5) and 108 tpy of nitrogen oxides. LCGS is considered a major stationary source under the Prevention of Significant Deterioration (PSD) program.

On April 25, 2012, the Department issued a synthetic minor source Permit to Construct to BEPC for the construction of LCGS. The permit allowed the installation of one General Electric (GE) Model LM6000PF SPRINT simple cycle natural gas-fired turbine that would be used to generate approximately 45 MW of electricity.

BEPC has now proposed to add two identical turbines to LCGS. We note that a plot plan submitted by BEPC dated 2/22/2012 shows Unit #1 would be located on a pad with ample space left for two additional units. The current application shows that units #2 and #3 would be located in the previously-vacant space on that pad. It appears that BEPC intended to construct all three SCCTs as early as the 2/22/2012 application, but did not submit a proper PSD application for all three units until it could no longer claim synthetic minor status.

Best Available Control Technology (BACT)

Nitrogen Oxides

NDDH proposes Selective Catalytic Reduction (SCR) as BACT for all three units at LCGS with a limit of 5.0 ppmvd @ 15% O_2 for all operating periods except startup. During startup, emissions shall not exceed 18.5 lb per SCCT. We agree with NDDH's determination.

Greenhouse Gases (GHG)

The proposed combustion turbine will be fired on natural gas only. Natural gas combustion has one of the lowest carbon dioxide (CO_2) emission factors of any fuel.

BEPC has proposed GE Model LM6000 PF SPRINT combustion turbines. The LM6000 PF SPRINT combustion turbine has an efficiency of approximately 37% based on the high heating value of natural gas and site-specific conditions. (This is better than the LM6000 PC SPRINT permitted at BEPC's Pioneer facility, and may account for the lower emissions at LCGS.) NDDH proposes that BACT for GHG is represented by use of the GE LM6000 PF SPRINT turbine and the combustion of natural gas. We agree with this determination.

Modeling Analyses

PSD Class I Analysis

BEPC elected to pursue the FLAG[1] "Q/d" screening method to address impact on AQRVs beyond 50 km. Although BEPC used annual values, NDDH used maximum short-term values as recommended by FLAG to show that no further ARRV analyses were needed. We commend NDDH for making this correction.

Because the CT Project will be located about 22 kilometers from the TRNP Class I area, BEPC conducted analyses of impacts on Air Quality Related Values AQRVs there.

Deposition Analysis

The deposition analysis involves determination of total sulfur and nitrogen deposition in the Class I area from the new or modified source. For the LCGS Project deposition analysis, the CALPUFF modeling system was applied. LCGS NO_X and SO_2 emission rates were set to worst-case values reflective of 100 percent load and winter ambient conditions. Emissions from the existing unit along with the two proposed new units were included. CALPUFF was run with TRNP North receptor locations, meteorological data, and input conditions consistent with the Class I significant impact analysis for PSD increment. The LCGS Project is predicted to not exceed Deposition Analysis Thresholds at TRNP North Unit.

Visibility Analysis

BEPC conducted a VISCREEN Level-2 analysis and predicted that the LCGS plume will have no discernible visibility impact at TRNP North Unit. Because the Fort Union National Historic Site is farther from the project, we expect lower visibility impacts and do not request a discrete plume analysis there.

Conclusions and Recommendations

While we agree with NDDH's proposal, we recommend that NDDH address the issue of cumulative impacts of energy development near Theodore Roosevelt National Park.

[1] Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report –Revised 2010

August 30, 2013

Via Electronic Mail

Mr. Terry O'Clair, P.E.
Director, Division of Air Quality
North Dakota Department of Health
918 E. Divide Ave.
Bismarck, ND 58501-1947
toclair@state.nd.us

Re: Proposed Air Pollution Permit to Construct Basin Electric Power Cooperative's Lonesome Creek Station

Dear Mr. O'Clair,

We respectfully submit the following comments on the North Dakota Department of Health's ("NDDH") proposed Air Pollution Permit to Construct for Basin Electric Power Cooperative's Lonesome Creek Station. We represent North Dakotans and people throughout the nation that care deeply about protecting the air quality in our national parks and wilderness areas in the Midwest. As such, we are concerned about the lack of prospective evaluation of cumulative impacts to Theodore Roosevelt National Park and other public lands from a growing set of smaller sources associated with energy development, like the Lonesome Creek Station. We ask NDDH to undertake an evaluation that accounts for emissions from these sources to provide a comprehensive and efficient accounting of air pollution. We believe that such an accounting is necessary to evaluate potential air quality impacts at the front end of this growth. Furthermore, assessing these emissions in the aggregate will help regulators and the regulated establish a framework and plan for limiting pollution that will be more effective than trying to devise a piecemeal cleanup plan for emissions after new sources are built.

These sources, including a growing number of simple combustion turbines like Lonesome Creek, rigs, wells, compressors, and other sources associated with energy development, are coming into a situation that, in several significant ways, already has degraded air quality. First, Theodore Roosevelt National Park, just 22 km from Lonesome Creek, experiences human-made haze that significantly impairs visibility. According to the most recently available IMPROVE data, unlike most Class I areas in the country, Theodore Roosevelt's visibility does not appear to be improving towards the Congressionally-mandated goal of natural visibility.[1] Likewise, on a global scale,

[1] http://vista.cira.colostate.edu/improve/data/IMPROVE/summary_data.htm.

emissions of greenhouse gases are already problematically elevated – new sources of these pollutants, however small, are adding to an existing problem. Finally, even those standards with which North Dakota is currently in compliance (e.g. state and national ambient air quality standards) may be threatened by the collective emissions released by the numerous sources, each contributing a seemingly "acceptable" portion. The pollutants of concern – including nitrogen oxides, sulfur dioxide, and particulate matter – also contribute to localized issues like acid rain, ozone formation, and nitrogen deposition in park ecosystems, harming wildlife, vegetation, soil health, and water quality.

To effectively protect the valued natural, cultural, and historic resources at Theodore Roosevelt National Park as well as the other national public lands in the region, Lonesome Creek cannot be evaluated in a vacuum, but must be considered in the context of the significantly increased and increasing energy development– the "boom" of oil and gas sources as well as a number of other similar natural gas turbine projects. Each in its own right may not trigger applicable thresholds today, but cumulatively, the contribution to existing and potential air quality threats may be significant. NDDH's analysis illustrates no plume visibility from Lonesome Creek at the nearest unit of the park, and low Q/d at the others, but it is nonetheless true that this source will exacerbate existing visibility impairment at Theodore Roosevelt that is being caused by the cumulative contributions of a wide variety of sources. The most recent regional haze plan for North Dakota failed to account for the recent growth this area, and therefore cannot provide the type of comprehensive view and guidance that is necessary to avoid wasting our citizens' resources by permitting these sources in a fragmented way.

To adequately protect air quality, it is impractical to shield this increasing number of relatively small emitters from emission control requirements. While we have yet to quantify or fully realize impacts to the region's resources and population, as the National Park Service has articulated, we too believe that there is cause for concern and exercise of precautionary measures, and at a minimum comprehensive analysis, is warranted.

Therefore, we ask NDDH to evaluate the collective emissions and cumulative impacts from all of the sources associated with energy development in the region. We request that NDDH use that information to guide its permitting processes for sources like Lonesome Creek and ensure that it and related emitting sources be adequately controlled, both individually and collectively. It is within the state's authority to do so. A cumulative approach towards regulating Lonesome Creek and sister sources is needed to safeguard the region's air quality and prevent worsening existing problems or causing new ones.

Thank you for your attention to this matter and for the opportunity to submit comments.

Sincerely,

Tim Stevens
Northern Rockies Regional Director
National Parks Conservation Association
109 W. Callender St. Suite 4W
Livingston, MT 59047
Phone: 406-222-2268
tstevens@npca.org

Attachment B
Public Hearing Transcript

Public Hearing Transcript
Lonesome Creek Generating Station
Permit to Construct
August 22, 2013

I am Terry O'Clair and I will be acting as hearing officer for this public hearing.

It is now 1:00 CDT on August 22, 2013 in the McKenzie County Courthouse meeting room in Watford City, North Dakota. At this time, I open this hearing.

This public hearing has been called for the purpose of allowing all interested individuals an opportunity to submit information concerning Basin Electric Power Cooperative's application for a Permit to Construct for the addition of two natural gas-fired turbines to the Lonesome Creek Generating Station located in Section 23 of T150N, R101W of McKenzie County and the Department's Air Quality Effects Analysis and the proposed Permit to Construct.

Information gathered at this hearing will be considered by the Department of Health in making its final decision whether to issue the Permit to Construct. The comments received at this hearing, along with any written comments that are received, will be considered. The Department of Health will respond to all comments in writing. You may request a copy of the written response and one will be provided to you.

This hearing is being taped and we ask everyone to use the podium so that the tape will be of good quality for transcribing purposes. Please identify yourself for the record before you speak.

Everyone present will be given the opportunity to speak. If you have a prepared statement, a written copy of your statement is appreciated and will be helpful. We request that any statements pertain only to air pollution from this project.

A registration sheet has been placed on the table next to the door. I ask that everyone present please sign this sheet and indicate if you wish to present oral testimony.

At this point, I call on Tom Bachman of the Department to summarize the proposed project and the Department's preliminary findings.

Thank you Terry.

Tom Bachman - On April 25, 2012, the Department issued an Air Pollution Control Permit to Construct to Basin Electric Power Cooperative for the Lonesome Creek generating Station to be located in McKenzie County. This permit allowed the installation of one natural gas-fired turbine with a nominal rating of 46 MWe. An application for a Permit to Construct for the addition of two combustion turbines to the Lonesome Creek Generating Station was submitted by Basin Electric Power Cooperative on January 9, 2013. The application was revised and was declared complete as of April 5, 2013. The application, along with supporting data, has been reviewed by the Department and the effects of the emissions from this facility upon ambient air quality predicted.

The combustion turbines will be used for peak power demand and load following. Each turbine will have a nominal rating of 46 MWe gross output at -20° F. The units will have a nominal maximum rated heat input of 412 x 10^6 Btu/hr at -20° F and 100% load. The units will be fired exclusively on pipeline quality natural gas.

The addition of the combustion turbines is considered construction under the Prevention of Significant Deterioration (PSD) program. Under the PSD program, the facility will have a significant increase of particulate matter (PM_{10} and $PM_{2.5}$), nitrogen oxides, and greenhouse gases. As a result of these emissions, the Prevention of Significant Deterioration requirements of NDAC 33-15-15 and other requirements of the North Dakota Air Pollution Control Rules are applicable to the facility. The expected emissions from the entire facility (3 units) are:

- Particulate Matter 65 tpy
- Sulfur Dioxide 5 tpy
- Nitrogen Oxides 108 tpy
- Carbon Monoxide 91 tpy
- Greenhouse Gases 660,912 tpy CO_2e

The Department has determined from its review of the application that the technologies proposed to control emissions are representative of best available control technology. The emission rates for the various sources of air contaminants are expected to comply with applicable emission rate standards specified in the North Dakota Air Pollution Control Rules, which are at least as stringent as Federal requirements.

The Department used air quality dispersion modeling of the emissions from the proposed facilities to predict the impact on air quality. The results of the dispersion modeling indicate that emissions from the proposed facility will not cause or contribute to air pollution in violation of any North Dakota Ambient Air Quality Standard or the Prevention of Significant Deterioration increments. In addition, the Department finds there will be no adverse impact on air quality related values.

The public comment period is from August 1 through August 30, 2013. Comments may be submitted in writing to the Department's Division of Air Quality at 918 East Divide Ave., 2nd Floor, Bismarck, ND 58501-1947. All documents regarding this project are available on the

Department's website or a copy may be obtained by contacting us at (701) 328-5188.

I now open the hearing for comment. Would Basin Electric like to make some comments at this time?

Myron Steckler - Good afternoon. Thank you for this opportunity to comment. My name is Myron Steckler. I am the Generation Resource Project Manager for Basin Electric Power Cooperative.

Basin Electric is a regional wholesale electric generation and transmission cooperative headquartered in Bismarck, North Dakota. Basin Electric provides power to 137 member cooperatives serving more than 2.8 million consumers in nine states, including North Dakota. Basin Electric's resource portfolio at year-end 2013 was 3,148 megawatts from coal, 810 megawatts from gas turbines, 77 megawatts from nuclear energy, 181 megawatts from oil and diesel fuel, 316 megawatts from hydro energy and 757 megawatts from renewable energy for a total winter season portfolio of 5,289 megawatts. Basin Electric has two Class A members that serve the Williston Basin: Central Power Electric Cooperative, headquartered in Minot, North Dakota and Upper Missouri G&T, headquartered in Sidney, Montana.

In April of 2012, Basin Electric updated its annual load forecast and identified an even more rapid growth than previously forecasted for our northwestern North Dakota and eastern Montana member load. The forecast reflected that Basin Electric would be short of generation capacity starting in 2014. Basin Electric's Planning Engineers determined this need was best met by adding two additional simple-cycle combustion turbines at the existing Lonesome Creek Station (LCS) site and two additional turbines at the existing Pioneer Generation Station. The Pioneer Generation Station is located approximately 15 miles northwest of Williston and has been previously permitted by the Department. LCS is located in the heart of the Williston Basin, approximately 15 miles west of Watford City.

This requested expansion of LCS will provide additional reliability benefits during transmission outages, system-wide generation shortfalls and provide for contingency if the load in the Williston Basin region grows even faster than is currently forecasted. The fast start and quick response capability of these simple-cycle units are required for a peaking application and to respond to transmission upsets. The flexibility of these units also provide for a quick response during varying wind conditions to follow the over 700 megawatts of wind generation in Basin Electric's generation fleet.

LCS is currently permitted for one unit; with the applied-for expansion, LCS would consist of three units. The units will be simple-cycle natural gas-fueled aero derivative combustion turbine generators manufactured by General Electric. They are a LM6000-PF Sprint model.

Construction of the first unit is scheduled to be completed by late 2013 and on the expansion units by late 2014.

The LM6000-PF Sprint turbine output rating is a nominal 45 megawatts with an approximate heat rate of 9300 Btu per kilowatt hour HHV. These units utilize dry low-emissions burner technology along with a Selective Catalytic Reduction (SCR) system for NO_X control. Anhydrous ammonia will be utilized as the SCR reagent. Also included are Catalytic Oxidation Reduction (COR's) to minimize carbon monoxide (CO) emissions. Following the COR and SCR emissions-control equipment, flue gas from each of the three units will be released to the atmosphere through individual 80-foot tall stacks.

LCS Unit I is unique in that it will include a clutch. The clutch will allow the unit to act as a "synchronous condenser" to provide voltage support at times when additional generation is not required. The clutch allows the turbine to disconnect from the generator after the unit is on line. The generator will still be connected to the grid, which will provide voltage support.

Natural gas utilized by the LCS will come from the 42-inch Northern Border gas transmission pipeline. Along with natural gas from Canada, this pipeline transports processed oil field associated natural gas from northwestern North Dakota to out-of-state markets. The LCS units will utilize a portion of the associated natural gas from the North Dakota oil wells. Electrical interconnection for the LCS is through the two-mile, 115 kilovolt transmission line to McKenzie Electric Cooperative's Hay Butte Substation.

That is the end of my comments. Thank you.

Terry O'Clair - Anyone else wish to testify at this time?

Erwin Prater - Good afternoon. My name is Erwin Prater. I am a Certified Consulting Meteorologist in the Environmental Services Group at Sargent & Lundy LLC. Sargent & Lundy is a full-service engineering and design firm headquartered in Chicago, IL. Over the past several years, my work at Sargent & Lundy has focused on permitting new electric generating units. I have been actively involved in the siting and permitting of coal, natural gas combined-cycle, natural gas simple-cycle, integrated gasification combined-cycle, and wind energy projects. A majority of my environmental permitting work has focused on New Source Review (NSR) pre-construction air quality analysis for new generating resources.

In April 2012, Basin Electric engaged the services of Sargent & Lundy to prepare the air construction permit application for the Lonesome Creek Station ("LCS"). As Mr. Steckler described, the Lonesome Creek Station is needed to meet the rapidly growing load requirements in northwestern North Dakota and eastern Montana. The station is needed to provide peaking power during periods of high load demand, and to cycle and load-follow to mitigate for grid instability caused by the intermittency of wind generation in western North Dakota. Upon completion, the station will consist of three General Electric LM6000PF SPRINT natural gas-fired combustion turbines, each with a full load generating capacity of approximately 45 MW (the "LCS Project").

Based on emission calculations prepared for the LM6000 combustion turbines, it was determined that LCS will be classified as a major stationary source of emissions. Once a facility is considered a major source, all regulated air pollutants emitted at a rate above the significant rate, as that term is defined in North Dakota Administrative Code Section 33-15-15-01, are subject to North Dakota's Prevention of Significant Deterioration ("PSD") program in North Dakota Administrative Code Chapter 33-15-15. Based on potential emissions from the facility, it was determined that the LCS Project is subject to PSD review for nitrogen oxide (NOx) emissions, particulate matter, including PM, PM10 and PM2.5 emissions, and greenhouse gas (GHG) emissions, primarily carbon dioxide (CO_2). Although carbon monoxide (CO) emissions from the proposed facility were below the applicable PSD significant rate, Basin Electric elected to apply the PSD requirements to CO emissions from LCS as well.

A source subject to the PSD rules is required to control emissions using the best available control technology (or "BACT"). The BACT review must be conducted for each air pollutant that the source has the potential to emit above the significant rate. Basin's permit application for the LCS Project included a comprehensive BACT analysis, evaluating the technical feasibility and effectiveness of NOx, PM, CO, and GHG emission controls.

Basin's BACT analysis included an evaluation of both add-on air pollution control technologies, as well as an evaluation of alternative generating technologies available to meet the goals, objectives, and design criteria established by Basin for the LCS Project. Important goals and objectives of the project that affect the basic design and operation of the facility included:

- The need for an additional 135 MW of generating capacity to meet the rapidly growing load requirements in this area of western North Dakota and eastern Montana;
- Generating capacity should be designed to utilize natural gas as its primary fuel, as natural gas is available in the vicinity of the generating station with minimal infrastructure upgrades;
- The station should be designed with proven generating technology;
- The generating capacity must have quick start capability and be able to provide peaking power during periods of high load demand; and
- The generating capacity must be capable of load-following and must be able to cycle frequently in order to respond to, and mitigate, grid instability caused by the intermittency of wind generation in western North Dakota.

Basin's alternative generating technology evaluation concluded that natural gas-fired LM6000PF SPRINT simple-cycle combustion turbines were the best power generating alternative for the Lonesome Creek Station. Other alternatives, including larger simple-cycle combustion turbines, gas-fired reciprocating engines, and combined-cycle combustion turbines failed to meet one, or more, of the project's goals and objectives.

In addition to the alternative generating technology evaluation, Basin's BACT analysis included an evaluation of add-on control technologies capable of reducing NOx, PM, CO, and GHG emissions. The BACT analysis followed the 5-step "top-down" evaluation process described in U.S. EPA's New Source Review Workshop Manual (Draft, October 1990). In general, the top-down approach involves the following steps for each pollutant subject to review: (1) identification of all potential control technologies; (2) elimination of the technically infeasible control options; (3) ranking the remaining control technologies by control effectiveness; (4) evaluating the control technologies for economic, energy, and environmental impacts; and (5) selecting BACT.

Based on the control technology evaluation prepared by S&L and reviewed by Basin, the following control technologies were proposed as BACT for the LCS Project:

- NOx – Dry low-NOx combustion and Selective Catalytic Reduction;
- PM – Natural gas firing and combustion controls;
- CO – Catalytic Oxidation; and
- GHG – Natural gas firing and combustion turbine efficiency.

In addition to the BACT evaluation, a source subject to the PSD rules is required to demonstrate, through air quality impact modeling, that allowable emissions from the proposed source will not cause or contribute to any increase in ambient concentrations that would exceed any applicable ambient air quality standard (AAQS) or available PSD increments for Class I and Class II areas, or adversely impact the Air Quality Related Values (AQRVs), including visibility and pollutant deposition, in the Class I areas.

S&L provided ambient air quality dispersion modeling to predict potential ambient air quality impacts from the LCS Project. The modeling analysis included an assessment of potential impacts on the AAQS, PSD increments for Class I and Class II areas, and Class I area AQRVs from LCS emissions. Following the Air Dispersion Modeling Protocol submitted as part of the permitting process, S&L used the AERMOD dispersion model to assess potential near-field (that is, within 50 km of LCS) impacts, and the CALPUFF dispersion model to assess potential far-field (that is, greater than 50 km) impacts. AAQS and PSD increment modeling was conducted in two phases, with the initial phase consisting of a significant impact analysis which compared the maximum impacts of the project with the Class I and Class II significant impact levels ("SILs"). Impact modeling was conducted to assess potential impacts from both full- and partial-load emissions with all three combustion turbines operating, and emissions during combustion turbine startups.

Air quality modeling shows that predicted ambient air quality impacts from the LCS Project are below the applicable Class I and Class II SILs for all relevant species and averaging periods, indicating that the project will have insignificant impacts on ambient air quality in the Class I and Class II areas. Modeling also demonstrated that emissions from the LCS Project would have no discernible visibility impact at the Class I areas, and that emissions from the LCS Project will have an insignificant impact on sulfur and nitrogen deposition in the Class I areas.

Basin submitted an application for the LCS Project to the Department in January 2013, and supplemented the application with additional information, in response to questions from the Department, in February 2013. In addition to the information and analyses provided in Basin's permit application, the Department conducted an independent analysis of air pollution control technologies available for the proposed project, and verified and supplemented the ambient air quality impact modeling to independently confirm results obtained by Sargent & Lundy. Results of the Department's evaluations are included in the "Air Quality Effects Analysis and Permit Application" document prepared by the Department for the Lonesome Creek Station. That document is available for public review.

