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November 25, 2013

C-11921
Jerry

Ms. Marion Massoth
Kansas Department of Health and Environment
Bureau of Air and Radiation
1000 SW Jackson, Suite 310
Topeka, KS 66612-1366

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NOV 26 2013
BUREAU OF AIR

Dear Ms. Massoth:

On behalf of Midwest Energy, Inc., Burns & McDonnell is submitting a Prevention of Significant Deterioration (PSD) air construction permit application associated with the development and construction of three additional electrical generating reciprocating internal combustion engines (RICE) at the Goodman Energy Center (Source ID 0510057). The Project will consist of three new RICE plus auxiliary equipment at the existing Goodman Energy Center, located in Ellis County, Kansas. Three signed copies of the application are attached. The $5,500 permit application fee is also attached to this letter.

As KDHE proceeds with the evaluation process, please contact the following persons with questions or for additional information:

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Burns & McDonnell
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Midwest Energy appreciates the input and efforts to date by your office to help expedite this permit application and the subsequent review process. If we can be of any assistance to facilitate your staff's efforts, please do not hesitate to contact us.

Sincerely,

Minda Nelson

Minda Nelson, P.E.
Senior Environmental Engineer

Enclosure Attachment
cc: William N. Dowling

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BUREAU OF AIR

Prevention of Significant Deterioration Air Construction Permit Application

for the

Goodman Energy Center Expansion Project

prepared for

Midwest Energy, Inc.

November 2013

Project No. 75189

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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ACRONYM LIST

a*	color hue
AERMOD	AMS/EPA Regulatory Model
AERMAP	AERMOD's terrain pre-processor
AQAT	Air Quality Assessment Tool
b*	saturation
BACT	Best Available Control Technology
BPIP-PRIME	Building Profile Input Program-Plume Rise Model Enhancements
Btu/KW-hr	British thermal units per kilowatt-hour
CCAR	California Climate Action Registry
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent (greenhouse gases)
CSAPR	Cross State Air Pollution Rule
EGU	electric generating unit
EPA	U.S. Environmental Protection Agency
ESPs	electrostatic precipitators
°F	degrees Fahrenheit
FLAG	Federal Land Managers' Air Quality Related Values Work Group
FLM	Federal Land Manager
ft/s	feet per second
GEP	Good Engineering Practice
g/cm^3	gram per cubic centimeter
g/hp-hr	gram per horsepower hour
GW-hr	gigawatt-hour
g/kw-hr	gram per kilowatt hour
H_2SO_4	sulfuric acid
HAPs	hazardous air pollutants
HHV	higher heat value
hp	horsepower
K.A.R	Kansas Administrative Regulations
KDHE	Kansas Department of Health and Environment
kW	kilowatt
L*	brightness
lb/gal	pound per gallon
lb/hr	pound per hour
lb/MMBtu	pound per million British thermal units
MACT	Maximum Achievable Control Technology
CH_4	methane
Midwest Energy	Midwest Energy Center, Inc.
MMBtu/hr	million British thermal units per hour
$MTCO_2$/MW-hr	metric tons greenhouse gas per megawatt-hour

MW	megawatt
NAAQS	National Ambient Air Quality Standards
NAD	North American Datum
NED	National Elevation Dataset
NESHAP	National Emission Standard for Hazardous Air Pollutants
NSPS	New Source Performance Standards
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
N_2O	nitrous oxide
NMHC	non-methane hydrocarbons
OAQPS	Office of Air Quality Planning and Standards
PANs	peroxyacetyl nitrates
PBL	Planetary Boundary Layer
PM	particulate matter
$PM_{2.5}$	particulate matter of 2.5 microns in diameter or smaller
PM_{10}	particulate matter of 10 microns in diameter or smaller
ppm	parts per million
ppmvd	parts per million by volume, dry
PRIME	plume rise model enhancements
PSD	Prevention of Significant Deterioration
PTE	potential-to-emit
PVMRM	Plume Volume Molar Ratio Method
RBLC	RACT/BACT/LAER Clearinghouse
RICE	reciprocating internal combustion engines
RMP	risk management plan
ROI	radius of impact
rpm	revolutions per minute
SCR	selective catalytic reduction
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
SO_4	sulfate
TPY	tons per year
U	wind speed
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
VOC	volatile organic compounds
$\mu g/m^3$	micrograms per cubic meter
μm	micrometer
4SLB	4 stroke lean burn
$\sigma_z \sigma_y$	vertical and horizontal diffusion coefficients

* * * * *

1.0 EXECUTIVE SUMMARY

Pursuant to the requirements specified in the Kansas Administrative Regulations (K.A.R) 28-19-350, Midwest Energy, Inc. (Midwest Energy) submits this Prevention of Significant Deterioration (PSD) construction permit application for the installation of three reciprocating internal combustion engines (RICE) plus auxiliary equipment at the existing Goodman Energy Center (hereinafter referred to as the Project), located in Ellis County, Kansas approximately 4 miles northwest of Hays. The Project will increase nominal power output at the Goodman Energy Center by approximately 28 megawatts (MW) and the RICE electric generating units (EGUs) will be fired solely by natural gas.

As required by the above-referenced rules, this permit application contains the following analyses/assessments regarding the emission of regulated pollutants associated with the construction and operation of the Project:

- Evaluation of ambient air quality in the area for each regulated pollutant for which the Project will cause a significant increase in net emissions
- Demonstration by air dispersion analysis that emissions from the Project will not cause or contribute to any exceedance of a National Ambient Air Quality Standard (NAAQS)
- Demonstration by air dispersion analysis that emissions from the Project will not exceed the remaining available PSD Class II increment consumption allowances
- Assessment of any adverse impacts on soils, vegetation, visibility, or growth in the area
- A Best Available Control Technology (BACT) analysis for each regulated pollutant for which the potential-to-emit (PTE) for the Project will result in a significant increase in net emissions.

Potential emissions from the Project are shown in Table 1-1. Start-up emissions for the engines are also included in Table 1-1. A full description of equipment associated with the Project is provided in Part 3 of the application.

Table 1-1: Project Potential Emissions and PSD Significance Levels

Pollutant[A]	Preliminary Estimated Potential Emissions (Tons per Year [TPY])[B]	PSD Significance Levels (TPY)
NO_X	36.7	40
CO	47.1	100
SO_2	0.7	40
VOC	37.8	40
$PM/PM_{10}^{C}/PM_{2.5}^{C}$	**28.4**	25/15/10
CO_2e	**123,117**	75,000
H_2SO_4 Mist	0.1	7
Lead	2.2×10^{-3}	0.6

[A] NO_x = nitrogen oxides; CO = carbon monoxide; SO_2 = sulfur dioxide; VOC = volatile organic compounds; PM= total particulate matter; PM_{10} = particulate matter less than 10 microns in diameter; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; CO_2e = carbon dioxide equivalent (greenhouse gases); H_2SO_4 Mist = sulfuric acid mist
[B] Numbers in **bold** indicate the PSD significance level is exceeded
[C] Filterable plus condensable

HAP Emissions

The Project itself will not be a major source of hazardous air pollutants (HAPs) (greater than 25 tons per year of total HAPs and greater than 10 tons per year of any single HAP).[1] The existing Goodman Energy Center site is considered an area source of HAPS. However, since the two sites will be considered one site for National Emission Standards for Hazardous Air Pollutants (NESHAP) applicability, when the HAPs from both sites are added together, the site is major for HAPs. Therefore, the Project will be considered major for HAPs.

Project NAAQS Impact Analysis

The existing air quality in the Ellis County area is designated as attainment or unclassifiable with regard to the NAAQS for all criteria pollutants. An air dispersion modeling analysis was performed for the pollutants subject to PSD review to assess potential impacts on the NAAQS. The modeling was performed in accordance with relevant Kansas Department of Health and Environment (KDHE) and U.S. Environmental Protection Agency (EPA) modeling guidance. The air dispersion modeling protocol were submitted to KDHE for its review in September 2013.

[1] All sources of HAPs that are not major sources are categorized as "area" sources.

The modeling analysis results (included in Part 7 of this application) demonstrate that the Project for PSD pollutants will not cause or contribute to a violation of the NAAQS. Further, the PSD Class II increment analysis demonstrates that Project impacts are less than the increment consumption allowances established for the area for the PSD pollutants.

Recent Federal Land Manager (FLM) guidance advises that a proposed major source, in the course of a PSD application, perform an assessment of air quality impacts at Class I areas if these areas are located within approximately 300 kilometers of the proposed facility. As there are no Class I areas that are within 300 kilometers of the Project, an assessment of air quality impacts at Class I areas was not performed.

BACT for Reciprocating Internal Combustion Engines

A "top-down" BACT analysis was performed for each of the pollutants in Table 1-1 that the PTE was above the associated PSD significance level: $PM/PM_{10}/PM_{2.5}$ and CO_2e (greenhouse gases).

Pre-combustion and controlled combustion systems coupled with state-of-the-art pollution control equipment and consistently achievable emission limitations have has been selected as BACT for this Project. Use of clean fuels and good combustion practices will control emissions of $PM/PM_{10}/PM_{2.5}$. Greenhouse gas emissions will be limited by the use of efficient lean-burn engines and by use of natural gas as a fuel.

Table 1-2 displays the BACT results.

Table 1-2: Summary of BACT Results: RICE

Pollutant	Systems and Controls	BACT Emission Limitation [pound per hour (lb/hr)][A]	Equivalent Emissions[B] (g/hp-hr)	Averaging Period
$PM/PM_{10}/PM_{2.5}$	Combustion Controls and Low Ash Fuels	2.10	0.164	3-hr
CO_2e	Use of Efficient Lean-Burn Engines, Use of Natural Gas as a Fuel	9,330	373	Annual

[A] Engine emission rate while operating at loads of 40 percent and greater under steady state conditions unless otherwise noted.
[B] Equivalent emissions in gram per horsepower hour (g/hp-hr) for loads of 40% and higher are shown for comparison to the RACT/BACT/LAER Clearinghouse (RBLC) emission rates purposes only. These are not proposed as BACT emission limitations.

BACT Analysis for Auxiliary Equipment

The auxiliary equipment to be installed at the Project consists of a dew point heater, an emergency fire pump, and an emergency generator. A BACT analysis was performed for the pollutants in Table 1-1 that are emitted in total Project quantities above the PSD significance levels for the each of the auxiliary equipment. The following pre-combustion, combustion and pollution control equipment and operational practices have been established as applicable BACT requirements for the auxiliary equipment as shown in Table 1-3.

Table 1-3: Summary of BACT Results: Auxiliary Equipment

Pollutant	Emissions Unit	Limiting Systems and Controls	BACT Emission Limitation
$PM/PM_{10}/PM_{2.5}$	Dew Point Heater	Combustion Control	0.0075 pound per million British thermal units (lb/MMBtu)
	Emergency Generator	Combustion Control and Low Ash Fuels	0.15 g/hp-hr[A]
	Emergency Fire Pump	Combustion Controls and Low Ash Fuels	0.22 g/hp-hr
CO_2e	Dew Point Heater	Use of Clean Fuels, Maintaining and Tuning the Heater, Recordkeeping	N/A
	Emergency Generator	Selection of the Most Efficient Engines that Meet the Applicant's Project Needs	
	Emergency Fire Pump	Selection of the Most Efficient Engines that Meet the Applicant's Project Needs	

Additional Impacts Analysis

The potential impacts of the Project on visibility, soils, vegetation, and growth are discussed in Part 8 of this application. As shown by the analysis, the addition of the Project will not have a significant impact on visibility, soils, growth, or vegetation in the surrounding area.

* * * * *

2.0 INTRODUCTION

Midwest Energy, Inc. (Midwest Energy) is proposing to expand the electric generating capacity at its existing Goodman Energy Center facility located in Ellis County, Kansas. The Goodman Energy Center Expansion Project (hereinafter referred to as the Project) will consist of three nominal 9.34-MW reciprocating internal combustion engines (RICE) and associated equipment and will be operated by Midwest Energy. Midwest Energy currently has a Title V permit application under KDHE's review for the conversion of the existing facility to a major source due to the new GHG emission regulations. Potential emissions indicate that the Project will be categorized as a major modification at an existing major source; as a result, the Project will be subject to Prevention of Significant Deterioration (PSD) construction permit review. In addition to the three RICE, a dew point heater, emergency generator, emergency fire pump and two fuel oil tanks will be included as part of the Project. There will be no new switchers/breakers installed as part of this Project; as a result, there will be no sulfur hexafluoride (SF_6) emissions associated with this Project.

Table 2-1 identifies the maximum potential air emissions associated with the Project. Start-up emissions for the engines as well as auxiliary equipment emissions are included in the emissions estimate in Table 2-1 as well. The potential air emissions of the new units are based on unlimited hours per year of operation. The start-up emissions are based on 1,095 start-up events per year for each engine. The maximum emissions from each operating load and scenario for the RICE was used to demonstrate the maximum potential emissions for each pollutant.

Table 2-1. Project Potential Emissions and PSD Significance Levels

Pollutant[A]	Preliminary Estimated Potential Emissions (Tons per Year [TPY])[B]	PSD Significance Levels (TPY)
NO_X	36.7	40
CO	47.1	100
SO_2	0.7	40
VOC	37.8	40
$PM/PM_{10}^{C}/PM_{2.5}^{C}$	**28.4**	25/15/10
CO_2e	**123,117**	75,000
H_2SO_4 Mist	0.1	7
Lead	2.2×10^{-3}	0.6

[A] NO_x = nitrogen oxides; CO = carbon monoxide; SO_2 = sulfur dioxide; VOC = volatile organic compound; PM= total particulate matter; PM_{10} = particulate matter less than 10 microns in diameter; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; CO_2e = carbon dioxide equivalent (greenhouse gases); H_2SO_4 Mist = sulfuric acid mist
[B] Numbers in **bold** indicate the PSD significance level is exceeded
[C] Filterable plus condensable

As shown by the above table, the Project will result in emission increases above the significance level for $PM/PM_{10}/PM_{2.5}$ and CO_2e (greenhouse gases or GHG). Therefore, these pollutants will be subject to PSD review.

The Project itself will not be a major source of HAPs (greater than 25 tons per year of total HAPs and greater than 10 tons per year of any single HAP), but the combination of the Project with the facility's existing sources will be a major source of HAPs. Therefore, the Project will be reviewed as a major source for National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 Code of Federal Regulations (CFR) Part 63) applicability.

This construction permit application is divided into the following sections:

- Part 1 – Executive Summary
- Part 2 – Introduction
- Part 3 – Project Description
- Part 4 – Emissions Estimates (this section provides estimates of emissions associated with the Project)
- Part 5 – Regulatory Review (this section identifies applicable state and federal air quality regulations)
- Part 6 – Best Available Control Technology (BACT) Analysis

- Part 7 – Air Dispersion Modeling (this section provides model descriptions and data requirements for the air quality impact assessment as well as interpretation, analysis, and comparison of the modeling results with applicable air quality regulations)
- Part 8 – Additional Impact Analysis (this section addresses other potential air quality-related impacts (i.e., growth, soil, vegetation, and visibility))

Construction permit application forms required by the Kansas Department of Health and Environment (KDHE) are included in Appendix A of this application.

* * * * *

3.0 PROJECT DESCRIPTION

Midwest Energy is proposing to add three nominal 9.34-MW RICE and associated equipment at their existing Goodman Energy Center Facility in Ellis County, Kansas. The existing Goodman Energy Center has nine RICE (8.44 MW, each) and associated equipment on site, and is located approximately four miles northwest of Hays, Kansas. Ellis County is currently designated as an attainment/unclassified area for all criteria pollutants. See 40 CFR Part 81. The location of the Goodman Energy Center is shown in Figure 3-1 (Appendix B). A scaled site layout showing the plant and equipment is shown in Figure 3-2 (Appendix B). A second scaled site layout showing the plant and fence line is shown in Figure 3-3 (Appendix B).

The Project will consist of three RICE with a nominal gross electrical output of up to 28 MW. Midwest Energy proposes that each of the RICE will operate without restriction on utilization. The dew point heater will be permitted for 8,760 hours annually because it will be operational whenever gas is flowing to any of the engines. The emergency fire pump and emergency generator are proposed to operate up to 100 annual hours, and their use will be limited primarily to testing and maintenance. Table 3-1 displays each of the emission units along with maximum operating hours per year. The Project will be major for PSD based on potential emissions of $PM/PM_{10}/PM_{2.5}$ and greenhouse gasses (CO_2e).

Table 3-1: Emission Units and Hours of Operation for the Project

Emissions Unit	Size	Number of Units	Fuel	Annual Hours of Operation
RICE	9.34 MW	3	Natural Gas	8,760 (each)
Dew Point Heater	1 million British thermal units per hour (MMBtu/hr)	1	Natural Gas	8,760
Emergency Fire Pump	100 horsepower (hp)	1	Diesel	100
Emergency Diesel Generator	250 kilowatts (kW)	1	Diesel	100

3.1.1 RICE Engines and Emission Controls

The RICE will be natural gas-fired 20V34SG Wärtsilä engines. This additional generating capacity is being constructed to meet the projected energy and capacity demands and to provide ancillary support for substantial renewable energy resources proposed in the region. The three engines are being permitted to operate unlimited hours annually.

To control emissions of NO_x, each engine will be equipped with selective catalytic reduction (SCR) systems and lean-burn combustion systems. To minimize the emissions of SO_2, H_2SO_4 mist and $PM/PM_{10}/PM_{2.5}$, the engines will be controlled through the use of low-sulfur/low ash fuels and good combustion practices. Emissions of CO and VOC will be controlled through the use of good combustion practices as well as an oxidation catalyst (also referred to as a CO catalyst). Greenhouse gas emissions will be minimized with the use of efficient lean-burn engines and the use of natural gas fuel.

3.1.2 Dew Point Heater

A one MMBtu/hr dew point heater will be installed to maintain the temperature of the natural gas to the engines, in compliance with the manufacturer's recommendations for fuel quality parameters. Emissions estimated for the dew point heater assume an annual operational schedule of 8,760 hours per year.

3.1.3 Emergency Fire Pump

An emergency fire pump will be installed for use in case of fire. The emergency fire pump may be tested each week to confirm that it is working properly. The fire pump will have a maximum output of 100 hp and will be operated solely on ultra-low sulfur diesel. Midwest Energy expects to operate the emergency fire pump for up to 100 hours annually for testing and maintenance purposes, and therefore requests an administrative limitation on its routine hours of operation.

3.1.4 Emergency Generator

An emergency generator will be built to support the plant safety and control features in case of a power interruption. The emergency generator will have a maximum power output of 250 kW and will be operated solely on diesel fuel. Midwest Energy expects to operate the emergency generator for up to 100 hours annually for testing and maintenance purposes, and therefore requests an administrative limitation on routine hours of operation for this equipment.

3.1.5 Fuel Oil Storage Tanks

The project will include two small diesel storage tanks, one 20 gallon tank to provide fuel to the emergency fire pump and one 200 gallon tank to provide fuel to the emergency generator. The tanks will be equipped with an exhaust vent system that minimizes vapor discharge to the atmosphere.

* * * * *

4.0 EMISSIONS ESTIMATES

Air pollution emissions result from the combustion of natural gas in the RICE, and from operation of the dew point heater, emergency fire pump, emergency generator, and two fuel oil storage tanks.

4.1 Emission Sources

Emissions from the Project will originate from the RICE and auxiliary equipment. Figure 4-1 and Figure 4-2 present a RICE process flow diagram and auxiliary equipment flow diagram for the Project, respectively. Each emission point is discussed in more detail below. Procedures for estimating emissions are also discussed below. The emission calculations are included in Appendix C.

4.1.1 Engine Emissions Calculation Method

Emissions from the RICE are dependent on the ambient temperature conditions and the RICE's operating load. To account for representative seasonal climatic variations, the potential emissions from the RICE were analyzed at 40, 75, and 100 percent load conditions. The projected emissions were based on data provided by the RICE manufacturer (Wärtsilä) and/or from AP-42 emission factors. Detailed calculations of the engines' emissions are provided in Appendix C.

The following conservative assumptions were used to determine potential emissions from the Project:

- Emissions are based on normal operation and start-up. Two scenarios were considered: maximum emissions for 40 percent to 100 percent load operation for 8,760 hours per year and maximum annual startup emissions plus full load operation for the remainder of the year.
- Start-up emissions are based on the start-up profiles (assumes 30 minutes per start-up) and 1,095 start-up events per year per engine
- CO emissions are based on the vendor's maximum guaranteed emissions rate with an oxidation catalyst of 2.67 pound per hour (lb/hr) per engine for loads of 40 percent and greater
- $PM/PM_{10}/PM_{2.5}$ emissions are based on an estimated maximum emission rate of 2.10 lb/hr per engine for loads of 40 percent and greater; primary emissions from the combustion of natural gas fuel for PM, PM_{10}, and $PM_{2.5}$ are assumed to be the same
- NO_x emissions are based on the manufacturer's maximum guaranteed emission rate of 1.45 lb/hr per engine equipped with SCR for loads of 40 percent and greater
- SO_2 emissions are based on the sulfur content of the pipeline quality natural gas fuel and an estimated maximum emission rate of 0.05 lb/hr per engine for loads of 40 percent and greater

- VOC emissions are based on an estimated maximum emission rate of 2.67 lb/hr per engine for loads of 40 percent and greater
- CO_2e emissions are based on vendor data for carbon dioxide (CO_2); methane (CH_4) and nitrous oxide (N_2O) were calculated using 40 CFR Part 98 emission factors, and ratioed with their appropriate CO_2 equivalency ratio and summed to obtain CO_2e

Based on these assumptions, the maximum expected hourly emission rates for each RICE engine are shown in Table 4-1.

Table 4-1. RICE Maximum Expected Hourly Emission Rates

Pollutant	NO_X	CO	PM/ PM_{10}/ $PM_{2.5}$	VOC	SO_2	H_2SO_4 Mist	CO_2e	Lead
Emission Rate Per Engine (lb/hr)[A]	1.45	2.67	2.10	2.67	0.05	0.01	9,330	--

[A] Excludes start-up emissions

4.1.2 RICE Start-Up/Shutdown Emissions Calculation Method

Potential start-up emissions are based on the manufacturer's start-up profile and 1,095 start-up events per year per engine. Start-up events are assumed to take up to thirty minutes, after which control technologies will be fully functional. Potential start-up emissions for the combustion engines are shown in Table 4-2. Detailed calculations of the potential start-up emissions are provided in Appendix C.

Table 4-2. Potential Combustion Engine Start-up and Shutdown Emissions

Pollutant	lb/Start-up per Engine	lb/Shutdown per Engine	Start-up Plus Shutdown Emissions per Engine (TPY)[A]
NO_x	11.2	0.062	12.1
CO	8.4	0.026	15.6
$PM/PM_{10}/PM_{2.5}$	1.5	0.062	28.3
VOC	2.9	0.033	12.6
SO_2	0.05	0.05	0.24
H_2SO_4 Mist	--	--	0.03
CO_2e	2,171.7[B]	6.8[B]	39,423

[A] Based on 1,095 start-ups and 1,095 shutdowns per year per engine
[B] CO_2 lb/start-up and shutdown only

Normal operation has higher emissions than shutdown. Therefore, total emissions on an annual basis include the maximum number of start-ups, with the remaining hours assumed to be full load operation, as both of those cases result in greater emissions than does a shutdown condition.

4.1.3 HAP Emissions Calculation Method

The addition of the Project to the existing facility will make the Goodman Energy Center a major source of HAPs (greater than 25 tons per year of total HAPs and greater than 10 tons per year of any single HAP).[2] The calculation of total HAP emissions from the RICE and associated equipment combined with the existing equipment is provided in Appendix C.

4.1.4 Dew Point Heater Calculation Method

A one MMBtu/hr dew point heater will be installed at the facility to regulate the temperature of natural gas fuel. Emissions for the dew point heater are estimated using AP-42 emission factors[3] and an assumed annual operation schedule of 8,760 hours per year. Detailed calculations of the dew point heater emissions are provided in Appendix C.

4.1.5 Emergency Fire Pump Calculation Method

One fire pump will be installed on-site to handle fire suppression for the facility. The fire pump will combust ultra-low sulfur diesel and will have a maximum power output of 100 hp. An annual testing and maintenance schedule of 100 hours is assumed for the fire pump. Emissions for this unit are estimated based on New Source Performance Standards (NSPS) emission rates for NOx, CO, and $PM/PM_{10}/PM_{2.5}$, while all other pollutant emissions are estimated using AP-42 emission rates.[4,5] The CO_2e emission factors (for CO_2, CH_4, and N_2O) from the EPA Mandatory Greenhouse Gas Reporting Rule (40 CFR Part 98) are used to estimate CO_2e emissions. Detailed calculations of the fire pump emissions are provided in Appendix C.

4.1.6 Emergency Generator Calculation Method

One 250-kW emergency generator will be installed to support the engines in case of a power interruption; the generator will be fired solely with ultra-low sulfur diesel. An annual testing and maintenance schedule of 100 hours is assumed for the emergency generator. Emissions for this unit are estimated

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[2] All sources of HAPs that are not major sources are categorized as "area" sources.
[3] AP-42 Section 1.4, *Natural Gas Combustion* (7/98)
[4] Fire pump limits (40 CFR 60 Subpart IIII Table 4)
[5] AP-42 Section 3.3, *Gasoline And Diesel Industrial Engines* (10/96)

based on NSPS emission rates[6] for NOx, CO, and $PM/PM_{10}/PM_{2.5}$, while all other pollutant emissions are estimated using AP-42 emission factors[7]. The CO_2e emission factors (for CO_2, CH_4, and N_2O) from the EPA Mandatory Greenhouse Gas Reporting Rule (40 CFR Part 98) are used to estimate CO_2e emissions. Detailed calculations of emergency generator emissions are provided in Appendix C.

4.1.7 Diesel Fuel Oil Tanks Calculation Method

Two fuel oil storage tanks will be installed to store ultra-low sulfur diesel as defined in Part 5. Emissions are estimated for the storage tanks using the EPA TANKS emission software. Detailed calculations of the fuel oil storage tank emissions are provided in Appendix C.

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[6] Generator limits (40 CFR 60.4202(a)(2) and 40 CFR 89.112)
[7] AP-42 Section 3.3, *Gasoline And Diesel Industrial Engines* (10/96)

5.0 REGULATORY REVIEW

The Project is subject to various federal and state air regulations. Part 5 of this application contains a discussion of the PSD regulations, applicable NSPS, applicable NESHAPS for Source Categories, and applicable Kansas Administrative Code (K.A.R) provisions. Where applicable, reference to general limitations is provided when there is no specific requirement that applies to an emission source.

In certain instances there are multiple regulatory requirements. For instance, where a BACT emission limitation is established, it will be at least as stringent as a companion NSPS limitation. In each situation it is understood that compliance with the most restrictive requirement will demonstrate compliance with all other less stringent requirements.

5.1 PSD Regulations

PSD review is required for all criteria pollutants that will be emitted above significant levels in accordance with K.A.R 28-19-350 and 40 CFR 52.21 as revised on July 1, 2007. PSD review consists of the following:

- A BACT analysis
- An air quality analysis
- An analysis of additional impacts on visibility, soils, vegetation, and growth in the area of the Project

Three criteria were evaluated to determine PSD applicability:

1. Whether the Project is sufficiently large (in terms of its emissions) to be a "major" stationary source or "major" modification.

2. Whether the Project will be located in a region designated as "attainment" or "unclassified."

3. Whether the pollutants to be emitted from the Project exceed the significant emission levels set forth at K.A.R 28-19-350 (f)(1).

The pollutants that are subject to PSD requirements per Kansas rules are PM, PM_{10}, $PM_{2.5}$, and CO_2e. The definition of a "major stationary source" is established at K.A.R 28-19-16a. The existing Goodman

Energy Center is considered a major stationary source due to greenhouse gas emissions.[8] The Project emissions will exceed the PSD significance levels for some PSD pollutants; thus satisfying the first criteria for PSD applicability.

The Project is located in an attainment/unclassified area for all criteria pollutants and therefore is subject to PSD review.

The maximum potential emissions from the Project are listed in Table 5-1, which includes start-up emissions from the RICE.

Table 5-1. Project Potential Emissions and PSD Significance Levels

Pollutant[A]	Preliminary Estimated Potential Emissions (TPY)[A]	PSD Significance Levels (TPY)
NO_X	36.7	40
CO	47.1	100
SO_2	0.7	40
VOC	37.8	40
PM/PM_{10}[B]$/PM_{2.5}$[B]	**28.4**	25/15/10
CO_2e	**123,117**	75,000
H_2SO_4 Mist	0.1	7
Lead	2.2×10^{-3}	0.6

[A] Numbers in **bold** indicate the PSD significance level is exceeded
[B] Filterable plus condensable

PSD regulations require that the following issues be addressed:

- Determination of BACT on a case-by-case basis, taking into account capital and operating costs as well as energy, environmental, and economic impacts
- Demonstration that the potential increase in emissions will not cause or contribute to an exceedance of the National Ambient Air Quality Standards (NAAQS), or a PSD Class II increment consumption allowance
- Analysis of the impairment, if any, to visibility, soils, vegetation, and growth in the area

[8] Midwest Energy currently has a Title V permit application under KDHE's review for the conversion of the existing facility to a major source due to the new GHG emission regulations.

5.2 New Source Performance Standards

The Project will be subject to the applicable NSPS standards[9] that are identified below. A description of the Midwest Energy compliance plan to meet each standard is included.

40 CFR Part 60, Subpart JJJJ

Subpart JJJJ—Standards of Performance for Stationary Spark Ignition Internal Combustion Engines became effective March 18, 2008. The Wärtsilä RICE engines are subject to Subpart JJJJ.

RICE Engines Emission Standards

The RICE are subject to the NSPS Subpart JJJJ limits for non-emergency spark ignited natural gas engines greater than 500 hp manufactured after July 1, 2010. The applicable limits are:

- 1 g NO_x/hp-hr (82 parts per million by volume, dry (ppmvd) at 15 percent O_2)
- 2 g CO/hp-hr (270 ppmvd @15 percent O_2)
- 0.7 g VOC/hp-hr (60 ppmvd @ 15 percent O_2)

The RICE will satisfy these requirements.

40 CFR Part 60, Subpart IIII

Subpart IIII (§60.4200 *et seq.*) applies to stationary compression ignition internal combustion engines and the manufacturers and/or owners and operators of these engines. For purposes of this application, Subpart IIII is applicable to the emergency fire pump and emergency generator. Both the emergency fire pump and emergency generator will meet the definition of "emergency stationary internal combustion engine" under this subpart. For purposes of estimating potential emissions associated with the emergency fire pump and emergency generator, Midwest Energy proposes a 100-hour-per-year-per-engine non-emergency use limitation for required testing and maintenance.

Emergency Fire Pump Emission Standards

The emergency fire pump will be certified in accordance with the limits in 40 CFR 60.4202(d), which refer to the emission standards of Table 4 of Subpart IIII. If the fire pump is model year 2010 or greater, then the limits are as follows for engines in the 100 to 175 hp range (Table 4 of Subpart IIII of Part 60):

- 3.0 gram per horsepower hour (g/hp-hr) for NMHC plus NO_x

[9] 40 CFR Part 60 and K.A.R 28-19-720

- 3.7 g/hp-hr for CO
- 0.22 g/hp-hr for PM

Emergency Generator Emission Standards

The emergency generator will be certified in accordance with the limits in 40 CFR 60.4202(d), which refer to the emission standards of Table 1 of 40 CFR 89.112. If the emergency generator is model year 2006 or greater, then the limits are as follows for engines in the 225 to 450 kW range (Table 1 of 40 CFR 89.112):

- 4.0 gram per kilowatt hour (g/kW-hr) for NMHC plus NO_x
- 3.5 g/kW-hr for CO
- 0.20 g/kW-hr for PM

Diesel Fuel Requirements

Pursuant to 40 CFR 60.4207(b), owners and operators of CI ICE subject to Subpart IIII with a displacement of less than 30 liters per cylinder that use diesel fuel must purchase diesel fuel that meets the requirements of 40 CFR 80.510(b) for non-road diesel fuel. As stated in 40 CFR 80.510(b), non-road diesel fuel must be limited to 15 parts per million (ppm) maximum sulfur content. The cetane index is limited to a minimum of 40 and the maximum aromatic content is limited to 35 volume percent. Midwest Energy will be subject to the applicable requirements of this rule for the emergency fire pump and emergency generator.

5.3 National Emission Standards for Hazardous Air Pollutants (NESHAP) and Maximum Achievable Control Technology (MACT)

The NESHAP contained in 40 CFR Part 63 are adopted by reference in K.A.R 28-19-735. NESHAP are emissions standards set by EPA for particular source categories. The NESHAP require the maximum degree of emission reduction of certain HAP emissions that EPA determines to be achievable. These Maximum Achievable Control Technology (MACT) standards are adopted by reference in K.A.R 28-19-750.

The following MACT standards are applicable to the Project.

Subpart ZZZZ

The Stationary RICE MACT is applicable to stationary RICE at both major and area sources of HAP emissions.

The RICE are spark ignition four-stroke-lean-burn (4SLB) stationary RICE and will be an affected source under Subpart ZZZZ. Based on the classification as 4SLB engines with a site rating of more than 500 hp which is located at a major source of HAP emissions pursuant to 40 CFR 63.6600(b), the engines must comply with the emission limitations in Table 2a of the subpart. The engines must reduce CO emissions by 93 percent or more or limit the concentration of formaldehyde in the exhaust to 14 ppmvd or less at 15 percent O_2. The engines will have CO catalysts installed that will achieve 93 percent reduction of CO.

The emergency generator and emergency fire pump will be affected sources under Subpart ZZZZ. The engines will be subject only to the requirements of 40 CFR 60 Subpart IIII based on their classification as a new emergency stationary RICE with a site rating of less than or equal to 500 brake hp located at a major source of HAP emissions pursuant to 40 CFR 63.6590(c)(6).

The RICE, emergency generator, and emergency fire pump will comply with the applicable requirements of this rule.

Subpart DDDDD

The Boiler MACT is applicable to industrial, commercial, or institutional boilers and process heaters located at a major source of HAP.

The Project includes a one MMBtu/hr natural gas-fired dew point heater. According to the Boiler MACT, the dew point heater falls under the definition of a process heater and therefore is an affected source under Subpart DDDDD. Under this subpart natural gas-fired process heaters less than five MMBtu/hr are required to complete a tune up on the unit every five years.

The dew point heater will comply with the applicable requirements of this rule.

5.4 Kansas Air Quality Standards and Regulations

This section describes the regulations which apply to the Project as set forth at K.A.R. 28-19.

K.A.R 28-19-31 Emission Limitations for Indirect Heating Equipment

The dew point heater will be subject to the emission limitation in K.A.R 28-19-31(a) and K.A.R 28-19-31(b)(2). Particulate emissions from the dew point heater are limited to 0.6 lb PM/MMBtu (K.A.R. 28-19-31(a)). The visible contaminant emissions from the dew point heater will be limited to 20 percent (K.A.R. 28-19-3(b)(2)). The dew point heater will comply with the applicable requirements of this rule.

K.A.R 28-19-300 to 304 Construction Permits and Approvals; Applicability

Midwest Energy will submit the required application and fees to obtain a construction permit from KDHE before commencing construction of the Project.

K.A.R 28-19-350 Prevention of Significant Deterioration (PSD) of Air Quality

A PSD evaluation has been completed for all regulated NSR pollutants that will be emitted from the Project (NO_x, SO_2, CO, VOC, PM, PM_{10}, $PM_{2.5}$, H_2SO_4 mist, hydrogen sulfide, fluorides, total reduced sulfur, reduced sulfur compounds, CO_2e and lead). Part 6 of this application contains BACT analyses for each pollutant that exceeds its PSD significance level (state or federal). Part 7 of this application contains air dispersion modeling analyses for each PSD-subject pollutant, and Part 8 of this application contains additional impacts analyses for the PSD-subject pollutants. Emissions of NOx, CO, VOC, lead, SO_2, hydrogen sulfide, fluorides, and H_2SO_4 mist resulting from the Project will not exceed their respective significance levels; therefore, these pollutants are not subject to PSD review.

K.A.R 28-19-500 to 518 Operating Permit; applicability

Midwest Energy will obtain a Class I (Title V) operating permit for Goodman Energy Center in accordance with the provisions of K.A.R 28-19-510. (Midwest Energy currently has a Title V permit application under KDHE's review for the conversion of the existing facility to a major source due to the new GHG emission regulations.)

K.A.R 28-19-645 Opening Burning Prohibited

Midwest Energy will not conduct open burning at Goodman Energy Center except for the limited purposes of providing fire training (K.A.R 28-19-647(c)(2)).

K.A.R 28-19-650 Emissions Opacity Limits

The opacity of visible emissions from the emission sources at the Goodman Energy Center may not exceed 20 percent opacity per K.A.R 28-19-650(a)(3). The Project's emission points will not cause greater than 20 percent opacity.

5.5 Mandatory Reporting of Greenhouse Gases – 40 CFR Part 98

40 CFR Part 98 requires facilities that emit 25,000 metric tons or more per year of greenhouse gases to submit annual reports to EPA. Goodman Energy Center will exceed the reporting threshold. Therefore, Midwest Energy will report GHG emissions as required.

5.6 NAAQS

As noted above, Part 7 of this application discusses the ambient air quality analysis and dispersion modeling that has been performed for the Project. That analysis and modeling demonstrate that the Project will not cause or contribute to a violation of any NAAQS.

5.7 Other Ambient Air Quality Standards

Recent Federal Land Manager (FLM) proposed guidance advises, in the course of a PSD application, an assessment of air quality impacts at Class I areas if a proposed major source is located within a certain distance of the Class I area. The nearest Class I area to the Goodman Energy Center site is the Wichita Mountains Wilderness located approximately 455 kilometers south.

The maximum total emissions of the pollutants that contribute to visibility impairment are less than ten times the distance to the Wichita Mountains Wilderness. In accordance with proposed Federal Land Managers' Air Quality Related Values Work Group (FLAG) guidance, a Class I visibility analysis is not required. Nonetheless, a visibility analysis using VISCREEN has been performed on two Class II areas and is presented in Part 8 of this application.

The PSD Class I and Class II Increment analyses can be found in Part 7 of this application.

5.8 Additional Impact Analysis

The potential impact of the Project on soils, vegetation, and visibility has been considered as part of the PSD process. In addition, a growth impact analysis has been included to quantify growth resulting from the construction and operation of the proposed project and assess air quality impacts that would result from that growth. The construction and operation of the Project at Goodman Energy Center is not expected to have a detrimental effect on plants, soils, or visibility. The project would not increase industrial, commercial, or residential growth in the vicinity and therefore emissions would not significantly increase due to growth-inducing effects of the facility. A full analysis of these impacts is set forth in Part 8 of this application.

5.9 Non-Applicable Regulations and Guidance

Certain regulations and guidance that might be expected to be applicable in facilities of similar design to the Project are nonetheless not applicable because of fuel choices, size, and other reasons attributable to geography or physical location. These are as follows:

- 40 CFR 60 Subpart Kb— This NSPS regulation is not applicable because the fuel oil storage tank capacity is less than 75 cubic meters.

- 40 CFR 60 Subpart TTTT— This NSPS regulation, as proposed, is not applicable because the proposed standards apply only to all individual electrical utility generating units with a nameplate capacity of 25 MW or more that commence construction after April 13, 2012.
- K.A.R 28-19-20 Particulate Matter Emission Limitations. This regulation applies only to the transfer or processing of solid materials; it does not apply to gaseous fuels.
- K.A.R 28-19-65 VOC Liquid Storage in Permanent Fixed Roof Type Tanks. This regulation is not applicable because the fuel oil storage tank capacity is less than 40,000 gallons.
- 40 CFR PART 75 – The Acid Rain provisions of the Clean Air Act are not applicable because each affected engine meets the new unit utility exemption of 40 CFR 72.7(a). Therefore, in accordance with the applicable Acid Rain regulations, Midwest Energy will submit the new unit exemption application forms before operation commences.

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6.0 BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

Per K.A.R. 28-19-350, an owner of a facility applying for a PSD construction permit must perform a BACT analysis for each regulated NSR pollutant for which there would be a significant net emissions increase at the stationary source. This requirement applies to any proposed emissions unit at which a net emissions increase in the air pollutant would occur as a result of a physical change or change in the method of operation in the emissions unit.

As can be seen in Table 2-1, the Project is subject to PSD review for $PM/PM_{10}/PM_{2.5}$, and CO_2e (greenhouse gases).

Therefore, a BACT analysis was performed for each of these pollutants. A summary of the selected control technologies and the associated BACT emission limitations for the RICE is presented in Table 6-1.

Table 6-1. Summary of BACT Results: RICE

Pollutant	Control Technology	BACT Emission Limitation (lb/hr)[A]	Equivalent Emissions[B] (g/hp-hr)	Averaging Time
$PM_{10}/PM/PM_{2.5}$	Combustion Controls and Low Ash Fuels	2.10	0.164	3-hr
CO_2e	Use of Efficient Lean-Burn Engines, Use of Natural Gas, and Maintain Efficiency of Engines Through Maintenance Procedures	9,330	373	Annual

[A] Maximum engine emission rate under steady state conditions unless otherwise noted.
[B] Equivalent emissions in g/hp-hr for loads of 40% and higher are shown for comparison to the RBLC emission rates purposes only. These are not proposed as BACT emission limitations.

Table 6-2 displays the BACT results for the auxiliary equipment (dew point heater, emergency fire pump and emergency generator).

Table 6-2. Summary of BACT Results: Auxiliary Equipment

Pollutant	Emissions Unit	Limiting Systems and Controls	BACT Emission Limitation
$PM/PM_{10}/PM_{2.5}$	Dew Point Heater	Combustion Control	0.0075 pound per million British thermal units (lb/MMBtu)
	Emergency Generator	Combustion Control and Low Ash Fuel	0.15 g/hp-hr
	Emergency Fire Pump	Combustion Controls and Low Ash Fuel	0.22 g/hp-hr
CO_2e	Dew Point Heater	Use of Clean Fuels, Maintaining and Tuning the Heater, Recordkeeping	N/A
	Emergency Generator	Selection of the Most Efficient Engines that Meet the Applicant's Project Needs	
	Emergency Fire Pump	Selection of the Most Efficient Engines that Meet the Applicant's Project Needs	

6.1 PSD BACT Process

6.1.1 The "Top-Down" Process

As part of the permitting process, a major stationary source needs to prepare a BACT analysis in conjunction with a PSD permit application. While there is no legal requirement to perform the BACT analysis utilizing a specific criteria or process, EPA has developed guidance that establishes a five-step "top down" BACT process/methodology.[10]

For purposes of this application, Midwest Energy has conducted its BACT analysis consistent with EPA's top down approach, which consists of the following steps for each pollutant to be emitted from each source:

Step 1 – Identify all potential control technologies

Step 2 – Determine technical feasibility (of potential technologies)

[10] U.S. Environmental Protection Agency. New Source Review Workshop Manual – Draft. North Carolina: Office of Air Quality Planning and Standards, 1990.

Step 3 – Rank control technologies by control effectiveness

Step 4 – Evaluate most effective controls and document results

Step 5 – Select BACT

Each of these steps is discussed in further detail below.

Step 1 – Identify all potential control technologies. The first step in a "top-down" analysis is to identify, for all applicable emission units, all "available" control options. Available control options are defined as those air pollution control technologies or techniques that have a practical potential for application to the emissions unit and the regulated pollutant under evaluation and have been demonstrated in practice.

Step 2 – Determine technical feasibility (of potential options). In the second step, the technical feasibility of each control option identified in Step 1 is evaluated with respect to the source-specific factors. A demonstration of technical infeasibility should be documented and should show, based on physical, chemical, and engineering principles, that technical difficulties would preclude the successful use of the control option on the emissions unit under review. Technically infeasible control options are then eliminated from further consideration in the BACT analysis.

Step 3 – Rank control technologies by control effectiveness. All remaining control alternatives not eliminated in Step 2 are ranked and then listed in order of overall control effectiveness for the pollutant under review, with the most effective control alternative at the top. A list should be prepared for each pollutant and for each emissions unit (or grouping of similar units) subject to a BACT analysis.

Step 4 – Evaluate most effective controls and document results. After the identification of available and technically feasible control technology options, the energy, environmental, and economic impacts of each such option are taken into account and the technology for control of emissions of the pollutant is selected at Step 4.

Step 5 – Select BACT. The BACT emission limitation determination is made at Step 5.

6.1.2 General Principles

The BACT analysis for the Project is also based on the following concepts:

- There is no single prescriptive approach to determining the appropriate control technology and emission limitation for a given project
- BACT does not redefine the facility as proposed (including fuels)

- The control technology must be available and feasible for this specific project
- Emission limitations are defined on a "case-by-case" analysis that considers site specific factors
- Emission limitations must be "achievable" on a long-term, day in and day out, basis

There is no prescriptive approach to performing a case-by-case control technology and emission limitation analysis. PSD permitting authorities determine emission limitations on a case-by-case basis. These case-by-case determinations must take into account source-specific and site-specific characteristics. This is not a "cookie-cutter" approach, and there is no single right answer to determining either the appropriate control technology or the appropriate emission limitation for a specific source or for a specific pollutant.

KDHE is not required to set any emission limitation at the most stringent emission limitation that has been demonstrated by a facility using similar emissions control technology. Similarly, an emission limitation does not need to be set at the most stringent emission limitation found in another permit. Rather, KDHE has the authority and the ability to evaluate and determine the proper control technologies and emissions limitations for a particular project based on project-specific factors, including location. The BACT process does not require that each determination establish an emission limitation that is equal to or more stringent than the most stringent previous determination.

Further, in establishing emission limitations, KDHE must confirm that those limitations are achievable by the specific facility that is subject to them: (1) over the life of the facility; and (2) during all operating conditions, not just ideal conditions. The use of a safety factor or margin is well-established in the air permitting context to appropriately account for the uncertainty and operational variability that will occur over the life of a facility. This safety factor must be sufficient to allow a permit holder to comply on a continuous basis. Emission limitations are not required to be based on the lowest emissions rate or highest control efficiency ever documented by a similar facility for a short-term period. The emission limitations must account for a full range of operating conditions and the inherent variability of complex fuel combustion and air pollution control systems.

In order to be considered in the BACT process, a control technology must be commercially available (*i.e.,* it must be offered for sale at commercial scale through commercial channels). Permit applicants are not required to explore Research & Development projects to determine whether or not a particular technology is potentially feasible. In addition, in order to be considered feasible technology for purposes of inclusion in an analysis, a particular technology must have been previously demonstrated, on a long-term basis, at commercial scale.

In its March 2011 guidance, EPA affirmed that a BACT review for a project should not operate to redefine the project. "EPA has recognized that a Step 1 list of options need not necessarily include inherently lower polluting processes that would fundamentally redefine the nature of the source proposed by the permit applicant. BACT should generally not be applied to regulate the applicant's purpose or objective for the proposed facility." The March 2011 guidance continues, "The 'redefining the source' issue is ultimately a question of degree that is within the discretion of the permitting authority." Similarly, EPA's March 2011 "Guidance for Determining Best Available Control Technology for Reducing Carbon Dioxide Emissions from Bioenergy Production" states, "However, while Step 1 is intended to capture a broad array of potential options for pollution control, this step of the process is not without limits. EPA has recognized that a Step 1 list of options need not necessarily include inherently lower polluting processes that would fundamentally redefine the nature of the source proposed by the permit applicant. BACT should generally not be applied to regulate the applicant's purpose or objective for the proposed facility."

6.1.3 GHG BACT Process

Based on EPA GHG Guidance,[11] the GHG BACT process is similar to the PSD BACT process summarized above. Potential control strategies are identified at Step 1 and technologically infeasible options are then eliminated at Step 2. The remaining technically feasible control technologies are ranked at Step 3. The most effective control technologies from an environmental, energy, and economic perspective are evaluated and the most appropriate control technology is selected at Step 4. Finally, the BACT emission limitation is made at Step 5. The general principles of PSD BACT analysis discussed above are equally applied to the GHG BACT process.

6.2 BACT Technology and Emission Limitations for Similar Units

The first step in the "top-down" BACT process is the identification of potentially available control technologies. A good source of information on such technologies is EPA's RACT/BACT/LAER Clearinghouse (RBLC) database maintained on EPA's Technology Transfer Network website at www.epa.gov/ttn/catc. This database includes recent BACT determinations for similar projects.

Advanced queries of the database were conducted to identify control technology determinations from January 2003 to October 2013 for sources similar to the RICE to be used for the Project. Queries were

[11] PSD and Title V Permitting Guidance for Greenhouse Gases, U.S. EPA, Office of Air Quality Planning and Standards, March 2011.

also made for the Project's auxiliary equipment for the same time period. The results of the RBLC queries can be found in Appendix D in Tables D1 to D5.

To identify previous control technology determinations for comparable sources, two types of queries were run for each set of operational modes. The first query was a "basic search" in which the RBLC database was searched for:

- Internal Combustion Engines (>500 hp), 17.130 – Natural gas combustion

In addition to the RBLC database search, other known RICE electric generating unit (EGU) projects that are known by Midwest Energy and permitted (but filed under a different category in the RBLC) were located within the RBLC and included in the tables as well. All known projects that used natural gas engines of similar engine size (4-10 MW) and were subject to PSD review were included in the RBLC search. To the extent practicable, clearly non-applicable projects were removed from the RBLC tables presented in this application. For example, the following process types are incorrectly used in the RBLC to identify internal combustion engine projects; therefore, these categories were also examined:

- Boilers (>250 MMBtu/hr), 11.310 - Natural gas combustion
- Combined Cycle Combustion Turbines (<25 MW), 15.210 - Natural gas combustion

Additionally, the most recent and relevant permit for comparison to this application is Mid-Kansas Electric, LLC's Rubart Station PSD air permit issued by KDHE in January 2013. Although Rubart Station's permit is for Caterpillar engines (this Project proposes to use Wärtsilä engines), the projects are very similar and Rubart Station BACT limits have been included in this BACT analysis. It should be noted, however that the Caterpillar engines are 10 MW (the Project engines are 9.34 MW) and the guarantees available for the two engines are very different, even though they both utilize SCR and oxidation catalysts.

Permitted BACT emission rates for other internal combustion engines have been compared to the RICE to be used in the Project. The best comparison is made to other turbo-charged, four-stroke, lean-burn machines (turbo charged, as opposed to naturally aspirated). However, differences in size (MW) and speed (revolutions per minute (rpm)) of some other permitted engines makes such units dissimilar to the Project RICE. EPA's RBLC provides insufficient data to determine if other permitted machines are indeed turbo-charged, four-stroke, lean-burn engines. Most of the RBLC-listed machines are slow speed, gas-compression machines or higher speed, non-turbo machines. These differences must be taken into account when comparing the RICE to be used in this Project to other previously-permitted engines. Of

the vendors and engines that are commercially available, Wärtsilä, Jenbacher, and Caterpillar manufacture and sell natural gas-fired reciprocating engines that are appropriate for this Project. However, only Wärtsilä has permitted and *operated* units of this size that are natural-gas fired. Permits for projects that include similar-sized Wärtsilä RICE and the Rubart CAT RICE have been collected by Midwest Energy. The Wärtsilä permitted emission rates are listed in Table 6-3, below. These projects represent the most applicable technology that is similar to this Project.

Table 6-3. Emission Rates for Engines Similar to Project Engines at Full Load (g/hp-hr)

Plant	State	NO_x[A]	CO[A]	VOC[A]	PM_{10} Total[A]
Western 102	Nevada	0.054	0.087	0.087	0.094
Plains End 2	Colorado	0.059	4.000	1.000	0.102
Goodman	Kansas	0.097	0.097	0.097	--
Humboldt	California	0.064	0.086	0.106	0.075
Pearsall	Texas	0.087	0.308	0.308	0.181
Antelope	Texas	0.052	0.096	0.157	0.075
Lea County	New Mexico	0.054	0.104	0.104	0.080
Woodland 3	California	0.053	0.084	0.074	0.052
Hutchinson	Minnesota	0.030	0.746	0.299	0.082
Quail Brush	California	0.048	0.057	0.057	0.050
Greenville Electric	Texas	0.086	0.308	0.308	0.181
Mid-Kansas Rubart Station (Caterpillar)	Kansas	0.07	0.13	0.20	0.044

[A] The values are originally given in different units and here converted to similar units for comparison purposes (rounded to integral values). Also, many of these plants were not subject to PSD review. All units have CO catalysts and SCR, except for Hutchinson which does not have a CO catalyst. Note that emissions levels vary based on engine size, type and location.

6.3 New Source Performance Standards

6.3.1 Subpart JJJJ

Subpart JJJJ—Standards of Performance for Stationary Spark Ignition Internal Combustion Engines became effective March 18, 2008.[12] The RICE engines are subject to the NSPS Subpart JJJJ limits for

[12] "Standards of Performance for Stationary Spark Ignition Internal Combustion Engines," Title 40 Code of Federal Regulations, Part 60, Subpart JJJJ. 2011 ed.

non-emergency spark ignited natural gas engines greater than 500 HP manufactured after July 1, 2010. The applicable emission limitations are listed in Section 5.2.

All BACT emission limitations for the Project are more stringent than the applicable NSPS.

6.4 BACT for Particulate Matter ($PM/PM_{10}/PM_{2.5}$) – RICE

6.4.1 STEP 1. Identify Potential Control Strategies

$PM/PM_{10}/PM_{2.5}$ emissions from natural gas combustion sources consist of several components: a) inert contaminants in natural gas; b) sulfates from fuel sulfur or mercaptans used as odorants, c) dust drawn in from the ambient air, and d) particulate of carbon and hydrocarbons resulting from incomplete combustion. Therefore, units firing fuels with low ash content and high combustion efficiency exhibit correspondingly low particulate emissions.

Because of their extremely low particulate concentrations and resulting large costs per ton of particulate matter removed, post-combustion controls, such as electrostatic precipitators (ESPs) or baghouses, have not been applied to commercial gas-fired engines. In addition, no vendors of the RICE to be used for the Project have identified any similar engines that have particulate control devices. Therefore, the use of ESPs and baghouse filters are both technically infeasible and do not represent an available control technology.

In the absence of add-on controls, the most effective control method demonstrated for gas engines is the use of low ash fuel, such as natural gas, and combustion controls. This was confirmed by a survey of the RBLC database (Table D-1) which disclosed no add-on $PM/PM_{10}/PM_{2.5}$ control technologies for the RICE to be used for this Project. **Because proper combustion control and the firing of fuels with negligible or zero ash content (such as natural gas) are the only control methods, they are BACT for the RICE. Further control technology is not necessary or appropriate.**

6.4.2 STEP 5. $PM/PM_{10}/PM_{2.5}$ BACT Emission Limitation

The use of low ash fuels and good combustion control will limit steady state $PM/PM_{10}/PM_{2.5}$emissions to 2.10 lb/hr, based on the guarantees from RICE engine vendors. **Therefore, the BACT emission limitation for $PM/PM_{10}/PM_{2.5}$ emissions from the RICE is 2.10 lb/hr. This limitation includes both filterable and condensable $PM/PM_{10}/PM_{2.5}$ emissions.**

6.5 BACT for Greenhouse Gases (GHG) – RICE

6.5.1 Introduction

As of January 2, 2011, EPA required the States to begin permitting GHG emissions from major sources in concert with EPA's June 3, 2010, Tailoring Rule.

In March 2011, EPA finalized guidance to assist permit writers and permit applicants in addressing the PSD and Title V permitting requirements for GHGs.[13] This guidance document: (1) describes, in general terms and through examples, the requirements of the PSD and Title V permit regulations; (2) reiterates and emphasizes relevant past EPA guidance on the PSD and Title V review processes for other regulated air pollutants; and (3) provides additional recommendations and suggested methods for meeting the permitting requirements for GHGs to be considered by the States, which are illustrated by examples.

6.5.2 Summary of GHG BACT – RICE

The following is BACT for GHG emissions from the RICE:

1. Use of lean-burn, four-stroke, internal combustion engine generating technology to generate up to 9.34 MW while maximizing the greatest amount of "economic dispatch" power from each unit of fuel combusted
2. Use of natural gas as the only fuel in the RICE

6.5.3 STEP 1 and STEP 2. Identify Potential Control Strategies and Eliminate Technologically Infeasible Options

Steps 1 and 2 of the top-down method are presented together in this analysis. Table D-2 in Appendix D presents the GHG BACT determinations for similar sources. No controls other than energy efficiency are listed in the RBLC. Table 6-4 summarizes the potentially available control technologies for GHG and those that have been eliminated and/or included for consideration as BACT for the project.

[13] See PSD and Title V Permitting Guidance for Greenhouse Gases, U.S. EPA, Office of Air Quality Planning and Standards, March 2011.

Table 6-4. Summary of Potential GHG Control Technologies

GHG Technology	Evaluation Status
Add-on GHG controls	Considered (Not Feasible)
Good combustion design	Considered and Applied
VOLUNTARY CONSIDERATIONS	
Inherently lower-emitting GHG processes, practices, or designs	Considered and Applied
Renewable energy technology (solar or wind)	Considered (Not Feasible)
Alternative generating technologies	Considered (Not Feasible)
Alternative fuels	Considered (Not Feasible)
Energy efficiency	Considered and Applied
Carbon capture and sequestration (CCS)	Considered (Not Feasible)

Unlike other regulated air pollutants, which can be reduced by controlling the combustion process or through addition of add-on controls, there is at this time no corresponding way to reduce the amount of CO_2 generated during combustion, as CO_2 is an inherent product of the chemical reaction between the fuel and oxygen in which it burns. As such, the only way to reduce the amount of CO_2 generated by a fuel-burning power plant is to design and operate it through the use of the most efficient generating technologies for the anticipated load requirement.

Emissions of CO_2 during fossil fueled combustion are strongly correlated to the amount of carbon in the fuel stream. As stated above, a fundamental objective of the Project is to utilize pipeline quality natural gas. Thus, specification of any other fuel would take away a Project objective. That said, in comparison to all other potential fuels, natural gas will achieve the lowest emissions of CO_2 and other GHG. Natural gas combustion produces only about half as much CO_2 as coal and substantially less emissions of both criteria and toxic air pollutants (see EPA's AP-42 for emission rates for coal (Section 1.1) and natural gas (Section 1.4) for a comparison on emissions).[14] Based on the Project design size and objectives and the analysis presented herein, Midwest Energy has determined that reciprocating engine technology (firing with natural gas and with RICE sizes between 4 to 10 MW)) constitutes the most efficient electric generating technology available for the Project.

[14] EPA. Compilation of Air Pollutant Emission Factors, Fifth Edition. (AP-42), Section 3.2 (7/00).

Midwest Energy considered both renewable energy technologies (hydroelectric processes, geothermal power processes, energy from biomass, solar energy, wind energy) and other fossil-fuel energy technologies (conventional boiler and steam turbine, conventional simple-cycle combustion turbine, conventional combined-cycle power plant and advanced combustion turbine designs). In every case, however, these alternative generating technologies fail to meet fundamental Project objectives and/or were not technically feasible at the proposed scale (up to 28 MW) and were therefore eliminated from consideration.

A comparison of emissions rate factors for the various fuels as presented in Table 6-5 shows that natural gas, when used as a fuel in stationary sources, typically produces less CO_2 than other fuels.

Table 6-5. CO_2 Emission Factors for Various Fuels

Fuel	Stationary Source Emission Factors[A]	
	CCAR [pound per gallon (lb/gal)]	CCAR (lb/MMBtu)
Nat Gas	15.12	116.98
LNG	9.63	-
LPG	13.11	139.24
Diesel #2	22.38	161.27
Gasoline	19.55	-
Residual Oil	25.99	173.72
Propane	12.57	139.04
Biodiesel	20.99	-
Wood-Biomass	-	200.49
Kerosene	21.54	159.41
Coal	-	206.04

[A] Source: California Climate Action Registry (CCAR), General Protocol, V3.1, 1/2009, and Power Sector Protocol, V1.1, May 2009.

6.5.3.1 Carbon Capture and Sequestration

Carbon capture, compression, transport, and storage are the terms typically used to describe a series of technologies designed to capture CO_2 emitted from industrial and energy-related sources before it enters the atmosphere, compressing it to supercritical pressures, injecting it deep underground in secure

geological formations, and then ensuring it remains stored there indefinitely.[15] The EPA generally considers CCS to be an "available" add-on pollution control technology for facilities emitting CO_2 in large amounts and industrial facilities with high-purity CO_2 streams.[16] However, EPA also recognizes that CCS may not be an available option in all cases.[17]

The RICE units proposed for Goodman Energy Center are such a source where CCS is not an available technology. Current post-combustion CO_2 capture processes (e.g., amine systems) that may potentially be applicable to the Goodman Energy Center RICE are complicated chemical processes that do not lend themselves to the rapid cycling and ramp rates associated with the Goodman Energy Center facility, which is discussed above. Additionally, they have never been demonstrated on the exhaust of a natural gas fired RICE at any scale. There is not a single reference plant design that describes exactly what such systems might include for such a source. The BACT process does not require a source to consider unavailable technology that would require research and development before it can be designed, tested and deployed.

Unlike the sources where EPA has concluded that CCS is technically available, the exhaust gases from the individual RICE sources at Goodman Energy Center will neither be continuous, of large amounts, nor of a high-purity CO_2 concentration. The full load potential-to-emit (PTE) of each of the three individual RICE sources would be less than 40,864 tons per year, and the CO_2 concentration will be only about 6 percent of the gas stream. Further, even if the individual RICE exhaust gas streams were combined, the CO_2 concentration in such streams would be expected to vary from less than 2 tons/hour (1 RICE) to as much as 14 tons/hour (three RICE), making it difficult to design a system to handle such a wide range.

Nonetheless, Midwest Energy has attempted to identify the type and components of such as system. Midwest Energy has been unable to find a chilled-ammonia capture system that would have applicability at Goodman Energy Center. None of these have been particularly successful and none are currently being operated in the U.S. A CO_2 capture plant for Goodman Energy Center might be more like an amine system such as those that have been used in stripping small amounts of very-low concentration CO_2 in

[15] In the alternative, CO_2 injected into oil-bearing formations at supercritical pressures is useful in tertiary oil recovery operations. CO_2 has been used for these purposes, primarily in the Permian basin of Texas, for over two decades. Studies for similar utilization have been suggested to the U.S. Department of Energy for Kansas oil fields, but decisions for funding this research have been declined in favor of those in central Oklahoma. While EOR has been in use for many years, its purpose has not been the indefinite storage of CO_2 and therefore it is unknown whether current EOR practices result in the actual removal of the CO_2 from the atmosphere or simply transfers the release to a different location. EPA has raised these very issues in their evaluation of EOR as CCS.

[16] EPA. PSD and Title V Permitting Guidance for Greenhouse Gases (EPA-457/B-11-001). March 2011. Page 35.

[17] EPA. PSD and Title V Permitting Guidance for Greenhouse Gases (EPA-457/B-11-001). March 2011. Page 36.

natural gas cryogenic processing plants. These types of systems have never been installed experimentally in any power application. Further these unproven, untried systems would have to be deployed three times at Goodman Energy Center, once for each engine.

An amine plant would require several additional plant systems, including the provision of relatively large amounts of steam. Since simple Otto-cycle engines like the proposed RICE do not produce steam, the cycle would either need to be augmented with auxiliary boilers or combined with substantial heat recovery systems, duct burners, or other regenerative-type heaters. It takes 6 to 12 hours to place a typical amine system in service. In addition, relatively large amounts of cooling water, associated water and wastewater treatment systems, a very large cooling tower system (not unlike that found in a typical steam plant for recirculation of the cooling water), an exhaust gas amine-based CO_2-absorber to strip the CO_2 from the engine exhaust, a chemical CO_2-desorber to regenerate amine for reuse, as well as substantial amounts of piping and mass and heat transfer systems between the various pieces of equipment would at a minimum be required for a CO_2 amine-based capture system.

Furthermore, once the CO_2 is captured, large compressors, including variable speed compressors to account for the variable CO_2 capture rates, must be used to compress CO_2 to supercritical pressure conditions before discharging it into a special high-pressure pipeline for reuse in enhanced oil recovery operations or disposal in deep injection wells for sequestration. But, as previously stated, such a system has not been demonstrated for a source like the proposed Goodman Energy Center and would require considerable research and development with no guarantee that it would be successful.

But for the analysis above, in which Midwest Energy found that CCS is not an available technology, Midwest Energy would have reached the same conclusion that was reached by every other proposed project for which it was evaluated under BACT. No other power production facility – peaking or otherwise (including natural gas combined-cycle), no natural gas compressor station or processing facility, nor any ethanol-producing facility or other major source sector has concluded that CCS is feasible (Step 2) or affordable (Step 4) in any BACT analysis prepared for this purpose.

For all the reasons provided above, CCS is not an available control technology for the Project.

6.5.4 STEP 3. Rank the Technically Feasible Control Technologies

The amount of CO_2 and other GHGs emitted during combustion of fossil fuels is directly correlative to the amount of fuel consumed, which in turn is correlative to the specific types of electrical and auxiliary demands being met by the technology. Thus, the only available means of reducing emissions of CO_2 from the generation of power is to reduce the amount of fuel consumed per unit of energy or auxiliary

service generated. Accordingly, a comparison of various generating technologies' relative efficiency – or operational design, expressed in terms of "heat rate" – provides an appropriate basis for comparing and ranking the control efficiency of such technologies. For the Project, the only fuel to be used in the power generation cycle will be natural gas. In addition, the efficient use of that fuel in a 28-MW plant meeting the Project design objectives needs to be factored into that initial control efficiency ranking. The Project therefore will minimize GHG emissions in its generation of firm, quick, start and stop, dispatchable power by using natural gas and highly efficient RICE technology with a low heat rate and high efficiency across the Project's entire load range. The high efficiency and operational design aspects of the RICE technology includes the following; lean-burn four-stroke combustion configuration employing spark ignition, use of clean fuels, air-to-fuel ratio control, turbocharger technology, open interface cooling system, and a lube oil cooling system designed as an integral part of the engine.

Table 6-6 presents a generalized ranking of the identified generation technologies based on their known ranges of heat rates, as considered in the BACT analysis for this Project.

Table 6-6. Ranking of Potential Generating Technologies by Heat Rate

Technology	Heat Rate Range (HHV basis)[A]	Technologically Feasible for This Project?
Renewable energy sources	n/a	No
Nuclear power	n/a	No
Biomass and other biofuels	n/a	No
CCS	n/a	No
Combined cycle turbines	~7000-8000 Btu/KW-hr	Yes
Reciprocating IC engines	~7500-8600 Btu/KW-hr	Yes
Simple cycle turbines	~8500-10000 Btu/KW-hr	Yes
Boilers	>10000 Btu/KW-hr	No

[A] HHV = Higher heat value; Btu/KW-hr = British thermal units per kilowatt hour

Notably, simple-cycle combustion turbine technology generally has a higher heat rate than reciprocating engine technology. Table 6-7 presents a comparison of various power plant facility heat rates and GHG performance.

Table 6-7. Power Plant Heat Rates and GHG Performance

Facility[A]	Heat Rate (Btu/KW-hr)	Est. Energy Output (GW-hr)[B]	GHG Performance ($MTCO_2$/MW-hr)
Goodman Energy Center (RICE)	8,450	~245	~0.498
Rubart Station (RICE)	7,860	~2,100	~0.484
Quail Brush (RICE)	8,600	~412	~0.464
Lea County (RICE)	8,596	350	0.484
EME Walnut (SC)	8,595	2,000	0.481
Mariposa Energy (SC)	9,450	800	0.541
Fremont Energy (CC)	7,161	3,000	0.381
SMEPA – Moselle (CC)	8,410	2,628	0.379
Gateway GS (CC)	7,123	2,490	0.378
Los Medanos EC (CC)	7,184	3,395	0.381
Delta EC (CC)	7,308	5,014	0.387
CCPP #6 (Boiler)	13,499	21	0.716
CCPP #7 (Boiler)	11,182	177	0.593

[A] RICE = reciprocating internal combustion engine(s); CC = combined cycle combustion turbine; SC = simple cycle combustion turbine; Boiler = gas-fired boiler; GW-hr = gigawatt-hour; $MTCO_2$/MW-hr = metric tons greenhouse gas per megawatt-hour

[B] Dependent upon purchase power agreement and actual facility dispatch. Values represent operations as limited by permit conditions.

At the present time, combined cycle plants utilizing efficient turbines, HRSGs, and clean fuels represent the highest efficiencies with respect to fuel burned versus power produced for large scale, firm base-load, and moderate cycling power resources. However, because a 500-700 MW combined cycle plant does not meet the Project design objectives (quick start and stop, up to 28 MW, low water use for cooling, partial and full load operation) and the site space, fuel and electric interconnection limitations, a combined cycle plant does not meet the Project's objectives.

As previously discussed, fast-start capabilities are currently only available for much larger turbines than would be needed to meet the Project's proposed capacity of up to 28 MW (the 300 MW Siemens SCC6-500F and GE 7FA Response System). Operation of a larger turbine at only a fraction of its capacity would result in significant losses in efficiency, such that the efficiency of the combined-cycle plant would likely be even less than a smaller simple-cycle plant. Further, although once-through steam generators might be used in-lieu-of conventional HSRG technology, the addition of a steam cycle to a plant intended only for economic dispatch generation likely would provide only marginal-to-no-efficiency gains, in comparison to a simple-cycle operation. Thus, for an economic dispatch plant that will undergo multiple daily start-ups, the steam cycle would likely provide no to marginal benefit while not meeting the Project's objectives regarding fast start and cycling capability.

For peaking and economic dispatch power production, simple cycle turbines and RICE typically represent the systems of choice due to the flexibility in overall operations, *i.e.*, fast start-up times, fast power ramp-up times, ability of air pollution control systems to reach optimum performance levels within short periods of time, and ability to vary loads versus demand. This last attribute — the ability to change load swiftly in response to demand — is more characteristic of RICE than simple-cycle turbines. Thus, a compelling advantage to the Project design in using several RICE, as opposed to one or two combustion turbines, is the wide range of dispatch scenarios that the Project can achieve.

Table 6-8 shows the flexibility of the system for a set of some selected operational loads between 3.7 and 28 MW. Note that any number of engines may operate from loads of 40 to 100 percent and from one to three engines may be operating at any time. This provides a significantly wide range of load levels available for the Project.

Table 6-8. Power Supply Sample Scenarios

# Engines	Load vs. MW			# of Engines Operating
	40%	75%	100%	
1 Engine				
MWs	3.7	7.0	9.3	1
2 Engines				
MWs	7.4	14.0	18.7	2
3 Engines				
MWs	11.1	21.0	28.0	3

In comparison, use of simple-cycle gas turbines to meet the Project's demand, such as a single one-frame-size 28-MW combustion turbine or several aeroderivatives (50 MW size) would not afford the same degree of flexibility as the multiple dispatch scenarios noted above for the reciprocating engines by . Moreover, as indicated by Table 6-6, RICE, such as those proposed for this Project, have a lower heat rate than simple-cycle combustion turbines. For these reasons the use of a simple-cycle gas turbine was rejected from further consideration.

As indicated above, a critical component of GHG BACT for the Project includes the use of clean fuels. The Project will use pipeline quality natural gas as the only fuel for power generation. Thus, the use of clean fuels, *i.e.*, fuels which inherently have lower CO_2e emissions, becomes an integral part of the overall GHG BACT applied to the Project.

Beyond consideration of the power generation, another critical component of the GHG BACT analysis is the efficiency of load-consuming elements of the overall plant design. The more efficiently the plant consumes energy, the more energy that can be provided to the grid, resulting in lower emissions of GHGs per MWh of energy provided to the grid. As a consequence, Midwest Energy will also consider the efficiency of other major components through prudent engineering and design protocol for the Project design.

Table 6-9 presents the ranking of the GHG technologies deemed feasible for the Project. While these three technologies are "ranked" in order of their presentation, they are more appropriately considered as a suite of measures that will be implemented to assure that the Project generates and consumes power in the most efficient manner and thereby achieves BACT for GHGs.

Table 6-9. GHG Technology Ranking for the Project

Technology	Ranking	Applied to Project
Reciprocating Engines (employing state-of-the-art design)	1	Yes
Clean Fuels	2	Yes
Energy Efficiency/Operational Design	3	Yes

For the reasons discussed above, the RICE power generation system utilizing efficient engine designs and firing natural gas is the most efficient system in terms of GHG emissions for the Project and therefore is BACT for those emissions.

6.5.5 STEP 4. Evaluate the Most Effective Control Technologies

6.5.5.1 Environmental, Energy, and Economic Feasibility of Control Options

Because the Project will utilize all three of the feasible technologies for reducing GHGs from the generation of power, no detailed analysis is provided to compare the available control technologies' relative environmental, energy and economic impacts.

6.5.6 STEP 5. GHG BACT Emission Limitation

The technology selected as BACT at Step 4 must be translated into an enforceable emissions limitation by KDHE. In its March 2011 Guidance, EPA encouraged permitting authorities to consider establishing

output-based limits or a combination of both output- and input-based limits.[18] EPA noted that, because the environmental concern related to GHG emissions is their cumulative impacts, the focus in establishing limits should be on longer-term averages, e.g., 12-month or 365-day rolling average, rather than short-term averages. For the purposes of this BACT analysis, Midwest Energy has determined that a CO_2e emission limitation of 9,330 lb/hr is BACT for the RICE.

6.6 BACT for Start-Up and Shutdown Emissions – RICE

6.6.1 STEP 1. Identify Potential Control Strategies

Start-up emissions on a lb/hr basis will be higher than during normal steady-state operation because the SCR and oxidation catalysts cannot operate until they reach certain minimum temperatures. Shutdown emissions, though, occur when catalysts are at proper operating temperature.

Midwest Energy is proposing 1,095 start-up/shutdown events per engine per year based on long range dispatch model runs for their electrical system. For the purposes of this permit application, it is assumed that all start-ups are "cold start-ups." This is a very conservative approach as a "cold start-up" has more emissions than a "warm start-up" and Midwest Energy expects to have many "warm start-ups" due to the expected daily fluctuations in electrical demand. A "cold start-up" is one which requires about 30 minutes of fired-operation for the SCR and CO catalysts to reach their respective minimum operating temperatures and has higher emissions than a "warm start-up" because it takes more time to reach the proper operating temperature required for the catalyst systems.

6.6.2 STEP 2. Identify Technically Feasible Control Technologies

Controls that are functional during normal operation are not available to control start-up and shutdown emissions. SCR and CO catalysts require minimum operating temperatures to control emissions (for the catalytic reactions to occur for removal of NO_x, CO, and VOC). This temperature is not reached until approximately 30 minutes after the unit is turned on. In addition, the air-to-fuel ratio is highly variable until approximately 20 percent load for the lean-burn combustion. **Therefore, there are no technically feasible control technologies for start-up and shutdown emissions from the RICE.**

[18] PSD and Title V Permitting Guidance for Greenhouse Gases, U.S. EPA, Office of Air Quality Planning and Standards, March 2011, Page 46.

6.6.3 STEP 3. Rank the Technically Feasible Control Technologies

Because there are no technically feasible control technologies for start-up and shutdown emissions, Step 3 is not applicable.

6.6.4 STEP 4. Evaluate the Most Effective Control Technologies

6.6.4.1 Energy, Environmental, and Economic Feasibility of Control Options

Because there are no technically feasible control technologies for start-up and shutdown emissions; Step 4 is not required.

6.6.5 STEP 5. Start-up and Shutdown BACT Determination

Table 6-10 sets forth the BACT levels for start-up and shutdown emissions. These units start-up quickly and will come into compliance with full load /controlled emission rates quickly compared to other types of technologies. The emission rates presented are based on vendor information regarding start-up and shutdown emissions and are consistent with the emission limitations for units similar to the Project's RICE. The RICE will take up to 30 minutes for the engines to reach the proper temperatures for the SCR and CO catalysts to operate to their full potential.

Table 6-10. Start-up and Shutdown Emissions Per RICE

Pollutant	lb/Start-up per Engine	lb/Shutdown per Engine	Start-up Plus Shutdown Emissions per Engine (TPY)[A]
$PM/PM_{10}/PM_{2.5}$	1.5	0.062	28.3
CO_2e	2,171.7[B]	6.8[B]	39,423

[A] Based on 1,095 start-ups and 1,095 shutdowns per year per engine.
[B] CO_2 lb/start-up and shutdown only.

6.7 BACT for the Dew Point Heater

The dew point heater which heats the gas before it enters the engines will be fired by natural gas. The dew point heater is a 1.0 MMBtu/hr heater that will operate 8,760 hours per year. The RBLC has limited BACT information for dew point heaters (Table D-3). The RBLC tables also show high variability for emission limitations for each pollutant. No add-on controls are listed for any pollutant because dew point heaters are so small.

6.7.1 BACT for Particulate Matter ($PM/PM_{10}/PM_{2.5}$) – Dew Point Heater

6.7.1.1 STEP 1. Identify Potential Control Strategies

The RBLC does not list any control strategies other than good combustion practices and low ash fuel (natural gas). No add-on controls were identified for significant removal of these pollutants from the dew point heater exhaust.

6.7.1.2 STEP 2. Identify Technically Feasible Control Technologies

The only technically feasible control option for $PM/PM_{10}/PM_{2.5}$ is good combustion practices and low ash fuel. **As these control measures are technically feasible, they are BACT for the dew point heater.**

6.7.1.3 STEPS 3-5. $PM/PM_{10}/PM_{2.5}$ BACT Emission Limitation

With good combustion control practices the dew point heater can attain an emission rate of 0.0075 lb/MMBtu. **Therefore, the BACT emission limitation for $PM/PM_{10}/PM_{2.5}$ emissions from the dew point heater is 0.0075 lb/MMBtu.**

6.7.2 BACT for Greenhouse Gases (GHG) – Dew Point Heater

The dew point heater will be fired exclusively on natural gas and is used to pre-heat that fuel to facilitate rapid starts and meet RICE engine manufacturer requirements. The unit is rated at approximately 1.0 MMBtu/hr, and will be fired a total of 8,760 hours per year. GHG emissions from this unit are estimated to be on the order of 518.4 tons CO_2e/yr. These GHG emissions are also *de minimis* when compared to the RICE engine GHG emissions or the Project total GHG emissions. The basic GHG BACT reasoning presented for the RICE applies to the dew point heater as well. GHG BACT for the dew point heater is the following:

- Using clean fuels (exclusive use of natural gas)
- Operating the unit in the most efficient manner possible, i.e. good combustion practices.
- Tuning the unit every two years according to the manufacturer's specifications.
- Recording the annual hours of operation and annual fuel use and reporting GHG emissions annually. GHG emissions from this unit will be included in the facility-wide annual GHG limitation.

6.8 BACT for the Emergency Fire Pump

The emergency fire pump (100 hp) will be limited to 100 hours per year of operation and will utilize ultra-low sulfur diesel, with a sulfur content of no more than 0.0015 weight percent. The emergency fire

pump will comply with the applicable NSPS (Section 5.2). The RBLC has limited information on BACT determinations for small engines such as the emergency fire pump (Table D-4). The RBLC tables also demonstrate high variability for emission rates for each pollutant. No add-on controls were listed in the RBLC for all pollutants, because the fire pump is an emergency unit and is so small.

6.8.1 BACT for Particulate Matter ($PM/PM_{10}/PM_{2.5}$) – Emergency Fire Pump

6.8.1.1 STEP 1. Identify Potential Control Strategies

The RBLC does not identify any control strategy other than good combustion practices and low ash fuel (natural gas) for the emergency fire pump. No add-on controls were identified for significant removal of these pollutants from the RICE exhaust.