Based on my experience permitting other similar electric generating facilities, including other natural gas-fired simple cycle combustion turbine projects, I would encourage the Department to issue the "Air Pollution Control Permit to Construct" as proposed for the Lonesome Creek Station. Air pollution control technologies and emission limits proposed by the Department represent BACT for a natural gas-fired electric generating station designed to provide peaking power during periods of high demand, load-follow, and respond rapidly to changing demand. Air quality impact modeling conducted by the Department demonstrates that emissions from the proposed facility will not cause or contribute to an exceedance of any applicable AAQS or PSD Increment, or adversely impact any Class I AQRV.

These are the end of my comments. Thank you.

Terry O'Clair - Is there anyone else that wishes to testify at this time?

Thank you all of coming. All of the information gathered at this hearing will be considered by the North Dakota Department of Health when making its final decision on the request for a Permit to Construct.

The record will be held open for written comment through August 30th, 2013.

At this point, I will close the hearing on the Basin Electric Power Cooperative's application for an

Air Pollution Control Permit to Construct.

Thank you

REGISTRATION SHEET
LONESOME CREEK GENERATING STATION HEARING
AUGUST 22, 2013

PLEASE PRINT

Name	Address	Representing	Check to Tesify
Jerry Menge	1717 E Interstate Ave.	Basin Electric	
Erwin Prater	55 E. Monroe Chicago, IL	Sargent & Lundy	✓
Myron Steckler	1717 E Interstate Ave, Bis	Basin Electric	✓
Deborah Levchak	1717 E. Interstate Ave, Bis	Basin Electric	
Lyle Witham	" " " " "	Basin Electric	
Curt Pearson	1717 E. Interstate Ave Bismarck	Basin Electric	

APPENDIX A-3 - SOUND ASSESSMENT STUDY

Sound Assessment Study

Lonesome Creek Station
Basin Electric Power Cooperative

prepared for

USDA Rural Utilities Service

May 2013

Project No. 69029

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

TABLE OF CONTENTS

Page No.

* * * * *

LIST OF TABLES

Page No.

LIST OF FIGURES

Page No.

* * * * *

1.0 SUMMARY

Basin Electric Power Cooperative (Basin Electric) is proposing to build a natural gas-fired generating plant in McKenzie County, North Dakota (Project). Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) was contracted to analyze the expected sound impacts from the Project. The site is capable of supporting three units. Basin Electric requested that the noise analysis be performed on a single-unit as well as a three-unit facility.

The objectives of this study were as follows:

- Identify federal, state, and/or local noise ordinances
- Estimate operational noise levels from the generating station and
- Examine the potential effects of the predicted noise levels on the surrounding areas due to operation of the proposed Project

Predictive modeling indicated that the facility will likely increase ambient sound levels in some locations. However, since there are no local or state regulations for noise in McKenzie County, sound levels were compared to Housing and Urban Development (HUD) guidelines. No exceedences of the HUD guideline noise levels are expected from this project.

The following sections describe the study in further detail.

* * * * *

2.0 ACOUSTICAL TERMINOLOGY

The term “sound level” is often used to describe two different sound characteristics called sound power and sound pressure. Every source that produces sound has a sound power level. The sound power level is the acoustical energy emitted by a sound source and is an absolute number that is not affected by the environment. The acoustical energy produced by a source propagates through a media as pressure fluctuations. These pressure fluctuations, also called sound pressure, are what human ears hear and microphones measure.

Sound is physically characterized by amplitude and frequency. The amplitude of sound is measured in decibels (dB) as the logarithmic ratio of a sound pressure to a reference sound pressure (20 microPascals). The reference sound pressure corresponds to the typical threshold of human hearing. Less than a 3-dB change in continuous broadband sound is generally considered “not noticeable” to the average listener. A 5-dB change is generally considered “clearly noticeable” and a 10-dB change is generally considered a doubling (or halving) of the apparent loudness.

Frequency is measured in hertz (Hz), which is the number of cycles per second. The typical human ear can hear frequencies ranging from approximately 20 to 20,000 Hz. Normally, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the low and high frequencies. As such, the A-weighting scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting scale emphasizes sounds in the middle frequencies and deemphasizes sounds in the low and high frequencies. Any sound level to which the A-weighting scale has been applied is expressed in A-weighted decibels or dBA. For reference, the A-weighted sound pressure level and subjective loudness associated with some common sound sources are listed in Table C2-1.

Table C2-1 Typical Sound Pressure Levels Associated with Common Sound Sources

Sound Pressure Level (dBA)	Subjective Evaluation	Environment	
		Outdoor	Indoor
140	Deafening	Jet aircraft at 75 feet	
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 feet	
120	Threshold of feeling	Elevated train	Hard rock band
110		Jet flyover at 1,000 feet	Inside propeller plane
100	Very loud	Power mower, motorcycle at 25 feet, auto horn at 10 feet, crowd sound at football game	
90		Propeller plane flyover at 1,000 feet, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately loud	Diesel truck (40 mph) at 50 feet	Inside auto at high speed, garbage disposal, dishwasher
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner
60	Moderate	Air-conditioner condenser at 15 feet, near highway traffic	General office
50	Quiet		Private office
40		Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Inside average residence (without TV and stereo)
20		Rustling leaves	Quiet theater, whisper
10	Just audible		Human breathing
0	Threshold of hearing		

Source: Adapted from Architectural Acoustics, M. David Egan, 1988 and Architectural Graphic Standards, Ramsey and Sleeper, 1994.

Sound in the environment is constantly fluctuating; for example, when a car drives by, a dog barks, or a plane passes overhead. Therefore, sound metrics have been developed to quantify fluctuating environmental sound levels. These metrics include the exceedance sound level. The exceedance sound level, L_x, is the sound level exceeded during “x” percent of the sampling period and is also referred to as a statistical sound level. The most common L_x value is L_{eq}.

* * * * *

3.0 APPLICABLE REGULATIONS

The State of North Dakota does not have applicable state-wide noise regulations and has delegated authority to the individual counties and cities. McKenzie County does not have applicable noise regulations. Therefore, because there are no applicable county or state regulations for noise, this project will be compared to HUD guideline noise levels for residential areas. HUD developed formal requirements related specifically to noise in 1971 (23 CFR 772). The noise regulations set forth the exterior noise standards shown in Table C3-1 for new housing construction assisted or supported by HUD. These noise levels are based on the L_{dn} noise level, which applies a 10-dB penalty to the nighttime noise levels. Essentially, the nighttime noise level should be below a L_{eq} of 55 dBA and the daytime noise level should be below a L_{eq} of 65 dBA to meet the HUD standard.

Table C3-1 HUD Site Acceptability Standards

Noise Level, L_{dn} (dBA)	Acceptability
Not exceeding 65	Acceptable
65 to 75	Normally not acceptable
Exceeding 75	Unacceptable

Based on the HUD guidance for new construction, a L_{dn} of 65 dBA would be considered acceptable for the residences and commercial property near the Project. The predicted noise levels from the Project will be compared to the HUD standards.

* * * * *

4.0 PREDICTIVE MODELING

Using industry-accepted sound modeling software, the expected sound-pressure levels were predicted. The program used for determination of noise levels was the Computer Aided Design for Noise Abatement (CadnaA) model, Version 4.3.143, published by DataKustik, Ltd., Munich, Germany. The CadnaA program is a scaled, three-dimensional program which takes into account each piece of sound-emitting equipment on the Project site and predicts future sound-pressure levels over an area of interest. The model calculates sound propagation based on ISO 9613-2:1996, General Method of Calculation. ISO 9613-2 assesses the sound levels based on the Octave Band Center-Frequency range from 31.5 Hz to 8000 Hz. The atmospheric conditions were assumed to be calm, and the temperature and relative humidity were left as the program default values.

The main generation equipment that is expected to be installed for this Project is the General Electric (GE) model LM6000-PF combustion turbine. There are several auxiliary pieces of equipment associated with each combustion turbine package, including two small oil fin-fan coolers, air compressors, water pump skids, and auxiliary equipment skids. There would be natural gas conditioning equipment on site.

The sound profile used for modeling purposes was provided by GE for all of the equipment. The turbine sound data is for LM6000 turbines that use different NO_x control technology (water injection) than will be used for this Project (dry NO_x control). GE documentation indicates that their dry NO_x controls equipment is capable of meeting the same sound levels as their water injection equipment, so estimates from these turbines should be similar to those that are installed. The provided sound power profiles used in the modeling for the Project are shown below in Table C4-1.

Table C4-1 Expected Equipment Sound Profiles

Equipment	Transformer Sound Power Level (Lw) at Octave Band Frequency (Hz) (dBA)									Overall Sound Level (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
Auxiliary Skid Cooler	82.0	90.0	92.0	84.0	86.0	86.0	84.0	78.0	72.0	90.4
Filter House Intake & Surface	80.0	81.0	87.0	98.0	87.0	84.0	86.0	79.0	70.0	93.0
Fin Fan	108.0	105.8	102.0	95.0	90.0	90.0	88.0	86.1	76.2	95.8
Gas Filter Skid	107.7	109.0	102.0	99.0	97.0	93.0	90.0	86.0	79.0	99.0
Gas Turbine Enclosure Surfaces	NP	NP	56.0	64.0	67.0	65.0	60.0	54.0	48.0	68.8
Gas Turbine Generator Enclosure Surfaces	NP	90.0	92.0	84.0	86.0	86.0	84.0	78.0	72.0	90.4
Generator Motor & Fan Surfaces	100.0	96.6	100.1	101.8	90.4	90.8	83.5	74.8	64.6	96.4
Intake Silencer Shell	NP	102.0	102.0	91.0	78.0	73.0	71.0	68.0	65.0	88.3
Liquid Fuel Forwarding Skid	91.8	79.9	94.7	102.5	86.3	88.9	87.7	86.1	79.4	96.9
Auxiliary Skid	NP	78.0	83.0	88.0	88.0	84.0	83.0	79.0	73.0	90.1
Stack (includes silencer)	123.0	120.0	107.0	96.0	85.0	80.0	77.0	77.0	79.0	96.9
Transformer	119.9	112.7	104.6	92.1	86.7	77.5	71.3	66.5	61.6	92.5
Turbine Vent Exhaust	103.1	104.7	97.4	94.1	78.9	76.6	75.5	69.5	59.9	88.5
Turbine Vent Motor & Fan Surfaces	100.2	92.9	96.6	98.3	92.4	91.7	93.6	92.4	86.0	99.5

NP – Not Provided by GE.

Noise receivers were placed at ten points near the proposed facility. Six of these locations are current residences, and four are points of commercial developments. See the attached Figure C4-1 for the locations of the modeled sound receivers and the Project as a single unit. Figure C4-2 shows the modeled receivers and the Project as three units.

A moderate ground absorption value was chosen that appropriately reflects the agricultural nature of the area surrounding the Project. The effects of shielding due to terrain were conservatively ignored. Second-order reflections were considered to account for the effects of reflected sound within the power block.

The modeled L_{eq} and L_{dn} sound pressure levels for the nearest residences and commercial properties are shown in Table C4-2. The table presents both the one-unit and three-unit scenarios. The measurement points in the table and figures are labeled “Res” for residence and “Com” for commercial property. The modeled single unit L_{eq} and L_{dn} sound pressure level noise contours are presented in Figure C4-3 and

Figure C4-4, respectively. The three units L_{eq} and L_{dn} sound pressure level noise contours are presented in Figure C4-5 and Figure C4-6, respectively. All of the noise contours are shown in 5 dBA increments.

Table C4-2 Expected Worst-Case L_{eq} and L_{dn} Sound Levels

Receiver	Sound Pressure Level			
	One Unit L_{eq} (dBA)	One Unit L_{dn} (dBA)	Three Units L_{eq} (dBA)	Three Units L_{dn} (dBA)
Res1	26.5	32.9	29.8	36.3
Res2	28.0	34.5	32.0	38.4
Res3	31.8	38.2	35.2	41.6
Res4	23.5	29.9	28.4	34.8
Res5	25.0	31.4	28.9	35.3
Res6	21.9	28.3	25.9	32.3
Com1	32.3	38.7	35.1	41.5
Com2	34.9	41.3	37.5	43.9
Com3	36.3	42.7	39.4	45.8
Com4	38.0	44.4	40.7	47.1

* * * * *

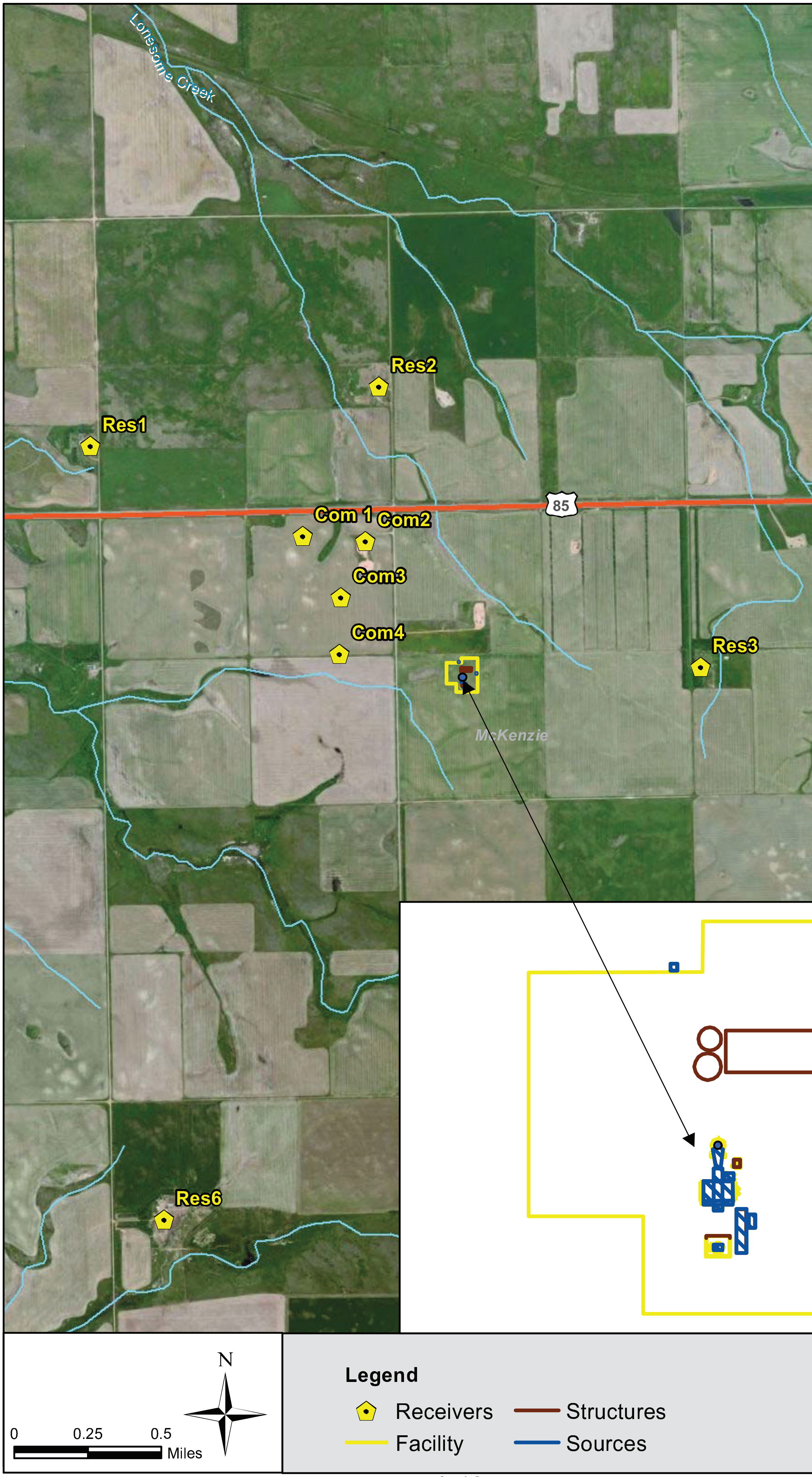

Figure C4-1:
Lonesome Creek
One Unit
Facility Modeling
Layout and Receivers

Path: R:\Basin\67626_LCNoise\GIS\DataFiles\ArcDocs\Figure C4-1.mxd jdringman 8/16/2013

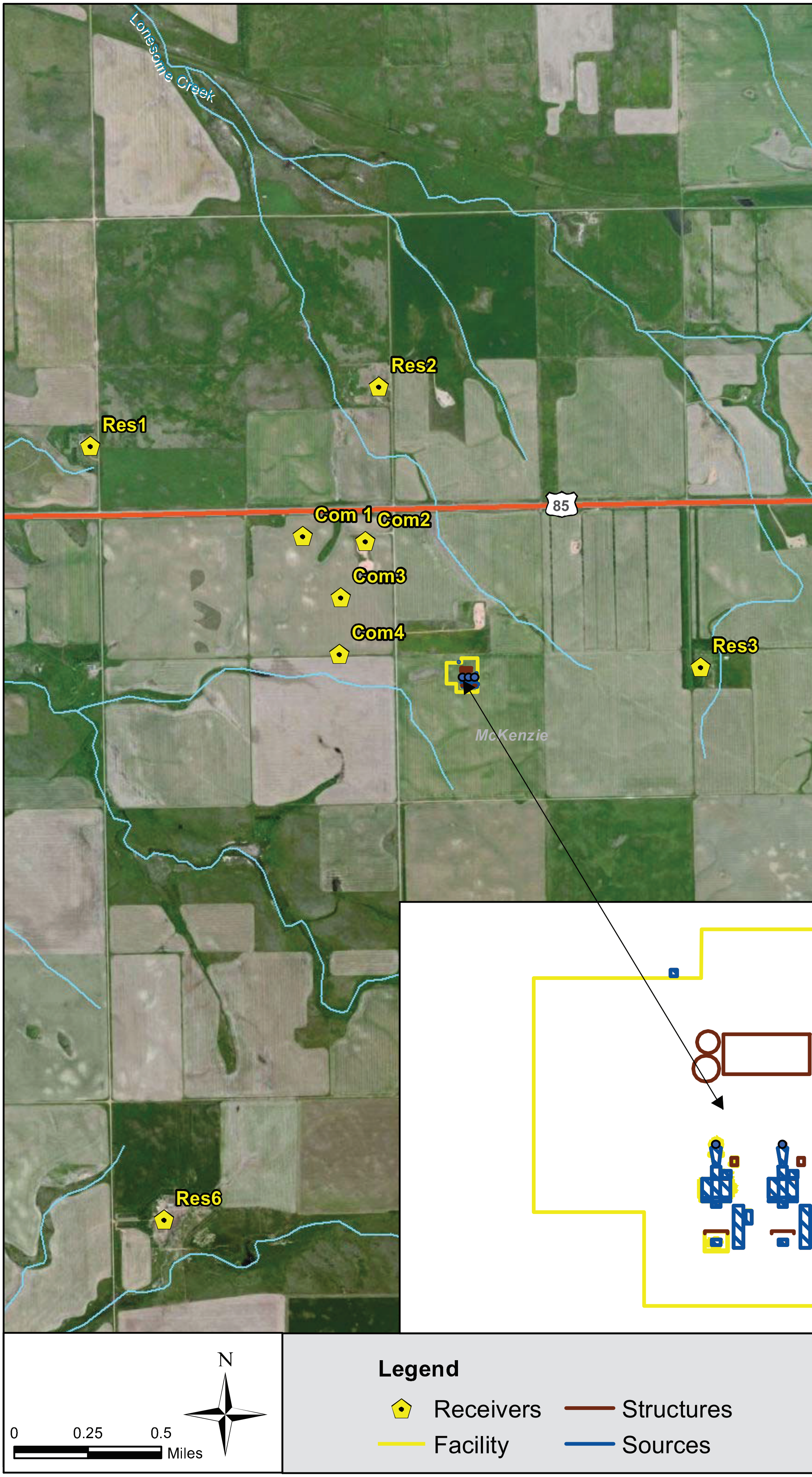

Figure C4-2:
Lonesome Creek
Three Unit
Facility Modeling
Layout and Receivers

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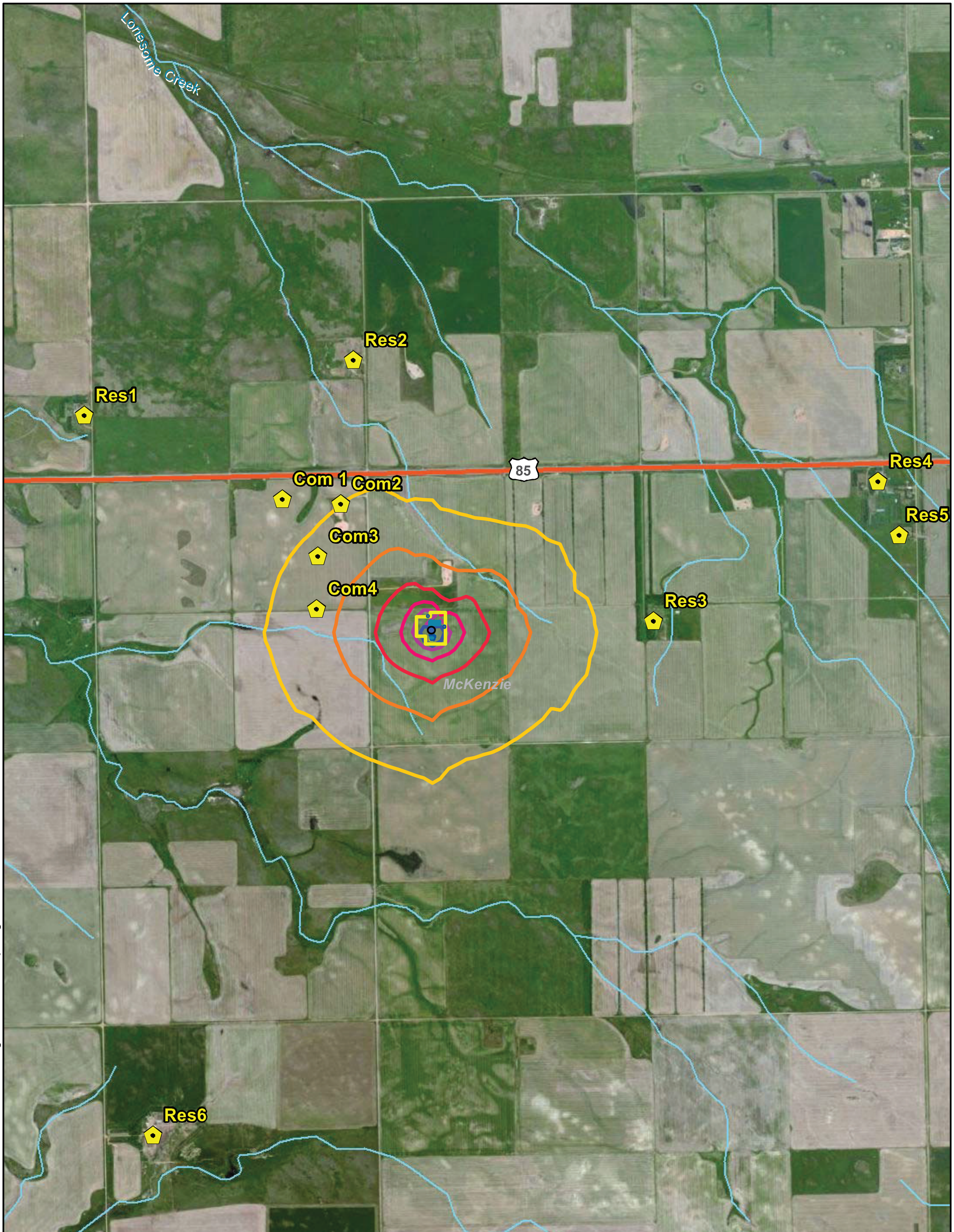