6.8.1.2 STEP 2. Identify Technically Feasible Control Technologies

The only technically feasible control option for $PM/PM_{10}/PM_{2.5}$ is good combustion practices and low ash fuel. **As these control measures are technically feasible, they are BACT for the emergency fire pump.**

6.8.1.3 STEPS 3-5. $PM/PM_{10}/PM_{2.5}$BACT Emission Limitation

The fire pump can limit its emissions to a rate of 0.22 g/hp-hr. **Therefore, the BACT emission limitation for the emergency fire pump is 0.22 g/hp-hr with the use of good combustion practices and low ash fuel.**

6.8.2 BACT for Greenhouse Gases (GHG) – Emergency Fire Pump

The emergency fire pump will be used for no more than 100 hours per year. The design of the diesel fire pump is dictated by the manufacturer, not by Midwest Energy. As such, Midwest Energy is limited to commercially available options, which include those engines meeting EPA Tier 3 requirements.

Consistent with the rationale for the BACT determination for GHG emissions from the RICE engines, Midwest Energy believes that BACT for this source involves selection of the most efficient stationary fire pump engine that can meet the Project's needs. Midwest Energy has provided information on the emissions from the specified diesel engine in the agency permitting documents. Midwest Energy has estimated total GHG emissions from the emergency fire pump at 5.9 tons of CO_2e per year. These GHG emissions also are *de minimis* when compared to the RICE GHG emissions or the Project total GHG emissions.

Midwest Energy is unaware of any alternative that is more fuel efficient than a Tier 3-certified engine for these purposes.

Additionally, operation of this source will be limited to reliability-related activities and Midwest Energy will be required to keep records of the operation of this source and its fuel usage. Therefore, no additional conditions are required to enforce this GHG BACT determination.

6.9 BACT for Emergency Generator

The emergency generator (250 kW) will be limited to 100 hours per year of operation and will comply with the applicable NSPS. The RBLC has limited information on BACT determinations for small engines such as the emergency generator (Table D-5). The RBLC tables also show high variability for emission rates for each pollutant. No add-on controls for emissions of any pollutant from the emergency generator were listed because generator is so small and has only emergency use.

6.9.1 BACT for Particulate Matter ($PM/PM_{10}/PM_{2.5}$) – Emergency Generator

6.9.1.1 STEP 1. Identify Potential Control Strategies

The RBLC does not identify any control strategies other than good combustion practices and low ash fuel (natural gas) for the emergency generator. No add-on controls were identified for significant removal of these pollutants from the engine's exhaust.

6.9.1.2 STEP 2. Identify Technically Feasible Control Technologies

The only technically feasible control options for $PM/PM_{10}/PM_{2.5}$ are good combustion practices and use of low ash fuel. **As these control measures are technically feasible, they are BACT for the emergency generator.**

6.9.1.3 STEP 5. $PM/PM_{10}/PM_{2.5}$ BACT Emission Limitation

The emergency generator is capable of limiting emissions to 0.15 g/hp-hr. **Therefore, the BACT emission limitation for $PM/PM_{10}/PM_{2.5}$ from the emergency generator is 0.15 g/hp-hr.**

6.9.2 BACT for Greenhouse Gases (GHG) – Emergency Generator

Consistent with the rationale for the BACT determination for GHG emissions from the RICE, BACT for this source involves selection of the most efficient stationary emergency generator engine that can meet the Project's needs. Midwest Energy has provided information on the emissions from the specified engine in the agency permitting documents. Midwest Energy has estimated total greenhouse gas

emissions from the emergency generator at 15.7 tons of CO_2e per year. These GHG emissions also are *de minimis*, when compared to the RICE GHG emissions or the Project total GHG emissions.

Midwest Energy is unaware of any more fuel-efficient alternative NSPS-certified engine for these purposes. Further, because emissions of GHG are directly correlative to operation of the unit, BACT requires that the engine shall be operated only for readiness testing, during emergencies, and other periods authorized by KDHE.

Because operation of this source will be limited by permit conditions for reliability-related activities and Midwest Energy will be required to keep records of the operation of this source and its fuel usage, no additional conditions are required to enforce this GHG BACT determination.

* * * * *

7.0 AIR DISPERSION MODELING

Because the Project is subject to PSD review, an air dispersion modeling analysis is required for each regulated NSR pollutant that exceeds its PSD significance level, i.e. PM/PM_{10}/$PM_{2.5}$ and CO_2e. Accordingly, an air quality analysis has been performed for PM_{10}/$PM_{2.5}$ using the EPA-approved AMS/EPA Regulatory Model (AERMOD). However, in accordance with guidance, modeling of PM and CO_2e has not been carried out, because there are no modeling thresholds for these pollutants.

A pre-project meeting with KDHE was held to discuss the modeling protocol to be used for this Project. The air dispersion modeling protocol that was submitted to the KDHE in September 2013 is presented in Appendix E.

A summary of the model, modeling techniques, and modeling results for the Project are discussed in the following sections.

7.1 Air Dispersion Model

Air dispersion modeling has been performed using the latest version of the AERMOD model (Version 12345). AERMOD is an EPA-approved, steady-state, Gaussian air dispersion model that is designed to estimate downwind ground-level concentrations from single or multiple sources using detailed meteorological data. AERMOD is a model currently approved for industrial sources and PSD permits. KDHE requested that Midwest Energy demonstrate regulatory compliance through its use.

Major features of AERMOD are as follows:

- Plume rise, in stable conditions, is calculated using Briggs equations that consider wind and temperature gradients at stack top and half the distance to plume rise; in unstable conditions, plume rise is superimposed on the displacements by random convective velocities, accounting for updrafts and downdrafts due to momentum and buoyancy as a function of downwind distance for stack emissions
- Plume dispersion receives Gaussian treatment in horizontal and vertical directions for stable conditions and non-Gaussian probability density function in vertical direction only for unstable conditions
- AERMOD creates profiles of wind, temperature, and turbulence, using all available measurement levels and accounts for meteorological data throughout the plume depth
- Surface characteristics, such as Bowen ratio, albedo, and surface roughness length, may be specified to better simulate the modeling domain

- Planetary Boundary Layers (PBL) such as friction velocity, Monin-Obukhov length, convective velocity scale, mechanical and convective height, and sensible heat flux may be specified
- AERMOD uses a convective (based upon hourly accumulation of sensible heat flux) and a mechanical mixed layer height
- AERMOD's terrain pre-processor (AERMAP) provides information for the advanced critical dividing streamline height algorithms and uses National Elevation Dataset (NED) to obtain elevations
- AERMOD uses vertical and horizontal turbulence-based plume growth (from measurements and/or PBL theory) that varies with height and uses continuous growth functions
- AERMOD uses convective updrafts and downdrafts in a probability density function to predict plume interaction with the mixing lid in convective conditions while using a mechanically mixed layer near the ground
- Plume reflection above the lid is considered
- AERMOD models impacts that occur within the cavity regions of building downwash via the use of the plume rise model enhancements (PRIME) algorithm, and then uses the standard AERMOD algorithms for areas without downwash

Details of the modeling algorithms contained in the AERMOD model are set forth in the User's Guide for AERMOD. The regulatory default option was selected for this analysis because it meets the EPA guideline requirements and KDHE modeling guidance requirements.

The following default model options, which are discussed in the air dispersion modeling protocol, were used:

- Gradual Plume Rise
- Stack-tip Downwash
- Buoyancy-induced Dispersion
- Calms and Missing Data Processing Routine
- Calculate Wind Profiles
- Calculate Vertical Potential Temperature Gradient
- Rural Dispersion

Further specifications, detailed in the air dispersion modeling protocol submitted to the KDHE in September 2013, are set forth in Appendix E of this application.

7.2 Model Parameters

Modeling runs were conducted at full load and partial loads to confirm that operation of the Project will not result in exceedances of any NAAQS or PSD Class II increment consumption allowance. The expected hourly emission rates and modeling parameters for a single engine are shown in Table 7-1. These emission rates represent projected worst-case ambient conditions under various operating loads including start-up emissions. The annual emissions are based on 8,760 hours per year.

Table 7-1. Engine Emissions and Modeling Parameters

Parameter	100% Load	75% Load	40% Load	Start-up
$PM_{10}/PM_{2.5}$	2.10 lb/hr	1.88 lb/hr	1.79 lb/hr	2.58 lb/hr (2.15 lb/hr)[A]
Stack Temperature	729.9 °F[B]	810.9 °F	837.9 °F	837.9 °F
Exit Velocity	82.58 ft/s[B]	65.89 ft/s	42.43 ft/s	42.43 ft/s
Stack Height	85 ft	85 ft	85 ft	85 ft
Stack Diameter	4 ft	4 ft	4 ft	4 ft

[A] Maximum annual emissions including 1,095 start-ups averaged over 8,760 hours per year
[B] °F = degrees Fahrenheit, ft/s = feet per second

The expected hourly emission rates and modeling parameters for the dew point heater, emergency fire pump, and emergency generator are shown in Table 7-2. Annual emissions for the emergency fire pump and emergency generator are based on 100 hours per year of operation.

Table 7-2. Dew Point Heater, Emergency Fire Pump and Emergency Generator Emissions and Modeling Parameters

Parameter	Dew Point Heater	Emergency Fire Pump	Emergency Generator
PM/ PM_{10}	0.007 lb/hr	0.05 lb/hr (5.63×10^{-4} lb/hr[A])	0.11 lb/hr (1.26×10^{-3} lb/hr[A])
Stack Temperature	500 °F	986 °F	986 °F
Exit Velocity	44.33 ft/s	145.33 ft/s	145.33 ft/s
Stack Height	15 feet	15 feet	15 feet
Stack Diameter	0.83 feet	0.42 feet	0.42 feet

[A] Equivalent lb/hr emissions averaged over 8,760 hours per year, based on operation of 100 hours.

The fence line coordinates for the Goodman Energy Center are listed in Table 7-3 below.

Table 7-3. Goodman Energy Center UTM Fence Line Coordinates

Easting[A] (meters)	Northing[A] (meters)
468,485.6	4,309,283
468,707	4,309,283
468,707	4,309,068
468,679	4,309,068
468,679	4,309,053
468,750	4,309,053
468,802	4,308,944
468,479.8	4,308,944
468,485.6	4,309,283

[A] NAD 83

The proposed expansion project will be located at Goodman Energy Center, with a midpoint as follows (NAD 83, Zone 14):

Easting: 468,611.5 meters Northing: 4,309,109.0 meters

7.2.1 Good Engineering Practice

Sources included in a PSD permit application are subject to Good Engineering Practice (GEP) stack height requirements outlined in 40 CFR Part 51, Sections 51.100 and 51.118. As defined by the regulations, GEP height is calculated as the greater of 65 meters (measured from the ground level elevation at the base of the stack) or the height resulting from the following formula:

$$GEP = H + 1.5L$$

Where

H = the height of nearby structure(s) measured from the ground level elevation at the base of the stack; and

L = the lesser dimension (height or projected width) of nearby structure(s) (i.e., building height or the greatest crosswind distance of the building - also known as maximum projected width).

To meet stack height requirements, each point source was evaluated in terms of its proximity to nearby structures. The purpose of this evaluation was to determine if the discharge from the stack will become caught in the turbulent wake of a building or other structure, resulting in downwash of the plume.

Downwash of the plume can result in elevated ground-level concentrations. The KDHE provides guidance for determining whether building downwash will occur in K.A.R 28-19-18. The downwash analysis was performed in accordance with the methods prescribed in K.A.R 28-19-18c.

Calculations for determining the direction-specific downwash parameters were performed using the most current version of EPA's Building Profile Input Program – Plume Rise Model Enhancements (Version 04274), otherwise referred to as the BPIP-PRIME downwash algorithm. The BPIP-PRIME algorithm provides direction-specific building dimensions to evaluate downwash conditions. Goodman Energy Center is located in a rural area, and the only buildings that could potentially affect emissions from the Project are the on-site structures.

According to the BPIP-PRIME model results, it was determined that the GEP stack height for the RICE will not exceed 65 meters. A stack height of 85 feet (25.91 meters) was used in the AERMOD modeling.

7.3 Modeling Methodology and Parameters

7.3.1 Receptor Grid

The overall purpose of the modeling analysis is to ensure that operation of the proposed facility will not result in, or contribute to, concentrations above the NAAQS or PSD Class II Increments. The modeling runs were conducted using the AERMOD model in simple and complex terrain mode within a 10- by 10-kilometer Cartesian grid to determine the significant impact area for each pollutant. The grid incorporates the following spacing between receptors: 50-meter out to one kilometer, 100-meter out to two kilometers, and 250-meter out to ten kilometers (Figure 7-1, Appendix F). Receptors also were placed along the fence line boundary at a spacing of 50 meters. The significant impact area did not exceed ten kilometers for any other pollutant or averaging period, so the receptor grid was not extended otherwise.

The appropriate U.S. Geological Survey (USGS) NED were used to obtain the necessary receptor elevations. North American Datum of 1983 (NAD 83) was used to develop the Universal Transverse Mercator (UTM) coordinates for this project.

AERMOD has a terrain preprocessor (AERMAP) which uses gridded terrain data for the modeling domain to calculate not only a XYZ coordinate, but a representative terrain-influence height associated with each receptor location selected. This terrain-influenced height is called the height scale and is separate for each individual receptor. AERMAP (Version 11103) was utilized to populate the model with receptor elevations.

7.3.2 Meteorological Data

Meteorological data obtained from KDHE was used for the modeling analysis. Integrated Surface Hourly meteorological data from Russell Municipal Airport (WBAN # 93997) and upper air data from the Dodge City Regional Airport (WBAN #13985) were used for years 2008 to 2012. A profile base elevation value of 568.1 meters was used. One-minute meteorological data is included in the meteorological files. The dominant wind direction is shown in Figure 7-2 in Appendix F.

7.3.3 Land Use Parameters

Based on the Auer scheme, the existing land use for a three-kilometer area surrounding the proposed project site is more than 50 percent rural, and the population density is less than 750 people per square kilometer for the same area. Therefore, rural dispersion coefficients were used in the AERMOD model.

7.3.4 Significant Impact Area Determination

The AERMOD model used the worst-case impact scenario for the RICE and auxiliary equipment. If any modeled pollutant was predicted to cause impacts only below the significance levels for each averaging period, no further modeling for that pollutant and averaging period was required in relation to either the NAAQS or PSD Class II increment consumption allowances. However, if the model predicted impacts at or above the modeling significance level for any pollutant, a cumulative analysis including all point sources within the radius of impact (ROI) was carried out for that pollutant and averaging period.

7.3.5 Background Air Quality

As stated previously, if any pollutant exceeds its respective PSD significance level, a refined analysis (cumulative analysis) will be performed for that pollutant and averaging period. This analysis will be used to determine compliance with the PSD Class II Increments and the NAAQS. The NAAQS are set up to protect the air quality for all sensitive populations and attainment is determined by the comparison to the NAAQS thresholds. As such, there is an existing concentration of each criteria pollutant that is present in ambient air that must be included in an analysis to account for items such as mobile source emissions that are not accounted for in the model. Monitored ambient concentrations will be added to the modeled ground level impacts to account for these sources.

The EPA and state agencies collect ambient air quality pollutant concentrations from monitors that are placed throughout each state. The data that is collected by the monitors is available on the EPA website (http://www.epa.gov/airdata/). For the Project, background values for each pollutant were identified from the representative monitors in the area. Each pollutant has been reviewed for applicable monitors and the

background values were identified based on this analysis. The monitored background levels will be added to the modeled NAAQS impacts, as previously discussed.

In accordance with EPA documentation[19], there are three criteria that should be considered when selecting a representative existing ambient air monitor to represent ambient air concentrations for a project. These three criteria include the following:

- Monitor Location
- Data Quality
- Currentness of Data

Further discussion on these three criteria is presented below.

7.3.5.1 $PM_{2.5}$ Monitor Location

The selected monitor to be used for the $PM_{2.5}$ background is the Cedar Bluff site (AIRS No 20-195-0001) located at the Cedar Bluff Reservoir in Trego County, Kansas and is shown in Figure 7-3. This is the closest operating $PM_{2.5}$ monitor and is 25 miles southwest from the Project in a generally downwind direction.

7.3.5.2 Land Use and Surrounding Sources

Land use was considered in the selection of representative monitors for the proposed Project. Monitored concentrations should represent the land use within the immediate vicinity of the site, as much as is practicable. The land use surrounding the Project and the selected $PM_{2.5}$ monitor are shown in Figures 7-4 and 7-5, Appendix F. As shown in the figures, the primary land classification surrounding the Cedar Bluff monitor are grasslands and open water. Cultivated cropland and grassland/herbaceous land surround the Goodman Energy Center, four miles northwest of Hays, Kansas. As demonstrated in the figures the monitor and Project site are both located in predominantly rural areas and are not classified as urban.

Another criteria used to show that the monitors are representative of the Project site is to show that the air emission sources near the monitors are similar to emission sources near the proposed Project site. Figures 7-6 and 7-7, Appendix F, display the pollutant sources near the Project as well as the pollutant sources

[19] U.S EPA. Ambient Air Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/4-87-007. May 1987.

near the selected $PM_{2.5}$ monitor. The selected monitor and the Project have very few sources of emissions surrounding the sites. The facility data shown in the figures were obtained from the actual emissions reported in the National Emissions Inventory Database (2011 data),[20] as this data was readily available and is based on actual emissions. Therefore, the selection of the proposed $PM_{2.5}$ monitor is representative of the Project.

7.3.5.3 Data Quality

Data quality was a factor in the selection of the proposed monitor. The selected monitor was reviewed for completeness and it was determined that all data years for $PM_{2.5}$ are more than 80 percent complete. Therefore, the monitor meets the requirement for 80 percent completeness per EPA documentation.[21]

7.3.5.4 Background Values

The background concentrations used in the NAAQS analysis are presented in Table 7-4. This data represents the most recent data available (2008 to 2012) at the most representative monitor near the facility.

Table 7-4. Background Level

Pollutant	Averaging Period	Background Concentration (micrograms per cubic meter ($\mu g/m^3$))	Air Quality System Monitor ID
$PM_{2.5}$	Annual	7	20-195-0001 (Cedar Bluff)
	24-hour	17	20-195-0001 (Cedar Bluff)

7.3.6 NAAQS and PSD Class II Increment Analysis

For the NAAQS and PSD Class II increment consumption allowances, all major stationary sources that emit pollutants subject to this analysis and located within the ROI of the Goodman Energy Center were addressed. KDHE provided the inventory of sources located in the ROI (Appendix G).

[20] The National Emissions Inventory: www.epa.gov/ttn/chief/net/2011inventory.html
[21] U.S. EPA. Ambient Air Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/4-87-007. May 1987.

7.3.7 Ambient Monitoring

The modeling analysis for emission sources at Goodman Energy Center addresses the pre-construction monitoring provision of the PSD regulations. The regulations specify significant monitoring levels for each PSD pollutant that triggers the requirement to perform one year of pre-construction ambient air monitoring. For any impacts predicted to be below the monitoring *de minimis* levels, Midwest Energy requests pre-construction ambient air monitoring not be required. For any predicted concentrations reaching or exceeding the monitoring *de minimis* levels, Midwest Energy will satisfy all pre-construction monitoring requirements stated in the EPA "Ambient Monitoring Guidelines for Prevention of Significant Deterioration" (EPA). The NAAQS, modeling/monitoring significance levels, and PSD Class II Increment thresholds for the modeled pollutants are shown in Table 7-5.[22]

Table 7-5. NAAQS, Significance, and Monitoring Levels and PSD Class II Increment

Pollutant	Averaging Period	NAAQS	Modeling Significance Level ($\mu g/m^3$)	Monitoring Significance Level ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
PM_{10}	annual	NA	1	NA	17
	24-hour	150	5	10	30
$PM_{2.5}$	annual	12	0.3[A]	NA	4
	24-hour	35	1.2[A]	4[B]	9

[A] United States Court of Appeals for the District of Columbia Circuit on January 22, 2013, vacated and remanded portions of the U.S. EPA rule establishing significant impact levels and vacated the rule establishing the significant monitoring concentration for $PM_{2.5}$ however, the $PM_{2.5}$ significant impact levels are still valid in Kansas per guidance from KDHE.
[B] The $PM_{2.5}$ 24-hour Significant Monitoring Concentration vacated by the United States Court of Appeals for the District of Columbia Circuit on January 22, 2013, is not considered valid in Kansas. However, representative local monitoring data is available for use.

7.4 $PM_{2.5}/PM_{10}$ Significance Model Results

The model predicts that no exceedances of the 24-hour and annual PM_{10} significant level will occur and that no further modeling is required. The model also predicts that impacts greater than the 24-hour and annual $PM_{2.5}$ significance levels will occur, and refined modeling is required.

Additionally, the 24-hour modeling impacts for PM_{10} are lower than the ambient air monitoring *de minimis* levels while the $PM_{2.5}$ impacts are greater than the ambient air monitoring *de minimis* levels.

[22] The pollutants that are allowed one NAAQS exceedance per year and one PSD Class II increment consumption allowance exceedance per year are: 1-hour and 8-hour CO, 3-hour SO_2, and 24-hour PM_{10}.

However, Midwest Energy requests that existing monitoring data (provided by KDHE) from the Cedar Bluff monitor (monitor number 20-195-0001) be used for existing ambient levels of $PM_{2.5}$. The maximum modeled concentrations for $PM_{2.5}$ and PM_{10} are shown in Table 7-6.

Table 7-6. Maximum Modeled Concentrations

Pollutant	Averaging Period	UTM Coordinates		Year	Predicted Concentration ($\mu g/m^3$)	Modeling Significance Level ($\mu g/m^3$)	Monitoring Significance ($\mu g/m^3$)
		Easting[A] (meters)	Northing[A] (meters)				
PM_{10}	Annual	468,550	4,309,550	2010	0.36[C]	1	--
	24-hour	468,550	4,309,500	2010	4.54[B]	5	10
$PM_{2.5}$	Annual	468,550	4,309,550	2010	0.36[C]	0.3	--
	24-hour	468,550	4,309,500	2010	4.54[B]	1.2	4

[A]NAD 83
[B] The maximum impact - 40% load operating scenario
[C] The maximum impact - long term-starts operating scenario

The modeling results demonstrate that the impacts of the 24-hour and annual PM_{10} emissions from the Project will not result in a significant impact at any location. Therefore, no further modeling is required.

The modeling analyses indicate that the Project's emissions will exceed the PSD modeling significance thresholds for annual and 24-hour $PM_{2.5}$ averaging periods. Therefore, a refined modeling analysis was conducted to demonstrate compliance with the NAAQS and PSD Class II increment consumption allowances.

Model input and output files for each pollutant are provided in Appendix G on CD-ROM. In addition, area plots with concentration contour plots of each pollutant are shown in Figures 7-8 to 7-11 in Appendix F.

7.5 $PM_{2.5}/PM_{10}$ PSD Class II Increment Modeling Results

A refined modeling analysis was conducted for the $PM_{2.5}$ annual and 24-hour averaging periods to demonstrate compliance with the PSD Class II increment consumption allowances.

An inventory of sources within the expected ROI was used in the refined analysis. This inventory of sources and modeled parameters are provided in Appendix G.

The modeling results show that the Project will not contribute to any PSD Class II increment exceedance. There were no modeled PSD increment consumption allowance exceedances for the $PM_{2.5}$ annual and 24-

hour averaging periods Therefore, there are sufficient available $PM_{2.5}$ PSD Class II increment allowances to construct and operate the Project.

The results of the PSD Class II Increment analysis are shown below in Table 7-7. The second highest high was used for the 24-hour averaging period.

Table 7-7. $PM_{2.5}$ and PM_{10} Increment Modeling Results

Pollutant	Averaging Period	UTM Coordinates		Year	Predicted Concentration ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
		Easting[A] (meters)	Northing[A] (meters)			
$PM_{2.5}$	Annual	468,707	4,309,239.7	2011	2.1[C]	4
	24-hour	468,500	4,309,550	2010	3.9[B,D]	9

[A] NAD 83
[B] Value is 2nd highest high
[C] The maximum impact – long-term 40% load operating scenario
[D] The maximum impact - starts operating scenario

The model input and output files are provided on CD-ROM in Appendix G. In addition, area plots with concentration contour plots are provided in Figures 7-12 to 7-13 in Appendix F.

7.6 $PM_{2.5}/PM_{10}$ NAAQS Modeling Results

A refined modeling analysis was conducted for the annual and 24-hour $PM_{2.5}$ averaging periods to demonstrate compliance with the NAAQS.

There were no modeled NAAQS exceedances for the $PM_{2.5}$ annual and 24-hour averaging periods. Therefore, the Project will not cause or significantly contribute to a violation of any NAAQS. The NAAQS analysis modeling results are provided in Table 7-8.

Table 7-8. NAAQS Modeling Results

Pollutant and Averaging Period		UTM Coordinates		Year	Predicted Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
		Easting[A] (meters)	Northing[A] (meters)					
$PM_{2.5}$	Annual	468,679	4,309,068.1	5 Years	1.5	7.0	8.5[B, C]	12
	24-hour	468,679	4,309,052.8	5 Years	17.2	17.0	34.2[B, C]	35

[A] NAD 83
[B] Value is highest first high
[C] The maximum impact – 40% load operating scenario

The model input and output files (including the additional analysis) are provided on CD-ROM in Appendix G. In addition area plots with concentration contour plots are provided in Figures 7-14 to 7-15 in Appendix F.

7.7 PSD Class I Analysis

FLM guidance requires that a proposed major source, in the course of a PSD application, perform an assessment of air quality impacts at Class I areas if these areas are located within approximately 300 kilometers of the proposed facility. There are no Class I areas that are within 300 kilometers of the proposed Project; therefore, no assessment of air quality impacts at Class I areas were performed for this Project.

7.8 Analysis of Secondary $PM_{2.5}$ Formation

In addition to direct emissions of $PM_{2.5}$, other pollutants, chiefly NO_x and SO_2, can lead to formation of $PM_{2.5}$ further downwind. The photochemical reactions that transform these pollutants into nitrates and sulfates, which become the major species of $PM_{2.5}$, take place over hours or days. Potentials to emit after controls for the Project are 36.2 tpy NO_x and 0.7 tpy SO_2.

NOx and SO_2 were both not modeled since the project's emissions are below the PSD threshold for NO_x and SO_2. Since the NO_2 and SO_2 standards are extremely restrictive, being below the PSD significance levels and PSD major project thresholds would likely prevent the pollutants from impacting secondary formation significantly enough to result in a violation of the $PM_{2.5}$ standards.

However, it is possible that some transformation into nitrates and sulfates from this source may occur and be transported downwind. No peer-reviewed regulatory model presently exists to examine the impacts of an individual source of SO_2 or NO_x. All photochemical models are regional scale and a source of this size would not show any measurable impact. Therefore, other available information from emissions inventories, meteorological analyses, and other modeling projects can be used to estimate the impact from this source.

Because of the well-established relationship between NO_x and SO_2, regional transport, and the formation of $PM_{2.5}$, to assist states to meet the $PM_{2.5}$ NAAQS, U.S. EPA finalized the Cross State Air Pollution Rule (CSAPR). Although CSAPR was vacated in August 2012, the rule included extensive modeling to support the emissions reductions necessary in each state to achieve the $PM_{2.5}$ NAAQS in the eastern U.S. that is still relevant to this analysis. The source category responsible for these reductions is EGU.

U.S. EPA used a regional model, CAMx, and the Air Quality Assessment Tool (AQAT) to determine levels of reduction from EGUs necessary to achieve the NAAQS at every site. The documentation includes extensive tables showing impacts at all $PM_{2.5}$ monitoring sites in the eastern U.S. and emission reduction levels necessary to achieve those results.

To examine the possible impact of the Project, the modeling U.S. EPA used to establish the final 2014 budgets in CSAPR is used for this analysis. The CSAPR website is located at http://www.epa.gov/airtransport/.

Tables showing projected base case 2014 $PM_{2.5}$ concentrations at existing monitoring sites versus control strategy $PM_{2.5}$ concentrations (2014 "remedy" case) are located in AQModeling.pdf,[23] Appendix B, pages B-43 for annual design values. Because the project is located in almost the middle of the state of Kansas, it is logical to look at Kansas's total projected reductions in SO_2 and NO_x as well as the expected resulting reductions in ground level annual $PM_{2.5}$ values for monitors close to the site. Information regarding SO_2 emission reductions necessary to achieve the future year modeled design values can be found in the "Final June Revisions Rule Significant Contribution Assessment TSD,"[24] Table 1, page 7. This table shows the base case annual SO_2 emissions for Kansas by 2014 were projected to be 69,819 tons, and 2014 remedy control scenario annual SO_2 emissions to be 45,740 tons. The difference between these is 24,079 tons. All surrounding states make similar significant reductions. The NO_x values are found in the Excel workbook "TransportRuleFinal_EmissionsSummaries" in docket EPA-HQ-OAR-2009-0491-4206 on www.regulations.gov.[25] See Table 7-9 for a table of these values.

Table 7-9: EPA's Cross-State Air Pollution Rule Emission Summary for Kansas

State	Pollutant	2014 Base (tons)	2014 Remedy (tons)	EGU Reduction (tons)
Kansas	SO_2	69,819	45,740	24,079
Kansas	NO_x	248,692	240,384	8,308
			Total	32,387

[23] http://www.epa.gov/airtransport/pdfs/AQModeling.pdf, accessed on October 23, 2013.
[24] http://www.epa.gov/airtransport/pdfs/FinalJuneRevisionsRuleSignificantContributionssessmentTSD.pdf, dated June 2012 and accessed on October 23, 2013.
[25] http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2009-0491-4206, accessed on June 28, 2013.

One can take the difference in ground-level modeled $PM_{2.5}$ annual values to see the reduction in $PM_{2.5}$ as a result of the SO_2 and NO_x reductions. As an example, the maximum annual modeled concentrations for each of the three $PM_{2.5}$ monitors in Sedgwick County are presented in Table 7-10 for both the 2014 base case and the 2014 control scenario. The theoretical reductions observed for the annual $PM_{2.5}$ ground level impacts between the base case and the remedy case are 0.68 μg/m^3, 0.69 μg/m^3, and 0.68 μg/m^3. In order for this modeled annual concentration reduction to occur, Kansas EGUs' modeled annual SO_2 and NOx emissions by 2014 were reduced by 32,387 tons of SO_2 and NO_x.

Table 7-10: EPA's Cross-State Air Pollution Rule Modeling Results

Monitor ID	State	County	2014 Base Ground Level Concentration (μg/m^3)	2014 Remedy Ground Level Concentration (μg/m^3)	2014 Base-Remedy (μg/m^3)
201730008	Kansas	Sedgwick	9.57	8.89	0.68
201730009	Kansas	Sedgwick	9.64	8.95	0.69
201730010	Kansas	Sedgwick	9.67	8.99	0.68
				Average	**0.68**

This particular monitoring site is not necessarily impacted by every EGU in Kansas, but in the surrounding states, hundreds of thousands of tons of annual SO_2 emission reductions have also occurred by 2014, many of which would impact this site. Therefore, to estimate the impact of the Project on modeled concentrations, the ratio of the Project SO_2 and NO_x emissions / 32,387 tons of SO_2 and NO_x can be compared to the ratio of the Project $PM_{2.5}$ impact / 0.68 μg/m^3 of $PM_{2.5}$. See Table 7-11.

The calculation to estimate secondary formation is as follows:

$$\frac{(tons\ SO2\ \&NOx\ from\ Project)}{(tons\ SO2\ \&NOx\ from\ State)} = \frac{(Project's\ impact\ \mu g/m^3)}{(State\ reduction\ target\ \mu g/m^3)}$$

Project $PM_{2.5}$ impact = (37.3 tons / 32,387 tons) x (0.68 μg/m^3 of $PM_{2.5}$) = 0.00079 μg/m^3 of $PM_{2.5}$

Table 7-11. EPA's Cross-State Air Pollution Rule Modeling Results & Estimated Project Impact

Monitor ID	County	2014 Base	2014 Remedy	2014 Base-Remedy (µg/m^3)	Source Impact (µg/m^3)	Source Impact (%)
201730008	Sedgwick	9.57	8.89	0.68	0.00078	0.08%
201730009	Sedgwick	9.64	8.95	0.69	0.00080	0.08%
201730010	Sedgwick	9.67	8.99	0.68	0.00078	0.08%

Since these concentrations are well below measurable values, there would be no change in projected modeled $PM_{2.5}$ concentrations at this site.

To further the conclusion that the increase in ground level impacts from secondary $PM_{2.5}$ (NO_x and SO_2 primarily) will not increase the $PM_{2.5}$ much at all, and will not create a NAAQS exceedance, one can look at the maximum $PM_{2.5}$ concentrations from the Project and perform a qualitative analysis of the increase in emissions. Secondary $PM_{2.5}$ impacts associated with precursor emissions are expected to be low near the emission release points where modeled concentrations associated with primary $PM_{2.5}$ emissions are highest, because there has not been enough time for the secondary chemical reactions to occur, while secondary $PM_{2.5}$ is normally found much farther out from the facility fence line due to the time it takes to form as a secondary pollutant and the particle characteristics. Since the high first high was used to determined compliance with the NAAQS rather than the high 8th high, the difference between these two impacts can be considered the impacts from secondary $PM_{2.5}$ formation.

Given emission levels from the facility and local emission inventories, no further analysis of secondary formation is necessary for this Project.

7.9 Conclusion

The modeling results provided in Table 7-6 demonstrate that no exceedances of the 24-hour and annual PM_{10} significant impact levels are predicted; consequently, no further modeling is required. A refined modeling analysis was conducted to demonstrate compliance with the 24-hour and annual $PM_{2.5}$ PSD Class II increment consumption allowances and NAAQS. The Project will not cause or contribute to any modeled Class II PSD Increment or NAAQS exceedances.

The operation of the Project will not cause or contribute to a significant degradation of ambient air quality. After examining the result of the model, it has been determined that the modeling requirements for $PM_{2.5}$ and PM_{10} have been fulfilled, and no further modeling is required.

* * * * *

8.0 ADDITIONAL IMPACT ANALYSIS

The additional impacts analysis requirement under K.A.R 28-19-350 includes construction impact analysis, soils and vegetation impacts, visibility impairment, and growth analysis for the Project.

8.1 Construction Impacts

Construction at Goodman Energy Center has the potential for short-term adverse effects on air quality in the immediate area around the site. Diesel fumes from construction vehicles and dust from site preparation and construction vehicle operation can affect local air quality during certain meteorological conditions. However, these instances are limited in time and area of effect.

The Ellis County area is in attainment or is unclassified for all criteria pollutants. Low sulfur fuel will be used for construction vehicles that use diesel fuel. Operation of these vehicles is not expected to significantly affect ambient air quality. Emissions will be minimized as much as practicable by reducing engine idling, operating vehicles as little as possible and employing vehicles with highly efficient engines. Fugitive dust will be minimized through the application of water to on-site roads used by construction equipment.

8.2 Vegetation Impacts

The following sections briefly describe the potential effects of $PM/PM_{10}/PM_{2.5}$ and CO_2e produced by the Project on the nearby vegetation. The potential effects of these air emissions on vegetation within the immediate vicinity of Goodman Energy Center were compared to scientific research examining the effects of pollution on vegetation. Damage to vegetation often results from acute exposure to pollution, but may also occur after prolonged or chronic exposures. Acute exposures are typically manifested by internal physical damage to leaf tissues, while chronic exposures are more associated with the inhibition of physiological processes such as photosynthesis, carbon allocation, and stomatal functioning.[26]

Ellis County is within the Rolling Plains and Breaks region of the Central Great Plains ecoregion.[27] The general land use in the vicinity of Goodman Energy Center is rangeland for grazing cattle. Agricultural production in Ellis County consist mostly of livestock (cattle), wheat (*Triticum aestivum*), and grain sorghum (*Sorghum bicolor*); however, small amounts of alfalfa (*Medicago sativa*), barley (*Hordeum*

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[26] Hallgren, 1984; Hill and Littlefield, 1969; Mansfield and Freer-Smith, 1984.

[27] Chapman, Omernik, Freeouf, Huggins, McCauley, Freeman, Steinauer, Angelo, and Schlepp. "Ecoregions of Nebraska and Kansas." U.S. Geological Survey, Reston, Virginia 2001.

vulgare), corn (*Zea mays*), rye (*Secale cereale*), oats (*Avena sativa*), and native hay are also produced.[28] Trees are generally uncommon but may sporadically occur along stream corridors, drainage ways, and the banks of impoundments. These species include Siberian elm (*Ulmus pumila*), eastern red cedar (*Juniperus virginiana*), cottonwood (*Populus deltoides*), and black willow (*Salix nigra*).[29] Remnants of native shortgrass prairie may occur near Goodman Energy Center. Common grasses in this community include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), switchgrass (*Panicum virgatum*), Indiangrass (*Sorghastrum nutans*),western wheatgrass (*Pascopyrum smithii*), and eastern gamagrass (*Tripsacum dactyloides*).[30]

8.2.1 Particulate Matter

Particulates are typically detrimental to vegetation within the immediate vicinity of the source. The phytotoxic response of a given plant species to particulate deposition on leaves varies depending on the concentration and composition of the airborne particulates. The most obvious effect of particle deposition on vegetation is a physical smothering of the leaf surface. This will reduce light transmission to the plant and cause a decrease in photosynthesis. However, experimental evidence indicates that the deposition of most common particulate materials on leaf surfaces result in less direct harm to plants than phytotoxic gases, which are absorbed and assimilated more rapidly and cause greater direct injury to plant tissues.[31] The maximum PM_{10} and $PM_{2.5}$ 24-hour modeled values for the Project are 4.54 $\mu g/m^3$. This level is relatively low, so it is highly unlikely that PM_{10} and $PM_{2.5}$ emissions will impact vegetation adjacent to Goodman Energy Center.

8.2.2 Carbon Dioxide

CO_2 is not known to injure plants. Long-term exposure to elevated CO_2 levels has shown to improve the efficiency of nutrient, water, and photosynthesis in some plants.[32] However, the improved efficiencies that result from elevated CO_2 levels may not necessarily result in greater yields for crop plants.[33] No adverse impacts to vegetation at or near Goodman Energy Center are expected from CO_2 stack emissions from the Project.

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[28] Glover, Zavesky, Swafford, and Markley 1975
[29] Stephens, 1969.
[30] Natural Resources Conservation Service Web Soil Survey 2013.
[31] Guderian 1986.
[32] Drake, Gonzalez-Meler, and Long 1997; Leakey, Ainsworth, Bernacchi, Rogers, Long, and Ort 2009
[33] Morgan, Bollero, Nelson, Dohleman, and Long 2005

8.3 Soil Impacts

Seven soil types are mapped at, or in the immediate vicinity of (within one mile), the Project site.[34] They include:

- Roxbury silt loam, frequently flooded
- Armo loam, 3 to 7 percent slopes and 7 to 15 percent slopes
- Brownell gravelly loam, 2 to 10 percent slopes
- Harney silt loam, 1 to 3 percent slopes and 3 to 7 percent slopes
- Mento silt loam, 1 to 3 percent slopes
- Mento soils, 3 to 7 percent slopes
- Wakeen silt loam, 3 to 7 percent slopes

Experimental evidence shows that elevated CO_2 levels indirectly affected soils by reduced soil respiration.[35] The elevated CO_2, levels resulted in increased soil respiration sensitivity to soil temperature changes and decreased soil respiration sensitivity to soil moisture changes. Elevated CO_2 levels also increased the abundance of bacteria and fungi in the soil, however, the experimental evidence indicated that elevated CO_2 levels had no significant effect on microscopic arthropod and nematode abundance within soils. The expected CO_2 stack emissions from the Project are relatively low and are not expected to have a measureable effect on the soils at or in the vicinity of the Goodman Energy Center.

Particulate deposition on soils can have an effect over time, depending on the concentration and composition of the airborne particulates. However, the maximum PM_{10} and $PM_{2.5}$ 24-hour modeled values for the Project are relatively low, so it is highly unlikely that PM_{10} and $PM_{2.5}$ emissions will result in significant impacts to soils adjacent to Goodman Energy Center.

8.4 Industrial, Residential, and Commercial Growth Impacts

The Project is expected to increase employment in the area. The building phase will last approximately one year. Construction employment is expected to peak at approximately 100 skilled construction jobs. Projected employment, reflecting full-time jobs directly tied to the operation of Goodman Energy Center is estimated to be eight people at the facility and will not increase as a result of this Project. This will result in moderate amounts of secondary employment being created by the economic activity of the

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[34] Glover, Zavesky, Swafford, and Markley 1975; Natural Resources Conservation Service Web Soil Survey 2013.
[35] Tingey, Johnson, Lee, Wise, Waschmann, Olszyk, Watrud, and Donegan. 2006.

facility. In the immediate vicinity of the facility and as a result of the Project at Goodman Energy Center, increased vehicular traffic is expected. However, these activities are not expected to significantly impact air quality.

The construction work at Goodman Energy Center may temporarily increase the number of people residing in the area. Many of the new employees are expected to already live in the area. However, some new employees are expected to move into the area, with only a slight increase in the residential growth in the area. This small increase in new residences is not expected to have a measurable impact on air quality.

The need for the project is based on meeting projected electrical demand from existing customers. While adding additional electricity to the grid in this area may increase the potential for industrial growth, the specifics concerning how increasing available electrical power in this area may affect future industrial growth are unknown.

8.5 Visibility and Deposition Analysis

8.5.1 Class I Area Analysis

FLM guidance requires that a proposed major source, in the course of a PSD application, perform an assessment of air quality impacts at Class I areas if these areas are located within approximately 300 kilometers of the proposed facility. There are no Class I areas that are within 300 kilometers of the proposed Project; therefore, no assessment of air quality impacts at Class I areas will be performed for this Project.

8.5.2 Class II Area Analysis

The proposed Project will be located in a Class II area. With respect to visibility conditions around the facility, there are no known Class II screening visibility criteria that have been recommended at this time. A visibility analysis was performed on the three sites listed below:

- Cedar Bluff State Park, the nearest state park located approximately 39.5 kilometers southwest of the proposed Project location
- Wilson State Park, a state park located approximately 75 kilometers east of the proposed Project location
- Hays Regional Airport, located approximately 12.5 kilometers southeast of the proposed facility.

The visibility analysis was performed in accordance with the guidelines set forth in EPA-450/4-88-015, Workbook for Plume Visual Impact Screening and Analysis. Within the document, the model VISCREEN is recommended for plume visibility analysis. Several refinement levels of VISCREEN are described. The first-level VISCREEN analysis uses worst-case meteorological conditions (F-class stability, one meter per second wind speed). This level of screening results in the most conservative (worst-case) visibility results. If the plume visibility against the sky and terrain is below a level perceivable to the human eye, the visibility modeling is complete. If the plume is above this level, a second-level VISCREEN analysis that uses actual meteorological data and refined particle characteristics can be performed. The second-level model will result in a more realistic visibility analysis. If this plume visibility still does not meet sky and terrain contrast levels, a third-level model may be performed which can add more statistical analysis.

First-Level VISCREEN

The first-level VISCREEN model was performed for the Project at Goodman Energy Center. The inputs into the model included particulate matter, NO_x, primary NO_2, soot, and primary sulfate (SO_4). The maximum annual particulate and NO_x emission rates of 28.4 and 36.7 tons per year respectively, were used in the VISCREEN analysis.

According to the workbook, primary NO_2, soot, and primary SO_4 can be assumed to be zero except for very specific sources. Since the facility is not one of the specified sources, the emissions for the last three pollutants (primary NO_2, soot, and primary SO_4) are assumed to be zero. The next set of inputs into the first-level VISCREEN model considers the distance between the source, observer and area, and the background visual range. Background visibility was determined from the VISCREEN manual to be 40 kilometers.

The last inputs into the model are particle sizes, background ozone, plume-source-observer angle, stability, and wind speed. All of these inputs are automatically set if the default option is chosen. For the first-level analysis, the workbook tells the analyst to choose the default option, which sets the following particle sizes:

- background fine = 0.3 micrometer (μm) diameter, 1.5 gram per cubic centimeter (g/cm^3) density
- background course = 6 μm diameter, 2.5 g/cm^3 density
- plume particulate = 2 μm diameter, 2.5 g/cm^3 density
- plume soot = 0.1 μm diameter, 2 g/cm^3 density
- plume primary sulfate = 0.5 μm diameter, 1.5 g/cm^3

The background ozone is 0.04 ppm, the plume-source-observer angle is 11.25 degrees, the worst case atmospheric stability is an F stability class, and the worst case wind speed is one m/s.

The VISCREEN model output compares the calculated Delta E and contrast from the plume to present default comparison values. Delta E is the color difference parameter used to characterize the perceptibility of the plume on a color difference between the plume and a viewing background such as the sky, a cloud, or a terrain feature. Color differences are due to differences in three dimensions: brightness (L*), color hue (a*), and saturation (b*). Delta E is calculated for several lines of sight. A green contrast analysis is also performed for various lines of sight using a green wavelength and contrasting the plume with the terrain and sky backgrounds. The critical E value is 2.0 and the green contrast value is 0.05 for Class I areas; however, there are currently no Class II screening visibility criteria for the state of Kansas.

The first-level VISCREEN analyses show that the emissions from the proposed Project do not exceed the Class I sky and terrain perceptibility threshold at Cedar Bluff State Park and Wilson State Park. However, the analysis exceeds the Class I sky and terrain perceptibility threshold at the Hays Regional Airport; therefore, a second-level VISCREEN analysis was performed for the Hays Regional Airport. The results of the first-level VISCREEN model are provided in Appendix G.

Second-Level VISCREEN

While the first-level screening uses the worst-case meteorological conditions, second-level screening uses observed meteorological data to provide a better, site-specific analysis of the visual impacts. The site-specific average wind speed and stability class were determined for the second-level analysis. Under most circumstances, the one percent worst atmospheric dispersion day (i.e., the fourth worst day of any year) is typically the worst dispersion conditions for a plume.

The workbook provides guidance on how to determine the one percent worst day. A second-level screening analysis allows the following parameters to be adjusted to representative data if available:

- Particle size distribution
- Background visual range
- Complex terrain
- One percent worst meteorological days

Since measurements of particle size are not known, and the background visual range has not been measured in the Hays area, these parameters were left at their workbook suggested values. The terrain

surrounding the proposed Project is assumed to be flat; therefore, no adjustments were made for terrain. The workbook suggests ranking the plume dispersion by the product of the vertical and horizontal diffusion coefficients ($\sigma_z\sigma_y$) and the wind speed (U). If the plume takes more than 12 hours to reach a receptor, the dispersion condition was not factored into the one percent worst day.

Wind rose plots for Dodge City Regional Airport (WBAN #13985) for years 1987 to 1991 and Russell Municipal Airport (WBAN # 93997) for years 2008 to 2012 were generated to confirm that the data was similar. The wind rose plots are shown in Appendix G and were determined to be comparable. Therefore, to determine the wind speed and stability class, integrated surface hourly meteorological data from the Dodge City Regional Airport was used for years 1987 to 1991 for this analysis. The analysis of the five-years of meteorological data used to determine the one percent worst day is provided in Appendix G for the Hays Regional Airport.

The visual results of the second-level screening analysis show that the emissions from the Project pass the Class I sky and terrain perceptibility thresholds at the Hays Regional Airport located 12.5 kilometers away, using the stability class and wind speed determined from the joint frequency distribution analysis. The results of the second-level VISCREEN are included in Appendix G.

8.6 Conclusion

As shown by the results presented in this section of the application and additional supplemental information, the Project will not have a significant adverse impact on the air quality, soils, vegetation, or visibility in the surrounding area. The need for the Project is based on responding to projected electrical demand and the Project is not expected to be growth-inducing by itself.

* * * * *

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APPENDIX A
KDHE CONSTRUCTION PERMIT APPLICATION FORMS

Kansas Department of Health and Environment
Bureau of Air and Radiation
Phone (785) 296-1570 Fax (785) 291-3953

Notification of Construction or Modification

(K.A.R. 28-19-300 Construction permits and approvals; applicability)

Check one: ☒Applying for a Permit under K.A.R. 28-19-300(a) ☐Applying for an Approval under K.A.R. 28-19-300(b)*

1) Source ID Number: 0510057

2) Mailing Information:
   Company Name: Midwest Energy, Inc.
   Address: 1330 Canterbury Rd. P.O. Box 898
   City, State, Zip: Hays, Kansas 67601

3) Source Location:
   Street Address: Southeast ¼ Section 07, Township 13, Range 18W - 4 miles northwest of Hays, Kansas
   City, County, State, Zip: Hays, Ellis County, Kansas
   Section, Township, Range: Southeast ¼ Section 07, Township 13, Range 18W
   Latitude & Longitude Coordinates: North 38° 55'49.53" West 99° 21'43.41"

4) NAICSC/SIC Code (Primary): 221112, Fossil Fuel Power Generation/ SIC 4911

5) Primary Product Produced at the Source: Electricity

6) Would this modification require a change in the current operating permit for your facility? ☒ Yes ☐No

   If no, please explain: _____

7) Is a permit fee being submitted? ☒ Yes ☐ No

   If yes, please include the facility's federal employee identification number (FEIN #) 48-0163970

8) Person to Contact at the Site: Michael Prindle Phone: (785) 625-1713

   Title: Plant Manager

9) Person to Contact Concerning Permit: William N. Dowling Phone: (785) 625-1432
   Title: Vice President of Engineering & Energy Supply
   Email: bdowling@mwenergy.com Fax: (785) 625-1487

Please read before signing:

Reporting forms provided may not adequately describe some processes. Modify the forms if necessary. Include a written description of the activity being proposed, a description of where the air emissions are generated and exhausted and how they are controlled. A simple diagram showing the proposed activity addressed in this notification which produces air pollutants at the facility (process flow diagrams, plot plan, etc.) with emission points labeled must be submitted with reporting forms. Information that, if made public, would divulge methods or processes entitled to protection as trade secrets may be held confidential. See the reverse side of this page for the procedure to request information be held confidential. A copy of the Kansas Air Quality Statutes and Regulations will be provided upon request.

Name and Title: William N. Dowling, Vice President of Engineering & Energy Supply

Address: 1713 230th Avenue
Hays, Kansas 67601

Signature: William N Dowling Date: 11/22/2013 Phone: (785)625-1432

* If you do not know whether to apply for a permit or an approval, follow approval application procedures.

March 15, 2006
Revision 6

Procedures For Requesting Information To Be Held Confidential

An applicant may request that information submitted to the Department, other than emission data or information in any air quality permit or approval, be treated as confidential if the information would divulge methods or processes entitled to protection as trade secrets.

A request to designate information within the Department's air quality files as confidential must include:

(1) An uncensored copy of the document clearly marked as confidential;

(2) A copy of the document, or copies if more than one is required to be filed with the Department, with the confidential information masked;

(3) Specification of the type of information to be held as confidential (i.e., product formulations, process rates);

(4) Specification and justification of the reason the information is qualified by statute to be treated as confidential (competitive advantage, company developed secret formulation, trade secret); and

(5) A reference at each place in the document or documents where information is masked referring to the specification of the type of information masked and the specification and justification the information is qualified by statute to be treated as confidential.

ONLY THE CONFIDENTIAL INFORMATION ON ANY DOCUMENT MAY BE MASKED. ALL INFORMATION ON ANY DOCUMENT WHICH IS NOT CONFIDENTIAL MUST REMAIN LEGIBLE.

The information will be treated as confidential until the secretary has acted upon the request and the owner or operator has had the opportunity to exhaust any available remedies if the secretary determines the information is not confidential.

Complete this and all reporting forms and submit to:

Kansas Department of Health and Environment
Bureau of Air and Radiation
1000 SW Jackson, Suite 310
Topeka, KS 66612-1366
(785) 296-1570

Sources located in Wyandotte County should obtain forms from, and submit forms to:

Unified Government of Wyandotte County
Department of Air Quality
619 Ann Avenue
Kansas City, KS 66101
(913) 573-6700

CALCULATING THE CONSTRUCTION PERMIT APPLICATION FEE

[These requirements are found at K.A.R. 28-19-304(b).]

Calculate the construction permit application fee as follows:

Estimated capital cost of the proposed activity for which the application is made, including the total cost of equipment and services to be capitalized.	**Line 1** $	30,000,000.00
Multiply by .05% (.0005)	x	.0005
Total	**Line 2** $	15,000.00
If Line 2 is less than $100, enter $100 on Line 3. If Line 2 is greater than $4,000, enter $4,000 on Line 3.		
Otherwise, copy Line 2 to Line 3.		
Construction permit application fee.	**Line 3** $	5,500* Minimum fee is $100 *Includes $1500 PSD fee

William N. Dowling
(Print)

Certifier of Capital Cost — William N. Dowling (Signature) — 11/22/2013 Date

K.A.R. 28-19-350 is a complex regulation pertaining to prevention of significant deterioration (PSD). An additional fee of $1,500 will be required if a PSD review is necessary. If you believe the proposed activity in this Notification of Construction or Modification will be subject to the requirements of K.A.R. 28-19-350, contact the Department for further evaluation.

For purposes of construction permit or approval applications, the following are not considered modifications:

1. Routine maintenance or parts replacement.
2. An increase or decrease in operating hours or production rates if:
   a. production rate increases do not exceed the originally approved design capacity of the stationary source or emissions unit; and
   b. the increased potential-to-emit resulting from the change in operating hours or production rates do not exceed any emission or operating limitations imposed as a permit condition.

Midwest Energy, Inc.
HAYS, KANSAS 67601

Bank of America 80-1789 / 815 MO

320936

ACCOUNTS PAYABLE CHECK

Date	Check Amount
11/22/13	5,500.00

VOID AFTER 180 DAYS

PAY: Five Thousand Five Hundred Dollars 00 cents

Pay To: KANSAS DEPT OF HEALTH &
ENVIRONMENT
1000 SW JACKSON ST, STE 310
TOPEKA KS 66612-1366

Vendor: 11454 Name: KANSAS DEPT OF HEALTH & Check Number: 320936

Inv Date	Invoice Number	Invoice Description	Invoice Amt	Discount Amt	Net Amt
11/21/13	11/21/13	PERMIT FEE	5,500.00	0.00	5,500.00

RECEIVED
NOV 26 2013
BUREAU OF AIR

Total: 5,500.00

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation

STATIONARY INTERNAL COMBUSTION ENGINES

1) Source ID Number : 0510057 Emission Point Number: 3 Engines (ENG_10 to ENG_12)

2) Company/Source Name: Midwest Energy, Inc. – Goodman Energy Center

3) Type of Engine: Turbine_____ ; Reciprocating X ; Other_____

4) Engine Manufacturer : Wartsila
   Model No.: 20V34SG
   Date of Manufacture: TBD
   Serial No.: TBD

5) Use of Engine: Electric power generation X ; Compressor ___; Pump___; Other - describe_____

6) Maximum Brake horsepower at continuous rating: _____ BHP
   Normal operating engine speed: _____ RPM
   Rated Brake Horsepower at normal operating RPM: _____ BHP
   or
   Maximum Generator Nameplate Capacity: 9,341 kW
   Maximum design heat input rate: 78.93 MMBTU/hr

7) Operating schedule: 8,760 hrs per year

8) Date of Installation: TBD
   Date of Last modification: TBD

TURBINES

9) Type of Gas Turbine: Simple cycle _____ ; Co-generation _____ ; Regenerative _____ ; Combined cycle_____

10) Fuel data for all the different types of fuel to be used :
    a) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon
    b) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon
    c) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon

11) Heat recovery unit or steam generator unit installed? Yes _____; No _____
Supplementary fired ? Yes _____; No ___ ___ If yes, type of fuel used: _____
Capacity of the burner _____ gals per hr
Fuel heating value _____ BTU per cu ft or gal
Sulfur content of fuel by weight _____ %; Please attach complete supplementary fuel oil/distillate analysis.

12) Emission control system(s) used: Water injection_____ ; Steam injection_____ ;
Selective Catalytic reduction with Water injection _____ ; Selective catalytic reduction _____ ;
Describe Selective Catalytic emission reduction control installed:_____
Manufacturer's name:_____ Model No.: _____

POLLUTANT	MANUFACTURER'S REDUCTION EFFICIENCY %

13) Did construction, modification, or reconstruction commence after October 3, 1977? Yes___X___; No _____
If yes, this facility may be subject to NSPS, 40 CFR 60, Subpart GG.

RECIPROCATING ENGINES

14) Engine design details:
Number of cylinders _20___
Aspiration: Normal _____ ; Turbo charged ___X___
Ignition: Spark__X__; Compression _____
Design class 2 cycle lean burn _____ ; 4 cycle lean burn __X__; 4 cycle rich burn _____

15) 2 or 4 cycle lean burn with combustion modification, increased air/fuel ratio and intercooling ?
Yes _____; No__X___
If yes, attach the guaranteed performance of the conversion supplier **or** the actual monitored performance, and the engine operating conditions for the guarantee of performance.

16) Type of integral emission control: Selective Catalytic Reduction___X___;
Non Selective Catalytic Reduction _____ ; Combustion Reduction _____(Describe)_Oxidation Catalyst_X_; None

17) Fuel(s): Gasoline _____ ; Diesel _____ ; Natural Gas___X___; Dual fuel _____

(cont.)

18) Fuel Heating Value: Gasoline _____ BTU per gal; Diesel _____ BTU per gal;
Natural Gas __1,020__ BTU per cu ft ; Dual fuel mix _ ____ % diesel _____ % natural gas
Sulfur content of diesel by weight _____ %

APPLICABLE TO ALL STATIONARY INTERNAL COMBUSTION ENGINES

19) Enclose available engine manufacturer's emissions data.

20) For emission control equipment, use the appropriate CONTROL EQUIPMENT form and duplicate as needed. Be sure to indicate the emission unit that the control equipment is affecting.

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation

CATALYTIC CONVERTER
(Stationary Internal Combustion Engine)

1) Source ID Number: 0510057

2) Company/Source Name: Midwest Energy, Inc. – Goodman Energy Center

3) Catalytic Converter identification number or designation: SCR_10 to SCR_12

4) What emission unit(s) or source(s) of emissions is(are) vented to the catalytic converter?
   a. ENG_10 to ENG_12 are vented to SCR_10 to SCR_12, respectively
   b. _____

5) Description of pollutant(s) collected: NOx

6) Engine:
   Manufacturer: Wartsila Model No. 20V34SG Serial No. TBD
   Maximum HP: 12,526

7) Catalytic Converter:
   Manufacturer: TBD Model No. TBD Serial No. TBD
   Operating temperature range of catalyst: 635 °F to 842 °F
   Temperature at which over temperature protection switch activates: 842 °F
   Describe any situations that could render the catalyst ineffective:
   - Operation at low engine loads (<40% of maximum engine output) a risk to destroy catalyst elements.
   - It is an unavoidable fact that the catalytic material loses activity over time. The actual ageing process is difficult to predict but after a certain point the activity of the catalyst has reached its design point and needs to be replaced.

   List the parameters and ranges that will define the proper operation of the catalytic converter:
   (e.g.: Output: __ to __ HP; O_2 Sensor: __ to __ volts; Exhaust temperature into the converter: __ to __°F)
   The Selective Catalytic Reduction (SCR) systems will work at operating loads of 40% to 100% load, except periods of unit start-up (30-min) and shutdown. The exhaust temperature must reach 635 degrees Fahrenheit for the catalyst temperature to reach the minimum temperature for maximum reduction of NOx.

8) Air/Fuel Ratio Controller:
   Manufacturer: _____ Model No. _____ Serial No. _____

CATALYTIC CONVERTER
(cont.)

9) Emissions Reduced	Emission Factor (after converter) in grams/hp-hr
NOx	0.052
CO	
Nonmethane Hydrocarbons	
Other:	

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation

CATALYTIC CONVERTER
(Stationary Internal Combustion Engine)

1) Source ID Number: 0510057

2) Company/Source Name: Midwest Energy, Inc. – Goodman Energy Center

3) Catalytic Converter identification number or designation: OxCat_10 to OxCat_12

6) What emission unit(s) or source(s) of emissions is(are) vented to the catalytic converter?
   a. ENG_10 to ENG_12 are vented to OXCAT_10 to OXCAT_12, respectively
   b. _____
   c. _____

7) Description of pollutant(s) collected: CO and VOC emissions

6) Engine:
   Manufacturer: Wartsila Model No. 20V34SG Serial No. TBD
   Maximum HP: 12,526

7) Catalytic Converter:
   Manufacturer: TBD Model No. TBD Serial No. TBD
   Operating temperature range of catalyst: 635 °F to 842 °F
   Temperature at which over temperature protection switch activates: 842 °F
   Describe any situations that could render the catalyst ineffective:

- Operation at low engine loads (<40% of maximum engine output) a risk to destroy catalyst elements.
- It is an unavoidable fact that the catalytic material loses activity over time. The actual ageing process is difficult to predict but after a certain point the activity of the catalyst has reached its design point and needs to be replaced.

List the parameters and ranges that will define the proper operation of the catalytic converter:
(e.g.: Output: __ to __ HP; O_2 Sensor: __ to __ volts; Exhaust temperature into the converter: __ to __°F)
The oxidation catalyst systems will work at operating loads of 40% to 100% load, except periods of unit start-up (30-min) and shutdown. The exhaust temperature must reach 635 degrees Fahrenheit for the catalyst temperature to reach the minimum temperature for maximum reduction of CO and VOC.

8) Air/Fuel Ratio Controller:
   Manufacturer: _____ Model No. _____ Serial No. _____

CATALYTIC CONVERTER
(cont.)

9) Emissions Reduced	Emission Factor (after converter) in grams/hp-hr
NOx	_____
CO	0.097
Nonmethane Hydrocarbons	0.097
Other: _____	_____

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation

STATIONARY INTERNAL COMBUSTION ENGINES

1) Source ID Number : 0510057 Emission Point Number: FP_1

2) Company/Source Name: : Midwest Energy, Inc. – Goodman Energy Center

3) Type of Engine: Turbine_____ ; Reciprocating X ; Other_____

4) Engine Manufacturer : TBD
   Model No.: TBD
   Date of Manufacture: TBD
   Serial No.: TBD

5) Use of Engine: Electric power generation ___ ; Compressor ___ ; Pump X ; Other - describe_____

6) Maximum Brake horsepower at continuous rating: 100 BHP
   Normal operating engine speed: _____ RPM
   Rated Brake Horsepower at normal operating RPM: 100 BHP
   or
   Maximum Generator Nameplate Capacity: _____kW
   Maximum design heat input rate: _____ BTU/hr

7) Operating schedule: 100 hrs per year

8) Date of Installation: TBD
   Date of Last modification: TBD

TURBINES

9) Type of Gas Turbine: Simple cycle _____ ; Co-generation _____ ; Regenerative _____ ; Combined cycle_____

10) Fuel data for all the different types of fuel to be used :
    a) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon
    b) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon
    c) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon

STATIONARY INTERNAL COMBUSTION ENGINES
(cont.)

11) Heat recovery unit or steam generator unit installed? Yes _____; No _____
Supplementary fired ? Yes _____; No _____ If yes, type of fuel used: _____
Capacity of the burner _____ gals per hr
Fuel heating value _____ BTU per cu ft or gal
Sulfur content of fuel by weight _____ %; Please attach complete supplementary fuel oil/distillate analysis.

12) Emission control system(s) used: Water injection_____ ; Steam injection_____ ;
Selective Catalytic reduction with Water injection _____ ; Selective catalytic reduction _____ ;
Describe Selective Catalytic emission reduction control installed:_____
Manufacturer's name:_____ Model No.: _____

POLLUTANT	MANUFACTURER'S REDUCTION EFFICIENCY %

13) Did construction, modification, or reconstruction commence after October 3, 1977? Yes_____; No _____
If yes, this facility may be subject to NSPS, 40 CFR 60, Subpart GG.

RECIPROCATING ENGINES

14) Engine design details: TBD
Number of cylinders _____
Aspiration: Normal _____; Turbo charged _____
Ignition: Spark _____; Compression ____
Design class 2 cycle lean burn _____ ; 4 cycle lean burn _____ ; 4 cycle rich burn _____

15) 2 or 4 cycle lean burn with combustion modification, increased air/fuel ratio and intercooling ?
Yes _____; No_____
If yes, attach the guaranteed performance of the conversion supplier **or** the actual monitored performance, and the engine operating conditions for the guarantee of performance.

16) Type of integral emission control: Selective Catalytic Reduction _____ ;
Non Selective Catalytic Reduction _____ ; Combustion Reduction _____(Describe)_____; None __X__

17) Fuel(s): Gasoline _____ ; Diesel __X__ ; Natural Gas _____ ; Dual fuel _____

STATIONARY INTERNAL COMBUSTION ENGINES
(cont.)

18) Fuel Heating Value: Gasoline _____ BTU per gal; Diesel _140,000_____ BTU per gal;
Natural Gas _____ BTU per cu ft ; Dual fuel mix _ _____ % diesel _____ % natural gas
Sulfur content of diesel by weight __0.0015____ %

APPLICABLE TO ALL STATIONARY INTERNAL COMBUSTION ENGINES

19) Enclose available engine manufacturer's emissions data.

20) For emission control equipment, use the appropriate CONTROL EQUIPMENT form and duplicate as needed. Be sure to indicate the emission unit that the control equipment is affecting.

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation

STATIONARY INTERNAL COMBUSTION ENGINES

1) Source ID Number : 0510057 Emission Point Number: GEN_1

2) Company/Source Name: Midwest Energy, Inc. – Goodman Energy Center

3) Type of Engine: Turbine_____ ; Reciprocating ___X___ ; Other_____

4) Engine Manufacturer : TBD
   Model No.: TBD
   Date of Manufacture: TBD
   Serial No.: TBD

5) Use of Engine: Electric power generation _X_ ; Compressor ___ ; Pump___ ; Other - describe_____

6) Maximum Brake horsepower at continuous rating: _____ BHP
   Normal operating engine speed: _____ RPM
   Rated Brake Horsepower at normal operating RPM: _____ BHP
   or
   Maximum Generator Nameplate Capacity: 250 kW
   Maximum design heat input rate: 2,680,000 BTU/hr

7) Operating schedule: 100 hrs per year

8) Date of Installation: TBD
   Date of Last modification: TBD

TURBINES

9) Type of Gas Turbine: Simple cycle _____ ; Co-generation _____ ; Regenerative _____ ; Combined cycle_____

10) Fuel data for all the different types of fuel to be used :
    a) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon
    b) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon
    c) Fuel Type _____ ; Sulfur content % by weight _____ ;
       Lower heating value _____ BTU per cu ft; **or** _____ BTU per lb; **or** _____ BTU per gallon

STATIONARY INTERNAL COMBUSTION ENGINES
(cont.)

11) Heat recovery unit or steam generator unit installed? Yes _____; No _____
Supplementary fired ? Yes _____; No _____ If yes, type of fuel used: _____
Capacity of the burner _____ gals per hr
Fuel heating value _____ BTU per cu ft or gal
Sulfur content of fuel by weight _____ %; Please attach complete supplementary fuel oil/distillate analysis.

12) Emission control system(s) used: Water injection_____ ; Steam injection_____ ;
Selective Catalytic reduction with Water injection _____ ; Selective catalytic reduction _____ ;
Describe Selective Catalytic emission reduction control installed:_____
Manufacturer's name:_____ Model No.: _____

POLLUTANT	MANUFACTURER'S REDUCTION EFFICIENCY %

13) Did construction, modification, or reconstruction commence after October 3, 1977? Yes_____; No _____
If yes, this facility may be subject to NSPS, 40 CFR 60, Subpart GG.

RECIPROCATING ENGINES

14) Engine design details: TBD
Number of cylinders ___
Aspiration: Normal _____ ; Turbo charged ___
Ignition: Spark _____ ; Compression _____
Design class 2 cycle lean burn _____ ; 4 cycle lean burn _____ ; 4 cycle rich burn _____

15) 2 or 4 cycle lean burn with combustion modification, increased air/fuel ratio and intercooling ?
Yes _____; No_____
If yes, attach the guaranteed performance of the conversion supplier **or** the actual monitored performance, and the engine operating conditions for the guarantee of performance.

16) Type of integral emission control: Selective Catalytic Reduction _____ ;
Non Selective Catalytic Reduction _____ ; Combustion Reduction _____(Describe)_____; None __X___

17) Fuel(s): Gasoline _____ ; Diesel ___X___ ; Natural Gas ____ ; Dual fuel _____

STATIONARY INTERNAL COMBUSTION ENGINES
(cont.)

18) Fuel Heating Value: Gasoline _____ BTU per gal; Diesel ____140,000____ BTU per gal;
Natural Gas _____ BTU per cu ft ; Dual fuel mix _ ____ % diesel _____ % natural gas
Sulfur content of diesel by weight _0.0015_____ %

APPLICABLE TO ALL STATIONARY INTERNAL COMBUSTION ENGINES

19) Enclose available engine manufacturer's emissions data.

20) For emission control equipment, use the appropriate CONTROL EQUIPMENT form and duplicate as needed. Be sure to indicate the emission unit that the control equipment is affecting.

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation

INDIRECT HEATING UNIT (BOILER)

1) Source ID Number: 0510057

2) Company/Source Name: Midwest Energy, Inc. – Goodman Energy Center

3) Emission Unit Identification: HTR_1

4) Manufacturer: TBD Model No.: TBD

5) Maximum design heat-input rate: 1,000,000 BTU/hr
   Heat-release Rate: 1,020 BTU/hr/cu. ft. of furnace volume
   Annual load factor: 100%
   Heater design: Cyclone _____; Underfeed stoker _____; Spreader stoker _____;
   Pulverized (dry-tangential or normal/wet)_____; Other (specify) _____
   Normal Operating Schedule: 8760 hours/year
   Date of latest modification: N/A

6) Primary Fuel Type:
   Natural Gas X Oil ____ Coal ____ Other (specify) _____
   Secondary Fuel Type: N/A
   Natural Gas ____ Oil ____ Coal ____ Other (specify) _____

7) If other fuel is waste liquid:
   What is the source of the waste? _____
   Will the waste be pretreated to remove any of the contaminants? Yes ____; No ____ If yes, describe method of pretreatment:

   _____

   _____

   If waste liquid is used in combination with fuel oil:
   Specify the volume percent of waste liquid:_____ %
   Specify the anticipated annual operating hours during which the fuel and waste combination will be used: _____ hrs.
   Fill in the data below for the fuel oil.

Include the chemical and physical characteristics of the waste liquid. Also, include any source emissions test data that is available from testing similar facilities that have disposed of this type liquid waste.

INDIRECT HEATING UNIT (BOILER)
(cont.)

8) Fuel Specific Data: (if other is specified, give appropriate data)
   Natural Gas:
   Heating value: 1,020 BTU/cu. ft.
   (If fuel gas is used, also specify %Sulfur: _____)
   Coal:
   Fuel Parameters: %Sulfur: _____ % Ash: _____
   Heating value: _____ BTU/lb.
   Fuel Oil:
   Fuel Parameters: %Sulfur: ____ Grade: _____
   Heating value: _____ BTU/gal.
   Density: _____ lb./gal.

9) Air Emissions Control Technology: NOx X SOx ____ CO ____ Particulate ____
   If yes, breakdown of Control Technology: Dry Low NOx Burners

10) Soot blowing (if applicable): frequency: _____ duration: _____

11) Has boiler been derated because of:
   Fuel change _____ Equip. limitations _____ Regulatory compliance _____

12) Emissions discharge to atmosphere 15 ft. above grade through stack or duct 0.83 ft. diameter at 500 F temperature, with 1,439 cfm flow rate and 44.33 fps velocity.

13) For emission control equipment, use the appropriate CONTROL EQUIPMENT form and duplicate as needed. Be sure to indicate the emission unit that the control equipment is affecting

14) Did construction, modification, or reconstruction commence after August 17, 1971 and on or before September 18, 1978 and does the indirect heating unit have a maximum design heat-input capacity to combust more than 250 million BTU/hour? Yes ____; No X
   If yes, this plant may be subject to NSPS, 40 CFR Part 60, Subpart D.

15) Did construction, modification, or reconstruction commence after September 18, 1978 and does the indirect heating unit have a maximum design heat-input capacity to combust more than 250 million BTU/hour? Yes _____; No X
   If yes, this plant may be subject to NSPS, 40 CFR Part 60, Subpart Da.

16) Did construction, modification, or reconstruction commence after June 19, 1984 and does the indirect heating unit have a maximum design heat-input capacity to combust more than 100 million BTU/hour but less than 250 million BTU/hour? Yes___; No X
   If yes, this plant may be subject to NSPS, 40 CFR Part 60, Subpart Db.

INDIRECT HEATING UNIT (BOILER)
(cont.)

17) Did construction, modification, or reconstruction commence after June 9, 1989 and does the indirect heating unit have a maximum design heat-input capacity to combust 10 million or more BTU/hour but less than 100 million BTU/hour? Yes _____; No _X_

If yes, this plant may be subject to NSPS, 40 CFR Part 60, Subpart Dc. **(Not applicable because the gas heater does not produce steam.)**

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation

LIQUID STORAGE TANKS/VESSELS

1) Source ID Number: 0510057

2) Company/Source Name: Midwest Energy, Inc. – Goodman Energy Center

3) Emission Unit Identification and Number: Tank FP 1

4) Type of Tank:
   1. External Floating Roof (E) _____
   2. Internal Floating Roof (I) _____
   3. Horizontal Fixed Roof (H) _____
   4. Vertical Fixed Roof (V) X
   5. Domed External Floating Roof (D) _____

5) Complete the following table:

Measurement, Physical State, etc.	External	Internal	Horizontal	Vertical	Domed External
Shell height (ft)				5	
Diameter (ft)				0.83	
Shell length (ft)					
Maximum liquid height (ft)				5	
Average liquid height (ft)				5	
Working volume / tank volume (gal)				20	
Turnovers per year				1.0	
Net throughput (gal/yr)				20	
Tank heated (yes/no)				No	
Tank underground (yes/no)					
Self-supported roof? (yes/no)					
Number of columns					
Column diameter (ft)					
Shell color/shade				W/W	
Shell condition (good/poor)				Good	
Shell paint condition (good/poor)					
Roof color/shade				W/W	
Roof paint condition (good/poor)				Good	

Measurement, Physical State, etc.	External	Internal	Horizontal	Vertical	Domed External
Roof type (cone, dome, pontoon, doubledeck)				Cone	
Roof height (ft)				0.0	
Dome roof radius (ft)					
Cone roof slope (ft/ft)				0.06	
Tank construction (welded, riveted)					
Primary seal (vapor-mounted, liquid-mounted, mechanical shoe)					
Secondary seal (weather shield, rim-mounted, none)					
Fitting category (typical, controlled, detail)					
Vacuum setting (psig)				-0.03	
Pressure setting (psig)				0.03	
Deck type (bolted, welded)					
If bolted, deck construction					
If bolted, deck seam length (ft)					
Deck fitting (typical, controlled, detail)					
Chemical category of liquid (crude oil, petroleum distillate, organic liquid)				Petroleum Distillate	
Single or multiple component mixture				Single	
Chemical name				Fuel Oil #2	
CAS number					
Vapor pressure of tank if different than ambient (psig)					
Temperature of tank if different than ambient (°F)					

LIQUID STORAGE TANKS/VESSELS
(cont.)

6) Tank shape: cylindrical __X____ spherical _____other, describe _____

7) Tank material: steel _X_____ fiberglass _____ other, describe _____

8) If tank is fixed roof, check the type of vapor recovery system:

Liquid absorption _____ Vapor compression _____ Carbon absorption _____
None__X____ Other, describe _____

9) Tank filling source: pipeline _____ railcar _____ truck __X___ other, specify _____

10) Type of filling: submerged _____ splash __X___

11) Maximum rate at which tank can be emptied _____gpm filled _____gpm

Is this storage vessel subject to any of the following NSPS (40 CFR 60) subparts?

12) (Subpart K - Petroleum Liquid Storage Vessels) Does the storage vessel have a capacity greater than 151,416 liters (40,000 gallons) but not exceeding 246,052 liters (65,000 gallons), and commenced construction or modification after March 8, 1974 and prior to May 19, 1978?
Yes ____ No __X__ Exempt _____

13) (Subpart K - Petroleum Liquid Storage Vessels) Does the storage vessel have a capacity greater than 246,052 liters (65,000 gallons) and commenced construction or modification after June 11, 1973 and prior to May 19, 1978?
Yes ____ No __X__ Exempt _____

14) (Subpart Ka - Petroleum Liquid Storage Vessels) Does the storage vessel have a capacity greater than 151,416 liters (40,000 gallons) and for which construction commenced after May 18, 1978 and prior to July 23, 1984?
Yes ____ No __X__ Exempt _____

15) (Subpart Kb - Volatile Organic Liquid Storage Vessels) Does the storage vessel have a capacity greater than or equal to 75 m^3 (19,813 gallons) and is used to store volatile organic liquids in which construction, reconstruction, or modification commenced after July 23, 1984?
Yes ____ No _X___ Exempt _____

16) (Subpart XX - Bulk Gasoline Terminals) Does the facility have a bulk gasoline terminal site?
Yes ____ No __X__
Have the loading racks at the bulk gasoline terminal been constructed or modified after December 17, 1980?
Yes ____ No _ ___ Exempt ____

17) (Subpart UU – Asphalt Processing and Asphalt Roofing Manufacturing) Is the tank an asphalt storage facility at a petroleum refinery or an asphalt roofing plant; or a mineral storage tank at an asphalt roofing plant; and did the equipment commence construction or modification after November 18, 1980?

Yes _____ No ___X____ Exempt _____

Is the equipment an asphalt storage tank or blowing still at an asphalt processing plant, petroleum refinery, or asphalt roofing plant; and
does the asphalt storage tank or blowing still process and/or store asphalt used for roofing only or for roofing and other purposes; and
did the equipment commence construction or modification after November 18, 1980?

Yes _____ No ___X_____ Exempt _____

Is the equipment an asphalt storage tank or blowing still at an asphalt processing plant, petroleum refinery, or asphalt roofing plant; and
does the asphalt storage tank or blowing still process and/or store only nonroofing asphalts; and
did the equipment commence construction or modification after May 26, 1981?

Yes _____ No ___X_____ Exempt _____

18) Reason for any exemptions:_____

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation

LIQUID STORAGE TANKS/VESSELS

1) Source ID Number: 0510057

2) Company/Source Name: Midwest Energy, Inc. – Goodman Energy Center

3) Emission Unit Identification and Number: Tank EMG 1

4) Type of Tank:
   1. External Floating Roof (E) _____
   2. Internal Floating Roof (I) _____
   3. Horizontal Fixed Roof (H) _____
   4. Vertical Fixed Roof (V) X
   5. Domed External Floating Roof (D) _____

5) Complete the following table:

Measurement, Physical State, etc.	External	Internal	Horizontal	Vertical	Domed External
Shell height (ft)				5	
Diameter (ft)				2.6	
Shell length (ft)					
Maximum liquid height (ft)				5	
Average liquid height (ft)				5	
Working volume / tank volume (gal)				200	
Turnovers per year				1.0	
Net throughput (gal/yr)				200	
Tank heated (yes/no)				No	
Tank underground (yes/no)					
Self-supported roof? (yes/no)					
Number of columns					
Column diameter (ft)					
Shell color/shade				W/W	
Shell condition (good/poor)				Good	
Shell paint condition (good/poor)					
Roof color/shade				W/W	
Roof paint condition (good/poor)				Good	

Measurement, Physical State, etc.	External	Internal	Horizontal	Vertical	Domed External
Roof type (cone, dome, pontoon, doubledeck)				Cone	
Roof height (ft)				0.0	
Dome roof radius (ft)					
Cone roof slope (ft/ft)				0.06	
Tank construction (welded, riveted)					
Primary seal (vapor-mounted, liquid-mounted, mechanical shoe)					
Secondary seal (weather shield, rim-mounted, none)					
Fitting category (typical, controlled, detail)					
Vacuum setting (psig)				-0.03	
Pressure setting (psig)				0.03	
Deck type (bolted, welded)					
If bolted, deck construction					
If bolted, deck seam length (ft)					
Deck fitting (typical, controlled, detail)					
Chemical category of liquid (crude oil, petroleum distillate, organic liquid)				Petroleum Distillate	
Single or multiple component mixture				Single	
Chemical name				Fuel Oil #2	
CAS number					
Vapor pressure of tank if different than ambient (psig)					
Temperature of tank if different than ambient (^{o}F)					

LIQUID STORAGE TANKS/VESSELS
(cont.)