N

0 0.25 0.5 Miles

Legend

Receivers

Facility

Leq Sound Levels dBA

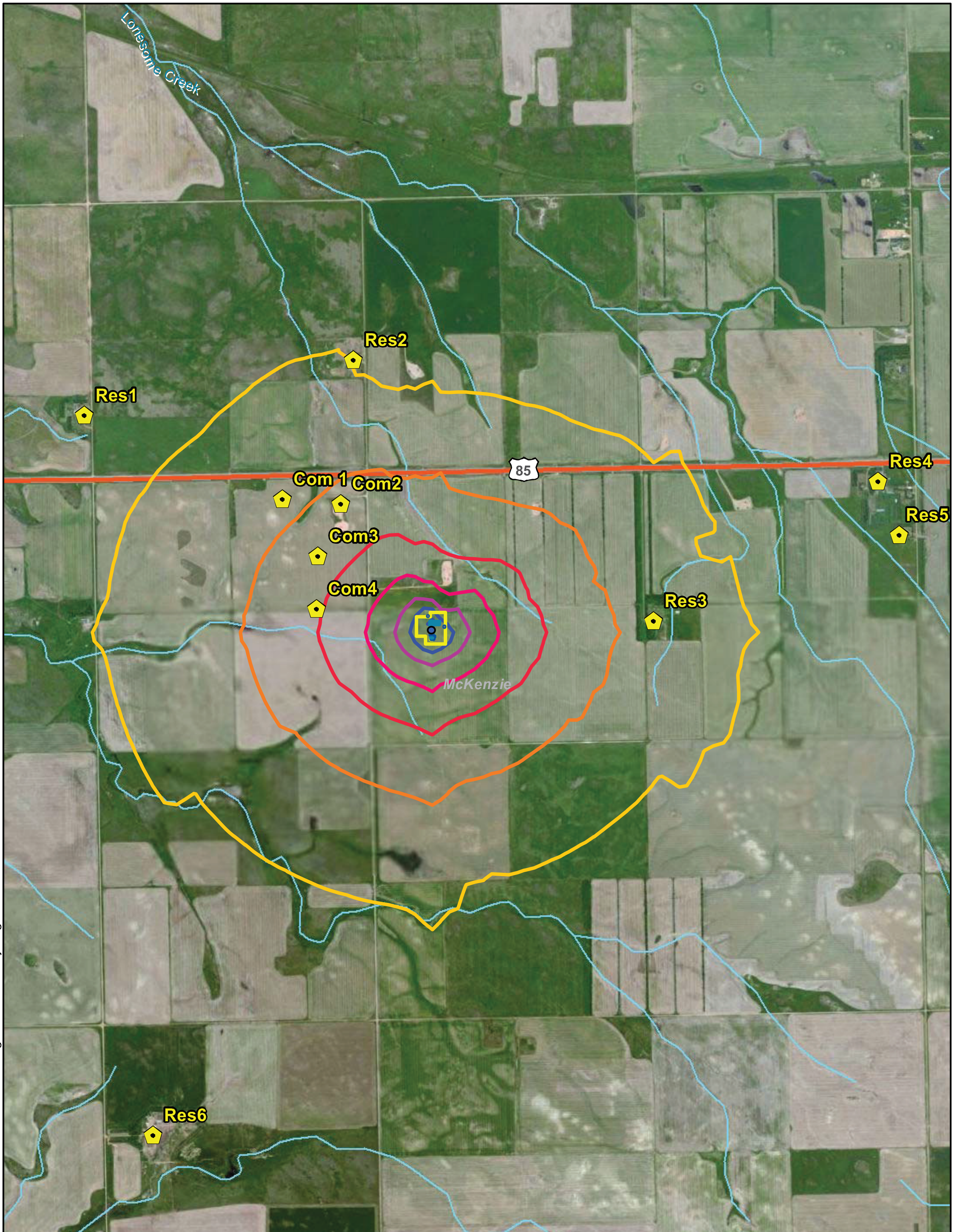
35 50

40 55

45 60

Figure C4-3:
Lonesome Creek
One Unit
Leq Noise Contours

Path: R:\Basin\67626_LCNoise\GIS\DataFiles\ArcDocs\Figure C4-3.mxd jdringman 8/16/2013



N

0 0.25 0.5 Miles

Legend Leq Sound Levels dBA

Receivers — 35 — 50

Facility — 40 — 55

— 45 — 60

Figure C4-4:
Lonesome Creek
One Unit
Ldn Noise Contours

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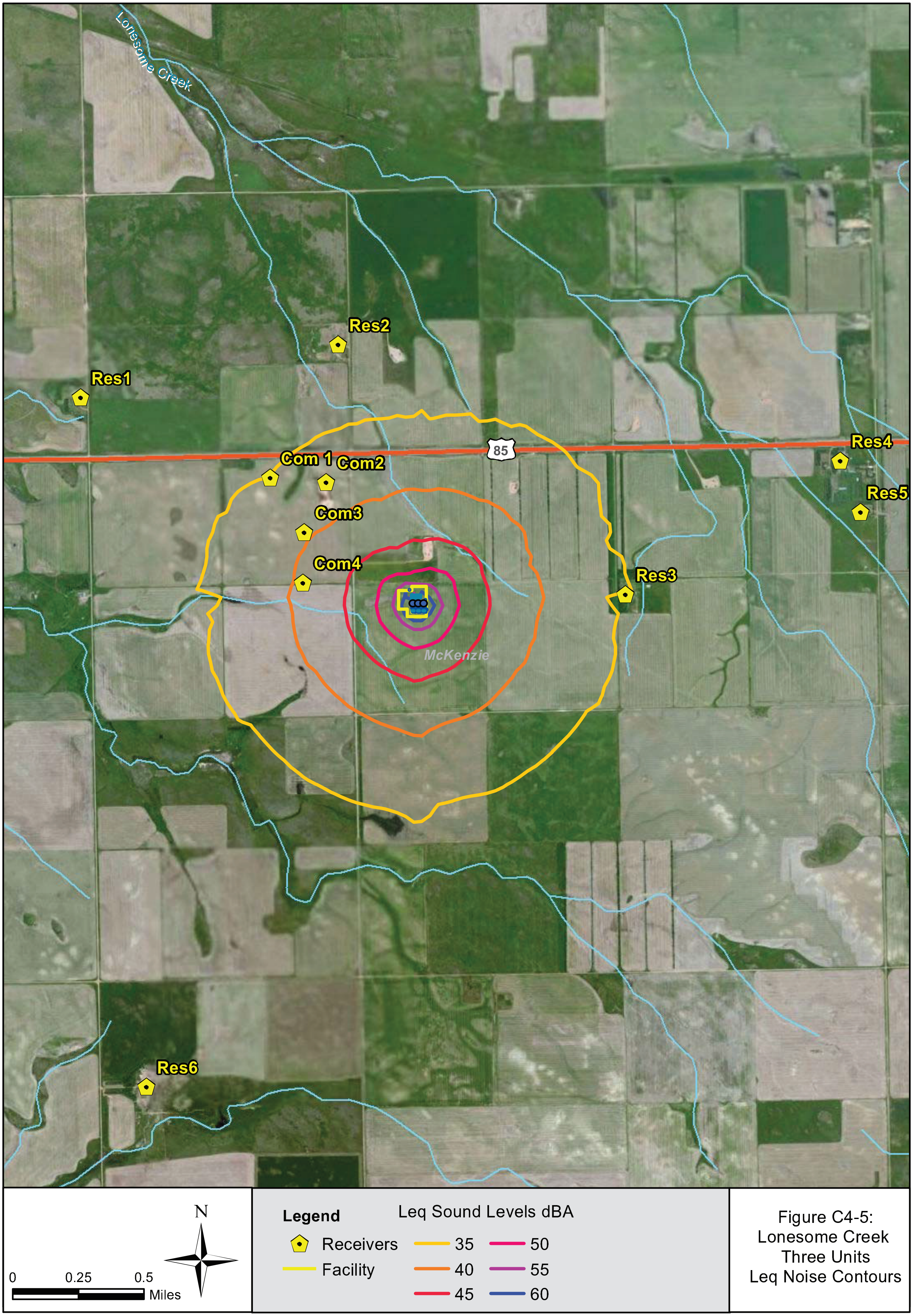

Figure C4-5:
Lonesome Creek
Three Units
Leq Noise Contours

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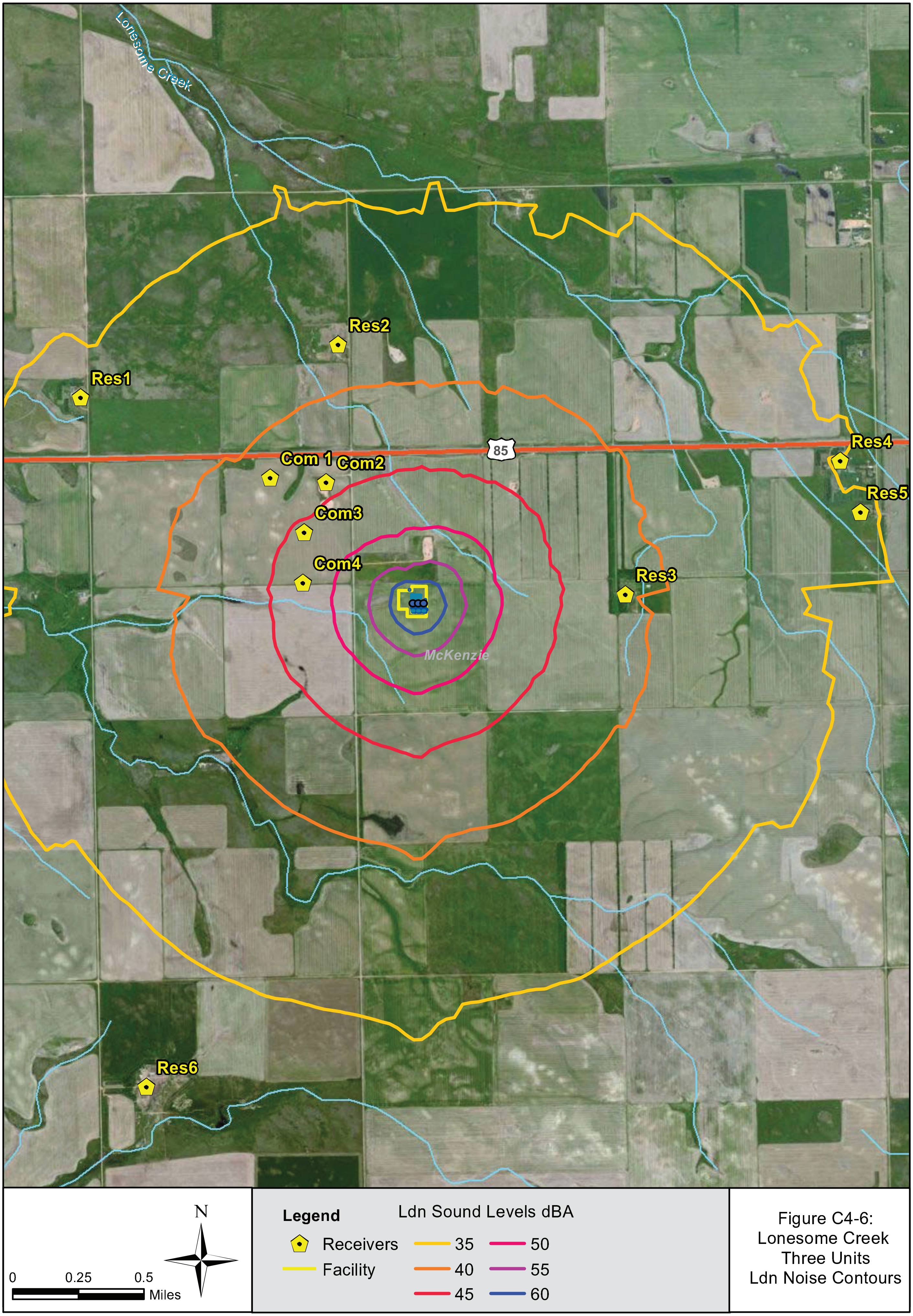


Figure C4-6:
Lonesome Creek
Three Units
Ldn Noise Contours

Path: R:\Basin\67626_LCNoise\GIS\DataFiles\ArcDocs\Figure C4-6.mxd jdringman 8/16/2013

5.0 CONCLUSION

The maximum L_{eq} sound level at the closest residence is expected to be 31.8 dBA with only one unit operating. This equates to an L_{dn} sound level of 38.2 dBA, significantly lower than the HUD guideline of 65 dBA for site acceptability. In addition to this being considered a quiet sound level at the exterior of a residence, standard housing construction will reduce outside noise levels by 10 to 20 dB to the inside of a house. Therefore, noise levels due to operation of one unit are expected to have little or no impact on the closest residences.

If three units are placed into operation, the maximum L_{eq} sound level at the closest residence could reasonably be expected to approach 35.2 dBA. This equates to an L_{dn} sound level of 41.6 dBA, which is again significantly lower than the HUD guideline of 65 dBA for site acceptability. This would still be considered a quiet sound level at the exterior of a residence, and standard housing construction will reduce outside noise levels by 10 to 20 dB to the inside of a house. Similarly to one unit, noise levels due to operation of three units are expected to have little or no impact on the closest residences.

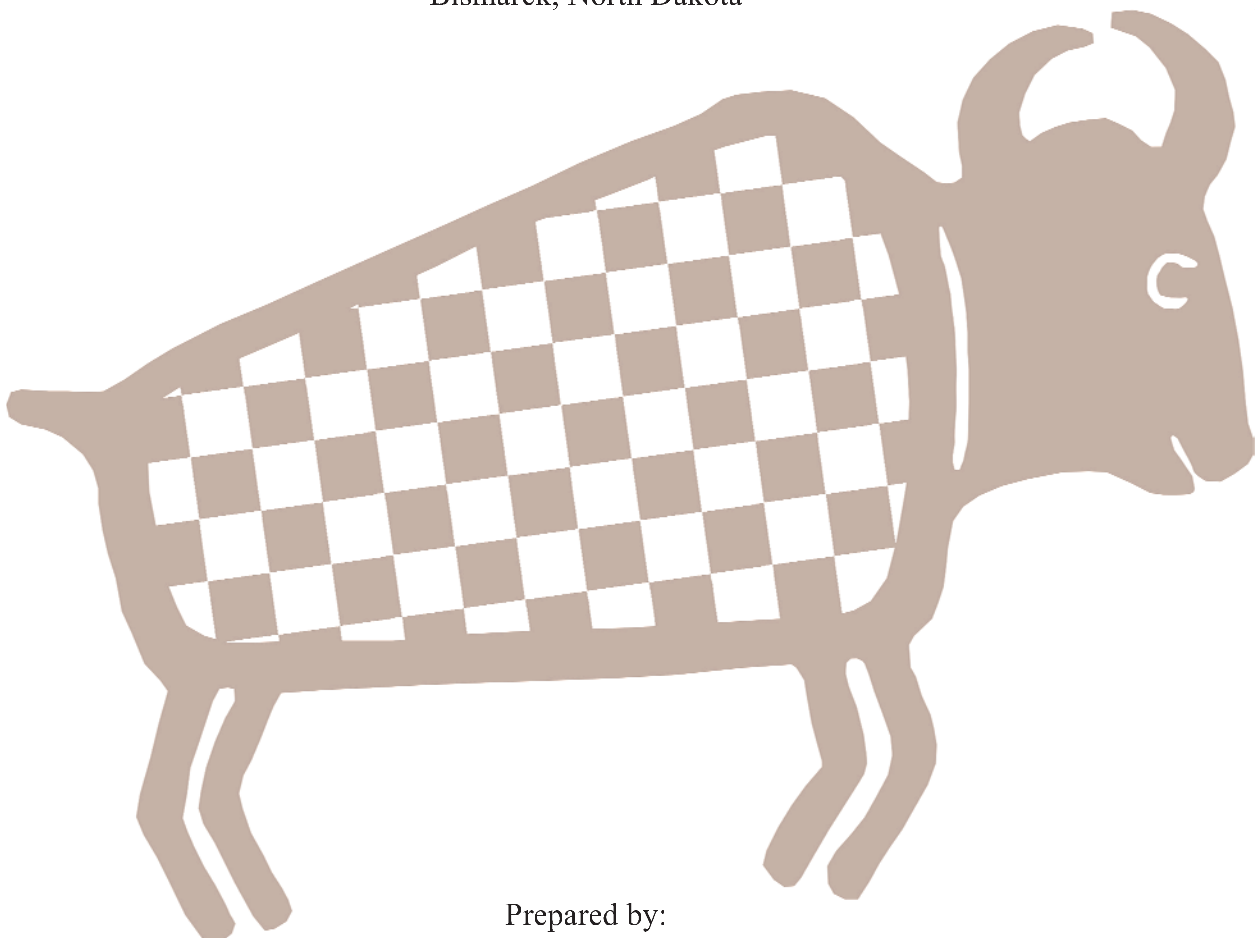
The maximum L_{eq} sound level at the closest commercial property is expected to be 38.0 dBA with only one unit operating and 40.7 dBA with three units operating. This equates to L_{dn} sound levels of 44.4 dBA and 47.1 dBA, for one unit and three units respectively. Even with three units operating, sound levels remain significantly lower than the HUD guideline of 65 dBA for site acceptability. These sound levels would be considered quiet at a residence, and commercial properties generally have less restrictive limits. Noise levels due to the operation of the facility are not expected to have a significant impact on the closest residences and commercial properties.

* * * * *

APPENDIX A-4 - CLASS III CULTURAL RESOURCES INVENTORY

BASIN'S LONESOME CREEK STATION: A CLASS III CULTURAL RESOURCE INVENTORY IN MCKENZIE COUNTY, NORTH DAKOTA

Prepared for:
Basin Electric Power Cooperative
Bismarck, North Dakota



Prepared by:
William Bluemle and Ed Stine

Principal Investigator:
Kimball Banks
Metcalf Archaeological Consultants, Inc.
Bismarck, North Dakota

March 2012

ABSTRACT

Basin Electric Power Cooperative requested that Metcalf Archaeological Consultants, Inc. (MAC) conduct an intensive pedestrian (Class III) inventory for a proposed substation, the Lonesome Creek Station, in McKenzie County, North Dakota. The undertaking area of potential effect (APE) consisted of a 171 acre block in the southwest quarter, of Section 23, T. 150N, R. 101W, McKenzie County.

This cultural resource inventory was conducted on January 27, 2012 by Ed Stine, (Project Director), William J. Bluemle, Matt Kinsey and William Christensen. The inventory was conducted to provide Basin Electric Power Cooperative and the North Dakota State Historic Preservation Office (NDSHPO), the state regulatory agency, with the information necessary to comply with the National Historic Preservation Act (NHPA), as amended.

No cultural resources were identified during the inventory. Metcalf Archaeological Consultants, Inc. recommends a finding of *No Historic Properties Affected* for the proposed undertaking as surveyed, mapped, and described herein.

Table of Contents

List of Figures

INTRODUCTION

Basin Electric Power Cooperative proposes to construct a substation in McKenzie County, North Dakota. There is no lead agency with oversight for this project but Basin, as a good faith effort, requested that Metcalf Archaeological Consultants, Inc. (MAC) conduct a Class III cultural resource inventory. The information from the inventory would allow Basin to avoid any cultural resources that may be present.

Metcalf Archaeological Consultants, Inc. (MAC) was contracted to conduct the Class III cultural resource inventory of the project's APE. Ed Stine, Project Director, and William Bluemle, Matt Kinsey, and William Christensen conducted the inventory on January 27, 2012.

Project Location

The undertaking APE is situated approximate five miles southeast of the community of Alexander, one half mile south of Highway 85 primarily in the southwest quarter, but also in the SE/SE/NW, the SW/SW/NE and the NW/NW/SE of Section 23, T. 150N, R. 101W, McKenzie County (Appendix A, Map 1). The APE can be found on the USGS 7.5' Rawson (1972) quadrangle map. The relevant portion of this map, depicting the APE, is found in Appendix A, Map 1.

Project Setting

The undertaking APE is in the Yellowstone River Study Unit (Unit #13) as defined in *The North Dakota Comprehensive Plan for Historic Preservation: Archeological Component* (SHSND 2008: 13.1-13.69). An overview of the area's archaeology and physiography can be found within the aforementioned citation. The area consists of gently rolling uplands and is in a plowed grain field approximately 15 miles south of Lake Sakakawea (Appendix A, Map 1). The plowed field provides 25 to 75 percent ground surface visibility (GSV) and averages approximately 40 percent. Soils are brown to dark brown loamy sand to sandy loam. Some fist sized and smaller rocks and gravels are present. Scoria was noted, particularly along the east edge, but becomes sparse along the west edge. One rock pile is located near the north end of the block.

Files Search

On January 26, 2012, prior to conducting the Class III inventory, Dierdre Snortland-Banks of MAC conducted a Class I files search at the State Historical Society of North Dakota. Site and manuscript files were reviewed to determine if cultural resources have been recorded or if cultural resource inventories have been conducted within the project undertaking area of potential effect (APE) and a surrounding one-mile radius.

The manuscript files contain five cultural resource reports for the search area. The reports pertain to three oil/gas lines, one transmission line and a segment of Highway 85. There are five cultural resources on file. The search revealed two historic sites and three prehistoric isolated finds. The historic sites consist of a WAPA Transmission Line and a foundation. The isolates all consist of chipped stone. The results of the files search are plotted on the project map in Appendix A and in table format in Appendix B.

Field Methods

The inventory was accomplished using pedestrian transects spaced at 15 meter intervals. Transects ran the length of the survey block. The archaeologists paid special attention to areas of enhanced GSV such as two-track cuts, rodent back dirt piles, and erosional features such as blow outs and cut banks. The APE boundaries were mapped using a hand-held GPS unit. Field conditions were documented with digital photographs (Figures 1 and 2) and detailed in the field notes. All electronic and paper records are on file at the MAC Bismarck office.

Results and Management Recommendations

Archaeologists encountered no cultural resources during the course of the inventory. MAC recommends a finding of *No Historic Properties Affected* for the proposed undertaking as surveyed, mapped, and documented herein.

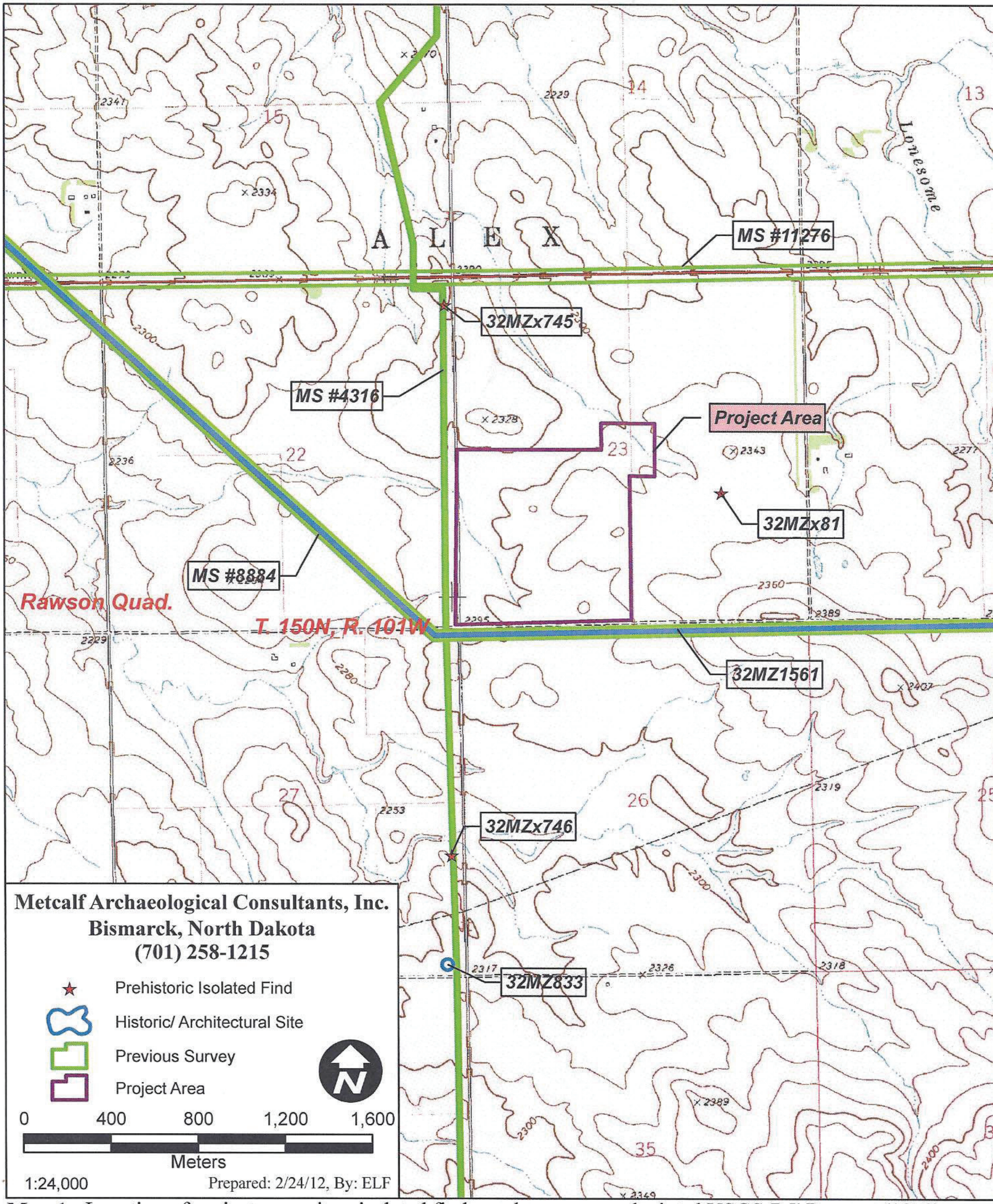
Figure 1: View to the north over the APE from the southern edge (Image 171).

Figure 2: View to the east over the APE from the western edge (Image 172).

REFERENCES CITED

State Historical Society of North Dakota (SHSND)
2008 *The North Dakota Comprehensive Plan for Historic Preservation: Archaeological Component*. http://history.nd.gov/hp/stateplan_arch.html.

APPENDIX A: TOPOGRAPHIC MAPS



Map 1: Location of project area, sites, isolated finds, and surveys as depicted USGS 7.5' Rawson (1972) quadrangle map.

APPENDIX B: SITE AND MANUSCRIPT FILES SEARCH

Table 1: Files Search Results Basin - Lonesome Creek Station

T/R-Section	SITS #	Site type & Description	Recorder, Date	MS #
150/101-22	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	3455, 4316, 8884, 11276
	32MZx0745	Archaeological- isolated find: chipped stone	Borchert, 1987	
150/101-23	32MZx0081	Archaeological- isolated find: chipped stone	Toom, 1980	3455, 11276
150/101-26	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	2532
150/101-27	32MZ0833	Historic- foundation, machinery	Shaw, 1987	2532, 4316
	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	
	32MZx0746	Archaeological- isolated find: chipped stone	Borchert, 1987	

Table 2: Manuscript Files Search Results Basin - Lonesome Creek Station

MS #	Reference
2532	Ecology and Environment, Inc. 1982 Cultural Resource Survey of the Proposed Lateral (B) Pipeline for he North Dakota System in McKenzie County, North Dakota
3455	Root, M. and M. Greeg 1983 Archaeology of the Northern Border Pipeline, North Dakota: Volume 2, Pts. 1-3 Survey and Background Information, McIntosh, Emmons, Morton, Stark, Mercer, Dunn, McKenzie, and Williams Counties, North Dakota
4316	Borchert, J. 1987 The Red Wing Creek Extension Cultural Resources Inventory, McKenzie County, North Dakota
8884	Fandrich, B. 2004 Williston to Charlie Creek: A Cultural Resource Inventory Along the Western Area power Administration 115kV Transmission Line From the Williston Substation th the Charlie Creek Substation, Williams and McKenzie Counties, North Dakota
11276	Leuchtmann, A. 2009 Highway 85 From North Dakota Highway 200 to North Dakota Highway 2: A Class III Cultural Resource Inventory, McKenzie and Williams Counties, North Dakota

Addendum Survey Report

Submitted by Metcalf Archaeological Consultants, Inc.
PO Box 2154, Bismarck, North Dakota 58502
Phone: (701) 258-1215, Email: macnodak@metcalfarchaeology.com

1. **Report Title:** Addendum to: Basin's Lonesome Creek Station: A Class III Cultural Resource Inventory in McKenzie County, North Dakota

2. **Author:** Danielle Bailly and William Bluemle

3. **Report Date(s):** June 2012

4. **Fieldwork Date:** May 17, 2012

5. **Acreage:** 46.6

6. **Project Sponsor:** Basin Electric Power Cooperative

7. **Historic Context (Study Unit):** The undertaking area of potential effect (APE) is in the Yellowstone River Study Unit (Unit #13) as defined in *The North Dakota Comprehensive Plan for Historic Preservation: Archeological Component* (SHSND 2008: 13.1-13.69). An overview of the area's archaeology and physiography can be found within the aforementioned citation.

8. **Legal Description/Location of Project Area:** The undertaking area of potential effect (APE) is situated approximately fifteen miles west of Watford City and one mile south of Highway 85 in Sections 22, 26, 27 and 28, T. 150N, R. 101W, McKenzie County, North Dakota (Figure 1). The APE can be found on the USGS 7.5' Rawson (1972) quadrangle map.

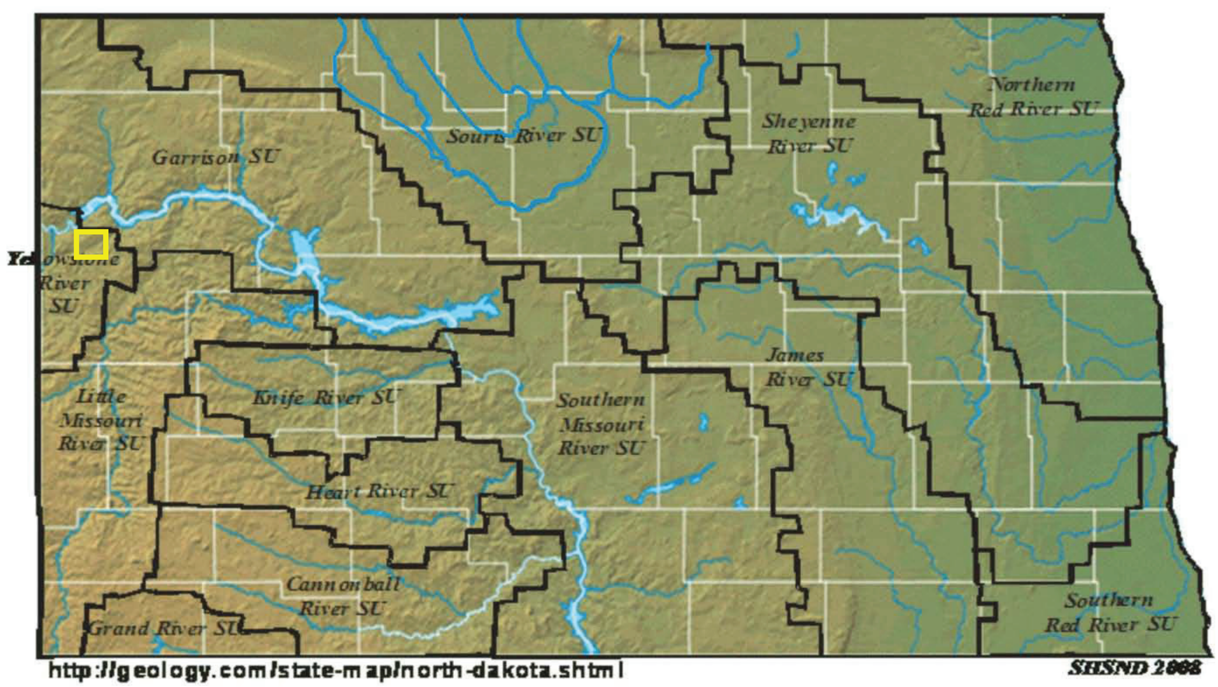


Figure 1: General map of the APE location.

Submitted by Metcalf Archaeological Consultants, Inc.
PO Box 2154, Bismarck, North Dakota 58502
Phone: (701) 258-1215, Email: macnodak@metcalfarchaeology.com

9. Description of Project: Basin Electric Power Cooperative proposes to construct a transmission line connecting to the Lonesome Creek Substation in McKenzie County, North Dakota. There is no lead agency with oversight for this project but Basin, as a good faith effort, requested that Metcalf Archaeological Consultants, Inc. (MAC) conduct a Class III cultural resource inventory. The information from the inventory will assist Basin in avoiding any cultural resources that may be present.

10. Records Search: On May 17, 2012, prior to conducting the Class III inventory, Dierdre Snortland-Banks of MAC conducted a Class I files search at the State Historical Society of North Dakota. Site and manuscript files were reviewed to determine if cultural resources have been recorded or if cultural resource inventories have been conducted within the project undertaking area of potential effect (APE) and a surrounding one-mile radius. The results of the files search are plotted on the project map in Map 1 and in table format in Tables 1 and 2.

There are eleven cultural resources on file: two prehistoric sites, two historic sites, one multi-component architectural/historic site, and six prehistoric isolated finds. The closest cultural resource to the APE is 32MZx746, which consists of chipped stone. No cultural resources will be impacted by the current project.

The manuscript files contain six cultural resource inventories for the search area. The reports pertain to four oil/gas lines, one power transmission line, and a segment of Highway 85.

Table 1: Files Search Results - Basin-Lonesome Creek Station Addendum

T/R-Section	SITS #	Site type & Description	Recorder, Date	MS #
150/101-14	No Sites			4316, 11276
150/101-15	32MZ0476	Archaeological- cultural material scatter, chipped stone	Root, 1980	3455, 4316, 11276
150/101-16	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	3455, 8884, 11276
150/101-21	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	8884, 11276
150/101-22	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	3455, 4316, 8884, 11276
	32MZx0745	Archaeological- isolated find: chipped stone	Borchert, 1987	
150/101-23	32MZx0081	Archaeological- isolated find: chipped stone	Toom, 1980	3455, 11276
150/101-25	32MZ0624	Archaeological- cultural material scatter, faunal remains, fire cracked rock, projectile point, chipped stone	Keller, 1982	2532, 3455
	32MZ1557	Multicomponent: Architectural- windmill, Historic- depression, foundation, machinery, cultural material scatter, glass, metal, wood	Fandrich, 2001	
	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	
	32MZx0258	Archaeological- isolated find: projectile point	Hetland, 1982	
150/101-26	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	2532
150/101-27	32MZ0833	Historic- foundation, machinery	Shaw, 1987	2532, 4316
	32MZ1561	Historic- WAPA Transmission Line	Fandrich, 2001	
	32MZx0746	Archaeological- isolated find: chipped stone	Borchert, 1987	
150/101-33	32MZx0514	Archaeological- isolated find: chipped stone	Floodman, 1988	2532, 4724
150/101-34	32MZx0747	Archaeological- isolated find: faunal remains	Borchert, 1987	4316, 4724
150/101-35	No Sites			4316, 4724

Table 2: Manuscript Files Search - Basin-Lonesome Creek Station Addendum

MS #	Reference
2532	Ecology and Environment, Inc. 1982 Cultural Resource Survey of the Proposed Lateral "B" Pipeline for the North Dakota System in McKenzie County, North Dakota
3455	Root, M. and M. Gregg 1983 Archaeology of the Northern Border Pipeline, North Dakota: Volume 2, Pts. 1-3 Survey and Background Information, McIntosh, Emmons, Morton, Stark, Mercer, Dunn, McKenzie, and Williams Counties, North Dakota
4316	Borchert, J. 1987 The Red Wing Creek Extension Cultural Resources Inventory, McKenzie County, North Dakota (U-W#1010)
4724	Floodman, M. 1988 A Cultural Resources Inventory of the Proposed Northern Border Connection Pipeline McKenzie County, North Dakota Volume I and II
8884	Fandrich, B. 2004 Williston to Charlie Creek: A Cultural Resource Inventory Along the Western Area Power Administration 115kV Transmission Line From the Williston Substation to the Charlie Creek Substation, Williams and McKenzie Counties, North Dakota
11276	Leuchtmann, A. 2009 Highway 85 From North Dakota Highway 200 to North Dakota Highway 2: A Class III Cultural Resource Inventory, McKenzie and Williams Counties, North Dakota

11. Field Personnel: William Bluemle

12. Field Methods and Conditions: The inventory was accomplished using pedestrian transects spaced at 15 meter intervals. The archaeologists paid special attention to areas of enhanced ground surface visibility (GSV) such as two-track cuts, rodent back dirt piles, and erosional features such as blow outs and cut banks. Approximately half of the survey area consists of cultivated field with 70 to 100 percent GSV. The remainder of the APE is plains pasture with prairie grasses and forbes providing 10 to 20 percent GSV. Two shallow unnamed drainages cut through the APE with a bit of water currently present in both.

The APE boundaries were mapped using a hand-held GPS unit. Field conditions were documented with digital photographs (Figures 2 and 3) and detailed in field notes. All electronic and paper records are on file at the MAC Bismarck office.

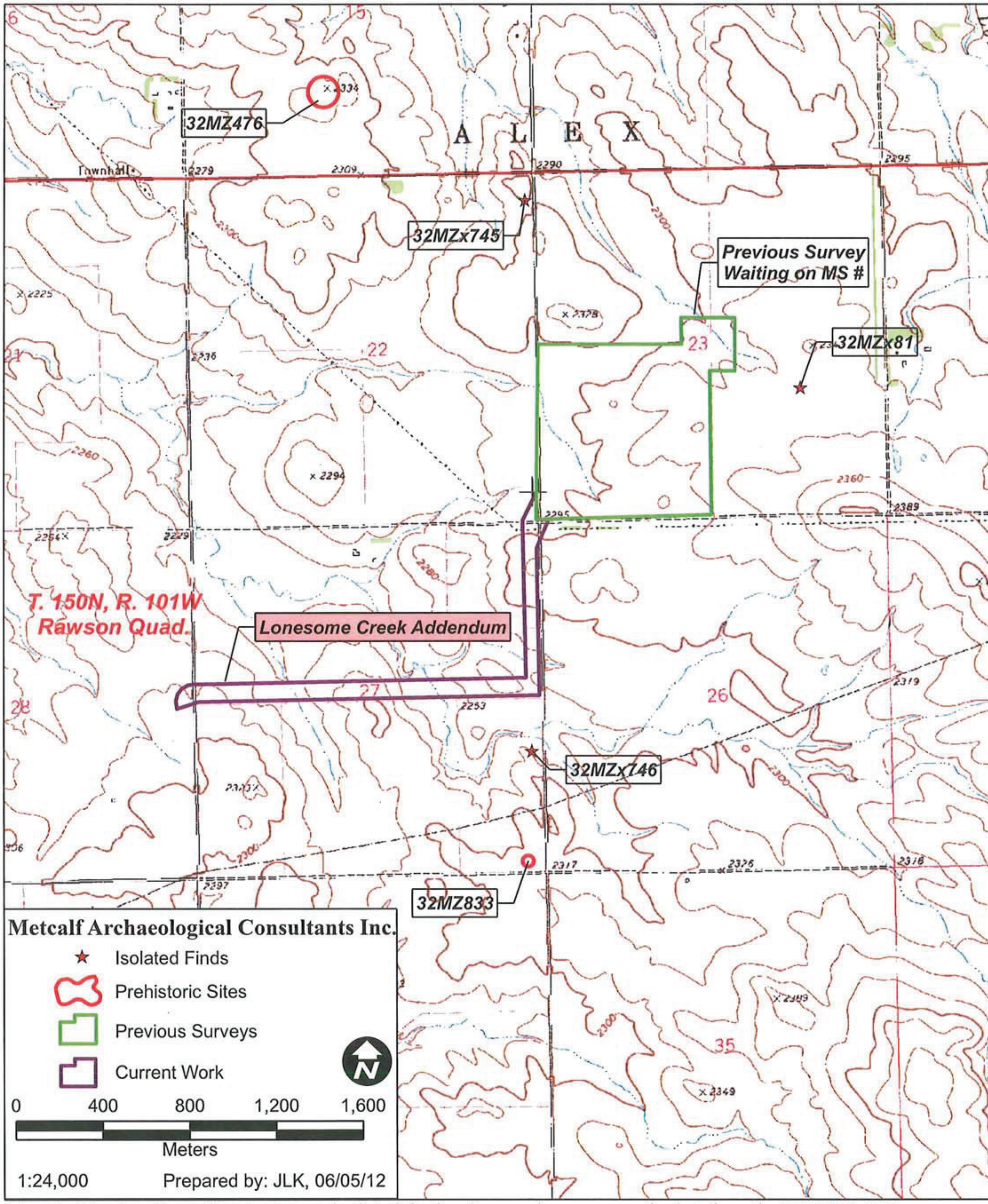
13. Results and Recommendations: No cultural resources were encountered during the course of the inventory. MAC recommends a finding of *No Historic Properties Affected* for the proposed undertaking as surveyed, mapped, and documented herein.

14. References

State Historical Society of North Dakota (SHSND)
2008 *The North Dakota Comprehensive Plan for Historic Preservation: Archaeological Component.* http://history.nd.gov/hp/stateplan_arch.html.

Figure 2: View to the east from the west over the center of the corridor (Image 2).

Figure 3: View to the south from the north end of the project corridor (Image 5).



Map 1: The location of project area, isolated finds, sites, and surveys as depicted on the USGS 7.5' Rawson (1972) quadrangle map.