6) Tank shape: cylindrical __X____ spherical _____ other, describe _____

7) Tank material: steel _X_____ fiberglass _____ other, describe _____

8) If tank is fixed roof, check the type of vapor recovery system:

Liquid absorption _____ Vapor compression _____ Carbon absorption _____
None__X____ Other, describe _____

9) Tank filling source: pipeline _____ railcar _____ truck __X___ other, specify _____

10) Type of filling: submerged _____ splash __X___

11) Maximum rate at which tank can be emptied _____gpm filled _____gpm

Is this storage vessel subject to any of the following NSPS (40 CFR 60) subparts?

12) (Subpart K - Petroleum Liquid Storage Vessels) Does the storage vessel have a capacity greater than 151,416 liters (40,000 gallons) but not exceeding 246,052 liters (65,000 gallons), and commenced construction or modification after March 8, 1974 and prior to May 19, 1978?
Yes ____ No __X__ Exempt _____

13) (Subpart K - Petroleum Liquid Storage Vessels) Does the storage vessel have a capacity greater than 246,052 liters (65,000 gallons) and commenced construction or modification after June 11, 1973 and prior to May 19, 1978?
Yes ____ No __X__ Exempt _____

14) (Subpart Ka - Petroleum Liquid Storage Vessels) Does the storage vessel have a capacity greater than 151,416 liters (40,000 gallons) and for which construction commenced after May 18, 1978 and prior to July 23, 1984?
Yes ____ No __X__ Exempt _____

15) (Subpart Kb - Volatile Organic Liquid Storage Vessels) Does the storage vessel have a capacity greater than or equal to 75 m^3 (19,813 gallons) and is used to store volatile organic liquids in which construction, reconstruction, or modification commenced after July 23, 1984?
Yes ____ No _X___ Exempt _____

16) (Subpart XX - Bulk Gasoline Terminals) Does the facility have a bulk gasoline terminal site?
Yes ____ No __X__
Have the loading racks at the bulk gasoline terminal been constructed or modified after December 17, 1980?
Yes ____ No _ ___ Exempt ____

17) (Subpart UU – Asphalt Processing and Asphalt Roofing Manufacturing) Is the tank an asphalt storage facility at a petroleum refinery or an asphalt roofing plant; or a mineral storage tank at an asphalt roofing plant; and did the equipment commence construction or modification after November 18, 1980?

Yes _____ No ___X____ Exempt _____

Is the equipment an asphalt storage tank or blowing still at an asphalt processing plant, petroleum refinery, or asphalt roofing plant; and
does the asphalt storage tank or blowing still process and/or store asphalt used for roofing only or for roofing and other purposes; and
did the equipment commence construction or modification after November 18, 1980?

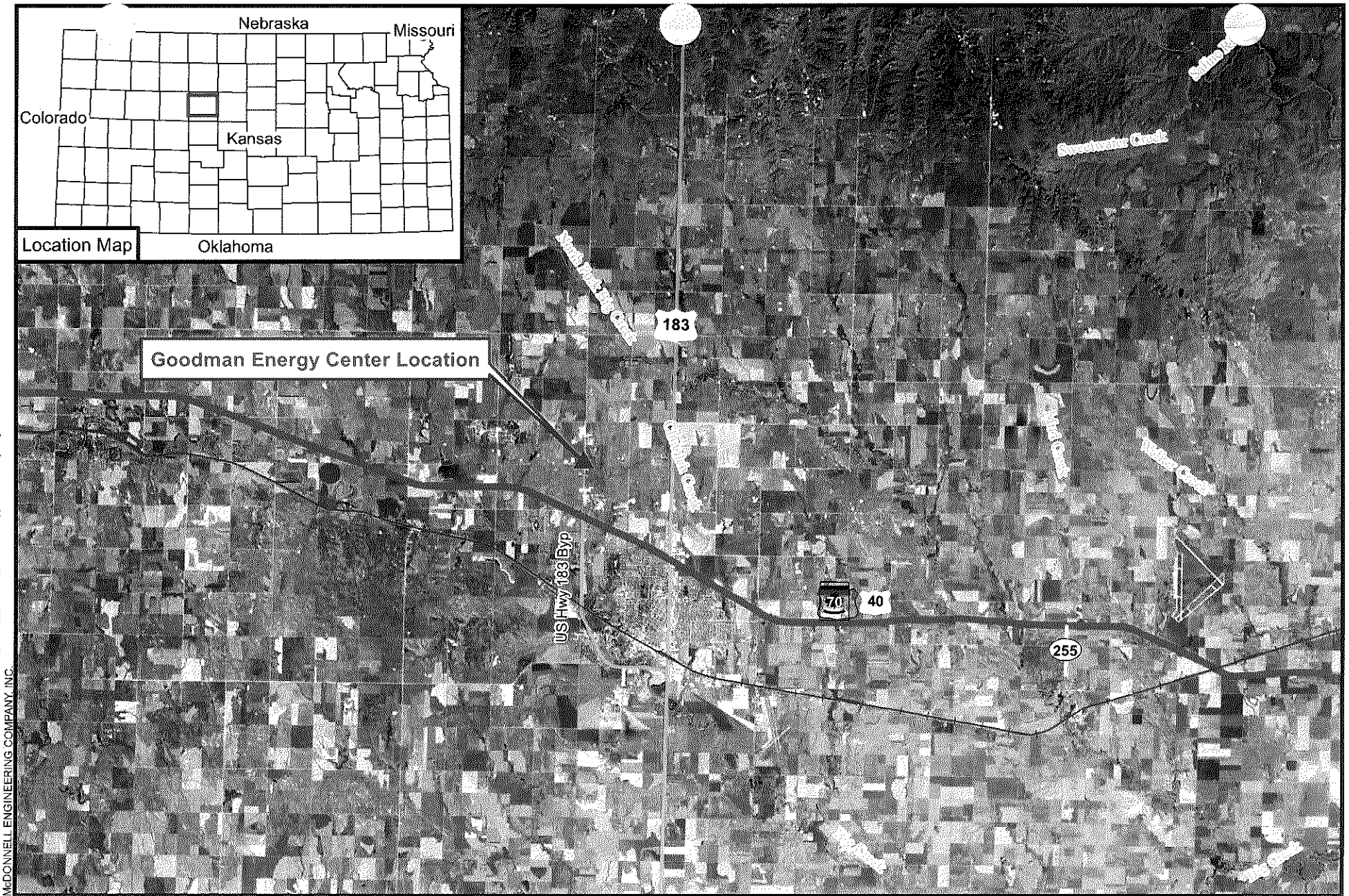
Yes _____ No ___X_____ Exempt _____

Is the equipment an asphalt storage tank or blowing still at an asphalt processing plant, petroleum refinery, or asphalt roofing plant; and
does the asphalt storage tank or blowing still process and/or store only nonroofing asphalts; and
did the equipment commence construction or modification after May 26, 1981?

Yes _____ No ___X_____ Exempt _____

18) Reason for any exemptions:_____

APPENDIX B
FIGURES



LEGEND

- Goodman Energy Center Location
- Municipal Boundaries
- Railroads
- Streams
- Interstate
- State Highway
- US Highway

NORTH

0 1.5 3
Miles

Burns & McDonnell
SINCE 1898

Figure 3-1:
Goodman Energy Center Expansion Project Location

Midwest Energy, Inc.

Source: ESRI, NHD, NRCS, Burns & McDonnell

Issued: 10/21/2013

Path: R:\Midwest_Energy\75189_Goodman\PSD\GIS\DataFiles\ArcDocs\Goodman_Energy_Center_Expansion_Site.mxd gweger
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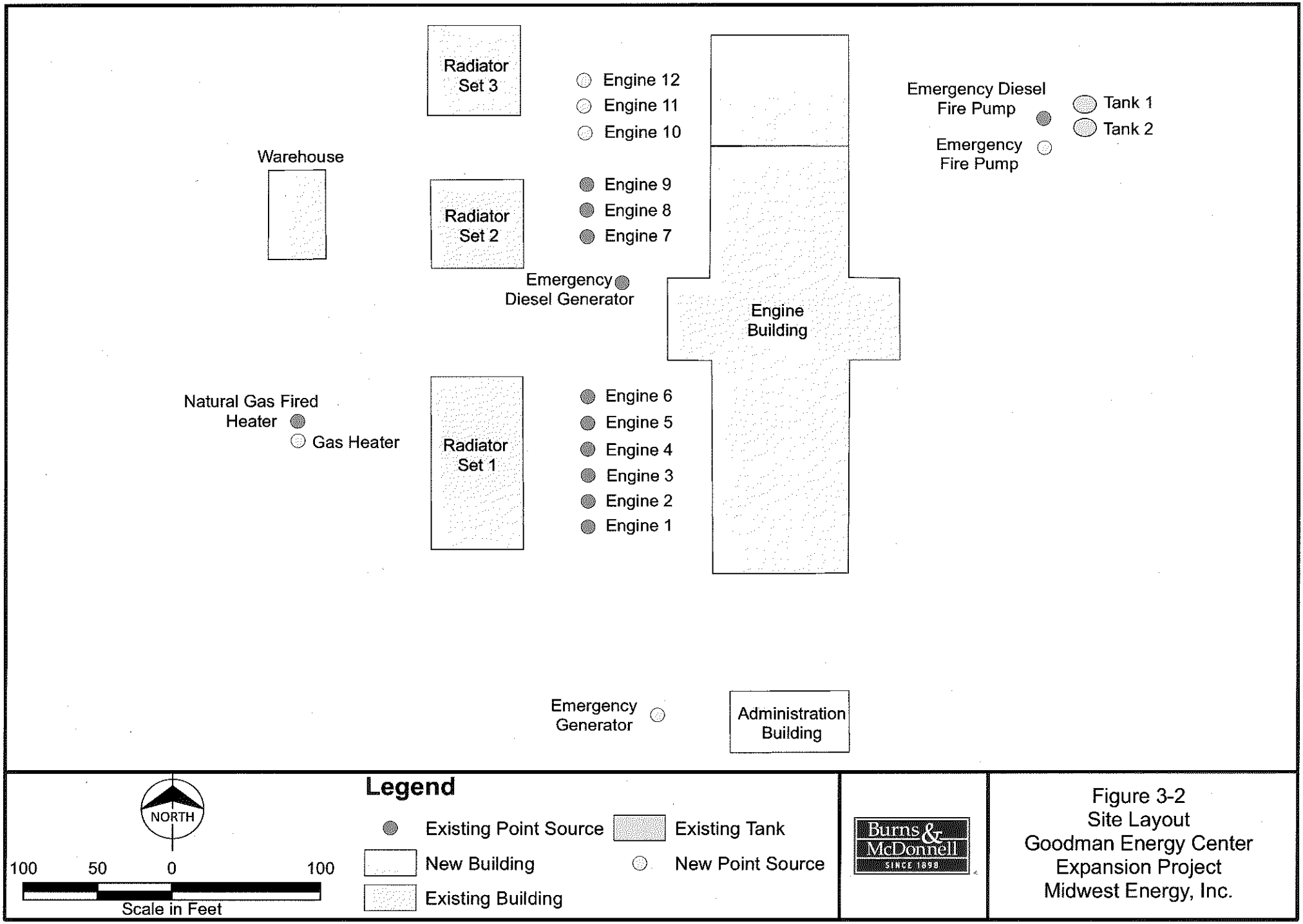

Figure 3-2
Site Layout
Goodman Energy Center
Expansion Project
Midwest Energy, Inc.

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550 275 0 550

Scale in Feet

NORTH

Legend

Fenceline

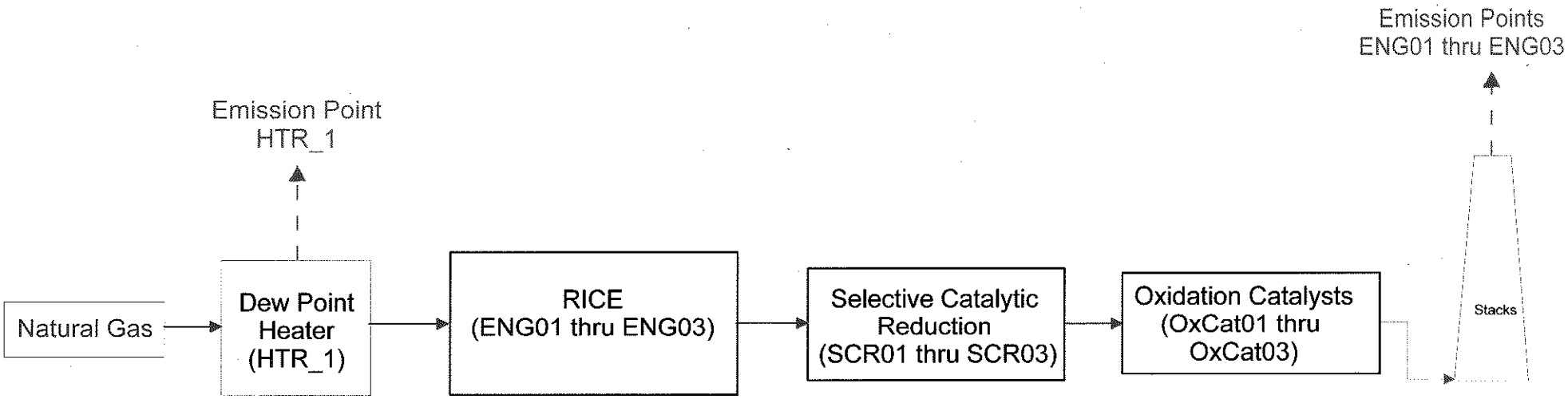
Building

Point source

Burns & McDonnell SINCE 1898

Figure 3-3
Plot Plan
Goodman Energy Center
Expansion Project
Midwest Energy, Inc.

Goodman Energy Center Expansion Project
RICE Process Flow Diagram



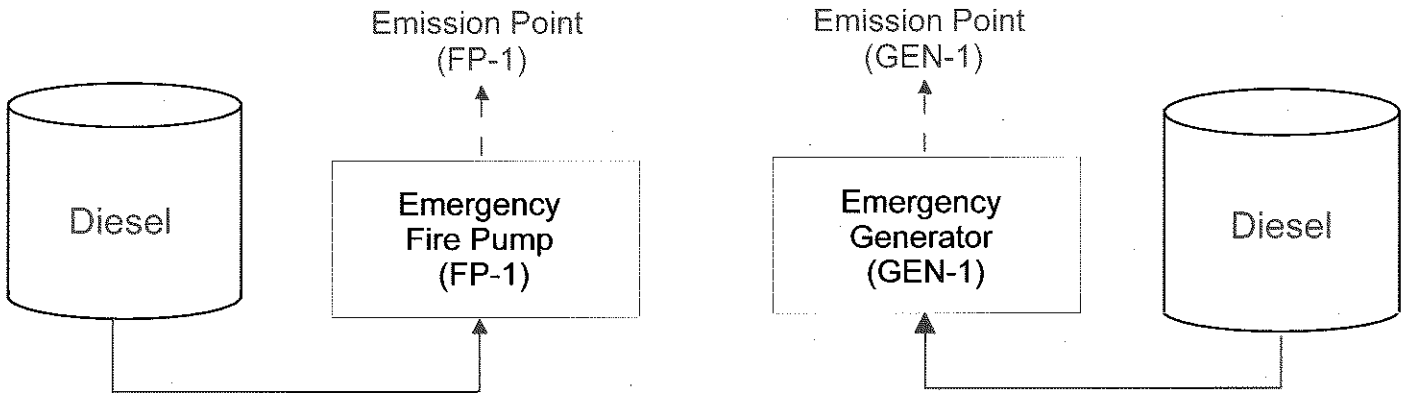
Natural Gas

Emissions

Burns & McDonnell
SINCE 1898

Figure 4-1
RICE Process
Flow Diagram

Goodman Energy Center Expansion Project
Auxiliary Equipment Process Flow Diagram



Diesel Fuel Oil

Emissions

Burns & McDonnell
SINCE 1898

Figure 4-2
Auxiliary Equipment
Process Flow Diagram

APPENDIX C
EMISSION CALCULATIONS

Midwest Energy - Goodman Energy Center Expansion Project
Overall Project Emissions

Maximum Annual Emission Rates

Pollutant	3 RICE[A] (Tons per Year)	Dew Point Heater (Tons per Year)	Emergency Fire Pump (Tons per Year)	Emergency Generator (Tons per Year)	Diesel Storage Tank (Tons per Year)	Potential Emissions (Tons per Year)	PSD Significance Levels (Tons per Year)
NO_X	36.2	0.429	0.033	0.110	--	36.7	40
CO	46.7	0.361	0.041	0.096	--	47.1	100
SO_2	0.65	0.003	0.010	0.034	--	0.7	40
VOC	37.7	0.024	0.013	0.042	0.0	37.8	40
PM	28.3	0.033	0.002	0.006	--	**28.4**	25
PM_{10}	28.3	0.033	0.002	0.006	--	**28.4**	15
$PM_{2.5}$	28.3	0.033	0.002	0.006	--	**28.4**	10
CO_2e	122,593	518.4	5.9	15.7	--	**123,117**	75,000
H_2SO_4 Mist	0.1	3.9E-04	1.6E-03	5.3E-03	--	0.1	7
Lead	--	2.2E-03	--	--	--	2.2E-03	0.6

[A] Represents worse-case emissions scenario

Assumptions		
Unit	**Limitation**	**Units**
Operation per RICE	8,760	Hours Per Year
Number of RICE	3	Engines
Total Hours for All RICE Combined	26,280	Hours Per Year
Number of RICE Startups per year	1,095	Startup/Shutdown Events Per Year
Hours of RICE Startup/Shutdowns per year	548	Hours Per Year
Dew Point Heater	8,760	Hours Per Year
Emergency Generator	100	Hours Per Year
Emergency Fire Pump	100	Hours Per Year
Heating Value of Natural Gas		
Natural Gas	1,020	MMBtu/MMCF

Maximum Hourly Emission Rates for Each RICE

Operating Load (%)	NO_x	CO	SO_2	VOC	$PM/PM_{10}/PM_{2.5}$	CO_2e	H_2SO_4 Mist
	lb/hr						
100	1.45	2.67	0.05	2.67	2.10	9,330	0.01
75	1.33	2.31	0.03	2.47	1.88	7,220	0.00
50	0.81	2.03	0.01	2.03	1.79	4,151	0.00

Maximum Annual Emission Rates for Each RICE

Operating Load (%)	NO_x	CO	VOC	$PM/PM_{10}/PM_{2.5}$	SO_2	CO_2e	H_2SO_4 Mist
	tpy						
100	6.33	11.72	11.72	9.19	0.20	40,864	0.03
75	5.82	10.13	10.80	8.24	0.12	31,623	0.02
50	3.56	8.90	8.90	7.83	0.04	18,183	0.01

Start-up Emissions for Each RICE

Pollutant	Number of Start-up Events per Year	lb per Start-up per Engine	Start-up Tons per Year per Engine	lb per Shutdown per Engine	Shutdown Tons per Year Per Engine
NO_X	1,095	11.20	6.13	0.06	0.03
CO	1,095	8.40	4.60	0.03	0.01
$PM/PM_{10}/PM_{2.5}$	1,095	1.50	0.82	0.06	0.03
VOC	1,095	2.90	1.59	0.03	0.02
SO_2	1,095	0.05	0.03	0.05	0.03
H_2SO_4 Mist	1,095	--	0.0019	--	0.0019
CO_2e*	1,095	2,172	1,191.6	7	6.36

*CO_2 lb/start-up and shutdown only

Midwest Energy - Goodman Energy Center Expansion F
New RICE Emissions Calculations

Engine Information

# RICE=	3	Heating Value
Hours of full load (each)	8,760	Total hours of

		100%	75%
Fuel input	mmBTU/hr	78.93	61.05
	kWe-gross	9,341	6,998

Stack Information

	100%	75%
Flue gas exit temperature	730	811
Flue gas exit velocity	82.6	65.9
Stack Diameter	4.0	ft
Stack Height	85.0	ft

[A] The start-up stack velocity and temperature were calculated based on a half-hour at 40

Emission Calculations

	100%	75%	40%		All RICE[5] Start-up + Normal Operation	All RICE[5] Shutdown+ Start-up + Normal Operation
Pollutant	lb/mmBtu				tpy	tpy
NO_x				9.0	36.2	34.9
CO				5.1	46.7	42.3
VOC				5.1	37.7	35.2
$PM/PM_{10}/PM_{2.5}$ (total)				7.6	28.3	25.7
SO_2[6]	5.88E-04	4.55E-04	2.68E-04	61	0.65	0.5
H_2SO_4 Mist				0.1	0.1	0.1
CO_2				468	118,381	92,382.5
CH_4	2.20E-03	1.71E-03	1.00E-03	2.3	2.3	1.6
NO_2	2.20E-04	1.71E-04	1.00E-04	0.2	0.2	0.2
CO_2e[7]				593	118,506	92,468

[1]assumes startup lasts for 30 minutes and other 30 minutes is 100% load for one hour tot
[2]assumes shutdown lasts for 1 minutes and other 59 minutes is 100% load for one hour to
[3]assumes startup lasts for 30 minutes, shutdown lasts for 2 minute and other 29 minutes i
[4]based on each RICE operating 8,760 hours per year
[5]based on total operation of 26,280 hours per year for all 3 RICE combin
[6]SO_2 emisions from AP-42 Chapter 3.2, Table 3.2-1, July 2000
[7]Includes global warming potential

Sulfuric Acid Mist
Assume 10% of SO2 is converted to SO3
Assume 100% of SO3 is converted to H2SO4

Name	lb/hr SO2	lb/hr SO2 converted to SO3
100%	4.6E-02	4.6E-03
75%	2.8E-02	2.8E-03
50%	9.6E-03	9.6E-04

Midwest Energy - Goodman Energy Center Expansion Project
9.3 MW Wartsila Spec Sheet

Expected Emissions (Controlled)

Applicable to One 20V34SG unit (steady state)				
Treated Emission Summary & Conversion Tables		100%	75%	40%
NOx (as NO2)	**ppm-v, 15 % O2, dry**	5	6	7
CO	**ppm-v, 15 % O2, dry**	15	17	24
VOC (as CH4)	**ppm-v, 15 % O2, dry**	25	31	42
PM10 (total)	**mg/Nm3, 15 % O2, dry**	16	19	30
CO2	**ppm-v, 15 % O2, dry**	34765	34799	34909
Ammonia	**ppm-v, 15 % O2, dry**	10	10	10
		100%	75%	40%
NOx (as NO2)	**g/kWhe**	0.070	0.086	0.100
CO	**g/kWhe**	0.130	0.150	0.250
VOC (as CH4)	**g/kWhe**	0.130	0.160	0.250
PM10	**g/kWhe**	0.102	0.122	0.220
CO2	**g/kWhe**	453	468	500
Ammonia	**g/kWhe**	0.052	0.054	0.062
	kWe defined at alternator			
		100%	75%	40%
NOx (as NO2)	**lb/h**	1.45	1.33	0.81
CO	**lb/h**	2.67	2.31	2.03
VOC (as CH4)	**lb/h**	2.67	2.47	2.03
PM10	**lb/h**	2.10	1.88	1.79
CO2	**lb/h**	9320	7214	4149
Ammonia	**lb/h**	1.07	0.83	0.50
	pounds per hour per engine			
Fuel use	mmBTU/h HHV	78.93	61.05	35.95
Output	kWe-gross	9,340.8	6,998.4	3,688.0
Formaldehyde	**lb/h**	0.22	0.21	0.18
Acetaldehyde	**lb/h**	0.36	0.36	0.36
Acrolein	**lb/h**	0.32	0.28	0.26
Methanol	**lb/h**	0.20	0.20	0.17
	pounds per hour per engine			

EXHAUST

30F	100%	75%	40%	
Flow	1042	831	535	acfs - wet
temp	741	822	849	F
O2	10.3	9.9	10.6	%vol wet
H20	9.5	9.8	9.2	%vol

70F	100%	75%	40%	
Flow	1039	829	534	acfs - wet
temp	734	815	842	F
O2	10.1	9.8	10.5	%vol wet
H20	10.5	10.8	10.2	%vol

90F	100%	75%	40%	
Flow	1038	828	533	acfs - wet
temp	730	811	838	F
O2	10.0	9.7	10.4	%vol wet
H20	10.9	11.2	10.6	%vol

WORSE CASE

	100%	75%	40%	
Flow	1038	828	533	acfs - wet
Velocity	82.6	65.9	42.4	ft/sec
temp	730	811	838	F

Stack Diameter (ft): 4.0
Stack Area (ft^2): 12.6

Midwest Energy - Goodman Energy Center Expansion Project
New Auxiliary Combustion Sources Emissions Calculations

Dew Point Heater

Size	1.00	MMBtu/hr
HHV	1,020	Btu/cf
Operation	8760	hours/year

Dew Point Heater Stack Parameters

Height (ft)	Temp. (F)	Velocity (ft/sec)	Diameter (ft)	ACFM	Stack Discharge Type	Fuel
15	500	44.33	0.83	--	Vertical	Natural Gas

Pollutant	Emission Factors		Source	Emissions	
	lb/MMcf	lb/MMBtu		lb/hr	tpy
NO_X	100	0.0980	AP-42[A]	0.1	0.4
CO	84	0.0824	AP-42[A]	0.08	0.4
$PM/PM_{10}/PM_{2.5}$	7.6	0.0075	AP-42[A]	0.007	0.03
VOC	5.5	0.0054	AP-42[A]	0.01	0.02
SO_2	0.60	0.0006	AP-42[A]	0.0006	0.003
H_2SO_4 Mist	--	--	Mass Balance	0.0001	0.0004
CO_2	--	117.6	AP-42[A]	117.6	515.3
CH_4	--	0.0023	AP-42[A]	0.002	0.01
NO_2	--	0.0022	AP-42[A]	0.002	0.009
CO_2e	--	118.3	AP-42[A]	118.3	518.4

[A] AP-42 Section 1.4 (7/98)

Emergency Fire Pump

Size	100.0	HP
	0.80	MMBtu/hr
Operation	100	hours/year

Emergency Fire Pump Stack Parameters

Height (ft)	Temp. (F)	Velocity (ft/sec)	Diameter (ft)	ACFM	Stack Discharge Type	Fuel
15	986	145.33	0.42	1,189	Vertical	Diesel

Pollutant	Emission Factors					Emissions	
	g/kw-hr	g/bhp-hr	lb/bhp-hr	lb/MMBtu	Source	lb/hr	tpy
NO_X	4.0	3.0	--	--	NSPS[B]	0.7	0.03
CO	5	3.7	--	--	NSPS[B]	0.8	0.04
$PM/PM_{10}/PM_{2.5}$	0.3	0.22	--	--	NSPS[B]	0.05	0.002
VOC	--	--	2.51E-03	--	AP-42[A]	0.3	0.01
SO_2	--	--	2.05E-03	--	AP-42[A]	0.2	0.01
H_2SO_4 Mist	--	--		--	Mass Balance	0.03	0.002
CO_2	--	--		116.9	Federal Register[C]	116.9	5.8
CH_4	--	--		0.002	Federal Register[C]	2.2E-03	1.1E-04
NO_2	--	--		0.00022	Federal Register[C]	2.2E-04	1.1E-05
CO_2e	--	--		117.0	Federal Register[C]	117.0	5.9

[A] AP-42 Section 3.3 (10/96)

[B] NSPS 40 CFR Part 60, Subapart IIII Limits

NSPS Limits - 40 CFR Part 60, Subapart IIII, (40 CFR 60 Table 4)

	NOx + VOC	CO	PM
g/kW-hr	4	5	0.3
g/hp-hr	2.9828	3.7285	0.2237

[C] Federal Register - Subpart C of Part 98

Midwest Energy - Goodman Energy Center Expansion Project
New Auxiliary Combustion Sources Emissions Calculations

Emergency Generator

Size	250.0	KW
	335.0	hp
	19.40	gal/hr
	2.68	MMBtu/hr
Operation	100	hours/year

Emergency Generator

Height (ft)	Temp. (F)	Velocity (ft/sec)	Diameter (ft)	ACFM	Stack Discharge Type	Fuel
15	986	145.33	0.42	1,189	Vertical	Diesel

Pollutant	Emission Factors					Emissions	
	g/kw-hr	g/bhp-hr	lb/bhp-hr	lb/MMBtu	Source	lb/hr	tpy
NO_X	4.0	3.0	--	--	NSPS[B]	2.2	0.11
CO	3.5	2.6	--	--	NSPS[B]	1.9	0.1
$PM/PM_{10}/PM_{2.5}$	0.2	0.15	--	--	NSPS[B]	0.1	0.006
VOC	--		2.51E-03	--	AP-42[A]	0.8	0.04
SO_2	--		2.05E-03	--	AP-42[A]	0.7	0.03
H_2SO_4 Mist	--		--	--	Mass Balance	0.1	0.005
CO_2	--		--	116.9	Federal Register[C]	312.9	15.6
CH_4	--		--	0.002	Federal Register[C]	5.9E-03	3.0E-04
NO_2	--		--	0.00022	Federal Register[C]	5.9E-04	3.0E-05
CO_2e	--		--	117.0	Federal Register[C]	313.3	15.7

[A] AP-42 Section 3.3 (10/96)

[B] NSPS 40 CFR Part 60, Subapart IIII Limits

NSPS Limits - 40 CFR Part 60, Subapart IIII, (40 CFR 60.4202(a)(2) and 40 CFR 89.112 - Table 1)

	NOx + VOC	CO	PM
g/kW-hr	4	3.5	0.2
g/hp-hr	2.9828	2.6099	0.15

[C] Federal Register - Subpart C of Part 98

Sulfuric Acid Mist

	Conversion Percent	
Assume 10% of SO2 is converted to SO3	10	SO2 + 1/2 O2 = SO3
Assume 100% of SO3 is converted to H2SO4	100	SO3 + H2O = H2SO4

Name	lb/hr SO2	lb/hr SO2 converted to SO3	lb/hr SO3 created	lb/hr H2SO4 created	tons / year H2SO4
Fuel Gas Heater	0.001	5.9E-05	7.4E-05	9.0E-05	3.9E-04
Emergency Fire Pump	0.2	2.1E-02	2.6E-02	3.1E-02	1.6E-03
Emergency Diesel Generator	0.7	6.9E-02	8.6E-02	1.1E-01	5.3E-03

Molecular Weights	
SO2	64.1
SO3	80.1
H2SO4	98.1

CO_2 Equivalent Ratios

Greenhouse Gas			CO_2 Equivalent Ratio*
Carbon Dioxide	124-38-9	CO_2	1
Methane	74-82-8	CH_4	25
Nitrous Oxide	10024-97-2	N_2O	298
Hydrofluorocarbons	Various	CHF (various)	12 - 11700
Perfluor0carbons	Various	CF (various)	6500 - 17340
Sulfur Hexafluoride	2551-62-4	SF_6	23900
Chlorofluorocarbons	Various	CCIF (various)	Not Available

* Based on Intergovernmental Panel on Climate Change (IPCC) for the Fourth Assessment Report (AR4), Published in 2007.

Midwest Energy - Goodman Energy Center Expansion Project
New Hazardous Air Pollutants Emissions

Goodman Energy Center New | **Center New**
RICE: HAPs Emissions | **l Generator: HAPs Emissions**

Total Hours of Operation (all RICE) = 2
Hours of Operation = | f Operation = 100 hrs/yr
Heater Fuel Input Capacity = | ut Capacity = 2.68 MMBtu/hr
Number of Units: | nber of Units: 1
Control Efficiency =

Pollutant	CAS. No.	Emission Factors lb/MMBTU	Control Efficiency %	tors	Emissions lb/hr	Emissions tpy	HAP Emissions (New Equipment) tpy
1,1,2,2-Tetrachloroethane	79-34-5	4.00E-05	77%				9.54E-03
1,1,2-Trichloroethane	79-00-5	3.18E-05	77%				7.59E-03
1,3-Butadiene	106-99-0	2.67E-04	77%		1.05E-04	5.23E-06	6.37E-02
1,3-Dichloropropene	542-75-6	2.64E-05	77%				6.30E-03
2-Methylnaphthalene	91-57-6	3.32E-05	77%				7.92E-03
2,2,4-Trimethylpentane	540-84-1	2.50E-04	77%				5.96E-02
3-Methylchloranthrene	56-49-5						7.73E-09
7,12-Dimethylbenz(a)anthracene	57-97-6						6.87E-08
Acenaphthene	83-32-9	1.25E-06	77%		3.80E-06	1.90E-07	2.98E-04
Acenaphthylene	203-96-8	5.53E-06	77%		1.35E-05	6.77E-07	1.32E-03
Acetaldehyde	75-07-0	Vendor	77%		2.05E-03	1.03E-04	4.67E+00
Acrolein	107-028	Vendor	77%		2.48E-04	1.24E-05	4.23E+00
Anthracene	120-12-7				5.01E-06	2.50E-07	3.35E-07
Arsenic	7440-38-2						8.59E-07
Benz(a)anthracene	56-55-3				4.50E-06	2.25E-07	3.00E-07
Benzene	71-43-2	4.40E-04	77%		2.50E-03	1.25E-04	1.05E-01
Benzo(b)fluoranthene	205-99-2	1.66E-07	77%		2.65E-07	1.33E-08	3.96E-05
Benzo(a)pyrene	50-32-8	4.15E-07	77%		5.03E-07	2.52E-08	9.90E-05
Benzo(g,h,i)perylene	191-24-2	4.14E-07	77%		1.31E-06	6.55E-08	9.89E-05
Benzo(k)fluoranthene	205-82-3				4.15E-07	2.07E-08	3.47E-08
Beryllium	7440-41-7						5.15E-08
Biphenyl	92-51-3	2.12E-04	77%				5.06E-02
Cadmium	7440-43-9						4.72E-06
Carbon Tetrachloride	56-23-5	3.67E-05	77%				8.75E-03
Chlorobenzene	108-90-7	3.04E-05	77%				7.25E-03
Chloroform	67-66-3	2.85E-05	77%				6.80E-03
Chromium	7440-47-3						6.01E-06
Chrysene	218-01-9	6.93E-07	77%		9.45E-07	4.73E-08	1.65E-04
Cobalt	7440-48-4						3.61E-07
Dibenzo(a,h)anthracene	53-70-3				1.56E-06	7.80E-08	1.07E-07
Dichlorobenzene	25321-22-6						5.15E-06
Ethylbenzene	100-41-4	3.97E-05	77%				9.47E-03
Ethylene Dibromide	106-93-4	4.43E-05	77%				1.06E-02
Fluoranthene	206-44-0	1.11E-06	77%		2.04E-05	1.02E-06	2.66E-04
Fluorene	86-73-7	5.67E-06	77%		7.82E-05	3.91E-06	1.36E-03
Formaldehyde	50-00-0	Vendor	77%		3.16E-03	1.58E-04	2.92E+00
Hexane	110-54-3	1.11E-03	77%				2.73E-01
Indeno(1,2,3-cd)pyrene	193-39-5				1.00E-06	5.02E-08	7.29E-08
Manganese	7439-96-5						1.63E-06
Methanol	67-56-1	Vendor	77%				2.63E+00
Methylene Chloride	75-09-2	2.00E-05	77%				4.77E-03
Mercury	7439-97-6						1.12E-06
Naphthalene	91-20-3	7.44E-05	77%		2.27E-04	1.14E-05	1.78E-02
Nickel	7440-02-0						9.02E-06
PAH	-	2.69E-05	77%		4.50E-04	2.25E-05	6.45E-03
Phenanthrene	85-01-8	1.04E-05	77%		7.87E-05	3.94E-06	2.49E-03
Phenol	108-95-2	2.40E-05	77%				5.73E-03
Propylene	115-07-1				6.91E-03	3.45E-04	4.49E-04
Pyrene	129-00-0	1.36E-06	77%		1.28E-05	6.40E-07	3.25E-04
Selenium	7782-49-2						1.03E-07
Styrene	100-42-5	2.36E-05	77%				5.63E-03
Tetrachloroethane	25322-20-7	2.48E-06	77%				5.92E-04
Toluene	108-88-3	4.08E-04	77%		1.09E-03	5.47E-05	9.74E-02
Vinyl Chloride	75-01-4	1.49E-05	77%				3.55E-03
Xylene	1330-20-7	1.84E-04	77%		7.63E-04	3.82E-05	4.39E-02
All HAPs					1.77E-02	8.86E-04	15.26

Emission factors from AP-42, Section 3 | AP-42, Section 3.3, 10/96

Pollutant	CAS. No.	Emission Factors lb/MMBTU	Control Efficiency %	tors	Emissions lb/hr	Emissions tpy	Total Emissions (all equipment) tpy
Lead	7439-92-1						2.19E-03

Individual HAP Emissions:

HAP	New Equipment tpy
1st Maximum: Acetaldehyde	4.67
2nd Maximum: Acrolein	4.23
3rd Maximum: Formaldehyde	2.92

Total Hazardous Air Pollutants Emissions:

HAP	New Equipment tpy	Existing Equipment tpy	New Facility tpy
Total HAPs	15.26	24.47	39.73

Midwest Energy - Goodman Energy Center Expansion Project
Diesel Storage Tanks

Description:
Vertical Fixed Roof Tanks

Assumptions for All tanks:
Weather - Topeka, KS
Type - Vertical Fixed Roof Tank
Color/Shade - White/White (Default)
Turnovers/throughput - 1 turnover per year
Fuel - Distillate #2 Fuel Oil
Monthly Calculation - Throughput distributed evenly over the entire year

Emergency Generator Fuel Oil Tank
Size: 200 gallons

VOC Emissions[1]	
lb/yr	tpy
0.00	**0.00**

Emergency Fire Pump Fuel Oil Tank
Size: 20 gallons

VOC Emissions[1]	
lb/yr	**tpy**
0.00	**0.00**

[1] *EPA TANKS program was run for VOC emissions from the fuel tanks. The emissions were found to be negligible.*

Midwest Energy - Goodman Energy Center Expansion Project
Existing Units Emissions Calculations

Unit ID	Unit	Size	Hours of Operation	Stack Height (ft)	Stack Diameter (ft)	Stack Velocity (ft/s)	Stack Temperature (F)	$PM_{10}/PM_{2.5}$ lb/hr
EU_ENG1	Wartsila RICE 1	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EU_ENG2	Wartsila RICE 2	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EU_ENG3	Wartsila RICE 3	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EU_ENG4	Wartsila RICE 4	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EU_ENG5	Wartsila RICE 5	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EU_ENG6	Wartsila RICE 6	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EU_ENG7	Wartsila RICE 7	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EU_ENG8	Wartsila RICE 8	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EU_ENG9	Wartsila RICE 9	8.439 MW	8,000	51.50	4.0	77.8	698	1.47
EMGDFP1	Emergency Diesel Fire Pump	55 HP	100	8.20	0.33	91.39	1083	0.049
EMGGEN1	Emergency Diesel Generator	250 KW	100	10.91	0.583	139.85	853.9	0.11
IA_HTR1	Natural Gas-Fired Gas Heater	0.95 MMBtu/hr	8,760	16.63	1.0	44.33	0.83	0.01

Site Elevation 2164.2 ft

CONFIDENTIAL Emission statement

Title:	Typical start up emissions after catalyst system in US installations (34 SG engine)	**Doc.ID:**	DBAC609785
		Revision:	-.1
Author:	Hanna Strandberg	**Status:**	Draft
Draft by:	Hanna Strandberg / 24.04.2013	**Pages:**	1 (2)
Organisation:	- General Power Plants		
Project :	IN026 – WNS-P DOCVISION		

Typical start up emissions for 34SG in US market.docx

This document provides engineering estimates on the start-up emissions for one Wärtsilä® 20V34SG engine equipped with an efficient emission control system. The system includes a selective catalytic reduction system and an oxidation catalyst. The figures are best estimates only and shall not be considered as guarantee data.