APPENDIX A-5 - UNANTICIPATED DISCOVERIES PLAN

Unanticipated Discoveries Plan

For

Basin Electric Power Cooperative

Lonesome Creek Generation Station Project

September 2013

Table of Contents

1.0 Emergency Contact List

Entity	Name	Role	Telephone Number
Basin Electric Power Cooperative	Lucas Tiegen	Manager of Construction	701.223-0441
Basin Electric Power Cooperative	Cris Miller	Senior Environmental Project Administrator	701.223-0441
Basin Electric Power	Myron Steckler	Project Manager	701.223-0441
Metcalf and Associates		Project Archaeologist	701.258-1518
State Historical Society of North Dakota	Paul Picha	State Archaeologist	701.328-3574

2.0 Unanticipated Discovery of Cultural Resources

2.1 Procedures at Time of Discovery of Unanticipated Cultural Resources

If unanticipated cultural resources are discovered during construction of Basin Electric Power Cooperative's (Basin Electric) Pioneer Generation Station Project (Project), all construction activity will immediately cease within 100 feet in all directions from the discovery. Basin Electric's project inspector and/or the contractor will immediately report the discovery to all parties identified in the Emergency Contact List in Section 1.0 of this plan. Ground-disturbing construction activities will not occur within 100 feet in any direction from the cultural resource until the State Historical Society of North Dakota (SHSND) permits construction to resume. In the event that an archaeologist, tribal monitor, or other necessary persons are not immediately available, the contractor will secure and protect the discovery until such time that the archaeologist and tribal monitor, if appropriate, can inspect and evaluate the discovery.

Metcalf's archaeologist will investigate any unanticipated discovery in consultation with the SHSND. Basin Electric may invite a tribal monitor to participate in the investigation, as appropriate. Metcalf's archaeologist, in conjunction with the tribal monitor if appropriate, will ascertain the nature and the extent of the resource, and the potential for intact deposits Evaluation will involve an examination of the ground surface, backfill piles, and exposed construction surfaces. Metcalf's archaeologist will discuss the potential for additional impacts to the resource with the construction manager. Based on this examination, Metcalf's archaeologist will recommend the locus is:
(1) not a site (e.g., isolated find or less than 50 years in age);
(2) not a historic property, ie. not eligible for inclusion in the National Register of Historic Places (NRHP);
(3) a historic property, ie. eligible for inclusion in NRHP-eligible or culturally sensitive site for which no further impacts are likely to occur;
(4) an NRHP-eligible or culturally sensitive site (e.g. exposed hearths, house pits) that is likely to be impacted with further construction; or,
(5) a site for which additional information is required to ascertain extent and NRHP eligibility.

Metcalf's archaeologist will provide information about the resource to SHSND to determine the most appropriate action.

2.2 Emergency Salvage of Cultural Resources

Unstable earth conditions in trenches or other unforeseen natural or cultural events could endanger cultural resources discovered during construction of the transmission line. If cultural resources are in imminent danger of destruction, Basin Electric will apply prudent methods to stabilize landforms around the unanticipated discovery. Once stabilized the resource shall be assessed as described above, subject to safety concerns.

2.3 Curation or Disposition of Cultural Materials

All cultural materials recovered from privately owned lands are the property of the landowner. After necessary laboratory analysis is completed, Basin Electric will provide the landowner with photographs and descriptions of cultural materials from his/her property. The landowner will be encouraged to contribute the materials for curation at the SHSND. If the landowner desires, Basin Electric will return cultural materials from his/her land to him/her.

3.0 Unanticipated Discovery of Human Remains

Any human remains encountered in a discovery situation will be handled according to the provisions of North Dakota Law. Treatment of human remains found on state or private lands in North Dakota is governed primarily under two laws: Protection of Human Burial Sites, Human Remains and Burial Goods in North Dakota Century Code (NDCC 23-06-27) and Protection of Prehistoric Sites and Deposits in the North Dakota Administrative Code (NDAC 40-02-03).

If human remains are discovered, all ground-disturbing construction activity will be immediately suspended within 100 feet in all directions from the human remains, and Basin Electric and Metcalf's archaeologist will be notified immediately. As required by law, Basin Electric will notify the McKenzie County Sheriff within 24 hours of discovery. Basin Electric will also notify the SHSND's of the finding.

If allowed by law enforcement, Basin Electric and/or the contractor will secure the location by means of flagging or roping the perimeter of the avoidance area and covering or otherwise protecting the human remains and any associated materials. The remains will not be further disturbed prior to completion of consultations with respective agencies unless such disturbance is necessary to preserve or protect the human remains. Any disturbance necessary to preserve or protect the remains must be done in consultation with law enforcement, SHSND, and Metcalf's archaeologist. The 100-foot-radius avoidance area may be expanded if the context of the human remains suggests additional human remains may exist within the construction area or if construction activities outside the 100-foot-radius area might destabilize or otherwise degrade the context of the human remains.

Law enforcement will determine whether the finding is associated with a crime scene within 15 days. If deemed not a crime scene, law enforcement will notify the SHSND of their findings. **No cultural resource investigations of human remains can occur without a permit from SHND**. Metcalf's archaeologist will work with SHSND to obtain a permit to conduct investigations of the location. If the remains are determined Native American, or if the ethnic identity of the remains is unknown, SHSND will notify the Intertribal Re-interment Committee. A meeting of interested parties will be set up as soon as possible, preferably within 36 hours of the decision that there is no evidence of a crime, to ensure that the disturbed remains receive the maximum protection and that costly delays are avoided. Together the SHSND, in consultation with the tribes (as appropriate) and Basin Electric will agree upon a suitable action.

Work cannot proceed until the stipulations of Protection of Human Burial Sites, Human Remains and Burial Goods in North Dakota Century Code (NDCC 23-06-27) and Protection of Prehistoric Sites and Deposits in the North Dakota Administrative Code (NDAC 40-02-03) have been met.

APPENDIX A-6 - WETLAND REPORT

ENVIRONMENTAL & STATISTICAL CONSULTANTS
4007 State Street, Suite 109, Bismarck, ND 58503
Phone: 701-250-1756 ◆ www.west-inc.com ◆ Fax: 701-250-1761

March 19, 2013

Cris Miller
Basin Electric Power Cooperative
1717 East Interstate Ave
Bismarck, North Dakota 58503

RE: Lonesome Creek Generator Station Wetlands

Dear Mr. Miller,

Western EcoSystems Technology, Inc. (WEST) conducted an initial review of wetland features for the Lonesome Creek Generator Station in the SE ¼ of Sec 23, T150N, R101W on January 27, 2012 (see attached map). Further, WEST reviewed the current National Wetland Inventory (NWI) data layer, National Hydrologic Dataset (NHD) information, and SSURGO soils database information to investigate if hydric soils were present on March 19, 2013. While the proposed station only encompasses the northern 40 acres of this quarter section, shown in yellow highlighted area on the map, the entire quarter section was reviewed.

Beside the database reviews, WEST completed a field survey of the transmission line route that is shown in red on the attached map and found no wetlands or waterbodies along the transmission line route within this quarter section. This includes the NHD line that is generally analogous to "blue lines" on USGS topographic maps that is within the western boundary of the generator station site.

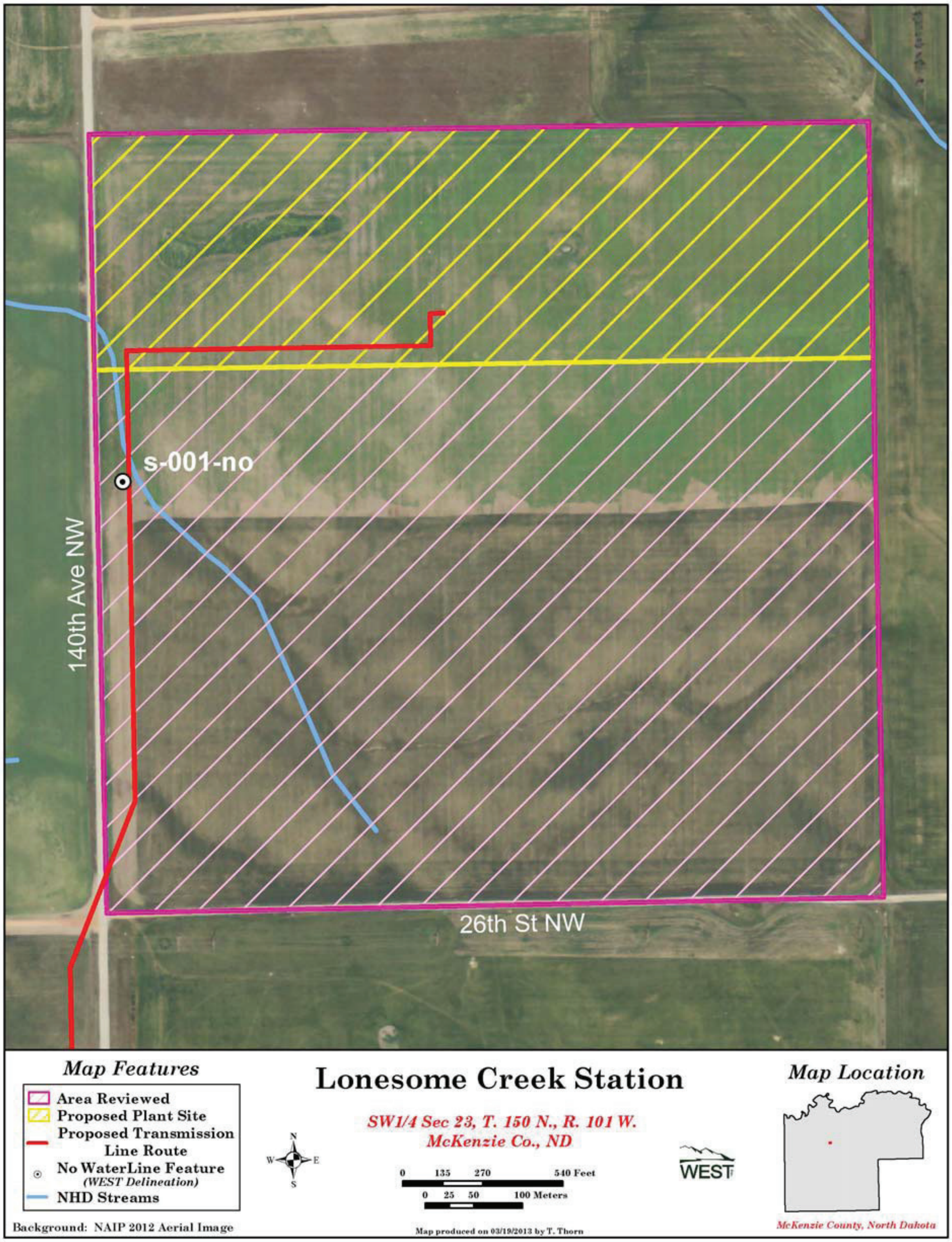
Based on the database review and field mapping of the transmission line, the quarter section as described does not contain any NWI wetlands, waterbodies, or hydric soils.

Please let me know if you need anything further.

Sincerely

Clayton Derby
Senior Manager

Attached: Map of SE ¼ of Sec 23, T150N, R101W


s-001-no
140th Ave NW
26th St NW
Map Features
Area Reviewed
Proposed Plant Site
Proposed Transmission Line Route
No WaterLine Feature (WEST Delineation)
NHD Streams
Background: NAIP 2012 Aerial Image
Lonesome Creek Station
SW1/4 Sec 23, T. 150 N., R. 101 W.
McKenzie Co., ND
N
E
S
W
0 135 270 540 Feet
0 25 50 100 Meters
WEST
Map produced on 03/19/2013 by T. Thorn
Map Location
McKenzie County, North Dakota

APPENDIX B - AGENCY LETTERS

Lonesome Creek Phase II Environmental Assessment

Agency Scoping Letter Responses

Comment Letters Received: as of 5 February 2013

FEDERAL

STATE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
3425 Miriam Avenue
Bismarck, North Dakota 58501

FEB 05 2013

Carla Shinn, NEPA Compliance Specialist
Burns & McDonnell
9400 Ward Parkway
Kansas City, Missouri 64114

Re: Scoping for the Proposed Lonesome Creek Natural Gas Turbine, Phase II
In reply, please reference TAILS #2013-CPA-0106

Dear Ms. Shinn:

This is in response to your letter dated December 6, 2012, regarding the proposed construction of two 45-MW simple cycle natural gas turbines (Phase II) and associated infrastructure at the existing Lonesome Creek Station Site (LCS). The project would be constructed by Basin Electric Power Cooperative (Basin Electric) in McKenzie County, North Dakota. The specific project location is:

T. 150 N., R. 103 W., Section 20

The U.S. Fish and Wildlife Service (Service) offers the following comments under the authority of and in accordance with the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 et seq.), Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds", the Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.), the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57), Executive Order 11990 "Protection of Wetlands", Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661-667e, as amended), the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d, 54 Stat. 250), and the National Environmental Policy Act (NEPA) (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended).

Threatened, Endangered and Candidate Species

To obtain information on Service trust resources including federally threatened, endangered and candidate species and designated critical habitat that may occur in the identified areas, or may be affected by the proposed activities, we recommend you access the North Dakota Ecological Services Field Office website at http://www.fws.gov/northdakotafieldoffice/. You may also access the Service's Information, Planning, and Conservation System (IPaC) website at http://ecos.fws.gov/ipac/.

If a federal agency authorizes, funds, or carries out a proposed action, the responsible federal agency, or its designated agent, is required to evaluate whether the action "may affect" listed species. If the federal agency determines the action "may affect, is likely to adversely affect" listed species, then the federal agency shall request formal section 7 consultation with this office, or work with this office to remove the likely adverse effects before proceeding. If the evaluation shows a "no effect" determination on listed species, further consultation is not necessary.

The responsibility for compliance with the ESA remains with the federal action agency. Therefore, section 7 consultation cannot be completed until the Rural Utilities Service (RUS) has provided the Service with written designation of Burns & McDonnell as its non-federal agent. Until such time as RUS designates a non-federal agent for informal consultation, the following comments should be considered as preliminary, and are to be used to assist with project planning.

Whooping Crane

The Aransas Wood Buffalo Population (AWBP) of the endangered whooping crane (*Grus americana*) is the only self-sustaining migratory population of whooping cranes remaining in the wild. Whooping cranes breed in the wetlands of Wood Buffalo National Park in Alberta and the Northwest Territories of northern Canada, and overwinter on the Texas coast. Whooping cranes in the AWBP annually migrate through North Dakota during their spring and fall migrations.

The proposed project lies within a corridor that includes approximately 95 percent of all reported whooping crane sightings in the State (enclosure). The presence of suitable roosting and feeding habitat for whooping cranes indicate the potential for whooping crane presence in the proposed project area. The Service recommends that if a whooping crane is sighted within one mile of project while it is under construction, that all work cease within one mile of that part of the project and the Service be contacted immediately. In coordination with the Service, work may resume after the bird(s) leave the area. Whooping cranes are unlikely to spend more than a few days in any one spot during migration.

Piping Plover

Piping plovers, a federally threatened species, are known to nest in the proposed project area. In North Dakota, piping plovers begin arriving on their breeding grounds in early to mid-April and are typically gone by September 1. Construction or maintenance activities during this time period may disturb nesting piping plovers. Critical habitat has been designated for the piping plover. Critical habitat can be viewed on the Service website at http://www.fws.gov/northdakotafieldoffice/endspecies/species/piping_plover.htm. Piping plover critical habitat in the project area, if the project is near alkali lakes, consists of sparsely vegetated beaches, salt-encrusted mud flats, and/or gravely salt flats, and adjacent uplands 200 ft. (61 m) above the high water mark of alkali lakes and wetlands (enclosure 1). Piping plover critical habitat in the project area, if the project is near the Missouri River system, consists of sparsely vegetated riverine sandbars and unvegetated shoreline along the Missouri River system. The Service recommends a ½ mile no entry buffer around all designated critical habitat and on wetlands with potential or documented plover nesting during this timeframe. If you are unable to maintain a ½ mile buffer around all piping plover nesting wetlands, the Service recommends that the project proponent provide additional protective measures in these areas to avoid the potential take of piping plovers.

Least Tern

The breeding season for the interior population of the least tern lasts from May through August. The peak of the nesting season occurs from mid-June to mid-July. Nests are bowl-shaped depressions, about 4" across, on barren, sandy areas. Least terns nest in colonies where the nests can be as close as a few feet apart. In North Dakota, the least tern utilizes sparsely vegetated sandbars on the Missouri and Yellowstone Rivers. Terns forage for small fish in the river and nearby wetlands.

Pallid Sturgeon

The pallid sturgeon is an ancient fish that evolved in turbid, free-flowing, large rivers with braided channels, sandbars and extensive backwater habitats, and was listed in 1990 as an endangered species. Historically, pallid sturgeon were found in the lower 200 miles of the Yellowstone River; the Missouri River from Fort Benton, Montana to St. Louis, Missouri; and in portions of the Mississippi River basin. The species is now found only in fragmented segments of free flowing rivers within the historic range, as well as upstream portions of impoundments.

Candidate Species

The Dakota skipper, Powershiek skipperling, Sprague's pipit, and sage grouse are species that are candidates for listing under the ESA. No legal requirement exists to protect candidate species; however, it is within the spirit of the ESA to consider these species as having significant value and worth protecting. The Service's Candidate Conservation Program provides a means for conserving these species. Early conservation preserves management options, minimizes the cost of recovery, and reduces the potential for restrictive land use policies in the future. Through Candidate Conservation Agreements and Candidate Conservation Agreements with Assurances the Service can work with interested public and private parties to identify threats to candidate species or species at risk. If there is a federal nexus, a federal agency may also request a conference on any proposed action that may affect a proposed or candidate species.

Dakota Skipper

The Dakota skipper (*Hesperia dacotae*), a candidate species, is a small to medium-sized hesperiine butterfly associated with high quality prairie ranging from wet-mesic tallgrass prairie to dry-mesic mixed grass prairie. The first type of habitat is relatively flat and moist native bluestem prairie. Three species of wildflowers are usually present: wood lily (*Lilium philadelphicum*), harebell (*Campanula rotundifolia*), and smooth camas (*Zygadenus elegans*). The second habitat type is upland (dry) prairie that is often on ridges and hillsides. Bluestem grasses and needlegrasses dominate these habitats. On this habitat type, three wildflowers are typically present in high quality sites that are suitable for Dakota skipper: pale purple (*Echinacea pallida*) and upright (*E. angustifolia*) coneflowers and blanketflower (*Gaillardia sp.*). Because of the difficulty of surveying for Dakota skippers and a short survey window, we recommend that the project avoid any impacts to potential Dakota skipper habitat.

Sprague's Pipit

Sprague's pipit (*Anthus spragueii*) was added to the candidate species list in 2010. Candidate species such as the Sprague's pipit are not protected under the ESA. However Sprague's pipit as a migratory bird is still protected under the MBTA. Sprague's pipits require large patches of grassland habitat for breeding, with preferred grass height between 4-12 in. (10-30 cm). The species prefers to breed in well-drained, open grasslands and avoids grasslands with excessive shrubs. They can be found in lightly to heavily grazed areas. They avoid intrusive human features on the landscape, so the impact of a development can be much larger than the actual footprint of the feature. If Sprague's pipit habitat is present within your proposed project area, the Service requests that you document any steps taken to avoid and minimize disturbance of this habitat, and that you share this information with our office.

Migratory Birds

The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, possession, and transportation, (among other actions) of migratory birds, their eggs, parts, and nests, except when specifically permitted by regulations. While the MBTA has no provision for allowing incidental take, the Service realizes that some birds may be killed during project construction and operation even if all known reasonable and effective measures to protect birds are used. The Service Office of Law Enforcement carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and agencies that have taken effective steps to avoid take of migratory birds, and by encouraging others to implement measures to avoid take of migratory birds. It is not possible to absolve individuals, companies, or agencies from liability even if they implement bird mortality avoidance or other similar protective measures. However, the Office of Law Enforcement focuses its resources on investigating and prosecuting individuals, companies, and agencies that take migratory birds without identifying and implementing all reasonable, prudent, and effective measures to avoid that take. Individuals, companies, or agencies are encouraged to work closely with Service biologists to identify available protective measures when developing project plans and/or avian protection plans, and to implement those measures prior to/during construction or similar activities.

To the extent practicable, schedule construction for late summer or fall/early winter so as not to disrupt migratory birds during the breeding season, February 1 to July 15 (**note that if least terns (*Sternula antillarum*) and/or piping plovers (*Charadrius melodus*)are present, the breeding season may extend through August 31).** If work is proposed to take place during the breeding season, there may be take of migratory birds, their eggs, or active nests. If project construction cannot avoid the nesting season, the Service suggests that the vegetation within the proposed project area be mowed/cleared outside of the nesting season, in advance of the project initiation to remove potential breeding habitat for nesting migratory birds in the project area. Once cleared, the project area should be maintained in a state that is unsuitable for nesting until the end of the breeding season or until construction is complete. Alternatively, a qualified biologist could be hired to conduct bird/nest surveys within five days prior to the initiation of construction. If active nests are identified, the project proponent should cease construction, maintain a sufficient buffer around active nests to avoid disturbing breeding activities and contact the Service immediately. The Service recommends that Basin Electric implement all practicable measures to avoid all take, such as suspending construction where necessary, and/or maintaining adequate buffers to protect the birds until the young have fledged. The Service further recommends that if you choose to conduct field surveys for nesting birds with the intent of avoiding take, that you maintain any documentation of the presence of migratory birds, eggs, and active nests, along with information regarding the qualifications of the biologist(s) performing the survey(s), and any avoidance measures implemented at the project site. Should surveys or other available information indicate a potential for take of migratory birds, their eggs, or active nests, the Service requests that you contact this office for further coordination on the extent of the impact and the long-term implications of the intended use of the project on migratory bird populations.

Bald and Golden Eagles

Bald and Golden Eagles are federally-protected under both the BGEPA and the MBTA. The BGEPA prohibits anyone without a permit issued by the Secretary of the Interior from taking bald eagles (*Haliaeetus leucocephalus*) or golden eagles (*Aquila chrysaetos*), including their parts, nests, or eggs. The BGEPA provides criminal and civil penalties for persons who take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. The BGEPA defines take as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagles return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

The Service's overall management objective for golden eagle and bald eagle populations is to ensure no declines in breeding populations of either species. Numerous relatively minor disruptions to eagle behaviors from multiple activities, even if spatially or temporally distributed, may lead to disturbance that would not have resulted from fewer or more carefully sited activities. The accumulation of multiple land development projects or siting of multiple infrastructures that may be hazardous to eagles can cumulatively reduce the availability of alternative sites suitable for breeding, feeding, or sheltering, resulting in a greater than additive risk of take to eagles.