The fast start-up of the engines results in transients in emissions, temperatures and flows which make accurate measurement and prediction of emissions virtually impossible. The flue gas emission estimates herein are based on emission measurement for steady conditions at different loads together with limited measurements performed during start-up. The emission control performance in a start up situation is based on supplier estimates and laboratory data. The data assumes that the engines will reach full load within 10 minutes.

The start-up emissions are estimated for two different conditions: cold catalyst start and warm catalyst start. A cold catalyst start is defined as a start where the emission control system is cold. A warm catalyst start is defined as a start where the temperature of the emission control system is minimum 270 °C at the time of the start. Typically this condition is fulfilled if the engine is started within 2 to 6 hours after the engine was stopped.

For cold start conditions, the engine will reach steady state conditions and the emission control system will typically reach its full abatement efficiency within 30 minutes from the start. For warm start conditions, the engine will reach steady state conditions and the emission control system will typically reach its full abatement efficiency within 15 minutes from the start.

The estimated cumulative flue gas emissions expressed as kg and lb per a start period (30 min) of one (1) Wärtsilä® 20V34SG engine are given in the table below for warm and cold start-up.

34SG-C2	Cold catalyst start emissions [kg/start]	Cold catalyst start emissions [lb/start]	Warm catalyst start emissions [kg/start]	Warm catalyst start emissions [lb/start]
NOx (as NO_2)	5,1	11,2	1,9	4,2
CO	5,3	9,7	1,1	2,0
VOC (as CH_4 eqv.)	1,3	2,9	0,9	2,0
PM_{10} (total)	0,7	1,5	0,7	1,5

34SG-D	Cold catalyst start emissions [kg/start]	Cold catalyst start emissions [lb/start]	Warm catalyst start emissions [kg/start]	Warm catalyst start emissions [lb/start]
NOx (as NO_2)	5,1	11,2	1,9	4,2
CO	3,8	8,4	0,9	2,0
VOC (as CH_4 eqv.)	1,3	2,9	0,9	2,0
PM_{10} (total)	0,7	1,5	0,7	1,5

34SG-D Cold start up optimised for NOx	Cold catalyst start emissions [kg/start]	Cold catalyst start emissions [lb/start]	Warm catalyst start emissions [kg/start]	Warm catalyst start emissions [lb/start]
NOx (as NO_2)	2,5	5,5	1,1	2,4
CO	5	11,0	1	2,2
VOC (as CH_4 eqv.)	1,7	3,7	1	2,2
PM_{10} (total)	0,7	1,5	0,7	1,5

The VOC (volatile organic compounds) emissions depends on the composition of the fuel gas. The emissions in this case are based on a VOC to THC ratio of 15 % in the fuel gas.

Stack emission measurements during start up sequences or heavy transient loads are challenging and the repeatability of start up emission measurement on site is low. The analysator respons time for the gaseous emissions needs special attention. Moreover the particulate emissions will stay on a theoretical level since the particulates can not be determinate by an isokinetic sampling reference method.

20V34SG engine Shutdown Emissions

Component	Shutdown kg/min	Shutdown lb/min
CO	0.012	0.026
NOx as NO2	0.028	0.062
VOC as CH4 equivalent	0.015	0.033
PM10 (total)	0.028	0.062

From: Matthew.Fisher@wartsila.com [mailto:Matthew.Fisher@wartsila.com]
Sent: Thursday, September 05, 2013 8:49 AM
To: Andracsek, Robynn
Subject: RE: TradWind_shutdown emissions

This document provides engineering estimates on the engine unloading emissions for one Wärtsilä® 20V34SG engine equipped with an efficient emission control system. The system includes an oxidation catalyst and a selective catalytic reduction system. The estimated emissions are typical only.

The short 60 seconds unloading time of the engines makes accurate measurements and prediction of emissions during unloading almost impossible. The flue gas emission estimates herein are based on engine factory test bed emission measurements, limited site measurements with fast response time analysers and an engine unloading time of 60 seconds.

The estimated cumulative flue gas emissions expressed as kg per an unloading period (60 s) of one (1) Wärtsilä®
20V34SG engine are given in the table below.

Component [kg per unloading]
CO 0.012
NOx as NO2 0.028
VOC as CH4 equivalent 0.015
PM10 (total) 0.028

Matthew Fisher
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410.573.2100 main
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EPA TANKS

TANK 0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Goodman Diesel Tank
City:	Kansas City
State:	Kansas
Company:	Midwest Energy
Type of Tank:	Vertical Fixed Roof Tank
Description:	Goodman Energy Center Emergency Generator Diesel Tank

Tank Dimensions

Shell Height (ft):		5.00
Diameter (ft):		0.83
Liquid Height (ft) :		5.00
Avg. Liquid Height (ft):		5.00
Volume (gallons):		20.24
Turnovers:		1.00
Net Throughput(gal/yr):		20.24
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		0.00
Slope (ft/ft) (Cone Roof)		0.06

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Topeka, Kansas (Avg Atmospheric Pressure = 14.28 psia)

TANK 0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Goodman Diesel Tank - Vertical Fixed Roof Tank
Kansas City, Kansas

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	Jan	42.93	38.35	47.52	53.99	0.0035	0.0031	0.0042	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045
Distillate fuel oil no. 2	Feb	45.67	40.77	50.57	53.99	0.0039	0.0032	0.0046	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045
Distillate fuel oil no. 2	Mar	51.09	45.47	56.71	53.99	0.0047	0.0039	0.0058	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065
Distillate fuel oil no. 2	Apr	56.55	50.28	62.81	53.99	0.0058	0.0046	0.0072	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065
Distillate fuel oil no. 2	May	61.14	54.87	67.41	53.99	0.0068	0.0055	0.0084	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Jun	65.35	59.08	71.62	53.99	0.0078	0.0063	0.0095	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Jul	67.56	61.17	73.95	53.99	0.0084	0.0068	0.0102	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Aug	66.24	59.98	72.50	53.99	0.0081	0.0065	0.0097	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Sep	62.00	55.93	68.06	53.99	0.0070	0.0057	0.0085	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Oct	56.51	50.61	62.42	53.99	0.0058	0.0046	0.0071	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065
Distillate fuel oil no. 2	Nov	50.16	45.31	55.01	53.99	0.0045	0.0038	0.0055	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065
Distillate fuel oil no. 2	Dec	44.59	40.35	48.82	53.99	0.0037	0.0031	0.0043	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045

TANK 0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Goodman Diesel Tank - Vertical Fixed Roof Tank
Kansas City, Kansas

Month:	January	February	March	April	May	June	July	August	September	October	November	December
Standing Losses (lb):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vapor Space Volume (cu ft):	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047
Vapor Density (lb/cu ft):	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
Vapor Space Expansion Factor:	0.0324	0.0347	0.0400	0.0445	0.0441	0.0438	0.0445	0.0436	0.0425	0.0417	0.0340	0.0295
Vented Vapor Saturation Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Tank Vapor Space Volume:												
Vapor Space Volume (cu ft):	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047
Tank Diameter (ft):	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300
Vapor Space Outage (ft):	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086
Tank Shell Height (ft):	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Average Liquid Height (ft):	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Roof Outage (ft):	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086
Roof Outage (Cone Roof)												
Roof Outage (ft):	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086
Roof Height (ft):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Roof Slope (ft/ft):	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625
Shell Radius (ft):	0.4150	0.4150	0.4150	0.4150	0.4150	0.4150	0.4150	0.4150	0.4150	0.4150	0.4150	0.4150
Vapor Density												
Vapor Density (lb/cu ft):	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035	0.0039	0.0047	0.0058	0.0068	0.0078	0.0084	0.0081	0.0070	0.0058	0.0045	0.0037
Daily Avg. Liquid Surface Temp. (deg. R):	502.6026	505.3383	510.7625	516.2177	520.8108	525.0179	527.2315	525.9078	521.6659	516.1829	509.8332	504.2574
Daily Average Ambient Temp. (deg. F):	26.6500	32.1500	43.5500	54.8500	64.5500	73.5500	78.4500	76.2000	67.7000	56.3000	43.0000	30.7500
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731
Liquid Bulk Temperature (deg. R):	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650
Tank Paint Solar Absorptance (Shell):	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	721.7893	956.8863	1,260.8310	1,620.6152	1,862.6922	2,046.7088	2,089.5402	1,841.1178	1,467.3738	1,119.6458	749.0745	610.7448
Vapor Space Expansion Factor												
Vapor Space Expansion Factor:	0.0324	0.0347	0.0400	0.0445	0.0441	0.0438	0.0445	0.0436	0.0425	0.0417	0.0340	0.0295
Daily Vapor Temperature Range (deg. R):	18.3397	19.6028	22.4896	25.0661	25.0664	25.0783	25.5702	25.0357	24.2647	23.6175	19.4056	16.9471
Daily Vapor Pressure Range (psia):	0.0011	0.0014	0.0020	0.0026	0.0029	0.0032	0.0034	0.0033	0.0028	0.0025	0.0017	0.0012
Breather Vent Press. Setting Range(psia):	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035	0.0039	0.0047	0.0058	0.0068	0.0078	0.0084	0.0081	0.0070	0.0058	0.0045	0.0037
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0031	0.0032	0.0039	0.0046	0.0055	0.0063	0.0068	0.0065	0.0057	0.0046	0.0038	0.0031
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0042	0.0046	0.0058	0.0072	0.0084	0.0095	0.0102	0.0097	0.0085	0.0071	0.0055	0.0043
Daily Avg. Liquid Surface Temp. (deg R):	502.6026	505.3383	510.7625	516.2177	520.8108	525.0179	527.2315	525.9078	521.6659	516.1829	509.8332	504.2574
Daily Min. Liquid Surface Temp. (deg R):	498.0176	500.4376	505.1401	509.9512	514.5442	518.7483	520.8389	519.6489	515.5997	510.2785	504.9818	500.0206
Daily Max. Liquid Surface Temp. (deg R):	507.1875	510.2390	516.3849	522.4842	527.0774	531.2875	533.6240	532.1668	527.7321	522.0873	514.6846	508.4942
Daily Ambient Temp. Range (deg. R):	20.7000	20.9000	22.9000	24.1000	22.5000	21.3000	21.7000	22.6000	24.0000	25.4000	22.0000	19.5000
Vented Vapor Saturation Factor												
Vented Vapor Saturation Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0035	0.0039	0.0047	0.0058	0.0068	0.0078	0.0084	0.0081	0.0070	0.0058	0.0045	0.0037
Vapor Space Outage (ft):	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086
Working Losses (lb):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vapor Molecular Weight (lb/lb-mole):	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035	0.0039	0.0047	0.0058	0.0068	0.0078	0.0084	0.0081	0.0070	0.0058	0.0045	0.0037
Net Throughput (gal/mo.):	1.6864	1.6864	1.6864	1.6864	1.6864	1.6864	1.6864	1.6864	1.6864	1.6864	1.6864	1.6864
Annual Turnovers:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Turnover Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Maximum Liquid Volume (gal):	20.2371	20.2371	20.2371	20.2371	20.2371	20.2371	20.2371	20.2371	20.2371	20.2371	20.2371	20.2371

Maximu 1 Height (ft):	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Tank Di ,ft):	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	0.8300	.8300
Working Product Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total Losses (lb):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TANK 0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: January, February, March, April, May, June, July, August, September, October, November, December

Goodman Diesel Tank - Vertical Fixed Roof Tank
Kansas City, Kansas

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.00	0.00	0.00

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Goodman Diesel Tank
City:	Kansas City
State:	Kansas
Company:	Midwest Energy
Type of Tank:	Vertical Fixed Roof Tank
Description:	Goodman Energy Center Emergency Generator Diesel Tank

Tank Dimensions

Shell Height (ft):		5.00
Diameter (ft):		2.60
Liquid Height (ft) :		5.00
Avg. Liquid Height (ft):		5.00
Volume (gallons):		198.58
Turnovers:		1.00
Net Throughput(gal/yr):		198.58
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		0.00
Slope (ft/ft) (Cone Roof)		0.06

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Topeka, Kansas (Avg Atmospheric Pressure = 14.28 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Goodman Diesel Tank - Vertical Fixed Roof Tank
Kansas City, Kansas

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	Jan	42.93	38.35	47.52	53.99	0.0035	0.0031	0.0042	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045
Distillate fuel oil no. 2	Feb	45.67	40.77	50.57	53.99	0.0039	0.0032	0.0046	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045
Distillate fuel oil no. 2	Mar	51.09	45.47	56.71	53.99	0.0047	0.0039	0.0058	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065
Distillate fuel oil no. 2	Apr	56.55	50.28	62.81	53.99	0.0058	0.0046	0.0072	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065
Distillate fuel oil no. 2	May	61.14	54.87	67.41	53.99	0.0068	0.0055	0.0084	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Jun	65.35	59.08	71.62	53.99	0.0078	0.0063	0.0095	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Jul	67.56	61.17	73.95	53.99	0.0084	0.0068	0.0102	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Aug	66.24	59.98	72.50	53.99	0.0081	0.0065	0.0097	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Sep	62.00	55.93	68.06	53.99	0.0070	0.0057	0.0085	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Oct	56.51	50.61	62.42	53.99	0.0058	0.0046	0.0071	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065
Distillate fuel oil no. 2	Nov	50.16	45.31	55.01	53.99	0.0045	0.0038	0.0055	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065
Distillate fuel oil no. 2	Dec	44.59	40.35	48.82	53.99	0.0037	0.0031	0.0043	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Goodman Diesel Tank - Vertical Fixed Roof Tank
Kansas City, Kansas

Month:	January	February	March	April	May	June	July	August	September	October	November	December
Standing Losses (lb):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vapor Space Volume (cu ft):	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438
Vapor Density (lb/cu ft):	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
Vapor Space Expansion Factor:	0.0324	0.0347	0.0400	0.0445	0.0441	0.0438	0.0445	0.0436	0.0425	0.0417	0.0340	0.0295
Vented Vapor Saturation Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Tank Vapor Space Volume:												
Vapor Space Volume (cu ft):	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438	0.1438
Tank Diameter (ft):	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000
Vapor Space Outage (ft):	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271
Tank Shell Height (ft):	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Average Liquid Height (ft):	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Roof Outage (ft):	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271
Roof Outage (Cone Roof)												
Roof Outage (ft):	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271
Roof Height (ft):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Roof Slope (ft/ft):	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625
Shell Radius (ft):	1.3000	1.3000	1.3000	1.3000	1.3000	1.3000	1.3000	1.3000	1.3000	1.3000	1.3000	1.3000
Vapor Density												
Vapor Density (lb/cu ft):	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035	0.0039	0.0047	0.0058	0.0068	0.0078	0.0084	0.0081	0.0070	0.0058	0.0045	0.0037
Daily Avg. Liquid Surface Temp. (deg. R):	502.6026	505.3383	510.7625	516.2177	520.8108	525.0179	527.2315	525.9078	521.6659	516.1829	509.8332	504.2574
Daily Average Ambient Temp. (deg. F):	26.6500	32.1500	43.5500	54.8500	64.5500	73.5500	78.4500	76.2000	67.7000	56.3000	43.0000	30.7500
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731
Liquid Bulk Temperature (deg. R):	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650	513.6650
Tank Paint Solar Absorptance (Shell):	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	721.7893	956.8863	1,260.8310	1,620.6152	1,862.6922	2,046.7088	2,089.5402	1,841.1178	1,467.3738	1,119.6458	749.0745	610.7448
Vapor Space Expansion Factor												
Vapor Space Expansion Factor:	0.0324	0.0347	0.0400	0.0445	0.0441	0.0438	0.0445	0.0436	0.0425	0.0417	0.0340	0.0295
Daily Vapor Temperature Range (deg. R):	18.3397	19.6028	22.4896	25.0661	25.0664	25.0783	25.5702	25.0357	24.2647	23.6175	19.4056	16.9471
Daily Vapor Pressure Range (psia):	0.0011	0.0014	0.0020	0.0026	0.0029	0.0032	0.0034	0.0033	0.0028	0.0025	0.0017	0.0012
Breather Vent Press. Setting Range(psia):	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035	0.0039	0.0047	0.0058	0.0068	0.0078	0.0084	0.0081	0.0070	0.0058	0.0045	0.0037
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0031	0.0032	0.0039	0.0046	0.0055	0.0063	0.0068	0.0065	0.0057	0.0046	0.0038	0.0031
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0042	0.0046	0.0058	0.0072	0.0084	0.0095	0.0102	0.0097	0.0085	0.0071	0.0055	0.0043
Daily Avg. Liquid Surface Temp. (deg R):	502.6026	505.3383	510.7625	516.2177	520.8108	525.0179	527.2315	525.9078	521.6659	516.1829	509.8332	504.2574
Daily Min. Liquid Surface Temp. (deg R):	498.0176	500.4376	505.1401	509.9512	514.5442	518.7483	520.8389	519.6489	515.5997	510.2785	504.9818	500.0206
Daily Max. Liquid Surface Temp. (deg R):	507.1875	510.2390	516.3849	522.4842	527.0774	531.2875	533.6240	532.1668	527.7321	522.0873	514.6846	508.4942
Daily Ambient Temp. Range (deg. R):	20.7000	20.9000	22.9000	24.1000	22.5000	21.3000	21.7000	22.6000	24.0000	25.4000	22.0000	19.5000
Vented Vapor Saturation Factor												
Vented Vapor Saturation Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0035	0.0039	0.0047	0.0058	0.0068	0.0078	0.0084	0.0081	0.0070	0.0058	0.0045	0.0037

Vapor Space Outage (ft):	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271
Working Losses (lb):	0.0002	0.0002	0.0002	0.0003	0.0003	0.0004	0.0004	0.0004	0.0004	0.0003	0.0002	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035	0.0039	0.0047	0.0058	0.0068	0.0078	0.0084	0.0081	0.0070	0.0058	0.0045	0.0037
Net Throughput (gal/mo.):	16.5485	16.5485	16.5485	16.5485	16.5485	16.5485	16.5485	16.5485	16.5485	16.5485	16.5485	16.5485
Annual Turnovers:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Turnover Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Maximum Liquid Volume (gal):	198.5820	198.5820	198.5820	198.5820	198.5820	198.5820	198.5820	198.5820	198.5820	198.5820	198.5820	198.5820
Maximum Liquid Height (ft):	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Tank Diameter (ft):	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000	2.6000
Working Loss Product Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total Losses (lb):	0.0002	0.0002	0.0003	0.0003	0.0004	0.0004	0.0005	0.0004	0.0004	0.0003	0.0002	0.0002

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: January, February, March, April, May, June, July, August, September, October, November, December

Goodman Diesel Tank - Vertical Fixed Roof Tank
Kansas City, Kansas

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.00	0.00	0.00

APPENDIX D
RBLC TABLES

Table D-1 - RBLC Results for PM/PM_{10} Emissions for RIC ral Gas) (In Order of Lowest to Highest Emission Limits)

RBLCID	Permit Date	Facility Name	Corporation	State	Throughput	Units	Control Device	Emission Limit 1	Units	Type
TX-0364	1/31/2003	SALT CREEK GAS PLANT	EXXON MOBIL CORPORATION	TX	1330	HP	NONE INDICATED	0.12	LB/H	Other Case-by-Case
CA-1068	4/17/2001	NEO CALIFORNIA POWER, LLC	NEO CALIFORNIA POWER, LLC	CA	3870	HP		0.17	LB/H	BACT-PSD
TX-0408	11/22/2002	INDIAN ROCK GATHERING COMPANY LP	INDIAN ROCK GATHERING COMPANY LP	TX	800	HP	GOOD COMBUSTION PRACTICE	0.3	LB/H	BACT-PSD
IA-0077	6/8/2005	STATION 204	NATURAL GAS PIPELINE OF AMERICA	IA	4735	HP		0.36	LB/H	Other Case-by-Case
TX-0364	1/31/2003	SALT CREEK GAS PLANT	EXXON MOBIL CORPORATION	TX	2000	HP EACH	NONE INDICATED	0.53	LB/H	Other Case-by-Case
TX-0364	1/31/2003	SALT CREEK GAS PLANT	EXXON MOBIL CORPORATION	TX	2400	HP	NONE INDICATED	0.62	LB/H	Other Case-by-Case
LA-0257	12/6/2011	SABINE PASS LNG TERMINAL	SABINE PASS LNG, LP & SABINE PASS LIQUEFACTION, LL	LA	2012	hp	fueled by natural gas	0.75	LB/H	BACT-PSD
WA-0289	2/22/2002	TRANSALTA CENTRALIA GENERATION LLC	TRANSALTA	WA	1448	HP		0.94	LB/H	BACT-PSD
WA-0289	2/22/2002	TRANSALTA CENTRALIA GENERATION LLC	TRANSALTA	WA	1448	HP		0.94	LB/H	BACT-PSD
WV-0020	2/14/2003	COLUMBIA GAS TRANSMISSIONS LOST RIVER	COLUMBIA GAS TRANSMISSIONS LOST RIVER	WV	4640	HP		1	LB/H	BACT-PSD
TX-0364	1/31/2003	SALT CREEK GAS PLANT	EXXON MOBIL CORPORATION	TX	3105	HP	NONE INDICATED	1.09	LB/H	Other Case-by-Case
TX-0541	5/18/2009	POWER LANE STEAM PLANT	GEUS	TX	8.44	MW EACH	TCEQ EMISSION LIMITS WERE NOT VERY COMPARABLE TO THE PROCESS GEUS IS USING. SO GEUS PROPOSES THE USE OF CLEAN FUELS AND GOOD	4.5	LB/H	BACT-PSD
TX-0542	1/23/2009	PEARSALL POWER PLANT	SOUTH TEXAS ELECTRIC COOPERATIVE INC.	TX	8.44	MW EACH	TCEQ'S CURRENT BACT GUIDELINES PROVIDE NO GUIDANCE FOR PM EMISSIONS FOR THIS TYPE OF ENGINE. LOW ASH FUEL AND COMBUSTION	4.5	LB/H	BACT-PSD

Table D-2 - RBLC Results for GHG Emissions for RICE (Gas) (In Order of Lowest to Highest Emission Limits)

RBLCID	Permit Date	Facility Name	Corporation	State	Throughput	Units	Control Device	Emission Limit	Units	Type
*AK-0080	6/6/2013	ANCHORAGE MUNICIPAL LIGHT & POWER	MUNICIPALITY OF ANCHORAGE	AK	408	MMBtu/hr	Good operating and combustion practices	0		OTHER
*AK-0080	6/6/2013	ANCHORAGE MUNICIPAL LIGHT & POWER	MUNICIPALITY OF ANCHORAGE	AK	2000	ekW	Good Combustion and Operation practices	0		OTHER
*LA-0266	5/1/2013	EUNICE GAS EXTRACTION PLANT	CROSSTEX PROCESSING SERVICES, LLC	LA	359	MM Btu/hr	Energy efficiency measures: improved combustion measures (e.g., combusti	0		BACT-PSD
*LA-0266	5/1/2013	EUNICE GAS EXTRACTION PLANT	CROSSTEX PROCESSING SERVICES, LLC	LA	0		Good combustion practices	0		BACT-PSD
*LA-0266	5/1/2013	EUNICE GAS EXTRACTION PLANT	CROSSTEX PROCESSING SERVICES, LLC	LA	31.2	MM Btu/hr	Good combustion practices	0		BACT-PSD
*LA-0266	5/1/2013	EUNICE GAS EXTRACTION PLANT	CROSSTEX PROCESSING SERVICES, LLC	LA	3550	HP	Compliance with NSPS JJJJ	0		BACT-PSD
LA-0257	12/6/2011	SABINE PASS LNG TERMINAL	SABINE PASS LNG, LP & SABINE PASS LIQUEFACTION, LL	LA	2012	hp	Fueled by natural gas, good combustion/operating practices	0.046751455	LB/HP-HR	BACT-PSD
*IN-0167	4/16/2013	MAGNETATION LLC	MAGNETATION LLC	IN	300	HP	USE OF NATURAL GAS AND GOOD COMBUSTION PRACTICES	0.050228311	LB/HP-HR	BACT-PSD
*IN-0167	4/16/2013	MAGNETATION LLC	MAGNETATION LLC	IN	620	HP	USE OF NATURAL GAS AND GOOD COMBUSTION PRACTICES	0.053026955	LB/HP-HR	BACT-PSD
LA-0256	12/6/2011	COGENERATION PLANT	WESTLAKE VINYLS COMPANY LP	LA	1818	HP	USE OF NATURAL GAS AS FUEL AND GOOD COMBUSTION PRACTICES	0.830159516	LB/HP-HR	BACT-PSD
LA-0257	12/6/2011	SABINE PASS LNG TERMINAL	SABINE PASS LNG, LP & SABINE PASS LIQUEFACTION, LL	LA	0.26	MMBTU/H	proper plant operations and maintain the presence of the flame when the g	116.7896031	LB/MMBTU	BACT-PSD
*IN-0167	4/16/2013	MAGNETATION LLC	MAGNETATION LLC	IN	1.7	MMBTU/H	USE OG NATURAL GAS AND GOOD COMBUSTION PRACTICES	116.9755573	LB/MMBTU	BACT-PSD
*IN-0167	4/16/2013	MAGNETATION LLC	MAGNETATION LLC	IN	19	MMBTU/H	USE OF NATURAL GAS AND GOOD COMBUSTION PRACTICES	117.0031242	LB/MMBTU	BACT-PSD
LA-0256	12/6/2011	COGENERATION PLANT	WESTLAKE VINYLS COMPANY LP	LA	475	MMBTU/H	USE OF NATURAL GAS AS FUEL AND GOOD COMBUSTION PRACTICES	117.0037263	LB/MMBTU	BACT-PSD
*IN-0167	4/16/2013	MAGNETATION LLC	MAGNETATION LLC	IN	1	MMBTU/H EA	USE OF NATURAL GAS AND GOOD COMBUSTION PRACTICES	818.9497717	LB/MMBTU	BACT-PSD
LA-0257	12/6/2011	SABINE PASS LNG TERMINAL	SABINE PASS LNG, LP & SABINE PASS LIQUEFACTION, LL	LA	286	MMBTU/H	Good combustion/operating practices and fueled by natural gas - use GE LM	3889.34684	LB/MMBTU	BACT-PSD
LA-0257	12/6/2011	SABINE PASS LNG TERMINAL	SABINE PASS LNG, LP & SABINE PASS LIQUEFACTION, LL	LA	286	MMBTU/H	Good combustion/operating practices and fueled by natural gas - use GE LM	3889.34684	LB/MMBTU	BACT-PSD
LA-0257	12/6/2011	SABINE PASS LNG TERMINAL	SABINE PASS LNG, LP & SABINE PASS LIQUEFACTION, LL	LA	286	MMBTU/H	Good combustion/operating practices and fueled by natural gas - use GE LM	3889.34684	LB/MMBTU	BACT-PSD
TX-0627	5/24/2012	LONE STAR NGL MONT BELVIEW GAS PLANT(LONE STAR)	ENERGY TRASFER PARTNERS, LP (ETP)	TX	4775	HP		1871.7	LB/MMSCF	BACT-PSD
TX-0627	5/24/2012	LONE STAR NGL MONT BELVIEW GAS PLANT(LONE STAR)	ENERGY TRASFER PARTNERS, LP (ETP)	TX	48.5	MMBTU/H		1102.5	LB/MMSCF	BACT-PSD
*IN-0167	4/16/2013	MAGNETATION LLC	MAGNETATION LLC	IN	450	T/H OF IRON (	ENERGY EFFICIENT FURNACE DESIGN, USE OF COKE BREEZE TO OFFSET THE	661208	T/YR	BACT-PSD

Table D-3 - RBLC Results ssions for the Gas Heater

RBLCID	Permit Date	Facility Name	Corporation	State	Throughput	Units	Pollutant	Control Device	Emission Limit	Units	Type
IA-0058	4/10/2002	GREATER DES MOINES ENERGY CENTER	MIDAMERICAN ENERGY	IA			filterable < 10 µ (FPM10)		0.0045	LB/MMBTU	BACT-PSD
MD-0040	11/12/2008	CPV ST CHARLES	COMPETITIVE POWER VENTURES, INC./CPV MARYLAND, LLC	MD	1.7	MMBTU/H	Particulate Matter (PM)		0.007	LB/MMBTU	BACT-PSD
MD-0040	11/12/2008	CPV ST CHARLES	COMPETITIVE POWER VENTURES, INC./CPV MARYLAND, LLC	MD	1.7	MMBTU/H	filterable < 10 µ (FPM10)		0.007	LB/MMBTU	BACT-PSD
MD-0040	11/12/2008	CPV ST CHARLES	COMPETITIVE POWER VENTURES, INC./CPV MARYLAND, LLC	MD	1.7	MMBTU/H	filterable < 2.5 µ (FPM2.5)		0.007	LB/MMBTU	LAER
NV-0050	11/30/2009	MGM MIRAGE	MGM MIRAGE	NV	2	MMBTU/H	filterable; 10 µ (FPM10)	GAS ONLY AND GOOD COMBUSTION PRACTICES	0.0075	LB/MMBTU	Other Case-by-Case
IA-0064	1/31/2003	ROQUETTE AMERICA	ROQUETTE AMERICA	IA	1.6	MMBTU/H	Particulate Matter (PM)	GOOD COMBUSTION PRACTICES	0.008	LB/MMBTU	BACT-PSD
NV-0035	8/16/2005	TRACY SUBSTATION EXPANSION PROJECT	SIERRA PACIFIC POWER COMPANY	NV	4	MMBTU/H	Particulate Matter < 10 µ (PM10)	BEST COMBUSTION PRACTICES.	0.02	LB/MMBTU	BACT-PSD
NV-0035	8/16/2005	TRACY SUBSTATION EXPANSION PROJECT	SIERRA PACIFIC POWER COMPANY	NV	4	MMBTU/H	Particulate Matter < 10 µ (PM10)	BEST COMBUSTION PRACTICES	0.02	LB/MMBTU	BACT-PSD
OH-0264	5/23/2002	NORTON ENERGY STORAGE, LLC	NORTON ENERGY	OH	11.45	MMBTU/H	filterable < 10 µ (FPM10)		0.087	LB/H	BACT-PSD
NJ-0036	10/24/2001	AES RED OAK LLC	AES RED OAK LLC	NJ	16	MMBTU/H	Particulate Matter (PM)	NONE- PM EMISSIONS ALREADY VERY LOW	0.12	LB/H	BACT-PSD
LA-0192	6/6/2005	CRESCENT CITY POWER	CRESENT CITY POWER, LLC	LA	19	MMBTU/H	Particulate Matter < 10 µ (PM10)	NATURAL GAS AND GOOD COMBUSTION PRACTICES	0.14	LB/H	BACT-PSD
LA-0244	11/29/2010	LAKE CHARLES CHEMICAL COMPLEX - LAB UNIT	SASOL NORTH AMERICA, INC.	LA	21	MMBTU/H	Particulate matter, total; 10 µ (TPM10)	No additional Control	0.21	LB/H	BACT-PSD
LA-0244	11/29/2010	LAKE CHARLES CHEMICAL COMPLEX - LAB UNIT	SASOL NORTH AMERICA, INC.	LA	87.3	MMBTU/H	Particulate matter, total; 10 µ (TPM10)		0.86	LB/H	BACT-PSD
LA-0244	11/29/2010	LAKE CHARLES CHEMICAL COMPLEX - LAB UNIT	SASOL NORTH AMERICA, INC.	LA	170	MMBTU/H	Particulate matter, total; 10 µ (TPM10)	No additional control	1.71	LB/H	BACT-PSD
*FL-0286	1/10/2007	FPL WEST COUNTY ENERGY CENTER	FLORIDA POWER AND LIGHT COMPANY	FL	10	MMBTU/H	Particulate Matter < 10 µ (PM10)		2	GR S/100 SCF GAS	BACT-PSD

Table D-4 - RBLC Results f sions for Diesel Generator

RBLCID	Permit Date	Facility Name	Corporation	State	Throughput	Units	Pollutant	Control Device	Emission Limit 1	Units	Type
*MN-0071	6/5/2007	FAIRBAULT ENERGY PARK	MINNESOTA MUNICIPAL POWER AGENCY	MN	1750	KW	Particulate Matter (PM)		0.0007	LB/HP-H	BACT-PSD
MN-0053	7/15/2004	FAIRBAULT ENERGY PARK	MN MUNICIPAL POWER AGENCY	MN	670	HP	Particulate Matter (PM)	CLEAN FUEL AND GOOD COMBUSTION.	0.1	LB/MMBTU	BACT-PSD
MN-0054	12/4/2003	MANKATO ENERGY CENTER		MN	1850	HP	Particulate Matter (PM)	GOOD COMBUSTION	0.07	G/B-HP-H	BACT-PSD
OH-0254	8/14/2003	DUKE ENERGY WASHINGTON COUNTY LLC	DUKE ENERGY NORTH AMERICA	OH	600	KW	Particulate Matter (PM)	LOW SULFUR FUEL, COMBUSTION CONTROL	0.72	LB/H	BACT-PSD
IA-0064	1/31/2003	ROQUETTE AMERICA	ROQUETTE AMERICA	IA	38.4	GAL/H	Particulate Matter (PM)	LOW ASH FUEL, GOOD COMBUSTION PRACTICES.	0.069	LB/MMBTU	BACT-PSD
*FL-0303	7/30/2008	FPL WEST COUNTY ENERGY CENTER UNIT 3	FLORIDA POWER AND LIGHT COMPANY (FP&L)	FL	21	MMBTU/H	Particulate Matter (PM)		0.4	G/B-HP-H	BACT-PSD
*MN-0071	6/5/2007	FAIRBAULT ENERGY PARK	MINNESOTA MUNICIPAL POWER AGENCY	MN	1750	KW	Particulate Matter < 10 µ (PM10)		0.0004	LB/HP-H	BACT-PSD
*FL-0286	1/10/2007	FPL WEST COUNTY ENERGY CENTER	FLORIDA POWER AND LIGHT COMPANY	FL			Particulate Matter < 10 µ (PM10)		0.4	GM/BHP-H	BACT-PSD
NC-0101	9/29/2005	FORSYTH ENERGY PLANT	FORSYTH ENERGY PROJECTS, LLC	NC	11.4	MMBTU/H	Particulate Matter < 10 µ (PM10)		1.14	LB/H	BACT-PSD
OH-0252	12/28/2004	DUKE ENERGY HANGING ROCK ENERGY FACILITY	DUKE ENERGY HANGING ROCK, LLC	OH	500	KW	Particulate Matter < 10 µ (PM10)		0.59	LB/H	BACT-PSD
LA-0194	11/24/2004	SABINE PASS LNG IMPORT TERMINAL	SABINE PASS LNG, LP	LA	2220	HP EA.	Particulate Matter < 10 µ (PM10)	GOOD COMBUSTION PRACTICES	1.96	LB/H	BACT-PSD
MN-0054	12/4/2003	MANKATO ENERGY CENTER		MN	1850	HP	Particulate Matter < 10 µ (PM10)	GOOD COMBUSTION	0.07	G/B-HP-H	BACT-PSD
TX-0374	3/24/2003	CHOCOLATE BAYOU PLANT	BP AMOCO CHEMICAL CO	TX			Particulate Matter < 10 µ (PM10)	NONE INDICATED	0.63	LB/H	BACT-PSD
OK-0090	3/21/2003	DUKE ENERGY STEPHENS, LLC STEPHENS ENERGY	DUKE ENERGY	OK	749	BHP	Particulate Matter < 10 µ (PM10)	COMBUSTION CONTROL AND GOOD ENGINE DESIGN	0.124	LB/MMBTU	BACT-PSD
ID-0018	6/25/2010	LANGLEY GULCH POWER PLANT	IDAHO POWER COMPANY	ID	750	KW	Particulate Matter (PM)	TIER 2 ENGINE-BASED, GOOD COMBUSTION PRACTICES (GCP)	0.2	G/KW-H	BACT-PSD
GA-0140	12/3/2010	MITCHELL STEAM-GENERATING PLANT (PLANT MITCHELL)	GEORGIA POWER CO.	GA	1050	bhp	Particulate matter, filterable ; 10 µ (FPM10)	Use of ultra-low sulfur diesel fuel only.	3000	H	BACT-PSD
*LA-0251	4/26/2011	FLOPAM INC. FACILITY	FLOPAM INC.	LA	193	hp	Particulate matter, filterable ; 10 µ (FPM10)	no additional control	0.01	LB/HR	BACT-PSD
NV-0050	11/30/2009	MGM MIRAGE	MGM MIRAGE	NV	3622	HP	Particulate matter, filterable ; 10 µ (FPM10)	TURBOCHARGER AND GOOD COMBUSTION PRACTICES	0.0001	LB/HP-H	Other Case-by-Case
NV-0050	11/30/2009	MGM MIRAGE	MGM MIRAGE	NV	2206	HP	Particulate matter, filterable ; 10 µ (FPM10)	TURBOCHARGER AND GOOD COMBUSTION PRACTICES	0.0001	LB/HP-H	Other Case-by-Case
*AK-0072	7/14/2011	DUTCH HARBOR POWER PLANT	CITY OF UNALASKA	AK	4400	KW	Particulate matter, filterable ; 2.5 µ (FPM2.5)	Positive Crankcase Ventilation Installed as part of the design	0.5	G/KW-H	BACT-PSD
*LA-0254	8/16/2011	NINEMILE POINT ELECTRIC GENERATING PLANT	ENTERGY LOUISIANA LLC	LA	1250	HP	Particulate matter, total ; 10 µ (TPM10)	ULTRA LOW SULFUR DIESEL AND GOOD COMBUSTION PRACTICES	0		BACT-PSD
MI-0389	12/29/2009	KARN WEADOCK GENERATING COMPLEX	CONSUMERS ENERGY	MI	2000	KW	Particulate matter, total ; 10 µ (TPM10)	ENGINE DESIGN AND OPERATION. 15 PPM SULFUR FUEL.	0.0573	LB/MMBTU	BACT-PSD
*LA-0254	8/16/2011	NINEMILE POINT ELECTRIC GENERATING PLANT	ENTERGY LOUISIANA LLC	LA	1250	HP	Particulate matter, total ; 2.5 µ (TPM2.5)	ULTRA LOW SULFUR DIESEL AND GOOD COMBUSTION PRACTICES	0		BACT-PSD
FL-0322	12/23/2010	SWEET SORGHUM-TO-ETHANOL ADVANCED BIOREFINERY	SOUTHEAST RENEWABLE FUELS (SRF), LLC	FL	0		Particulate matter, total (TPM)		0.2	G/KW-H	BACT-PSD
*FL-0323	12/28/2010	GAINESVILLE RENEWABLE ENERGY CENTER	GAINESVILLE REGIONAL UTILITY (GRU) DEERHAVEN	FL	0		Particulate matter, total (TPM)	Notification, Recordkeeping and Reporting Requirements	0.2	G/KW-HR	BACT-PSD
*FL-0324	12/23/2010	PALM BEACH RENEWABLE ENERGY PARK	SOLID WASTE AUTHORITY OF PALM BEACH COUNTY	FL	0		Particulate matter, total (TPM)	distillate (ULSD) fuel oil and GCP & demonstrate compliance in accordance with	0.2	G/KW-HR	BACT-PSD
MI-0389	12/29/2009	KARN WEADOCK GENERATING COMPLEX	CONSUMERS ENERGY	MI	2000	KW	Particulate matter, total (TPM)	ENGINE DESIGN AND OPERATION. 15 PPM SULFUR FUEL.	0.2	G/KW-H	BACT-PSD