If your proposed activity is anticipated to result in take of bald or golden eagles, you must first apply for, and receive a permit to take prior to the taking. The determination of the likelihood of take will entail identifying the impacts of your proposed activity.

According to the Service's data, there are a documented golden eagle nests in proximity to your proposed activity. There may be additional eagle nests in proximity to the proposed activity.

Recommendations Specific to Bald Eagles

The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site. In open areas where there are little or no forested or topographical buffers, such as in North Dakota, distance alone must often serve as the buffer. To avoid/minimize impacts to nesting bald eagles from construction activities, the Service recommends: (1) keeping a minimum ½-mile buffer between the activity and any bald eagle nest if no landscape buffer exists; (2) keeping a minimum 660-foot buffer and maintaining a landscape buffer or natural areas between the activity and around nest trees; and (3) avoiding activities during the bald eagle breeding season (February 1 – July 15). The buffer areas serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest sites and provide for alternative or replacement nest sites. The Service's May 2007, National Bald Eagle Management Guidelines contains detailed information on protecting bald eagles from disturbance due to human activity. The guidelines can be accessed on the Service's website at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BaldEagle/NationalBaldEagleManagementGuidelines.pdf.

Recommendations Specific to Golden Eagles

Information available to the Service regarding all existing and recent breeding territory data indicates that golden eagles may be present in your proposed activity area. Therefore, we recommend that you make every effort to avoid impacts to golden eagles. If activities are planned within a golden eagle territory, an assessment of the potential for take of a golden eagle will need to be made in conjunction with this office. This entails identifying your proposed activities that may occur in a golden eagle breeding territory, and sharing that information with this office.

The Service recommends that surveys be conducted prior to any on-the-ground activities, to determine the extent of any golden eagle breeding territories in the area that may be affected by the proposed activity. The Service recommends that aerial nest surveys (preferably by helicopter) be conducted within a one-mile wide evaluation corridor or buffer to identify any occupied and unoccupied eagle nest sites in proximity to the proposed project area, including any proposed new access roads. Aerial surveys should be conducted between March 1 and May 15, before leaf-out, so that nests are visible, and so their status (active or inactive) can be determined. A nesting territory or inventoried habitat should be designated as unoccupied by golden eagles ONLY after at least two complete aerial surveys in a single breeding season. Aerial surveys should include the following:

1. Due to the ability to hover and facilitate observations of the ground, helicopters are preferred over fixed wing aircraft, although small aircraft may also be used. The Service requests that [project proponent] report any eagle nests found, as well as nests of any other raptors found during the survey. Whenever possible, two observers should be used to conduct the surveys.
2. Observations of any eagle nest sites should be recorded using GPS. The date, location, nest condition, activity status, and habitat should be recorded for each sighting.
3. We request that you share the qualifications of the biologist(s) conducting the survey, method of survey, and results of the survey with the Service.

Alternatively, Basin Electric could conduct ground surveys to identify golden eagle nests within a one-mile wide evaluation corridor or buffer between March 1 and May 15. However, be aware that ground surveys are much less reliable than aerial surveys, even during leaf-off conditions, and typically may miss ¾ of eagle nests present. At least two ground observation periods lasting at least four hours or more are necessary to designate an inventoried habitat or territory as unoccupied as long as all potential nest sites and alternate nests are visible and monitored. If a golden eagle nest is observed, the project proponent should contact the Service for further consultation.

Please note that maintenance of a minimum ½-mile buffer around active nests may not be adequate to ensure avoidance of take of golden eagles. If the project proponent or federal action agency, if applicable, in conjunction with the Service, determines that any level of take is anticipated, including take due to disturbance, you should work with this office to modify your activity to avoid the take, or apply for a take permit and include the following information:

1. Collect and synthesize relevant project and biological data.
2. Document project avoidance and minimization measures.
3. Quantify the anticipated take.
4. Submit an application and furnish all required information.

Terrestrial Habitat Avoidance and Restoration

Construction activities should be conducted in a manner that will avoid/minimize impacts to the existing habitat in the project area. The following recommendations are intended to reduce construction related impacts:

- Make no stream channel alterations or changes in drainage patterns.
- Avoid placement of fill in wetlands.
- Replace unavoidable loss of wetland habitat with functionally equivalent wetlands.
- Install and maintain appropriate erosion control measures to reduce sediment transport to adjacent wetlands and stream channels.
- In replanting native prairie or other grassland habitat, the Service recommends planting a diverse mixture of native cool and warm season grasses and forbs. Recent research has suggested that a more diverse mix, including numerous forb species, is not only ecologically beneficial but is also more weed resistant, allowing for less intensive management and chemical use. In essence, the more species included in a mixture, the higher the probability of providing competition to resist invasion by non-native plants. The seed source should be as local as possible, preferably collected from the nearby native prairie. If seeds and/or plants are obtained commercially, we recommend obtaining seed stock from nurseries within 250 miles of the project area to ensure the particular cultivars are well adapted to the local climate. The Natural Resources Conservation Service (NRCS) compiles a list of vendors in North Dakota that supply conservation seed and plants at http://plant-materials.nrcs.usda.gov/pubs/ndpmcmt8152.pdf. Additional information on native grasses and forbs may be found at the NRCS Bismarck Plant Materials Center website at http://www.plant-materials.nrcs.usda.gov/ndpmc/.

Thank you for the opportunity to comment on this project proposal. If you require further information, please contact Heidi Riddle of my staff at (701) 250-4481 or at the letterhead address, or contact me directly.

Sincerely,

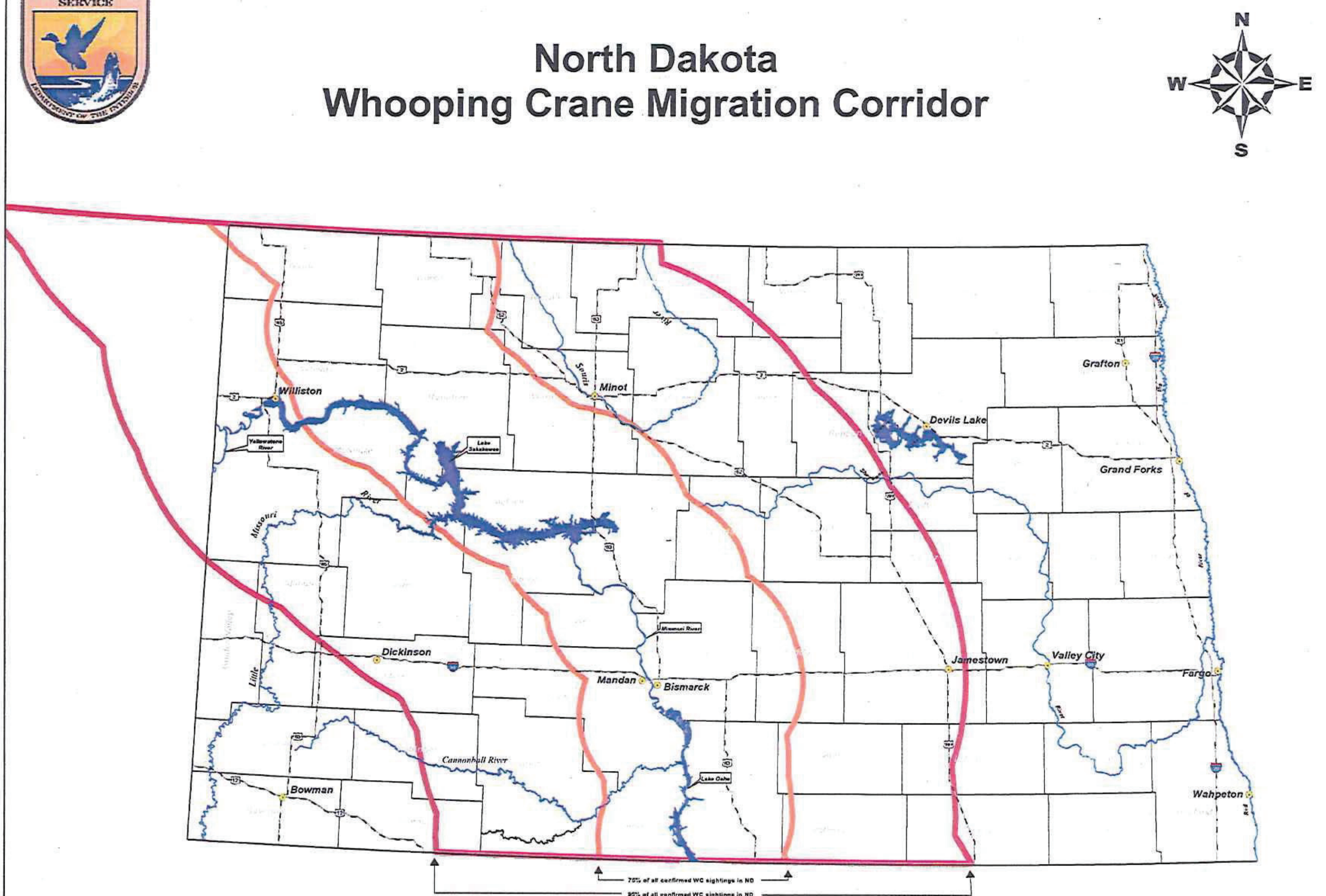
Jeffrey K. Towner

Jeffrey K. Towner
Field Supervisor
North Dakota Field Office

Enclosure

cc: North Dakota Game and Fish Department, Bismarck, ND

North Dakota Whooping Crane Migration Corridor



75% Whooping Crane Migration Corridor

95% Whooping Crane Migration Corridor

0 12.5 25 50 75 100 Miles

DISCLAIMER:

The USFWS makes no claim as to the accuracy or completeness of the displayed information. Species occurrence and habitat information is provided for illustrative purposes only. Federal action agencies and project proponents should contact the USFWS North Dakota Field Office for more detailed species information and technical assistance in evaluating potential project impacts to fish and wildlife resources.

Map produced 04/21/2010 by USFWS Ecological Services, Bismarck, ND.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
NORTH DAKOTA REGULATORY OFFICE
1513 SOUTH 12TH STREET
BISMARCK ND 58504-6640

REPLY TO
ATTENTION OF

December 20, 2012

North Dakota Regulatory Office

Ms. Carla Shinn
Burns and McDonnell
9400 Ward Parkway
Kansas City, Missouri 64114-3319

Dear Ms. Shinn:

This is in response to your letter dated December 6, 2012, requesting US Army Corps of Engineers (Corps) comments regarding the proposed construction of two 45-megawatt simple cycle natural gas turbines located in Section 20, Township 150 North, Range 103 West of McKenzie County, North Dakota.

Based on the information contained within your letter, it appears a Department of the Army permit may be required for all or part of your proposed project(s). In order for us to fully evaluate your project(s), please complete and submit the Corps permit application (copy enclosed). Be sure to accurately describe all proposed work and construction methodology. Once the application is complete, please mail it to the letterhead address.

Please be advised, Corps regulatory offices administer Section 10 of the Rivers and Harbors Act (Section 10) and Section 404 of the Clean Water Act (Section 404). Section 10 regulates work impacting navigable waters. Section 10 waters in North Dakota are the Missouri River (including Lake Sakakawea and Lake Oahe), Yellowstone River, James River south of the railroad track in Jamestown, North Dakota, Bois de Sioux River, Red River of the North, and the Upper Des Lacs Lake. Work over, in, or under navigable waters is considered to have an impact. Section 404 of the Clean Water Act regulates the discharge of dredged or fill material (temporarily or permanently) in waters of the United States. Waters of the United States may include, but are not limited to, rivers, streams, ditches, coulees, lakes, ponds, and their adjacent wetlands. Fill material includes, but is not limited to, rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mines or other excavation activities and materials used to create any structure or infrastructure in waters of the United States.

Do not hesitate to contact this office by letter or telephone (701) 255-0015 if we can be of further assistance.

Sincerely,

Daniel E. Cimarosti

Daniel E. Cimarosti
State Program Manager
North Dakota

Enclosure

Printed on Recycled Paper

U.S. ARMY CORPS OF ENGINEERS **APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT** 33 CFR 325. The proponent agency is CECW-CO-R.	OMB APPROVAL NO. 0710-0003 EXPIRES: 28 FEBRUARY 2013

Public reporting for this collection of information is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters, Executive Services and Communications Directorate, Information Management Division and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME First - Middle - Last - Company - E-mail Address -	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required) First - Middle - Last - Company - E-mail Address -
6. APPLICANT'S ADDRESS: Address- City - State - Zip - Country -	9. AGENT'S ADDRESS: Address- City - State - Zip - Country -
7. APPLICANT'S PHONE NOs. w/AREA CODE a. Residence b. Business c. Fax	10. AGENTS PHONE NOs. w/AREA CODE a. Residence b. Business c. Fax

STATEMENT OF AUTHORIZATION

11. I hereby authorize, ______________________ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

_______________________________ ____________
SIGNATURE OF APPLICANT DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable) Address
15. LOCATION OF PROJECT Latitude: °N Longitude: °W	City - State- Zip-

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID Municipality

Section - Township - Range -

17. DIRECTIONS TO THE SITE

18. Nature of Activity (Description of project, include all features)

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres

or

Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

24. Is Any Portion of the Work Already Complete? ☐ Yes ☐ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address-

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT DATE SIGNATURE OF AGENT DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Instructions for Preparing a Department of the Army Permit Application

Blocks 1 through 4. To be completed by Corps of Engineers.

Block 5. Applicant's Name. Enter the name and the E-mail address of the responsible party or parties. If the responsible party is an agency, company, corporation, or other organization, indicate the name of the organization and responsible officer and title. If more than one party is associated with the application, please attach a sheet with the necessary information marked Block 5.

Block 6. Address of Applicant. Please provide the full address of the party or parties responsible for the application. If more space is needed, attach an extra sheet of paper marked Block 6.

Block 7. Applicant Telephone Number(s). Please provide the number where you can usually be reached during normal business hours.

Blocks 8 through 11. To be completed, if you choose to have an agent.

Block 8. Authorized Agent's Name and Title. Indicate name of individual or agency, designated by you, to represent you in this process. An agent can be an attorney, builder, contractor, engineer, or any other person or organization. Note: An agent is not required.

Blocks 9 and 10. Agent's Address and Telephone Number. Please provide the complete mailing address of the agent, along with the telephone number where he / she can be reached during normal business hours.

Block 11. Statement of Authorization. To be completed by applicant, if an agent is to be employed.

Block 12. Proposed Project Name or Title. Please provide name identifying the proposed project, e.g., Landmark Plaza, Burned Hills Subdivision, or Edsall Commercial Center.

Block 13. Name of Waterbody. Please provide the name of any stream, lake, marsh, or other waterway to be directly impacted by the activity. If it is a minor (no name) stream, identify the waterbody the minor stream enters.

Block 14. Proposed Project Street Address. If the proposed project is located at a site having a street address (not a box number), please enter it here.

Block 15. Location of Proposed Project. Enter the latitude and longitude of where the proposed project is located. If more space is required, please attach a sheet with the necessary information marked Block 15.

Block 16. Other Location Descriptions. If available, provide the Tax Parcel Identification number of the site, Section, Township, and Range of the site (if known), and / or local Municipality that the site is located in.

Block 17. Directions to the Site. Provide directions to the site from a known location or landmark. Include highway and street numbers as well as names. Also provide distances from known locations and any other information that would assist in locating the site. You may also provide description of the proposed project location, such as lot numbers, tract numbers, or you may choose to locate the proposed project site from a known point (such as the right descending bank of Smith Creek, one mile downstream from the Highway 14 bridge). If a large river or stream, include the river mile of the proposed project site if known

Block 18. Nature of Activity. Describe the overall activity or project. Give appropriate dimensions of structures such as wing walls, dikes (identify the materials to be used in construction, as well as the methods by which the work is to be done), or excavations (length, width, and height). Indicate whether discharge of dredged or fill material is involved. Also, identify any structure to be constructed on a fill, piles, or float-supported platforms.

The written descriptions and illustrations are an important part of the application. Please describe, in detail, what you wish to do. If more space is needed, attach an extra sheet of paper marked Block 18.

Block 19. Proposed Project Purpose. Describe the purpose and need for the proposed project. What will it be used for and why? Also include a brief description of any related activities to be developed as the result of the proposed project. Give the approximate dates you plan to both begin and complete all work.

Block 20. Reasons for Discharge. If the activity involves the discharge of dredged and/or fill material into a wetland or other waterbody, including the temporary placement of material, explain the specific purpose of the placement of the material (such as erosion control).

Block 21. Types of Material Being Discharged and the Amount of Each Type in Cubic Yards. Describe the material to be discharged and amount of each material to be discharged within Corps jurisdiction. Please be sure this description will agree with your illustrations. Discharge material includes: rock, sand, clay, concrete, etc.

Block 22. Surface Areas of Wetlands or Other Waters Filled. Describe the area to be filled at each location. Specifically identify the surface areas, or part thereof, to be filled. Also include the means by which the discharge is to be done (backhoe, dragline, etc.). If dredged material is to be discharged on an upland site, identify the site and the steps to be taken (if necessary) to prevent runoff from the dredged material back into a waterbody. If more space is needed, attach an extra sheet of paper marked Block 22.

Block 23. Description of Avoidance, Minimization, and Compensation. Provide a brief explanation describing how impacts to waters of the United States are being avoided and minimized on the project site. Also provide a brief description of how impacts to waters of the United States will be compensated for, or a brief statement explaining why compensatory mitigation should not be required for those impacts.

Block 24. Is Any Portion of the Work Already Complete? Provide any background on any part of the proposed project already completed. Describe the area already developed, structures completed, any dredged or fill material already discharged, the type of material, volume in cubic yards, acres filled, if a wetland or other waterbody (in acres or square feet). If the work was done under an existing Corps permit, identity the authorization, if possible.

Block 25. Names and Addresses of Adjoining Property Owners, Lessees, etc., Whose Property Adjoins the Project Site. List complete names and full mailing addresses of the adjacent property owners (public and private) lessees, etc., whose property adjoins the waterbody or aquatic site where the work is being proposed so that they may be notified of the proposed activity (usually by public notice). If more space is needed, attach an extra sheet of paper marked Block 24.

Information regarding adjacent landowners is usually available through the office of the tax assessor in the county or counties where the project is to be developed.

Block 26. Information about Approvals or Denials by Other Agencies. You may need the approval of other federal, state, or local agencies for your project. Identify any applications you have submitted and the status, if any (approved or denied) of each application. You need not have obtained all other permits before applying for a Corps permit.

Block 27. Signature of Applicant or Agent. The application must be signed by the owner or other authorized party (agent). This signature shall be an affirmation that the party applying for the permit possesses the requisite property rights to undertake the activity applied for (including compliance with special conditions, mitigation, etc.).

DRAWINGS AND ILLUSTRATIONS

General Information.

Three types of illustrations are needed to properly depict the work to be undertaken. These illustrations or drawings are identified as a Vicinity Map, a Plan View or a Typical Cross-Section Map. Identify each illustration with a figure or attachment number.

Please submit one original, or good quality copy, of all drawings on 8½ x11 inch plain white paper (electronic media may be substituted). Use the fewest number of sheets necessary for your drawings or illustrations.

Each illustration should identify the project, the applicant, and the type of illustration (vicinity map, plan view, or cross-section). **While illustrations need not be professional (many small, private project illustrations are prepared by hand), they should be clear, accurate, and contain all necessary information.**

Vicinity Map

The vicinity map you provide will be printed in any public notice that is issued and used by the Corps of Engineers and other reviewing agencies to locate the site of the proposed activity. You may use an existing road map or US Geological Survey topographic (scale 1:24,000) as the vicinity map. Please include sufficient details to simplify locating the site from both the waterbody and from land. Identify the source of the map or chart from which the vicinity map was taken and, if not already shown, add the following:

- location of activity site (draw an arrow showing the exact location of the site on the map).
- latitude, longitude, river mile, if known, and/or other information that coincides with Block 6 on the application form.
- name of waterbody and the name of the larger creek, river, by, etc., that the waterbody is immediately tributary to.
- names, descriptions and location of landmarks.
- name of all applicable political (county, parish, borough, town, city, etc.) jurisdictions
- name of and distance to nearest town, community, or other identifying locations
- names or numbers of all roads in the vicinity of the site.
- north arrow.
- scale.

Plan View

The plan view shows the proposed activity as if you were looking straight down on it from above. your plan view should clearly show the following:

- Name of waterbody (river, creek, lake, wetland, etc.) and river mile (if known) at location of activity.
- Existing shorelines.
- Mean high and mean low water lines and maximum (spring) high tide line in tidal areas.
- Ordinary high water line and ordinary low water line if the proposed activity is located on a non-tidal waterbody.
- Average water depths around the activity.
- Dimensions of the activity and distance it extends from the high water line into the water.
- Distances to nearby Federal projects, if applicable.
- Distance between proposed activity and navigation channel, where applicable.
- Location of structures, if any, in navigable waters immediately adjacent to the proposed activity.
- Location of any wetlands (marshes, swamps, tidal flats, etc.)
- North arrow.
- Scale.
- If dredged material is involved, you must describe the type of material, number of cubic yards, method of handling, and the location of fill and spoil disposal area. The drawing should show proposed retention levees, weirs, and/or other means for retaining hydraulically placed materials.
- Mark the drawing to indicate previously completed portions of the activity.

Cross Section View and/or Elevation

The elevation and/or cross section view is a scale drawing that shows the side, front, or rear of the proposed activity. If a section view is shown, it represents the proposed structure as it would appear if cut internally for display. Your elevation should clearly show the following:

- Water elevations as shown in the plan view.

- Water depth at water-ward face of proposed activity or, if dredging is proposed, dredging and estimated disposal grades.
- Dimensions from mean high water line (in tidal waters) of proposed fill or float, or high tide line for pile supported platform. Describe any structures to be built on the platform.
- Cross section of excavation or fill, including approximate side slopes.
- Graphic or numerical scale.
- Principal dimensions of the activity

Notes on Drawings*

- Names of adjacent property owners who may be affected. Complete names and addresses should be shown in Block 5 on ENG Form 4345.
- Legal property description: Number, name of subdivision, block, and lot number. Section, Township, and Range (if applicable) from plot, deed, or tax assessment.
- Photographs of the site of the proposed activity are not required; however, pictures are helpful and may be submitted as part of any application.
- **While illustrations need not be professional (many small, private project illustrations are prepared by hand), they should be clear, accurate, and contain all necessary information.**

* Drawings should be as clear and simple as possible (ie, not too "busy").

United States Department of the Interior

BUREAU OF INDIAN AFFAIRS
Great Plains Regional Office
115 Fourth Avenue S.E., Suite 400
Aberdeen, South Dakota 57401

IN REPLY REFER TO:
DESCRM
MC-208

DEC 19 2012

Carla Shinn
NEPA Compliance Specialist
Burns & McDonnell
9400 Ward Parkway
Kansas City, Missouri 64114-3319

Dear Ms. Shinn:

We received your letter regarding the proposed two 45-megawat (MW) simple cycle natural gas turbines (Phase II) and associated infrastructure at the existing Lonesome Creek Station Site (LCS) in McKenzie County, North Dakota. We have considered the potential for both environmental damage and impacts to archaeological and Native American religious sites on lands held in trust by the Bureau of Indian Affairs, Great Plains Region. You should be aware, however, that Tribes or Tribal members may have lands in fee status near the site of interest. These lands would not necessarily be in our databases, and the Tribes should be contacted directly to ensure all concerns are recognized. The action considered has the following notification date and project location:

- December 6, 2012 Re: Environmental Assessment-Request for Resource Information and Issue Identification for the Proposed Lonesome Creek Phase II.

We have no environmental objections to this action as long as the project complies with all pertinent laws and regulations. Questions regarding environmental opinions and conditions can be addressed to Jeffrey Davis, Environmental Protection Specialist, at (605) 226-7656.

We also find that the listed action will not affect cultural resources on Tribal or individual landholdings for which we are responsible. Methodologies for the treatment of cultural resources now known or yet to be discovered – particularly human remains – must nevertheless utilize the best available science in accordance with provisions of the Native American Graves Protection and Repatriation Act, the Archaeological Resources Protection Act of 1979 (as amended), and all other pertinent legislation and implementing regulations. Archaeological concerns can be addressed to Dr. Carson N. Murdy, Regional Archaeologist, at (605) 226-7656.

Sincerely,

Acting

Deputy Regional Director – Indian Services

From:	Anderson.Carol@epamail.epa.gov
To:	Shinn, Carla
Subject:	Proposed Lonsome Creek Phase II EA
Date:	Thursday, January 03, 2013 4:12:26 PM

Hi Carla,

See below for my contact information. The current Director of the NEPA Compliance and Review Program is Suzanne J. Bohan. As I told you, we will not be submitting scoping comments but would like to be on the distribution list for the EA.

Thanks,

Carol

Carol M. Anderson
NEPA Compliance and Review Program
US Environmental Protection Agency, Region 8
EPR/N
1595 Wynkoop Street
Denver, CO 80202-1129
303-312-6058
anderson.carol@epa.gov

USDA United States Department of Agriculture | Forest Service | Dakota Prairie Grasslands | 240 W. Century Ave. Bismarck, ND 58503

File Code: 2820
Date: January 3, 2013

Burns & McDonnell
Attn: Carla Shinn
NEPA Compliance Specialist
9400 Ward Parkway
Kansas City, MO 64114

Dear Ms. Shinn:

This letter is in response to your letter dated December 6, 2012 regarding the Environmental Assessment – Request for Resource Information and Issue Identification for the Proposed Lonesome Creek Phase II project.

There are no National Forest System lands on or near the existing Lonesome Creek Station Site located in the Alex Township of McKenzie County in the SW ¼ of Section 20; T150N; R103W; approximately fourteen miles west of Watford City, North Dakota; therefore, we do not have any issues about this project. Thank you for coordinating this information with us.

Sincerely,

Dennis D. Neitzke

DENNIS D. NEITZKE
Grasslands Supervisor

cc: Mr. Chris Miller, Basin Electric
Mr. Jeff Ingalls, McKenzie Ranger District
Mrs. Karen Dunlap, Bismarck Supervisor Office

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
PO Box 1458
Bismarck, ND 58502-1458

December 18, 2012

Burns & McDonnell
9400 Ward Parkway
Kansas City, Missouri 64114-3319

RE: Environmental Assessment – Request for Resource Information and Issue Identification For the Proposed Lonesome Creek Phase II

Dear Sirs:

The Natural Resources Conservation Service (NRCS) has reviewed your letter dated December 6, 2012, concerning construction of two 45-megawatt (MW) simple cycle natural gas turbines and associated infrastructure at the existing Lonesome Creek Station Site (LCS).

NRCS has a major responsibility with the Farmland Protection Policy Act (FPPA) in documenting conversion of farmland (i.e., prime, statewide importance and local importance) to non agriculture use. Your proposed project consists of installing underground pipe which does not remove farmland from permanent production, therefore; FPPA does not apply to these activities. If the project includes the addition of permanent sites, such as pumping stations, FPPA may apply, and the Form AD-1006 must be completed. Water storage facilities are exempt. Below are instructions for completing the Farmland Conversion Impact Rating form.

Farmland

For those areas subject to FPPA, the following form must be completed. Enclosed is a Farmland Conversion Impact Rating Form AD-1006 or you may utilize a fillible web based form at http://www.nrcs.usda.gov/Programs/fppa/pdf_files/AD1006.PDF to record the following. If applicable, you may email the above information to Dustin Brodina, Acting Resource Conservationist, at dustin.brodina@nd.usda.gov . You will need to complete Part I and Part III. We will also need a map of the site at an appropriate scale so we can accurately assess the area (e.g., 1:20,000 or 1:24,000). If the farmland (i.e., prime, statewide importance and local importance) is determined to be subject to the FPPA, we will then complete Parts II and IV. NRCS will measure the relative value of the site as farmland on a scale of 0 to 100 according to the information sources listed in CFR 658.5(a). If FPPA applies to this site, Form AD-1006 will be returned to you for completion of Part VI, Site Assessment Criteria.

Wetlands

The Wetland Conservation Provisions of the 1985 Food Security Act, as amended, provides that if a USDA participant converts a wetland for the purpose or to have the effect of making agricultural production possible, loss of USDA benefits could occur. The Natural Resource Conservation Service has developed the following guidelines to help avoid impacts to wetlands and possible loss of USDA benefits for producers. If these guidelines are followed, the impacts to the wetland will be considered minimal allowing USDA participants to continue to receive USDA benefits. Following are the requirements:

- Disturbance to the wetland must be temporary.
- No drainage of wetland is allowed (temporary or permanent).
- Mechanized landscaping necessary for installation is kept to a minimum and preconstruction contours are maintained.
- Temporary side cast material must be placed in such a manner not to be dispersed in the wetland.
- All trenches in a wetland must be backfilled to the original elevation.

NRCS would recommend that impacts to wetland be avoided. If the alignment of the project requires passage through a wetland, NRCS can complete a certified wetland determination, if requested, by the landowner/operator

If you have additional questions pertaining to FPPA, please contact Steve Sieler, Liaison Soil Scientist, NRCS, Bismarck, ND at 701-530-2019.

Sincerely,

WADE D. BOTT
State Soil Scientist

Enc.

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request
Name Of Project	Federal Agency Involved
Proposed Land Use	County And State
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).* Yes ☐ No ☐		Acres Irrigated	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount Of Farmland As Defined in FPPA Acres: %	
Name Of Land Evaluation System Used	Name Of Local Site Assessment System	Date Land Evaluation Returned By NRCS	

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly					
B. Total Acres To Be Converted Indirectly					
C. Total Acres In Site		0.0	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide And Local Important Farmland					
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value					
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*		0	0	0	0
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use					
2. Perimeter In Nonurban Use					
3. Percent Of Site Being Farmed					
4. Protection Provided By State And Local Government					
5. Distance From Urban Builtup Area					
6. Distance To Urban Support Services					
7. Size Of Present Farm Unit Compared To Average					
8. Creation Of Nonfarmable Farmland					
9. Availability Of Farm Support Services					
10. On-Farm Investments					
11. Effects Of Conversion On Farm Support Services					
12. Compatibility With Existing Agricultural Use					
TOTAL SITE ASSESSMENT POINTS	160	0	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	0	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	0	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side) **Form AD-1006 (10-83)**

This form was electronically produced by National Production Services Staff

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 – Federal agencies involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form.

Step 2 – Originator will send copies A, B and C together with maps indicating locations of site(s), to the Natural Resources Conservation Service (NRCS) local field office and retain copy D for their files. (Note: NRCS has a field office in most counties in the U.S. The field office is usually located in the county seat. A list of field office locations are available from the NRCS State Conservationist in each state).

Step 3 – NRCS will, within 45 calendar days after receipt of form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland.

Step '4 – In cases where farmland covered by the FPPA will be converted by the proposed project, NRCS field offices will complete Parts II, IV and V of the form.

Step 5 – NRCS will return copy A and B of the form to the Federal agency involved in the project. (Copy C will be retained for NRCS records).

Step 6 – The Federal agency involved in the proposed project will complete Parts VI and VII of the form.

Step 7 – The Federal agency involved in the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA and the agency's internal policies.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

Part I: In completing the "County And State" questions list all the local governments that are responsible for local land controls where site(s) are to be evaluated.

Part III: In completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them.

2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities) that will cause a direct conversion.

Part VI: Do not complete Part VI if a local site assessment is used.

Assign the maximum points for each site assessment criterion as shown in § 658.5 (b) of CFR. In cases of corridor-type projects such as transportation, powerline and flood control, criteria #5 and #6 will not apply and will, be weighed zero, however, criterion #8 will be weighed a maximum of 25 points, and criterion #11 a maximum of 25 points.

Individual Federal agencies at the national level, may assign relative weights among the 12 site assessment criteria other than those shown in the FPPA rule. In all cases where other weights are assigned relative adjustments must be made to maintain the maximum total weight points at 160.

In rating alternative sites, Federal agencies shall consider each of the criteria and assign points within the limits established in the FPPA rule. Sites most suitable for protection under these criteria will receive the highest total scores, and sites least suitable, the lowest scores.

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, adjust the site assessment points to a base of 160. Example: if the Site Assessment maximum is 200 points, and alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site "A."}$$

NORTH DAKOTA
DEPARTMENT *of* HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

December 17, 2012

Ms. Carla Shinn
NEPA Compliance Specialist
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114-3319

Re: Basin Electric's Proposed Lonesome Creek Phase II
McKenzie County, North Dakota

Dear Ms. Shinn:

This department has reviewed the information concerning the above-referenced project submitted under date of December 6, 2012, with respect to possible environmental impacts.

This department believes that environmental impacts from the proposed construction will be minor and can be controlled by proper construction methods. With respect to construction, we have the following comments:

1. All necessary measures must be taken to minimize fugitive dust emissions created during construction activities. Any complaints that may arise are to be dealt with in an efficient and effective manner.

2. Care is to be taken during construction activity near any water of the state to minimize adverse effects on a water body. This includes minimal disturbance of stream beds and banks to prevent excess siltation, and the replacement and revegetation of any disturbed area as soon as possible after work has been completed. Caution must also be taken to prevent spills of oil and grease that may reach the receiving water from equipment maintenance, and/or the handling of fuels on the site. Guidelines for minimizing degradation to waterways during construction are attached.

3. Projects disturbing one or more acres are required to have a permit to discharge storm water runoff until the site is stabilized by the reestablishment of vegetation or other permanent cover. A new facility also may be required to obtain a permit to discharge storm water runoff from industrial activity. Further information on the storm water permits may be obtained from the Department's website or by calling the Division of Water Quality (701-328-5210).

   Cities or counties may impose additional requirements and/or specific best management practices for construction affecting their storm drainage system and may require provisions to address the quality of post-construction storm water runoff from new development and redevelopment projects. Check with the local officials to be sure any local storm water management considerations are addressed.

4. Noise from construction activities may have adverse effects on persons who live near the construction area. Noise levels can be minimized by ensuring that construction equipment is equipped with a recommended muffler in good working order. Noise effects can also be minimized by ensuring that construction activities are not conducted during early morning or late evening hours.

5. The proposed project appears to have the potential to be a source of emissions to the air capable of causing or contributing to air pollution and may be required to have an Air Pollution Control Permit to Construct/Operate as required by Chapter 33-15-14 of the North Dakota Air Pollution Control Rules. The applicant should contact the Department's Air Pollution Control Program at 701-328-5188 prior to commencing construction.

The department owns no land in or adjacent to the proposed improvements, nor does it have any projects scheduled in the area.

These comments are based on the information provided about the project in the above-referenced submittal. The U.S. Army Corps of Engineers may require a water quality certification from this department for the project if the project is subject to their Section 404 permitting process. Any additional information which may be required by the U.S. Army Corps of Engineers under the process will be considered by this department in our determination regarding the issuance of such a certification.

If you have any questions regarding our comments, please feel free to contact this office.

Sincerely,

L. David Glatt, P.E., Chief
Environmental Health Section

LDG:cc
Attach.

NORTH DAKOTA
DEPARTMENT *of* HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

Construction and Environmental Disturbance Requirements

These represent the minimum requirements of the North Dakota Department of Health. They ensure that minimal environmental degradation occurs as a result of construction or related work which has the potential to affect the waters of the State of North Dakota. All projects will be designed and implemented to restrict the losses or disturbances of soil, vegetative cover, and pollutants (chemical or biological) from a site.

Soils

Prevent the erosion of exposed soil surfaces and trapping sediments being transported. Examples include, but are not restricted to, sediment dams or berms, diversion dikes, hay bales as erosion checks, riprap, mesh or burlap blankets to hold soil during construction, and immediately establishing vegetative cover on disturbed areas after construction is completed. Fragile and sensitive areas such as wetlands, riparian zones, delicate flora, or land resources will be protected against compaction, vegetation loss, and unnecessary damage.

Surface Waters

All construction which directly or indirectly impacts aquatic systems will be managed to minimize impacts. All attempts will be made to prevent the contamination of water at construction sites from fuel spillage, lubricants, and chemicals, by following safe storage and handling procedures. Stream bank and stream bed disturbances will be controlled to minimize and/or prevent silt movement, nutrient upsurges, plant dislocation, and any physical, chemical, or biological disruption. The use of pesticides or herbicides in or near these systems is forbidden without approval from this Department.

Fill Material

Any fill material placed below the high water mark must be free of top soils, decomposable materials, and persistent synthetic organic compounds (in toxic concentrations). This includes, but is not limited to, asphalt, tires, treated lumber, and construction debris. The Department may require testing of fill materials. All temporary fills must be removed. Debris and solid wastes will be removed from the site and the impacted areas restored as nearly as possible to the original condition.

December 31, 2012

Carla Shinn
NEPA Compliance Specialist
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114-3319

EA REQUEST FOR RESOURCE INFORMATION AND ISSUE IDENTIFICATION FOR THE PROPOSED LONESOME CREEK, PHASE II, MCKENZIE COUNTY, NORTH DAKOTA

We have reviewed your December 6, 2012, letter.

This project should have no adverse effect on the North Dakota Department of Transportation highways.

However, if because of this project any work needs to be done on highway right of way, appropriate permits and risk management documents will need to be obtained from the Department of Transportation District Engineer, Walter Peterson at 701-774-2700.

Robert Fode

ROBERT A. FODE, P.E., DIRECTOR - OFFICE OF PROJECT DEVELOPMENT

57\raf\js

c: Walter A. Peterson, Williston District

December 27, 2012

Carla Shinn, NEPA Compliance Specialist
Burns & McDonnell
9400 Ward Parkway
Kansas City , MO 64114

Re: Environmental Assessment- Request for Resource Information and Issue Identification for the Proposed Lonesome Creek Phase II

Dear Ms. Shinn,

The North Dakota Forest Service has reviewed the information concerning the above-referenced project with regard to possible impacts on North Dakota's forest resources pursuant to the National Environmental Policy Act of 1969. We own no land in or adjacent to the proposed project and we believe that the impacts from the project will be minor.

We ask the project proponents to avoid disturbing forested areas where practical, and encourage the replacement of any trees or shrubs destroyed during the construction process or operation of the proposed project.

If you have any questions regarding our comments, please feel free to contact this office.

Sincerely,

Liz Kaiser Smith

Liz Smith, ND Forest Service

Cc: Larry Kotchman, State Forester

Liz Smith, Stewardship Specialist, NDSU-ND Forest Service
Bismarck Field Office 916 E. Interstate Ave. Suite #4 Bismarck, ND 58503
701-328-9916 liz.smith@ndsu.edu www.ndsu.edu/ndfs

C. SHINN
2F23H

Burns & McDonnell
SINCE 1898

December 6, 2012

Mr. Terry Steinwand
Director
North Dakota Game and Fish Department
100 N. Bismarck Expressway
Bismarck, ND 58501

Re: Environmental Assessment - Request for Resource Information and Issue Identification for the Proposed Lonesome Creek Phase II

Dear Mr. Steinwand,

To ensure electrical power generation reliability in northwestern North Dakota, Basin Electric Power Cooperative (Basin Electric) is proposing to construct two 45-megawatt (MW) simple cycle natural gas turbines (Phase II) and associated infrastructure at the existing Lonesome Creek Station Site (LCS). This site is located in Alex Township of McKenzie County in the SW ¼ of Section 20; T150N; R103W; approximately 14 miles west of Watford, North Dakota (Figure 1).

The U.S. Department of Agriculture's Rural Utilities Service (RUS) is considering an application for financial assistance from Basin Electric for the construction of LCS Units 2 and 3. Basin Electric has retained Burns & McDonnell to prepare an environmental assessment for RUS, which will analyze the potential for environmental impacts associated with constructing and operating the proposed LCS Units2 and 3.

The environmental assessment will be prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), the Council on Environmental Quality regulations implementing NEPA (40 CFR parts1500-1508), and RUS's "Environmental Policies and Procedures" (7 CFR part 1794), and other applicable statutes, regulations, executive orders,

The environmental assessment document and associated agency and public input and review will also meet the siting review requirements of Chapter 49-22 of the North Dakota Century Code, North Dakota Energy Conversion and Transmission Facility Siting Act, for the Certificate of Site Application to the North Dakota Public Service Commission.

At this time, we are requesting your input to identify any issues or concerns your agency might have with respect to the proposed project. We are specifically asking for information on potential impacts to the human environmental, including natural and cultural resources information that is either available or should be considered in the environmental assessment document. Additionally, we invite recommendations on measures that may be necessary to protect sensitive resources.

9400 Ward Parkway • Kansas City, MO 64114-3319
Tel: 816 333-9400 • Fax: 816 333-3690 • www.burnsmcd.com

Burns & McDonnell
SINCE 1898

Mr. Terry Steinwand
North Dakota Game and Fish Department
December 6, 2012
Page 2

I will be the primary point of contact for this project. Please send your comments to me at Burns & McDonnell, 9400 Ward Parkway, Kansas City, MO 64114. If you have questions regarding this project please contact me at (816) 822-3508 or Cris Miller with Basin Electric at (701) 557-5635. If you need to communicate directly with RUS, which is the responsible Federal agency for NEPA environmental review, you may contact Deirdre Remley, Environmental Protection Specialist, at (202) 720-9640 or at deirdre.remley@wdc.usda.gov. We would appreciate your response by January 10, 2013. We appreciate your time and assistance in providing this information.

Sincerely,

Carla D. Shinn

Carla Shinn
NEPA Compliance Specialist

Enclosure Figure 1, Project Area Map

cc: Mr. Cris Miller, Basin Electric

North Dakota Game & Fish Dept.
100 N. Bismarck Expressway
Bismarck, ND 58501-5095

We have reviewed the project and foresee no identifiable conflict with wildlife or wildlife habitat based on the information provided.

(for) Greg Link
Chief, Conservation & Communication Division
Date: 1/7/13

"VARIETY IN HUNTING AND FISHING"

NORTH DAKOTA GAME AND FISH DEPARTMENT

100 NORTH BISMARCK EXPRESSWAY BISMARCK, NORTH DAKOTA 58501-5095 PHONE 701-328-6300 FAX 701-328-6352

10 December 2012

ND Game & Fish Department
13932 West Front Street
Williston, ND 58801

Carla Shinn
NEPA Specialist
Burns and Mc Donnell
9400 Ward Parkway, Kansas City, MO 64114

Dear Ms. Shinn;

By letter dated 6 December 2012, you request information from the ND Game & Fish Department. I have forwarded your request for Resource Information and Issue Identification for the Proposed Lonesome Creek Phase II for the Environmental Assessment to Greg Link. Greg Link is the Chief of the Conservation and Communication Division in our Bismarck office and will be lead in responding to your request.

Sincerely,

Kent Luttschwager

Kent Luttschwager
Wildlife Resource Supervisor

North Dakota State Water Commission
900 EAST BOULEVARD AVENUE, DEPT 770 • BISMARCK, NORTH DAKOTA 58505-0850
701-328-2750 • TDD 701-328-2750 • FAX 701-328-3696 • INTERNET: http://swc.nd.gov

January 7, 2013

Carla Shinn
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114-3319

Dear Ms. Shinn:

This is in response to your request for review of environmental impacts associated with the Proposed Lonesome Creek Phase II Project. The site is located in Alex Township of McKenzie County in the SW ¼ of Section 20; T150N; R103W; approximately 14 miles west of Watford City, North Dakota.

The proposed project has been reviewed by State Water Commission staff and the following comments are provided:

- There are no floodplains identified and/or mapped where this proposed project is to take place. The project takes place in an unmapped county. No floodplain permits are necessary from McKenzie County relative to the National Flood Insurance Program.

- It is the responsibility of the project sponsor to ensure that local, state and federal agencies are contacted for any required approvals, permits, and easements.

- All waste material associated with the project must be disposed of properly and not placed in identified floodway areas.

- No sole-source aquifers have been designated in ND.

There are no other concerns associated with this project that affect State Water Commission or State Engineer regulatory responsibilities.