Table D-5 - RBLC Results for ns for Emergency Fire Pump

RBLCID	Permit Date	Facility Name	Corporation	State	Throughput	Units	Pollutant	Control Device	Emission Limit 1	Units	Type
*LA-0254	8/16/2011	NINEMILE POINT ELECTRIC GENERATING PLANT	ENTERGY LOUISIANA LLC	LA	350	HP	Particulate matter, total; 10 µ (TPM10)	ULTRA LOW SULFUR DIESEL AND GOOD COMBUSTION PRACTICES	0		BACT-PSD
GA-0141	12/17/2010	WARREN COUNTY BIOMASS ENERGY FACILITY	OGETHORPE POWER CORPERATION	GA	595	HP (combined, se	Particulate matter, total (TPM)	Compliance with 40 CFR 60, Subpart IIII.	0		BACT-PSD
*LA-0251	4/26/2011	FLOPAM INC. FACILITY	FLOPAM INC.	LA	444	hp	Particulate matter, filterable; 10 µ (FPM10)	no additional control	0.01	LB/HR	BACT-PSD
OH-0255	3/29/2001	AEP WATERFORD ENERGY LLC	AMERICAN ELECTRIC POWER	OH	290	KW	Particulate matter, filterable < 10 µ (FPM10)		0.017	T/YR	BACT-PSD
OK-0070	6/13/2002	GENOVA OK I POWER PROJECT	GENOVA OKLAHOMA LLC	OK	200	BHP	Particulate matter, filterable < 10 µ (FPM10)	ENGINE DESIGN AND GOOD COMBUSTION	0.031	LB/MMBTU	BACT-PSD
LA-0194	11/24/2004	SABINE PASS LNG IMPORT TERMINAL	SABINE PASS LNG, LP	LA	300	HP EA.	Particulate Matter < 10 µ (PM10)	OPERATING PRACTICES, AND USE OF LOW SULFUR DIESEL	0.06	LB/H	BACT-PSD
MN-0054	12/4/2003	MANKATO ENERGY CENTER		MN	290	HP	Particulate Matter (PM)	GOOD COMBUSTION	0.07	G/B-HP-H	BACT-PSD
MN-0054	12/4/2003	MANKATO ENERGY CENTER		MN	290	HP	Particulate Matter < 10 µ (PM10)	GOOD COMBUSTION	0.07	G/B-HP-H	BACT-PSD
*CA-1144	4/25/2007	BLYTHE ENERGY PROJECT II	CAITHNESS BLYTHE II, LLC	CA	303	HP	Particulate Matter < 10 µ (PM10)		0.1	LB/H	BACT-PSD
LA-0192	6/6/2005	CRESCENT CITY POWER	CRESENT CITY POWER, LLC	LA			Particulate Matter < 10 µ (PM10)	GOOD ENGINE DESIGN AND PROPER OPERATING PRACTICES	0.14	LB/H	BACT-PSD
MD-0040	11/12/2008	CPV ST CHARLES	COMPETITIVE POWER VENTURES, INC./CPV MARYLAND, LLC	MD	300	HP	Particulate Matter (PM)		0.15	G/HP-H	BACT-PSD
MD-0040	11/12/2008	CPV ST CHARLES	COMPETITIVE POWER VENTURES, INC./CPV MARYLAND, LLC	MD			Particulate Matter (PM)		0.15	G/HP-H	BACT-PSD
MD-0040	11/12/2008	CPV ST CHARLES	COMPETITIVE POWER VENTURES, INC./CPV MARYLAND, LLC	MD	300	HP	Particulate matter, filterable < 10 µ (FPM10)		0.15	GR-HP-H	BACT-PSD
MD-0040	11/12/2008	CPV ST CHARLES	COMPETITIVE POWER VENTURES, INC./CPV MARYLAND, LLC	MD			Particulate matter, filterable < 10 µ (FPM10)		0.15	G/HP-H	BACT-PSD
TX-0350	1/31/2002	ENNIS TRACTEBEL POWER	ENNIS-TRACTEBEL II LP	TX			Particulate matter, filterable < 10 µ (FPM10)	NONE INDICATED	0.15	LB/H	Other Case-by-Case
TX-0343	6/27/2001	MONTGOMERY COUNTY POWER PROJECT	MC ENERGY PARTNERS LP	TX			Particulate matter, filterable < 10 µ (FPM10)	NONE INDICATED	0.15	LB/H	Other Case-by-Case
NJ-0044	6/26/2001	MANTUA CREEK GENERATING FACILITY	MANTUA CREEK GENERATING FACILITY	NJ	1.5	MMBTU/H	Particulate matter, filterable < 10 µ (FPM10)		0.25	LB/H	N/A
NH-0018	7/26/2010	BERLIN BIOPOWER	LAIDLAW BERLIN BIOPOWER, LLC	NH	2.27	MMBTU/H	Particulate matter, filterable (FPM)		0.3	E-5 LB/MMBTU	MACT
MN-0053	7/15/2004	FAIRBAULT ENERGY PARK	MN MUNICIPAL POWER AGENCY	MN	250	HP	Particulate Matter (PM)	CLEAN FUEL AND GOOD COMBUSTION.	0.31	LB/MMBTU	BACT-PSD
OK-0090	3/21/2003	DUKE ENERGY STEPHENS, LLC STEPHENS ENERGY	DUKE ENERGY	OK	265	BHP	Particulate Matter < 10 µ (PM10)	COMBUSTION CONTROL AND GOOD ENGINE DESIGN	0.31	LB/MMBTU	BACT-PSD
OK-0056	2/12/2002	HORSESHOE ENERGY PROJECT	MUSTANG POWER LLC	OK	250	HP	Particulate matter, filterable < 10 µ (FPM10)	LOW ASH FUEL	0.31	LB/MMBTU	BACT-PSD
MI-0389	12/29/2009	KARN WEADOCK GENERATING COMPLEX	CONSUMERS ENERGY	MI	525	HP	Particulate matter, total; 10 µ (TPM10)	ENGINE DESIGN AND OPERATION. 15 PPM SULFUR FUEL.	0.31	LB/MMBTU	BACT-PSD
MI-0389	12/29/2009	KARN WEADOCK GENERATING COMPLEX	CONSUMERS ENERGY	MI	40	KW	Particulate matter, total; 10 µ (TPM10)	ENGINE DESIGN AND OPERATION. 15 PPM SULFUR FUEL.	0.31	LB/MMBTU	BACT-PSD
*FL-0286	1/10/2007	FPL WEST COUNTY ENERGY CENTER	FLORIDA POWER AND LIGHT COMPANY	FL			Particulate Matter < 10 µ (PM10)		0.4	GM/B-HP-H	BACT-PSD
MI-0389	12/29/2009	KARN WEADOCK GENERATING COMPLEX	CONSUMERS ENERGY	MI	40	KW	Particulate matter, total (TPM)	ENGINE DESIGN AND OPERATION. 15 PPM SULFUR FUEL.	0.4	G/KW-H	BACT-PSD
IA-0058	4/10/2002	GREATER DES MOINES ENERGY CENTER	MIDAMERICAN ENERGY	IA	235	BHP	Particulate matter, filterable < 10 µ (FPM10)		0.56	LB/H	BACT-PSD
OH-0252	12/28/2004	DUKE ENERGY HANGING ROCK ENERGY FACILITY	DUKE ENERGY HANGING ROCK, LLC	OH	265	HP	Particulate Matter (PM)		0.66	LB/H	BACT-PSD
TX-0352	12/31/2002	BRAZOS VALLEY ELECTRIC GENERATING FACILITY	BRAZOS VALLEY ENERGY LP	TX	300	HP	Particulate matter, filterable < 10 µ (FPM10)	NONE INDICATED	0.66	LB/H	Other Case-by-Case
TX-0407	12/6/2002	STERNE ELECTRIC GENERATING FACILITY	STEAG POWER LLC	TX	300	HP	Particulate matter, filterable < 10 µ (FPM10)		0.66	LB/H	BACT-PSD
LA-0224	3/20/2008	ARSENAL HILL POWER PLANT	SOUTHWEST ELECTRIC POWER COMPANY (SWEPCO)	LA	310	HORSEPOWER	Particulate Matter < 10 µ (PM10)	OPERATING HOURS AND PROPER ENGINE MAINTENANCE	0.68	LB/H	BACT-PSD
LA-0224	3/20/2008	ARSENAL HILL POWER PLANT	SOUTHWEST ELECTRIC POWER COMPANY (SWEPCO)	LA	310	HORSEPOWER	Particulate matter, filterable < 10 µ (FPM10)	OPERATING HOURS AND PROPER ENGINE MAINTENANCE	0.68	LB/H	BACT-PSD
OH-0254	8/14/2003	DUKE ENERGY WASHINGTON COUNTY LLC	DUKE ENERGY NORTH AMERICA	OH	400	HP	Particulate Matter (PM)	LOW SULFUR FUEL, COMBUSTION CONTROL	0.88	LB/H	BACT-PSD
NJ-0043	3/28/2002	LIBERTY GENERATING STATION	LIBERTY GENERATING STATION	NJ	3.5	MMBTU/H	Particulate matter, filterable < 10 µ (FPM10)	NONE	1.1	LB/H	Other Case-by-Case
NC-0101	9/29/2005	FORSYTH ENERGY PLANT	FORSYTH ENERGY PROJECTS, LLC	NC	11.4	MMBTU/H	Particulate Matter < 10 µ (PM10)		1.14	LB/H	BACT-PSD

Table D-5 - RBLC Results for ns for Emergency Fire Pump

LA-0194	11/24/2004	SABINE PASS LNG IMPORT TERMINAL	SABINE PASS LNG, LP	LA	660	HP EA.	Particulate Matter < 10 µ (PM10)	GOOD COMBUSTION PRACTICES	1.24	LB/H	BACT-PSD
NJ-0043	3/28/2002	LIBERTY GENERATING STATION	LIBERTY GENERATING STATION	NJ	14.1	MMBTU/H	Particulate matter, filterable < 10 µ (FPM10)	NONE	1.4	LB/H	Other Case-by-Case
CO-0052	8/11/2002	ROCKY MOUNTAIN ENERGY CENTER, LLC.	ROCKY MOUNTAIN ENERGY CENTER, LLC.	CO			Particulate matter, filterable < 10 µ (FPM10)		2.4	T/YR	Other Case-by-Case
GA-0140	12/3/2010	MITCHELL STEAM-GENERATING PLANT (PLANT MITCHELL)	GEORGIA POWER CO.	GA	1050	bhp	Particulate matter, filterable; 10 µ (FPM10)	Use of ultra-low sulfur diesel fuel only.	3000	H	BACT-PSD

APPENDIX E
MODELING PROTOCOL

Prevention of Significant Deterioration Class II Air Dispersion Modeling Protocol

Midwest Energy, Inc

Goodman Energy Center Expansion Project

Project No. 75189

September 2013

Prevention of Significant Deterioration Class II Air Dispersion Modeling Protocol

prepared for

Midwest Energy, Inc.

September 2013

Project No. 75189

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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1.0 INTRODUCTION

Midwest Energy, Inc. (Midwest Energy) is proposing to expand the electric generating capacity at its existing Goodman Energy Center facility located in Ellis County, Kansas. The Goodman Energy Center Expansion Project (hereinafter referred to as Project) will consist of three 9.34-MW (nominal) reciprocating internal combustion engines (RICE) and associated equipment. Potential emissions indicate that the Project will be a major modification at an existing major source; as a result, the Project will be subject to Prevention of Significant Deterioration (PSD) construction permit review. Since a PSD permit requires an assessment of ambient impacts for those pollutants subject to PSD review, this document presents a Class II air dispersion modeling protocol to be used in developing the PSD application. Submittal of this protocol will allow the Kansas Department of Health and Environment (KDHE) to review and comment upon the methodology to be employed in the modeling analysis.

Included in this document is a brief description of the project, proposed model to be used, and input parameters for the proposed model. This modeling protocol has been drafted in accordance with the U.S. Environmental Protection Agency (EPA) and KDHE modeling guidelines.

2.0 PROJECT DESCRIPTION

Midwest Energy is proposing to build three 9.34-MW (nominal) RICE and associated equipment at their existing Goodman Energy Center Facility in Ellis County, Kansas. The Goodman Energy Center currently has nine RICE and associated equipment on-site. The Project will be located within the area shown on Figure 1, Appendix A.

Ellis County is currently designated as an attainment/unclassified area for all criteria pollutants; therefore, the Project is not subject to non-attainment new source review.

The preliminary estimated air emissions for the proposed Project are presented in Table 1. The estimated potential air emissions are based on all three new engines operating year-round (8,760 hours per year, per engine). The project preliminary estimated potential emissions shown in Table 1 also include the emissions from 1,095 startups for each engine per year and emissions from a natural gas heater, emergency diesel fire pump, and emergency diesel generator. The maximum emissions from each operating load for the RICE were used to demonstrate the maximum preliminary estimated potential emissions for each pollutant. The proposed RICE operating loads will be from 40 percent to 100 percent load.

Table 1: Preliminary Estimated Potential Emissions and PSD Significance Levels for the Project

Pollutant[A]	Preliminary Estimated Potential Emissions (Tons per Year)[B,D]	PSD Significance Levels (Tons per Year)
NO_X	37.9	40
CO	49.3	100
SO_2	0.7	40
VOC	39.4	40
PM/ PM_{10}[C]/ $PM_{2.5}$[C]	**30.1**	25/15/10
CO_2e	**138,940**	100,000
H_2SO_4 Mist	0.1	7
Lead	2.1×10^{-6}	0.6

[A] NO_x = nitrogen oxides; CO = carbon monoxide; SO_2 = sulfur dioxide; VOC = volatile organic carbons; PM= total particulate matter; PM_{10} = particulate matter less than 10 microns in diameter; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; CO_2e = carbon dioxide equivalent (greenhouse gases); H_2SO_4 Mist = sulfuric acid mist
[B] Numbers in **bold** indicate the PSD significance level is exceeded
[C] Filterable plus condensable
[D] Based on 1,095 startups at 30 minutes each plus full load operation for the rest of the year (8,212 hours per engine) for each engine (worst-case emissions scenario).

Based on the preliminary estimated potential emissions shown in Table 1, it is expected that PM, PM_{10}, $PM_{2.5}$, and CO_2e will be subject to PSD review.

Auxiliary equipment will consist of a natural gas heater, emergency diesel fire pump and emergency diesel generator. Annual emissions for the natural gas heater will be based on 8,760 hours per year, while the annual emissions for the emergency fire pump and emergency diesel generator will be based on 100 hours per year for testing and maintenance. Midwest Energy understands that a limit of 100 hours per year will result in a similar permit limit.

3.0 PROPOSED MODEL

Midwest Energy is proposing to use the most current version of the AMS/EPA Regulatory Model (AERMOD) for the air quality analysis (Version 12345). The AERMOD model is an EPA-approved, steady-state Gaussian plume model capable of modeling multiple sources in simple and complex terrain.

The following default model options will be used:

- Gradual Plume Rise
- Stack-tip Downwash
- Buoyancy-induced Dispersion
- Calms and Missing Data Processing Routine
- Calculate Wind Profiles
- Calculate Vertical Potential Temperature Gradient
- Rural Dispersion

Details of the modeling algorithms contained in the AERMOD may be found in the User's Guide for AERMOD. The regulatory default option will be selected for this analysis.

4.0 MODELING PARAMETERS

It is expected that PM, PM_{10}, $PM_{2.5}$, and CO_2e will be subject to PSD review, and an air quality analysis will be performed for PM_{10} and $PM_{2.5}$. In accordance with guidance, modeling of PM and CO_2e will not be carried out because there are no modeling thresholds for these pollutants.

4.1 GOOD ENGINEERING PRACTICE STACK HEIGHT

Sources included in a PSD permit application are subject to Good Engineering Practice (GEP) stack height requirements outlined in 40 CFR Part 51, Sections 51.100 and 51.118. As defined by the regulations, GEP height is calculated as the greater of 65 meters (measured from the ground level elevation at the base of the stack) or the height resulting from the following formula:

$$GEP = H + 1.5L$$

Where,

H = the building height; and

L = the lesser of the building height or the greatest crosswind distance of the building - also known as maximum projected width.

To meet stack height requirements, the proposed point sources will be evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if the discharge from each stack will become caught in the turbulent wake of a building or other structure, resulting in downwash of the plume. Downwash of the plume can result in elevated ground-level concentrations. EPA provides guidance for determining whether building downwash will occur in *Guideline for Determination of Good Engineering Practice Stack Height* (EPA 1985). The downwash analysis will be performed consistent

with the methods prescribed in this guidance document. The point sources will be evaluated in terms of their proximity to nearby structures.

Calculations for determining the direction-specific downwash parameters will be performed using the most current version of the EPA's Building Profile Input Program – Plume Rise Model Enhancements, otherwise referred to as the BPIP-PRIME downwash algorithm (Version 04274). The BPIP-PRIME files will be submitted to KDHE as part of the modeling analysis.

4.2 EMISSION SOURCE PARAMETERS

Modeling runs will be conducted at full load and partial loads to confirm that operation of the Project will not exceed the required air dispersion modeling thresholds. In addition to modeling steady-state operation of the proposed RICE, startup operation will be modeled. The emission rates modeled will represent the projected worst-case ambient conditions under various operating loads. Annual emissions will be based on 1,095 startups per year at 30 minutes each plus full load operation for the rest of the year (8,212 hours per engine). No fugitive emission sources are proposed for this project.

5.0 MODELING METHODOLOGY

5.1 RECEPTOR GRID

The overall purpose of the modeling analysis is to ensure that operation of the proposed facility will not result in, or contribute to, concentrations above the NAAQS or PSD Class II Increments. The modeling runs will be conducted using the AERMOD model in simple and complex terrain mode within a 10- by 10-kilometer Cartesian grid to determine the significant impact area (SIA) for each pollutant. The grid will incorporate the following spacing between receptors: 50-meter out to 0.1 kilometers, 100-meter out to 2 kilometers, and 250-meters out to 10 kilometers. Receptors will also be placed along the fence line boundary at a spacing of 50 meters. If the SIA exceeds 10 kilometers, the grid will be extended to encompass the entire SIA and 500-meter spacing will be used. If the modeling impacts show "hot spots" outside 1,000 meters, 100-meter grid spacing will be used to encompass the maximum concentrations to ensure that the maximum impact has been identified.

After reviewing the topography of the project area, it was determined that terrain elevations should be incorporated into the model. Therefore, the appropriate U.S. Geological Survey (USGS) National Elevation Dataset (NED) will be used to obtain the necessary receptor elevations. North American Datum of 1983 (NAD 83) will be used to develop the Universal Transverse Mercator (UTM) coordinates for this project.

AERMOD has a terrain preprocessor (AERMAP) which uses gridded terrain data for the modeling domain to calculate not only a XYZ coordinate, but a representative terrain-influence height associated with each receptor location selected. This terrain-influenced height is called the height scale and is separate for each individual receptor. AERMAP (Version 11103) will utilize the electronic NED data to populate the model with receptor elevations.

5.2 METEOROLOGICAL DATA

AERMOD requires a preprocessor called AERMET to process meteorological data for five years from off-site locations to estimate the boundary layer parameters for the dispersion calculations. Meteorological inputs from AERSURFACE obtained from the KDHE will be used. Surface air meteorological data from Russell Municipal Airport (WBAN # 93997) and upper air data from the Dodge City Regional Airport (WBAN #13985) will be used in the analysis. A profile base elevation value of 568.1 meters will be used. The most recent five-year data set available covers the period of 2008 to 2012. One-minute meteorological data is included in the meteorological files.

5.3 LAND MODELING PARAMETERS

Based on the Auer scheme, the existing land use for a three-kilometer area surrounding the proposed project site is more than 50 percent rural. Also, the population density is less than 750 people per square kilometer for the same area. Because this area is considered rural, the rural dispersion coefficients option in the AERMOD model will be selected.

5.4 EMISSION FACTORS

Emissions factor (EMISFACT) modeling options in AERMOD allow a user to model emissions only when certain criteria are met. EMISFACT will be used to model the appropriate hourly restrictions on any equipment activities that only occur over a certain number of hours per day or seasons per year. A more detailed breakdown of operation times will be presented with the final modeling analysis if this option is utilized. Midwest Energy understands that hourly restrictions in the modeling will likely result in corresponding permit limitations.

5.5 SIGNIFICANT IMPACT AREA DETERMINATION

To determine the facility's SIA, all emission sources from the proposed Project will be modeled alone; that is, modeled without existing sources in the area. The initial step in defining the SIA will be to model the RICE units at 40, 75, and 100 percent capacity for each pollutant and at startup conditions along with all other emission sources from the proposed facility. The initial modeling analysis will be performed using the KDHE approved five-year meteorological data set. The SIA is determined to be the distance from the proposed fence line where any pollutant concentration exceeds its PSD modeling significance

threshold. Each load case will be analyzed using the five years of meteorological data. If the modeling results indicate that a pollutant exceeds the PSD modeling significance threshold for any averaging period, the maximum distance from the property line that the pollutant concentration exceeds the threshold level will be determined. This distance is then considered as a radius from the source, creating a circular SIA around the proposed source. The radius of impact (ROI) will then be identified and submitted to the KDHE for refined modeling purposes.

Depending on the initial modeling results, Midwest Energy will request from KDHE an emission inventory of PSD Class II Increment-consuming sources and NAAQS sources that are located within the ROI and that should be included in the modeling analyses.

5.6 BACKGROUND AIR QUALITY

As stated previously, if any pollutant exceeds its respective PSD significance level, a refined analysis (cumulative analysis) will be performed for that pollutant and averaging period. This analysis will be used to determine compliance with the PSD Class II Increments and the NAAQS. The NAAQS are set up to protect the air quality for all sensitive populations and attainment is determined by the comparison to the NAAQS thresholds. As such, there are existing concentrations of each criteria pollutant that is present in ambient air that must be included in an analysis to account for items such as mobile source emissions that are not accounted for in the model. Monitored ambient emission levels will be added to the modeled ground level impacts to account for these sources.

KDHE provided background values for each pollutant which will require a refined analysis. These values are based available monitors in the area. The monitored background levels will be added to the modeled impacts and are shown in Table 2 .

Table 2: Background Levels

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)	Air Quality System Monitor ID
PM_{10}	24-hour	97.8	20-057-0002 (Dodge City)
$PM_{2.5}$	Annual	7	20-195-0001 (Cedar Bluff)
	24-hour	17	20-195-0001 (Cedar Bluff)

5.7 NAAQS AND CLASS II INCREMENT ANALYSIS

If refined modeling is required, the inventories of sources within the ROI will be developed in accordance with applicable EPA guidance, input from the KDHE, and neighboring state agencies. For the NAAQS and PSD Class II Increment analysis, all stationary sources identified by KDHE that emit pollutants subject to this analysis and are located within the ROI will be addressed. Some sources within the ROI may be eliminated from the analysis if it is determined to have a negligible contribution to impacts when combined with the Project impacts. Midwest Energy will consult with KHDE to determine acceptable methods of eliminating sources from the analysis. Background air quality values were selected (as described in the previous section) to add to model-predicted concentrations for comparison to the NAAQS and are shown in Table 3. If the refined analysis does not result in any concentrations above the NAAQS or PSD Class II Increments, no further modeling will be conducted.

5.8 AMBIENT MONITORING

The modeling analysis for emissions sources for the proposed Project will also address the pre-construction monitoring provision of the PSD regulations. The regulations specify monitoring *de minimis* levels for each PSD pollutant that, if exceeded, trigger the requirement to perform one year of pre-construction ambient air monitoring. If any predicted concentrations reach or exceed the monitoring *de minimis* levels, Midwest Energy will consult with the KDHE to determine if pre-construction ambient air monitoring will be required. If modeled values exceed their respective monitoring *de minimus* values, Midwest Energy will request a waiver to use local ambient monitoring data to fulfill the pre-construction monitoring provisions of the PSD regulations or develop an acceptable monitoring plan at that time. For any impacts predicted to be below the monitoring *de minimis* levels, Midwest Energy will request an exemption from pre-construction ambient air monitoring, given that representative monitors in the area may be used for appropriate background concentrations.

The NAAQS, modeling/monitoring significance levels, and PSD Class II Increments are presented in Table 3.

Table 3: NAAQS, Significance/Monitoring, and PSD Class II Increments (μg/m³)

Pollutant[B]	Averaging Period	NAAQS	Modeling Significance Level	Monitoring Significance Level	PSD Class II Increment
PM_{10}	annual	NA	1	NA	17
	24-hour	150	5	10	30
$PM_{2.5}$	annual	12	0.3[A]	NA	4
	24-hour	35	1.2[A]	4[A]	9

[A] United States Court of Appeals for the District of Columbia Circuit on January 22, 2013 vacated and remanded portions of the U.S. EPA rule establishing significant impact levels (SILs) and vacated the rule establishing the significant monitoring concentration (SMC) for particulate matter less than 2.5 micrometers ($PM_{2.5}$), however the $PM_{2.5}$ SILs and SMCs may be used as for determining compliance with the NAAQS and PSD Class II increment in Kansas per guidance from KDHE.
[B] The pollutants that are allowed one NAAQS exceedance per year and one PSD Increment exceedance per year are: 1-hour and 8-hour CO; 3-hour SO_2; and 24-hour PM_{10}.

For PSD Class II increment, the 24-hour PM_{10} and 24-hour $PM_{2.5}$ will be compared to the second highest high. Annual standards will be compared to the first highest high. The NAAQS thresholds will be compared to the following highs shown in Table 4 for each averaging period.

Table 4: Modeled Highs

Pollutant	Averaging Period	Modeled High
PM_{10}	24-hour	Sixth High
$PM_{2.5}$	Annual	Highest First High
	24-hour	Highest First High

6.0 CLASS I AREA IMPACTS

Recent Federal Land Manager (FLM) guidance requires that a proposed major source, in the course of a PSD application, perform an assessment of air quality impacts at Class I areas if these areas are located within approximately 300 kilometers of the proposed facility. There are no Class I areas that are within 300 kilometers of the proposed Project; therefore, no assessment of air quality impacts at Class I areas will be performed for this Project.

7.0 ADDITIONAL IMPACT ANALYSIS

The additional impacts analysis requirement under PSD will include the ambient air quality impact analysis, soils and vegetation impacts, visibility impairment, and growth analysis on Class II areas. This

analysis will follow EPA's guidance provided in the New Source Review Workshop Manual (October 1990 draft).

The growth analysis will quantify the number of employees, the availability of housing in the area, and associated commercial and industrial growth, and construction related activities and mobile sources. The number of employees is not envisioned to be large enough to result in a quantifiable increase in emissions from residential, commercial, or industrial growth.

While there are no Class II visibility standards, a visual plume blight analysis will be performed in accordance with the guidelines set forth in EPA-450/4-88-015, Workbook for Plume Visual Impact Screening and Analysis (Revised). A visual plume blight analysis will be conducted for sensitive areas as identified by the KDHE, such as state parks, wilderness areas, or scenic sites and over looks. Midwest Energy will analyze the visibility impacts from the two nearest state parks, Wilson State Park and Cedar Bluff State Park, located approximately 75 km east and 40 km southwest, respectively, from the Project location.

8.0 REFERENCES

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Auer, A.H. "Correlation of Land Use and Cover with Meteorological Anomalies." Journal of Applied Meteorology. 17 (1978): 636-643.

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Irwin, J.S. Proposed Criteria for Selection of Urban Versus Rural Dispersion Coefficients. North Carolina: U.S. Environmental Protection Agency, Meteorology and Assessment Division, 1979.

National Park Service, U.S. Department of the Interior. Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report – Revised 2010. Natural Resource Report NPS/NRPC/NRR – 2010/232.

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U.S. Environmental Protection Agency. User's Guide for the AMS/EPA Regulatory Model –AERMOD. EPA-454/B-03-001. North Carolina: Office of Air Quality Planning and Standards, September 2004.

U.S. Environmental Protection Agency. New Source Review Workshop Manual – Draft. North Carolina: Office of Air Quality Planning and Standards, 1990.

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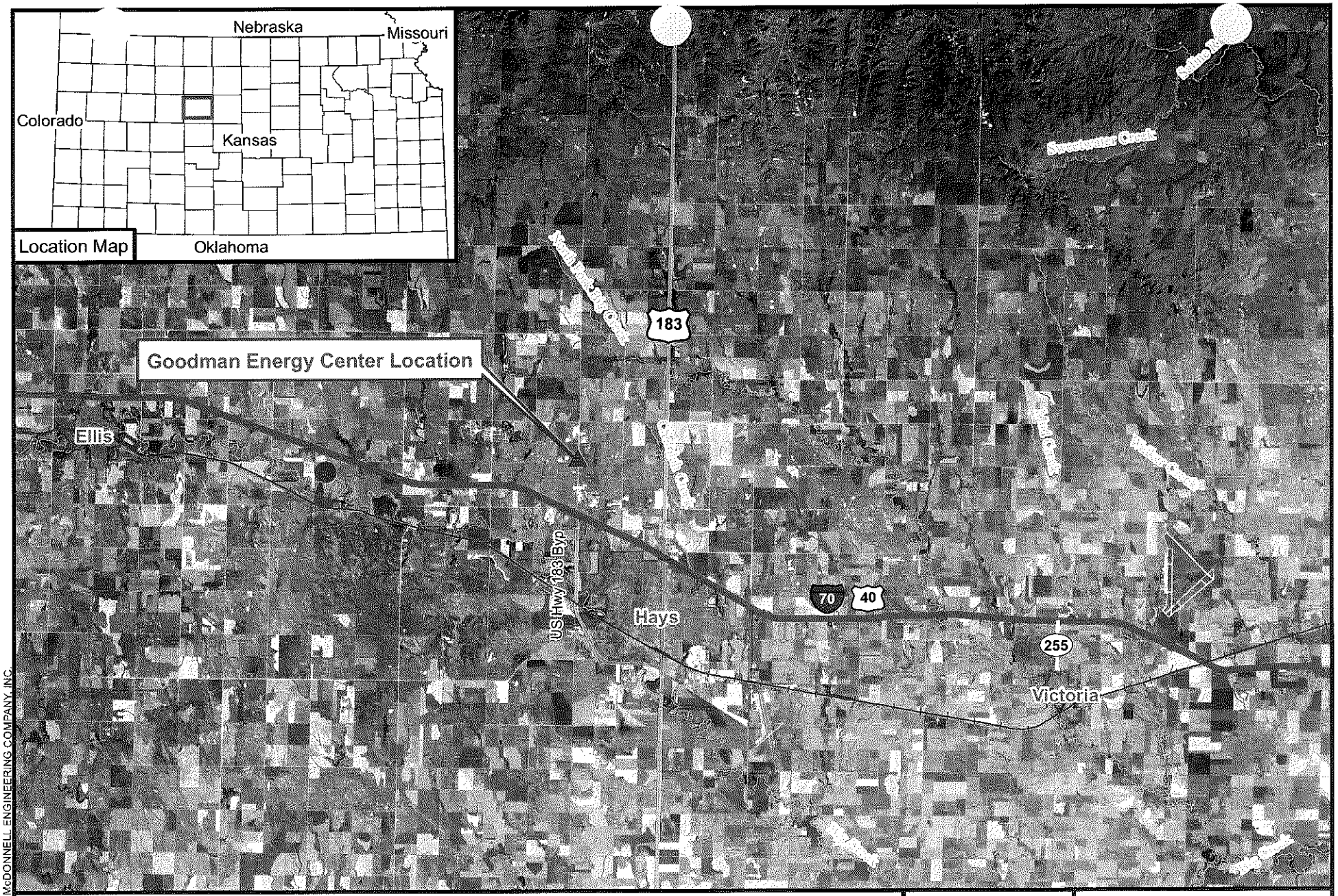
APPENDIX A



LEGEND

- Goodman Energy Center Location
- Municipal Boundaries
- Railroads
- Streams
- Interstate
- State Highway
- US Highway

NORTH

0 1.5 3
Miles

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Figure 1:
Goodman Energy Center Expansion Project Location

Midwest Energy, Inc.

Source: ESRI, NHD, NRCS, Burns & McDonnell

Issued: 9/5/2013

Path: R:\Midwest_Energy\75189_Goodman\PSD\GIS\DataFiles\ArcDocs\Goodman_Energy_Center_Expansion_Site.mxd kstaver
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Nelson, Minda

From: Mindy Bowman <mbowman@kdheks.gov>
Sent: Thursday, September 26, 2013 2:48 PM
To: Nelson, Minda
Cc: bdowling@mwenergy.com; mprindle@mwenergy.com; Susana Pjesky; Marian Massoth; Daye.Richard@epamail.epa.gov; Ward Burns (Burns.Ward@epamail.epa.gov); BAR ImageNow
Subject: FW: Midwest Energy, Inc. - Modeling Protocol for proposed Goodman Energy Center Expansion Project

Source ID No. 0510057
C-11584
Midwest Energy – Hays (Goodman Energy Center)
Copy to Modeling File

Hello Minda,

KDHE has reviewed the modeling protocol you submitted for the Midwest Energy Goodman Energy Center Prevention of Significant Deterioration (PSD) construction permit application for three new engines on September 12. We also shared the modeling protocol with EPA Region 7. Comments from EPA Region 7 are forwarded in the email below. KDHE comments are as follows:

- ***Section 5.1, Receptor Grid,*** *states that the grid will incorporate 50 meter spacing out to 0.1 kilometers.*

  KDHE comment:

  KDHE intends to review the modeling submittal using the AERSCREEN default receptor grid and/or the following receptor grid, and suggests that you follow the same grid spacing in your submittal:

Distance from fenceline (km)	Receptor spacing (m)
0-1	50
1-2	100
2-10	250
>10 km	500

- ***Section 5.7, NAAQS and Class II Increment Analysis,*** *states that all stationary sources identified by KDHE that emit pollutants subject to this analysis and are located within the ROI will be addressed. Some sources within the ROI may be eliminated from the analysis if it is determined to have negligible contribution to impacts when combined with the Project impacts.*

  KDHE comment:

  KDHE requests that for short term standards, nearby sources within 20 km be included. For short term standards, nearby sources at distances greater than 20 km are not required to be included.

- ***Section 5.8, Ambient Monitoring,*** *Table 3: NAAQS, Significance/Monitoring, and PSD Class II Increments, Footnote A*

KDHE comments:

The PM2.5 24-hour Significant Monitoring Concentration vacated by the United States Court of Appeals for the District of Columbia on January 22, 2013 is not considered valid in Kansas. However, representative local monitoring data is available for use.

- ***Section 7.0 Additional Impact Analysis***

KDHE Comment:

KDHE requests that a local school or airport be included in the VISCREEN analysis.

- ***Additional Comments***

-Please include modeling parameters, such as stack parameters, the coordinates of the center of the facility, and coordinates of the fenceline of the facility in the modeling report.

-For any modeling of haul roads (if any), please follow the recommendations in the March 2, 2012 US EPA Haul Road Workgroup Final Report.

-In the modeling report, please identify the operating scenario that gave the highest modeled concentrations.

-Please include in the modeling files the details of the emission calculations.

If you have any questions or would like to discuss, please contact me at (785) 296-6421 or Susana Pjesky at (785) 296-1691.

Sincerely,

Mindy Bowman

Mindy Bowman, P.E.
Environmental Engineer
Bureau of Air
1000 SW Jackson, Suite 310
Topeka, KS 66612
Phone: (785) 296-6421
Fax: (785) 291-3953

Please note new e-mail address: MBowman@kdheks.gov

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From: Daye, Richard [mailto:Daye.Richard@epa.gov]
Sent: Wednesday, September 25, 2013 12:57 PM
To: Mindy Bowman
Cc: Burns, Ward; Marian Massoth; Susana Pjesky; BAR ImageNow
Subject: RE: Midwest Energy, Inc. - Modeling Protocol for proposed Goodman Energy Center Expansion Project

Hi Mindy

The only comments that I have on the Goodman Energy Center Expansion Project Modeling Protocol are:

1. Recommend that the 50 meter receptor spacing be extended to 1000 meters
2. There should be justifications for the use of the various background values.

Please call me if you have any questions.

Mick

Richard L Daye
Regional Meteorologist
United States Environmental Protection Agency, Region 7
AWMD/APDB
11201 Renner Blvd
Lenexa, KS 66219

Tel: 913 551-7619

From: Mindy Bowman [mailto:mbowman@kdheks.gov]
Sent: Friday, September 13, 2013 9:45 AM
To: Daye, Richard
Cc: Burns, Ward; Marian Massoth; Susana Pjesky; BAR ImageNow
Subject: FW: Midwest Energy, Inc. - Modeling Protocol for proposed Goodman Energy Center Expansion Project

Source ID No. 0510057
C-11584
Midwest Energy – Hays (Goodman Energy Center)
Copy to Modeling File with Attachments

Hello Mick,

We received a modeling protocol from Midwest Energy yesterday for an expansion of the existing Goodman Energy Center, located in Ellis County, Kansas. The proposed expansion consists of 3 RICE engines, which are 9.34 MW each. This project will be subject to a Prevention of Significant Deterioration (PSD) review. I am forwarding the protocol for your review. KDHE respectfully requests your comments be submitted prior to September 27, to be included with the KDHE response.

If you have any questions or would like to discuss, please contact me at (785) 296-6421 or Susana Pjesky at (785) 296-1691.

Thank you,

Mindy Bowman

Mindy Bowman, P.E.
Environmental Engineer
Bureau of Air
1000 SW Jackson, Suite 310
Topeka, KS 66612

Phone: (785) 296-6421
Fax: (785) 291-3953

Please note new e-mail address: MBowman@kdheks.gov

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From: Nelson, Minda [mailto:mnelson@burnsmcd.com]
Sent: Thursday, September 12, 2013 9:50 AM
To: Mindy Bowman
Cc: bdowling@mwenergy.com; mprindle@mwenergy.com
Subject: Midwest Energy, Inc. - Modeling Protocol for proposed Goodman Energy Center Expansion Project

Mindy:
On behalf of Midwest Energy, Inc., please find attached the Class II Air Dispersion Modeling Protocol for the proposed Goodman Energy Center Expansion Project.

We would like to schedule a project kick-off meeting to discuss the project and the attached modeling protocol next week, if possible. Please let us know what days next week work for you and your staff.

Thank you for working with us on this project.