Thank you for the opportunity to provide review comments. If you have any questions, please call me at 701-328-4967.

Sincerely,

Linda Weispfenning
Water Resource Planner

LW:dp/1570

STATE HISTORICAL SOCIETY OF NORTH DAKOTA

December 4, 2012

Ms. Carla Shinn
NEPA Compliance Specialist
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114-3319

ND SHPO Ref.:13-0358 RUS Basin Electric Power Cooperative's proposed Lonesome Creek Station two 45-MW natural gas turbines (Phase II) and associated infrastructure in portions of [T150N R101W Section 23 SW ¼] McKenzie County, North Dakota

Dear Ms. Shinn,

We reviewed ND SHPO Ref.:13-0358 RUS Basin Electric Power Cooperative's Proposed Lonesome Creek Station two 45-MW natural gas turbines (Phase II) and associated infrastructure in portions of [T150N R101W Section 23 SW ¼] McKenzie County, North Dakota and if consulted by a federal agency, would concur with a "No Historic Properties Affected" determination, provided the project remains as described and mapped in your correspondence dated December 6, 2012. We note the previous submission of the cultural resource report entitled "Basin's Lonesome Creek Station: A Class III Cultural Resource Inventory in McKenzie County, North Dakota & Addendum," which noted no cultural resources in the project area.

Thank you for the opportunity to review this project. If you have any questions please contact Susan Quinnell, Review and Compliance Coordinator at (701) 328-3576, e-mail squinnell@nd.gov

Sincerely,

Merlan E. Paaverud, Jr.
State Historic Preservation Officer (North Dakota)
and Director, State Historical Society of North Dakota

North Dakota Heritage Center • 612 East Boulevard Avenue, Bismarck, ND 58505-0830 • Phone: 701-328-2666 • Fax: 701-328-3710
Email: histsoc@nd.gov • Web site: http://history.nd.gov • TTY: 1-800-366-6888

APPENDIX C - SITE PLAN AND MAPS

Path: R:\Basin\69029_LSC_EA\GIS\DataFiles\ArcDocs\PSC Figure 1 Project Location.mxd jbell 4/11/2013

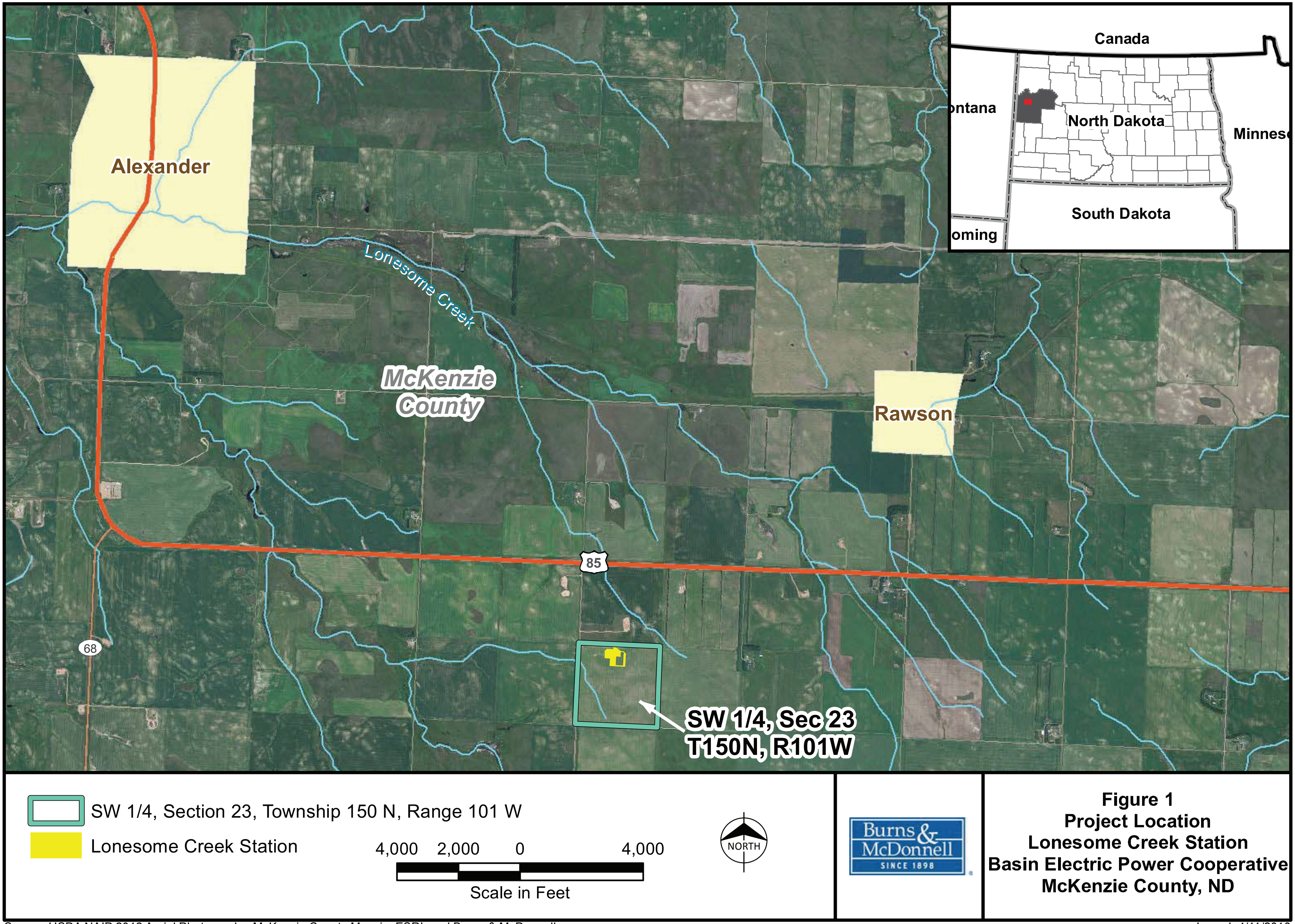


Figure 1
Project Location
Lonesome Creek Station
Basin Electric Power Cooperative
McKenzie County, ND

Source: USDA NAIP 2012 Aerial Photography, McKenzie County Mosaic, ESRI, and Burns & McDonnell

Issued: 4/11/2013

Path: R:\Basin\69029_LSC_EA\GIS\DataFiles\ArcDocs\PSC Figure 2 Site Layout.mxd jbell 4/11/2013

Energy Conversion Facility

Phase II Equipment

Plant Site Boundary

Laydown Area

NORTH

300 150 0 300

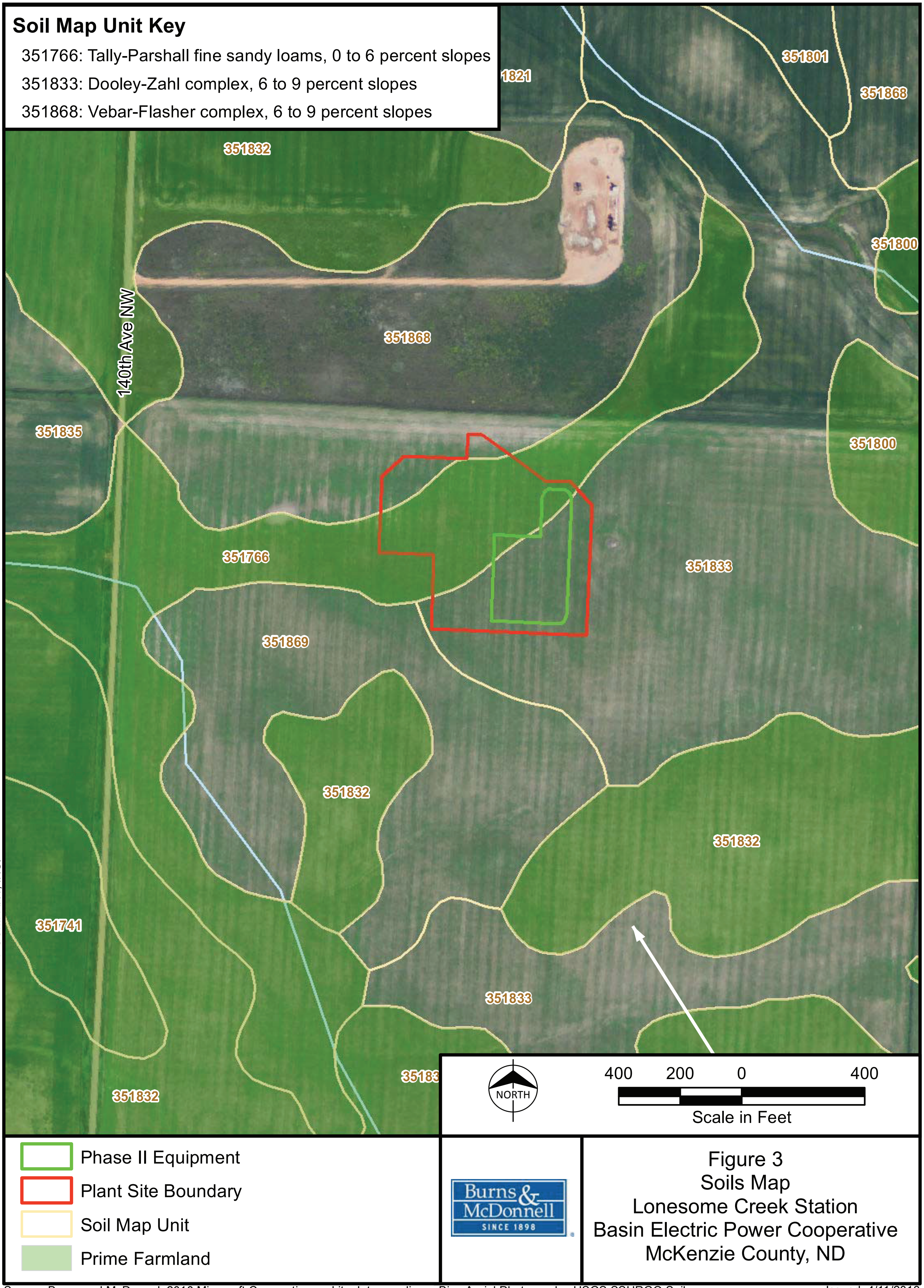
Scale in Feet

Burns & McDonnell SINCE 1898

Figure 2
Site Layout
Lonesome Creek Station
Basin Electric Power Cooperative
McKenzie County, ND

Source: Burns and McDonnel, 2010 Microsoft Corporation and its data suppliers - Bing Aerial Photography

Issued: 4/11/2013



Path: R:\Basin\69029_LSC_EA\GIS\DataFiles\ArcDocs\PSC Figure 3 Soils Map.mxd jbell 4/11/2013

Burns & McDonnell SINCE 1898

Figure 3
Soils Map
Lonesome Creek Station
Basin Electric Power Cooperative
McKenzie County, ND

Source: Burns and McDonnel, 2010 Microsoft Corporation and its data suppliers - Bing Aerial Photography, USGS SSURGO Soils

Issued: 4/11/2013

Energy Conversion Facility

Plant Site Boundary

Phase II Equipment

Intermittent Stream

Emergent Wetland

Open Water

NORTH

1,000 500 0 1,000

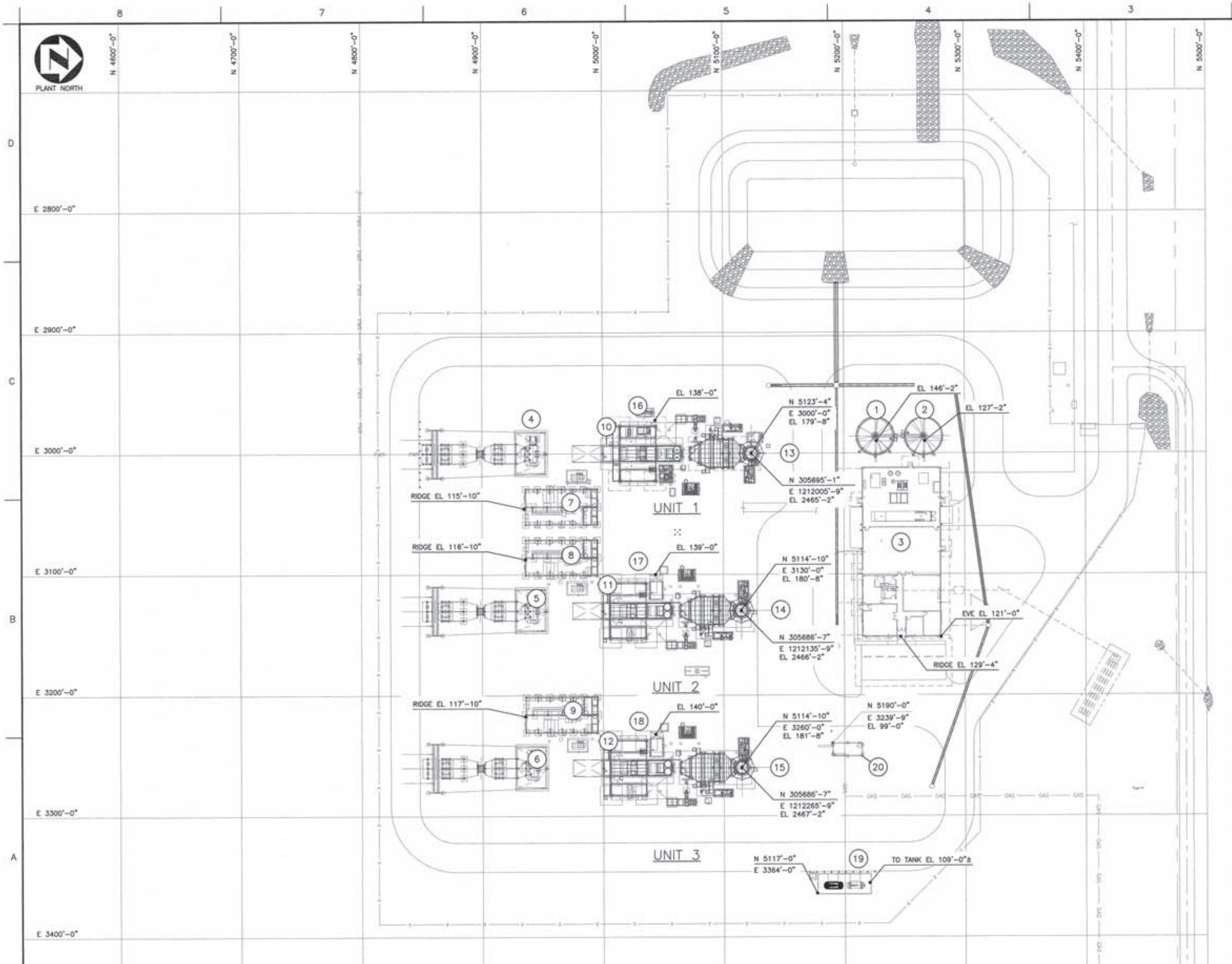
Scale in Feet

Burns & McDonnell SINCE 1898

Figure 4
Water Resources
Lonesome Creek Station
Basin Electric Power Cooperative
McKenzie County, ND

Source: USFWS NWI, USGS NHD, 2010 Microsoft Corporation and its data suppliers - Bing Aerial Photography, and Burns and McDonnell,

Issued: 4/11/2013



LEGEND	
NUM	DESCRIPTION
1	0ETF-350 – DEMINERALIZED WATER STORAGE TANK
2	0ETB-310 – SERVICE WATER STORAGE TANK
3	ADMIN WAREHOUSE BUILDING
4	GSU 1
5	GSU 2
6	GSU 3
7	PCM 1
8	PCM 2
9	PCM 3
10	1EGC-410 – COMBUSTION TURBINE 1
11	COMBUSTION TURBINE 2
12	COMBUSTION TURBINE 3
13	EUS-550 – CTG STACK 1
14	CTG STACK 2
15	CTG STACK 3
16	COMBUSTION AIR INLET 1
17	COMBUSTION AIR INLET 2
18	COMBUSTION AIR INLET 3
19	0EVH-821 – ANHYDROUS AMMONIA STORAGE
20	0FES-610 – FUEL GAS CONDITIONING SKID

NOTES:
1. PLANT ELEVATION BASIS: 100'-0" = 2295'-6"

GRAPHIC SCALE
(IN FEET)
1 inch = 40 ft.

DRAWING NO.	TITLE

REV	DATE	BY	APP'D	DESCRIPTION
B	10/7/13	KIS	ØØ	ISSUED FOR PERMITTING
A	7/12/12	KIS	GRW	ISSUED FOR PERMITTING
				PRELIMINARY ISSUE

BASIN ELECTRIC POWER COOPERATIVE
A Touchstone Energy® Cooperative

SCALE	1"=40'-0"	MO DAY YR
DRAWN	KIS	07/06/12
CHK'D		
APP'D	GRW	10/7/13
APP'D		
APPROVED		
DATE	10/7/13	
PROJECT	65386	

Harris Group Inc.
ENERGY

LONESOME CREEK STATION
UNIT 2 & 3
PERMIT TO CONSTRUCT

BASIN ELECTRIC POWER COOPERATIVE
WATFORD CITY, NORTH DAKOTA

DRAWING NUMBER M630002 REV B

APPENDIX D - LAND USE APPROVALS

Alex Township Zoning Board
May 16, 2012

The Alex Township Zoning Board was called to order at 7:00 pm May 16, 2012 at the Alexander City Hall by Jay Lewis. Present were Jay Lewis, Bob Dwyer, Dusty Bratsberg, Will Aasen and Clerk Wade Aasen with Deb Dwyer assisting with minute taking. Also present were recorded on a list that is on file with the clerk.

Wade read the minutes of the April 18, 2012 meeting. Motion made by Jay and second by Bob to approve, motion carried.

Discussion on billboards as permitted use only under Rural Commercial District.

Peter Skedsvolds request on a residence with a shop for a water well drilling equipment would fall under 5.2.9.

Shaw conditional use permit was withdrawn.

Jess Heggens request to put a trailer house in Rawson town site was tabled till nest meeting in June.

Michael Dwyer presented his proposal of an 80' X200' building with 5 different condo units. Each condo will have two truck stalls, and potentially office space. He will rent out each of five stalls.

Wade spoke on Western Area Water Supply Authority submission of multiple CUP applications to be acted on in June.

Bob presented Maas Brothers Oil Company proposed shop/office Space for a truck and tire repair shop and three family employees housing.

Discussion was held on Jason Smiths sub-division in NW ¼ of 17 as future project.

Nathan Dekkers CUP for Trailer and RV Park was discussed. Bob made a motion to approve with Jay second, motion carried.

Westwood Enterprises was not present for their proposal so was not acted upon.

Basin Electric presented their proposal. Motion by Bob second by Jay to approve a CUP for an energy conversion facility on 48.48 acres more or less at SW ¼ of Sec 23 and a 1 acre tract in both NE ¼ and SE ¼ with associated infrastructure and natural gas pipeline, motion carried. There is to be a follow up CUP application request for the 115 – kV transmission line.

Jack Dwyer talked on bonding with a reclamation agreement this was tabled till next meeting to get more information.

Discussion was held on forty acre spacing and whether they needed to be a legal square forty acres and was decided it did not need to be one quarter of a legal quarter.

Lance Powell brought up conflict of interests. It was consensus that Basin Electric should be ratified at the next meeting.

Next meeting will be held June 20th at 7:00 pm at the fire hall.

Hellings brought up the section line road to WFS, Wade will talk with them.

Lance brought up the concerns of the fire dept concerning fire suppression; Lance will get specifics from other zoning districts for next meeting.

Bob moved and Jay seconded to adjourn. Motion carried.

Respectfully submitted

C. Wade Aasen

Alex Township Zoning Board
July 18, 2012

The Alex Township Zoning Board was called to order at 7:00 pm July 18, 2012 at the Alexander Fire Hall by Tim Nelson. Present were Tim Nelson, Jay Lewis, Bob Dwyer, Will Aasen, Dusty Bratsberg and Clerk Wade Aasen with Deb Dwyer assisting with minute taking. Also present were recorded on a list that is on file with the clerk.

Wade read the minutes of the June 20, 2012 meeting. Motion made by Jay and second by Bob to approve, motion carried.

Tim Nelson called Upper Missouri Health concerning the over crowding on certain lots in Rawson without satisfying results. Tim will meet with Arnegard officials to approach the state to help resolve this.

Basin Electrics Cris Miller was present to present a proposal for a Conditional Use Permit for transmission line from Lonesome Creek station switchyard to Hay Butte Substation. Bob recused himself. Jay Lewis made a motion to approve the CUP, Tim Nelson second, motion carried.

Jason Novak and Steve Boynton representing Minnesota Field Services discussed the grandfathered project on the S ½ , NW ¼ , Sec 22. Homebridge of ND would develop a change from 8 bedroom trailers mixed with industrial buildings to a higher density man camp. Their project would be two projects on the west 40 acres to include 2 bedroom trailers or skid shacks without kitchens, gated with keys, bath house and rec center project, not an RV park. They would put in all the buildings and manage the site with water and sewage to be hauled. The board questioned them on fire protection and spacing requirements. This was tabled till next month when they would have a more detailed plan to apply for a CUP.

Brett Morlok of AE2S was present to address WAWSA application for a CUP for installation of 2and 4 inch rural water supply lines in sections 3, 4, 5, 6, 7, 8, 9, 10, 16, 17, 18, and 19 as outlined on the map the supplied . Bob Dwyer made a motion to approve CUP of project as depicted on supplied map conditional on WAWSA bore under roads and trees and get easements from landowners involved, Jay Lewis second, motion carried.

New Business;

Tim Nelson made a motion to eliminate township building permits with the county to require and oversee all building permits, Bob Dwyer second, motion carried.

Discussion was held on McKenzie County Zoning.

Next meeting will be on August 15 at the Alexander Fire Hall.

Bob Dwyer moved to adjourn meeting, Jay second, motion carried.

Respectfully submitted

C. Wade Aasen

October 2013

BASIN ELECTRIC POWER COOPERATIVE

A Touchstone Energy® Cooperative