Minda Nelson, PE*
Senior Environmental Engineer, Environmental Studies & Permitting
Burns & McDonnell
Phone: 816-822-4208
Fax: 816-822-4299
mnelson@burnsmcd.com
www.burnsmcd.com

*Registered in Kansas and Iowa

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APPENDIX F
MODELING FIGURES

Figure 7-1: 10 km by 10 km Cartesian Grid

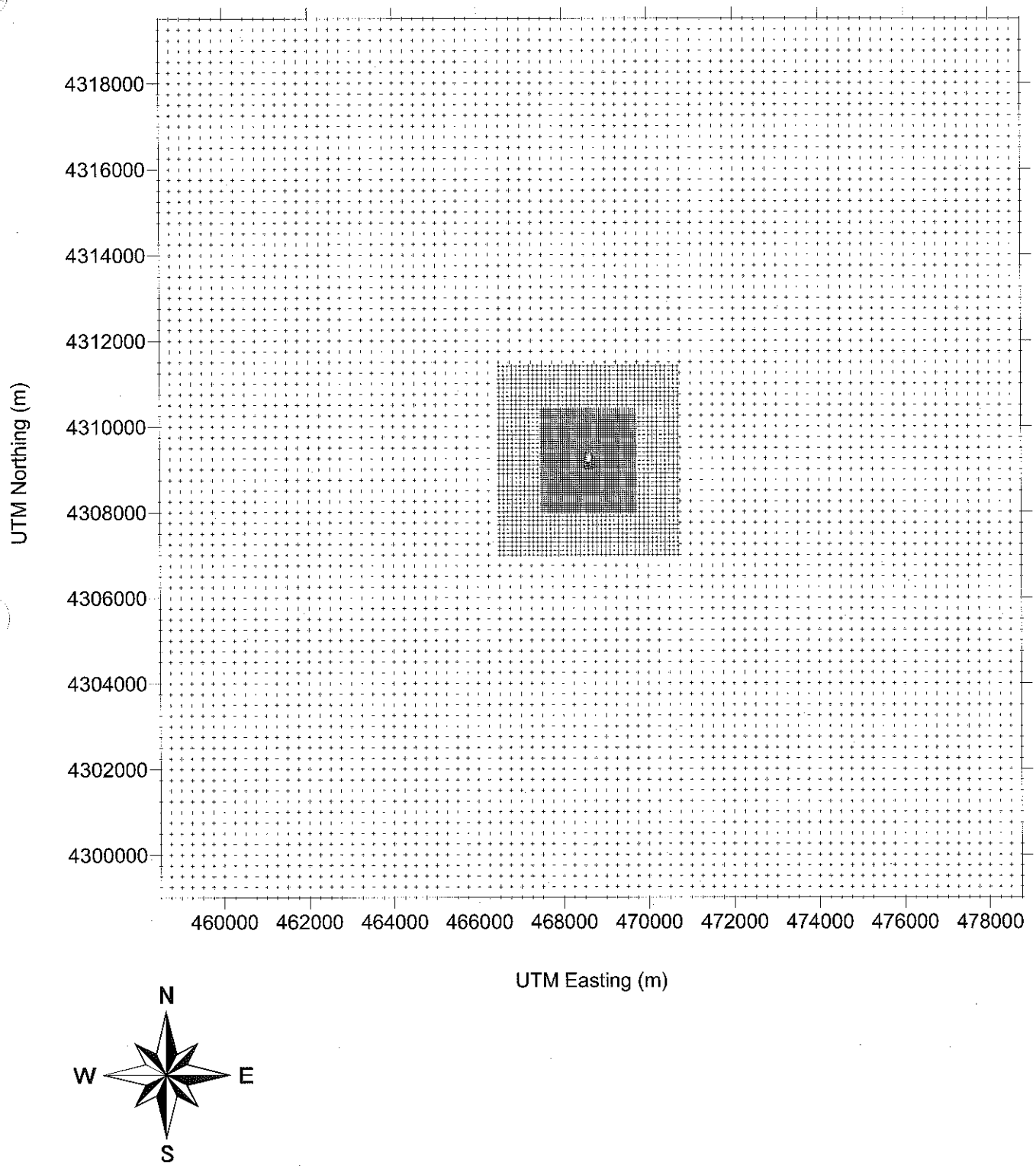

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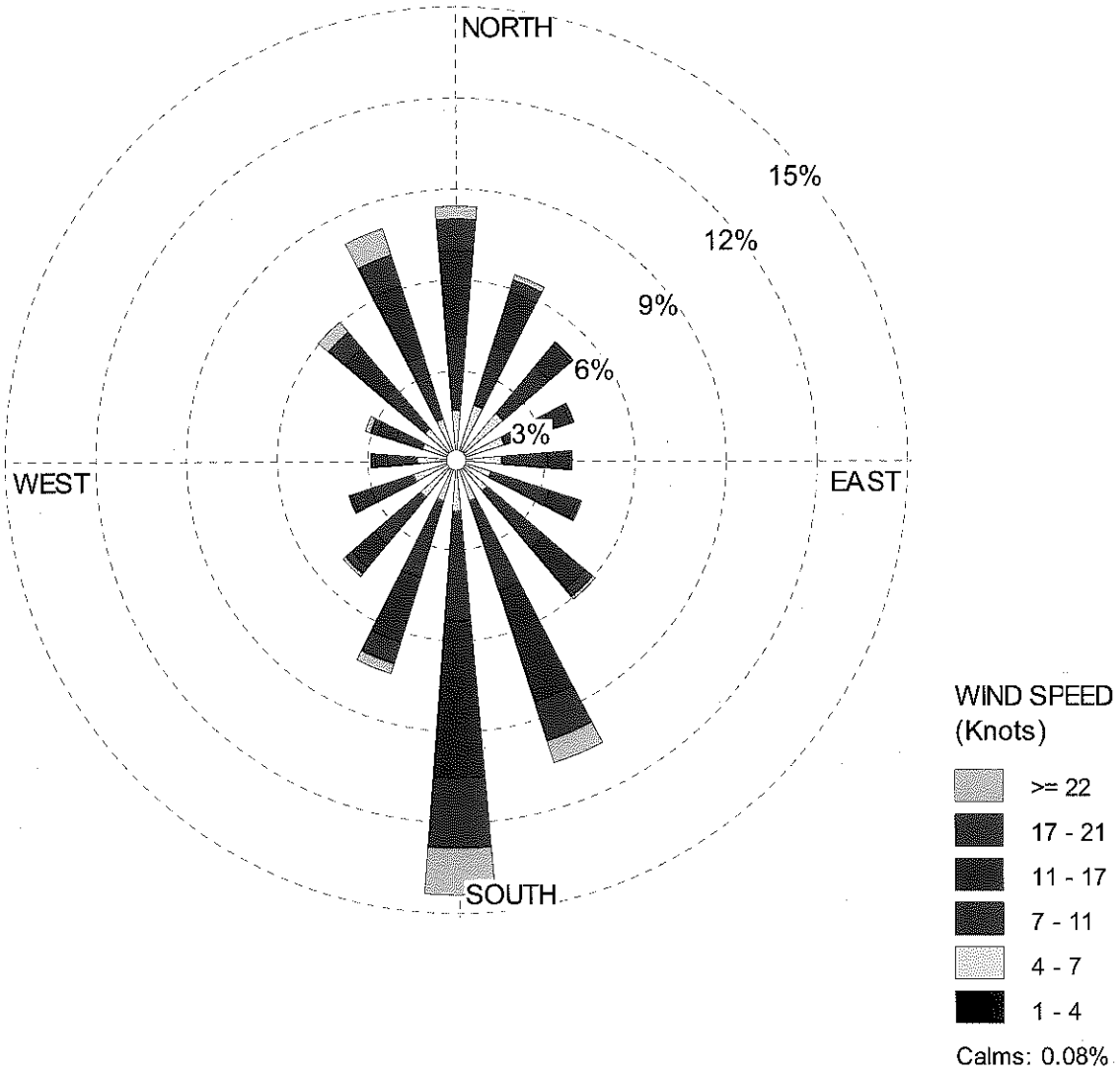
Figure 7-2: Russell Municipal Airport (WBAN # 93997) Wind Speed and Wind Direction for Years 2008 to 2012



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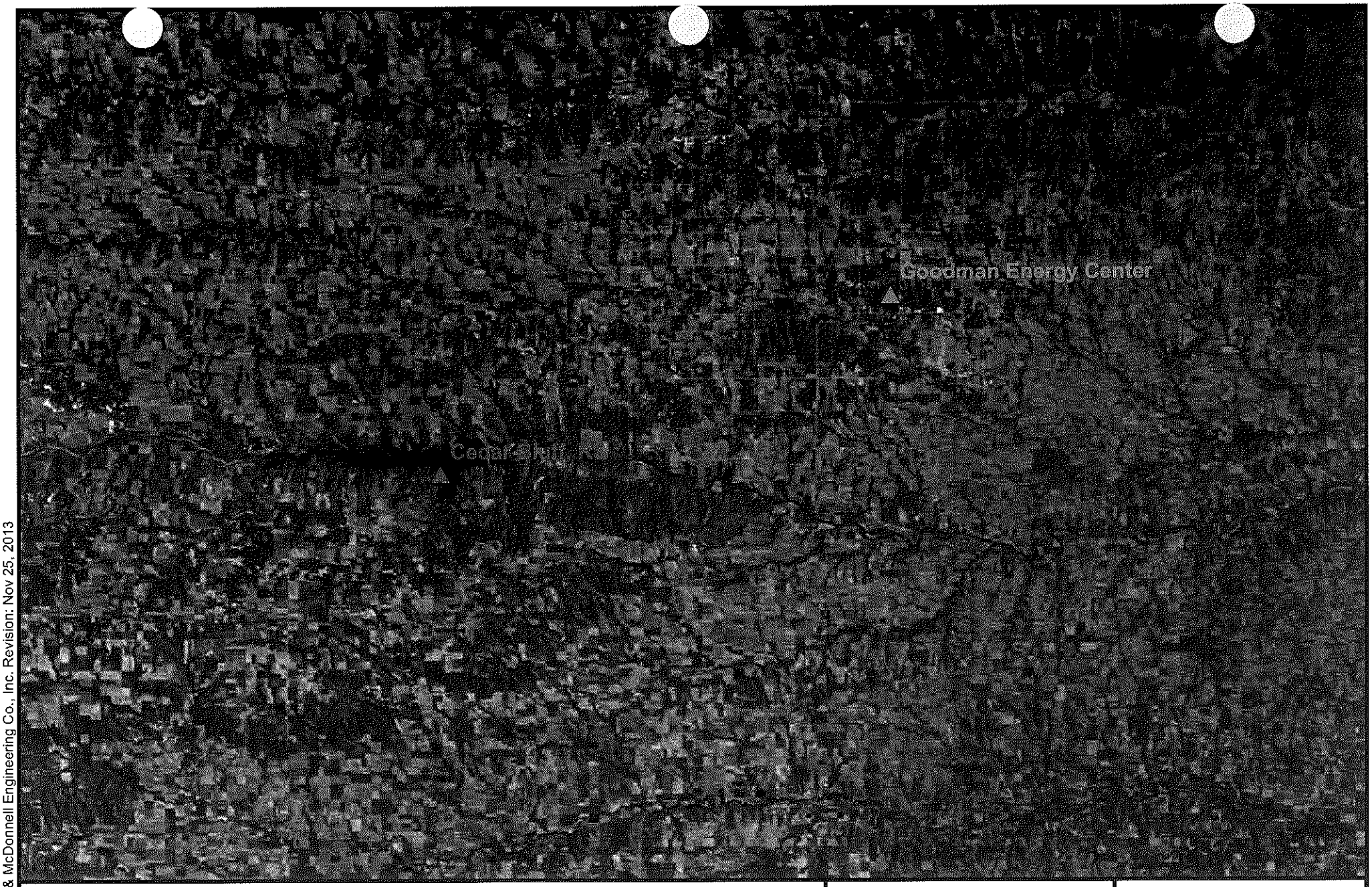

Monitor 20-195-0001

Goodman Energy Center

0 30,000 60,000 90,000 Feet

N W E S

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Figure 7-3
Monitor Locations

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Goodman Energy Center Location

2km Buffer Around Project Site

Land Use Classification

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Scrub/Shrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetland

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Figure 7-4
Primary Land Use
Goodman Energy Center

Midwest Energy, Inc.

Source: NLCD, Burns & McDonnell

Issued: 10/3/2013

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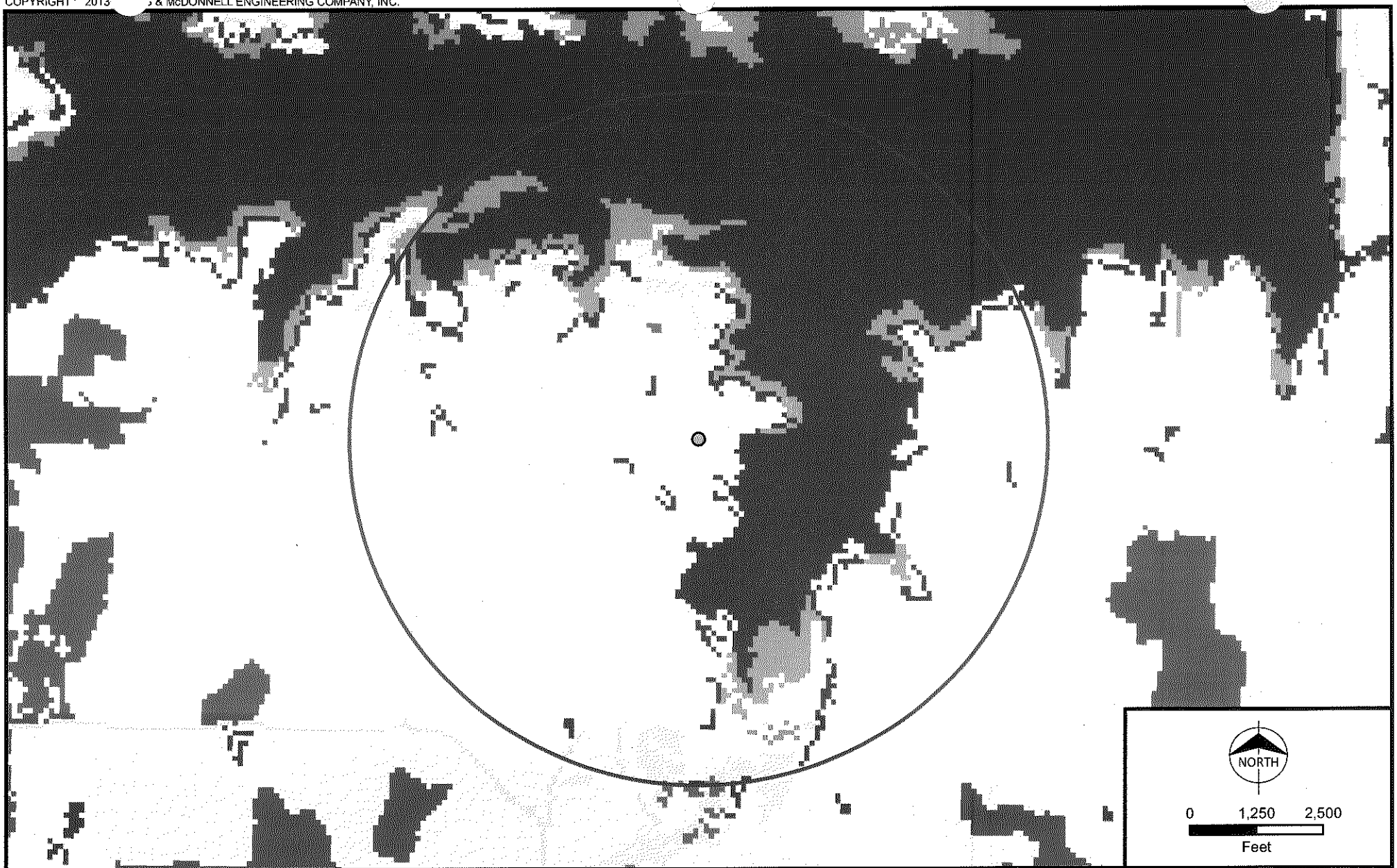

Monitoring Site

2km Buffer Around Project Site

Land Use Classification

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Scrub/Shrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetland

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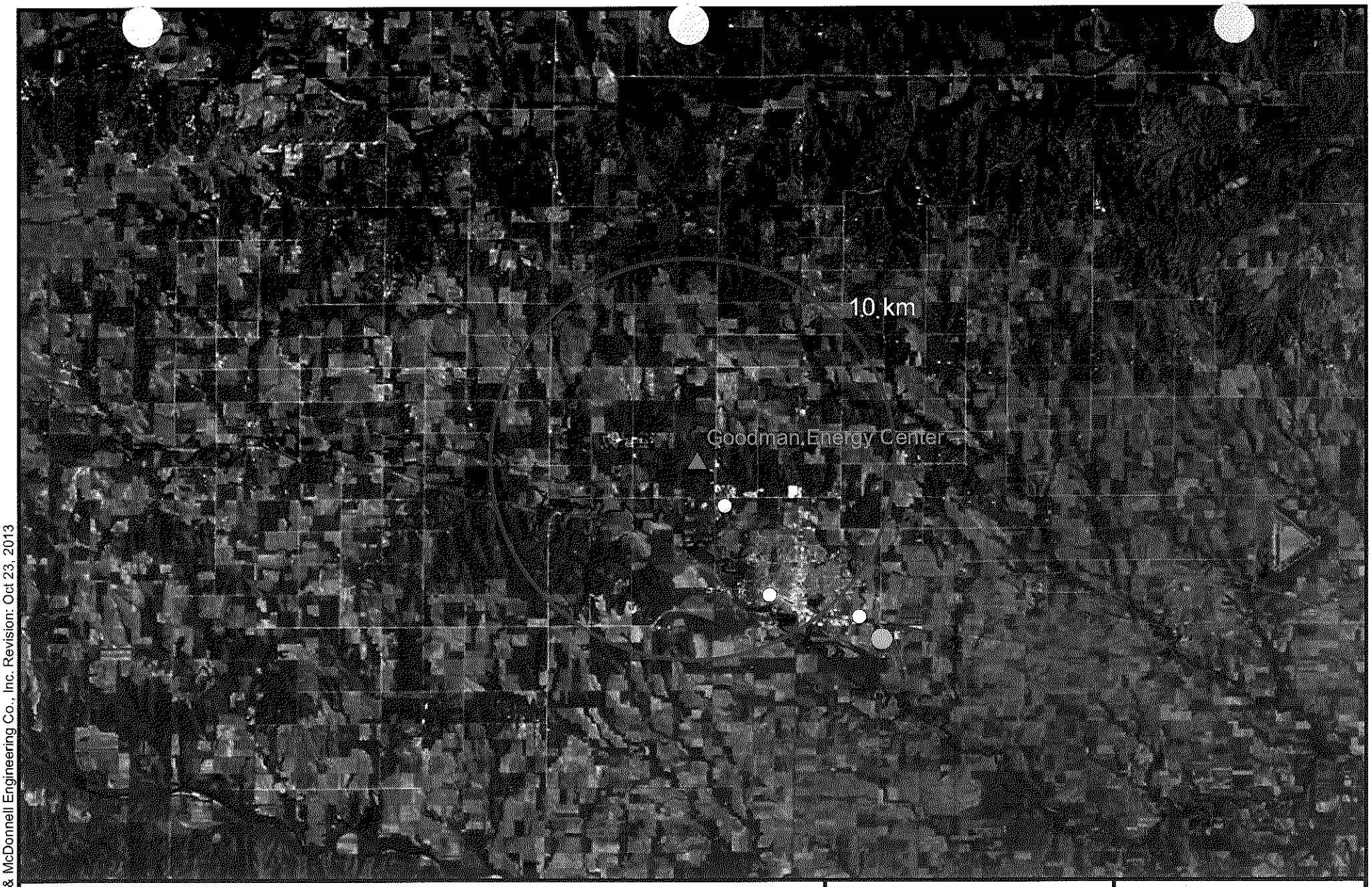
Figure 7-5
Primary Land Use
Monitor 20-195-0001
Cedar Bluff, KS

Midwest Energy, Inc.

Source: NLCD, Burns & McDonnell

Issued: 11/25/2013



PM2.5 Sources 1-15 tpy

PM2.5 Sources <1 tpy

Goodman Energy Center

0 7,500 15,000 30,000 45,000 Feet

N W E S

(Source Data from 2011 EPA National Emission Inventory database)

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Figure 7-6
PM2.5 Sources
Surrounding Goodman
Energy Center

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PM2.5 Sources 1-15 tpy

PM2.5 Sources <1 tpy

Monitor 20-195-0001

0 7,500 15,000 30,000 45,000 Feet

N W E S

(Source Data from 2011 EPA National Emission Inventory database)

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Figure 7-7
PM2.5 Sources
Surrounding Cedar Bluff
Monitor (20-195-0001)

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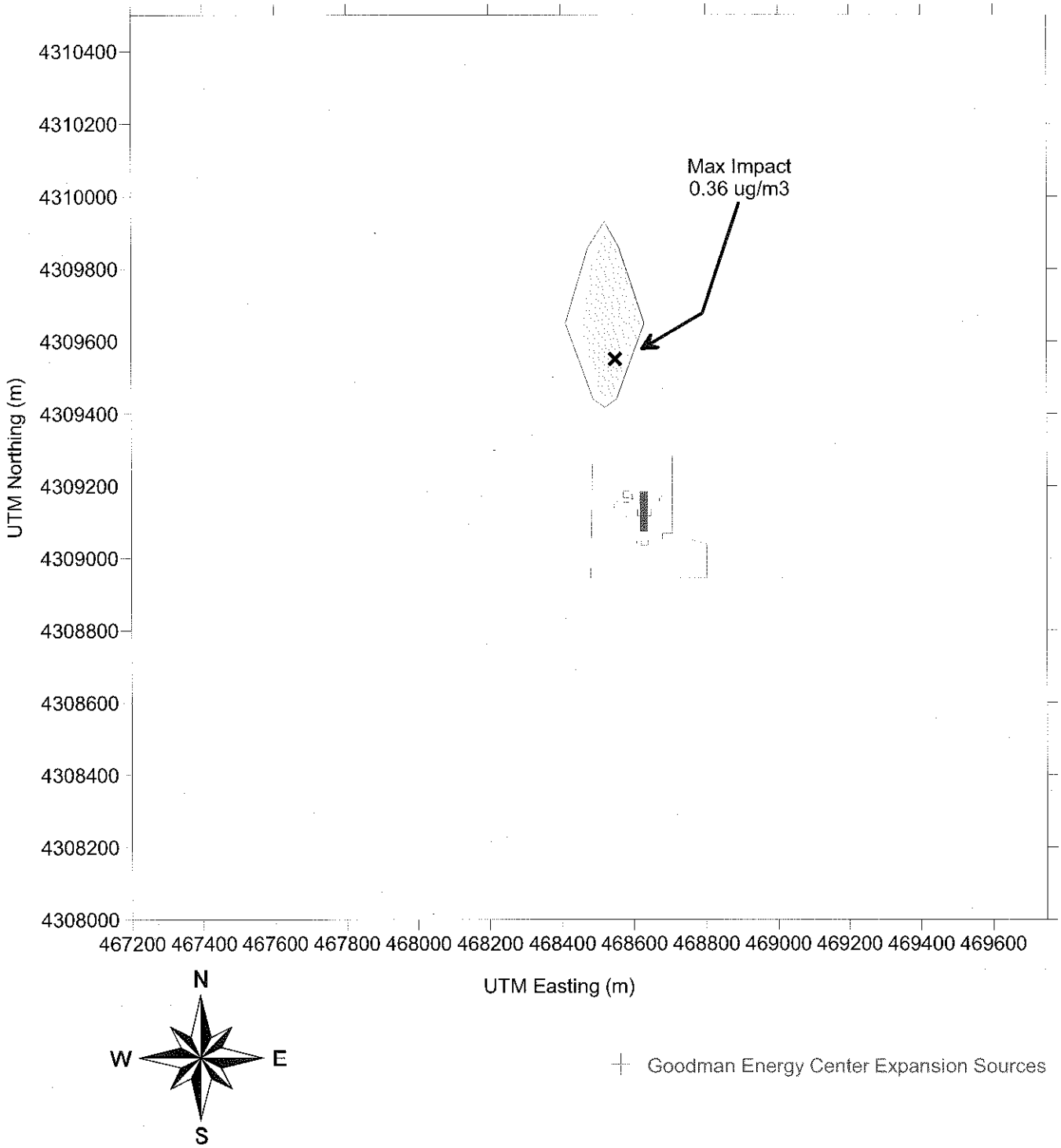
Figure 7-8: PSD PM10 Annual Significance (40% Load, 2010)



Modeled Concentrations (µg/m³)

0 0.25 0.5 0.75 1

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Figure 7-9: PSD PM10 24-Hour Significance (Starts, 2010)

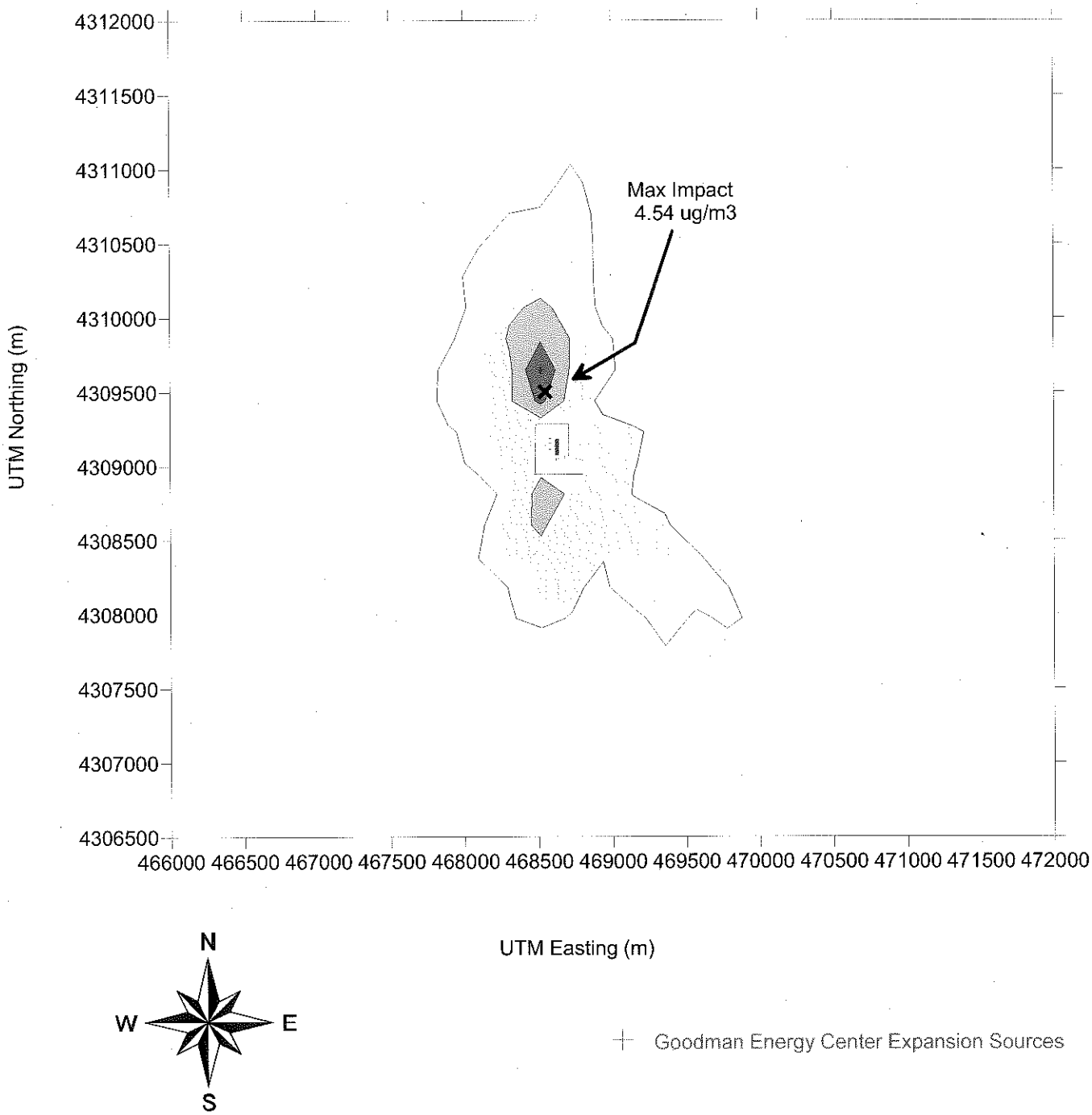

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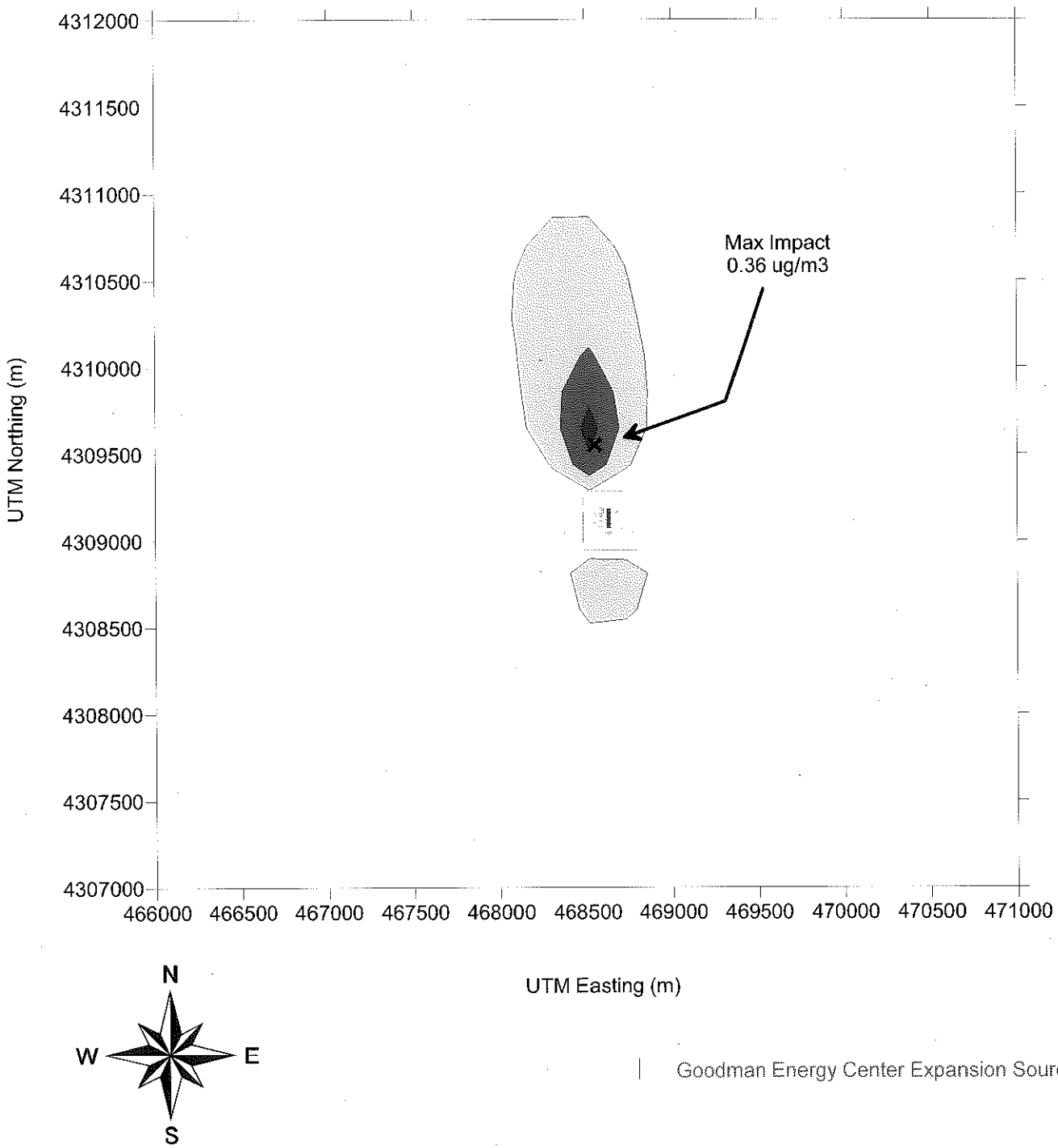
Figure 7-10: PSD PM2.5 Annual Significance (40% Load, 2010)



Goodman Energy Center Expansion Sources

Modeled Concentrations (µg/m³)

0 0.1 0.2 0.3

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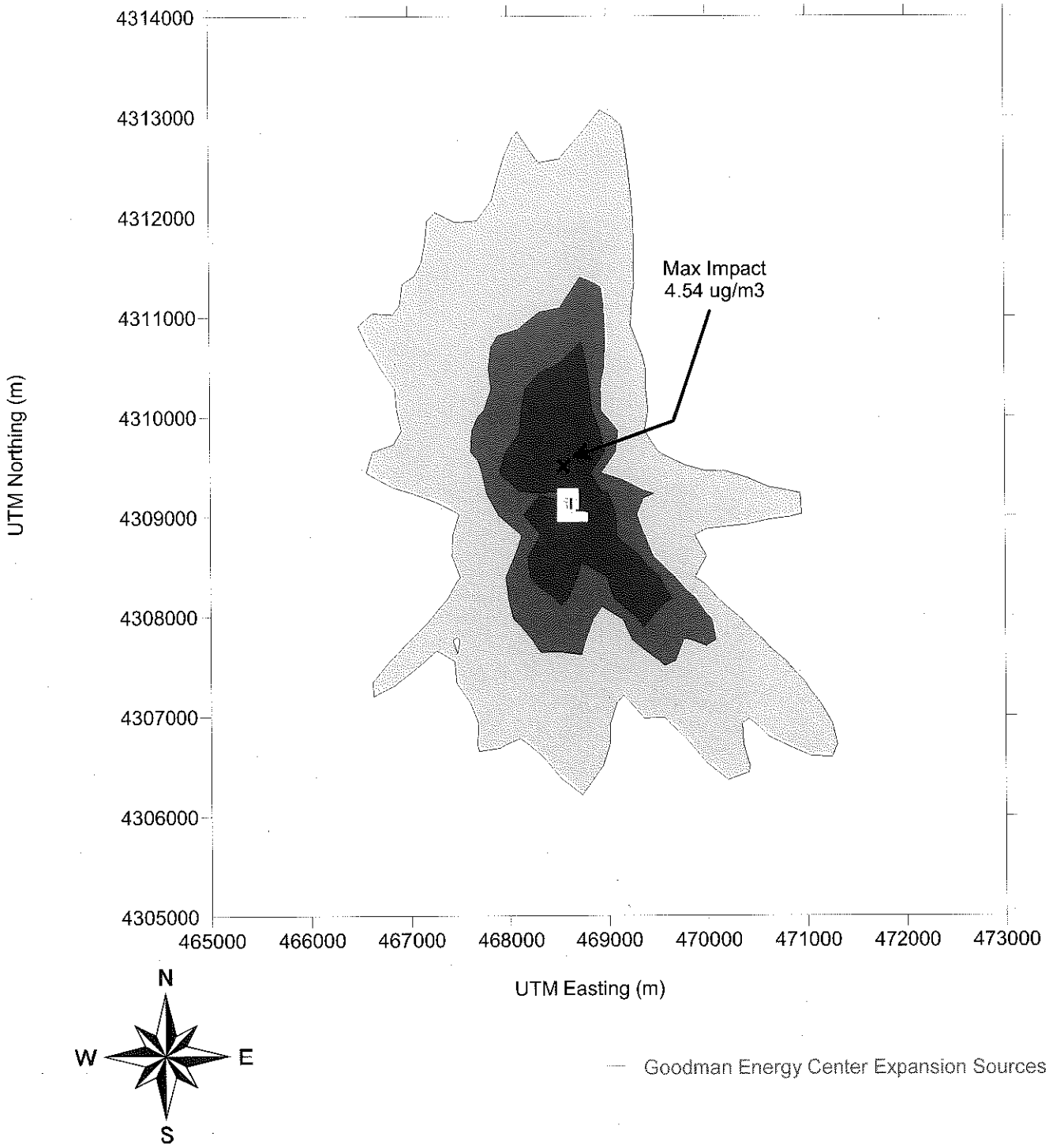
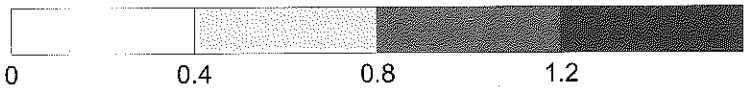
Figure 7-11: PSD PM2.5 24-hour Significance (Starts, 2010)



Modeled Concentrations (µg/m³)



Burns & McDonnell
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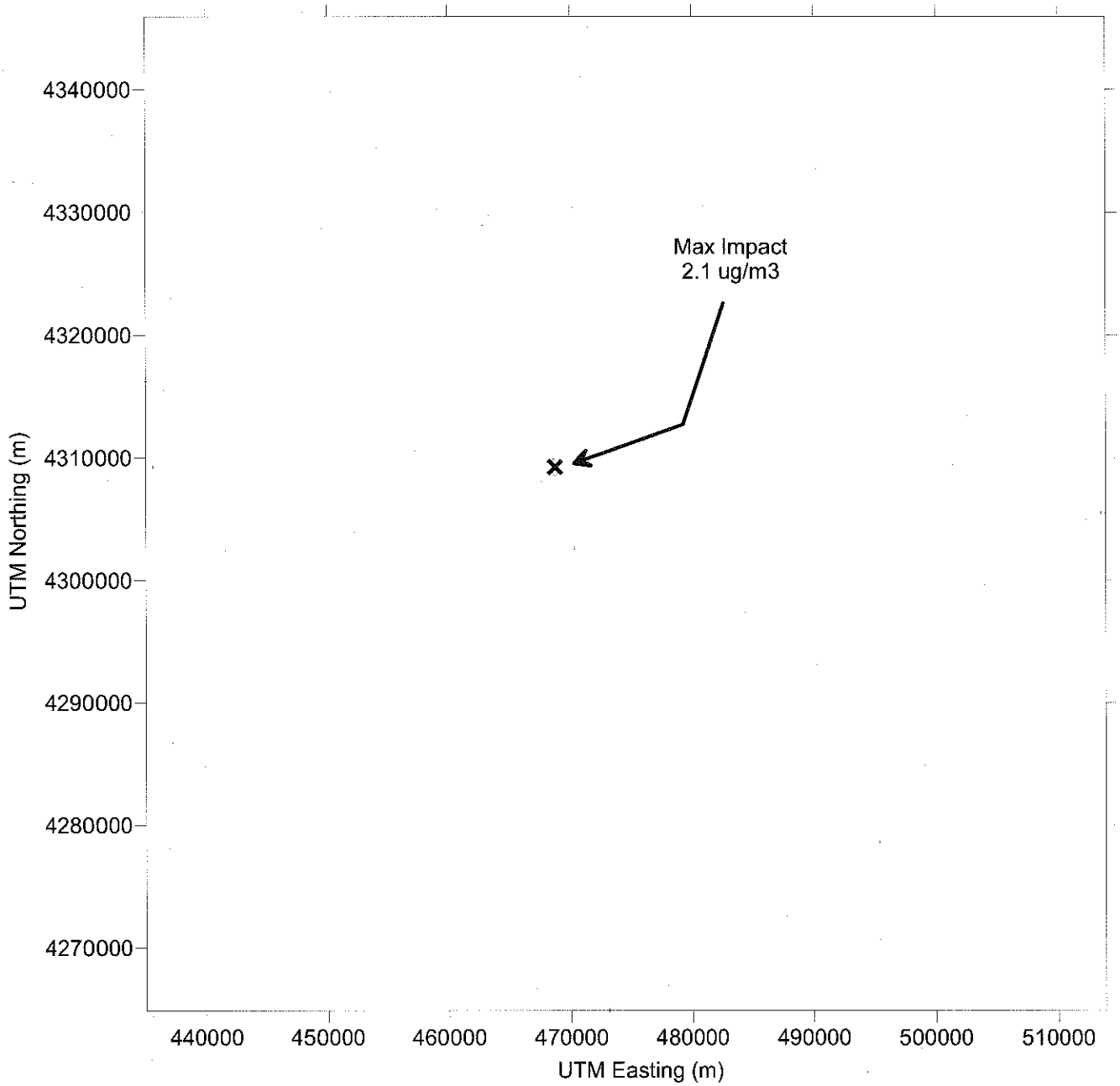
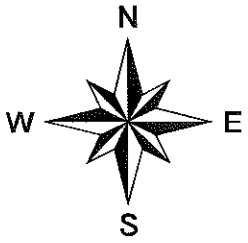
Figure 7-12: Increment PM2.5 Annual (40% Load, 2011)





Goodman Energy Center and Inventory Sources

Modeled Concentrations (μg/m³)

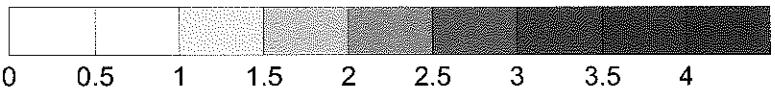


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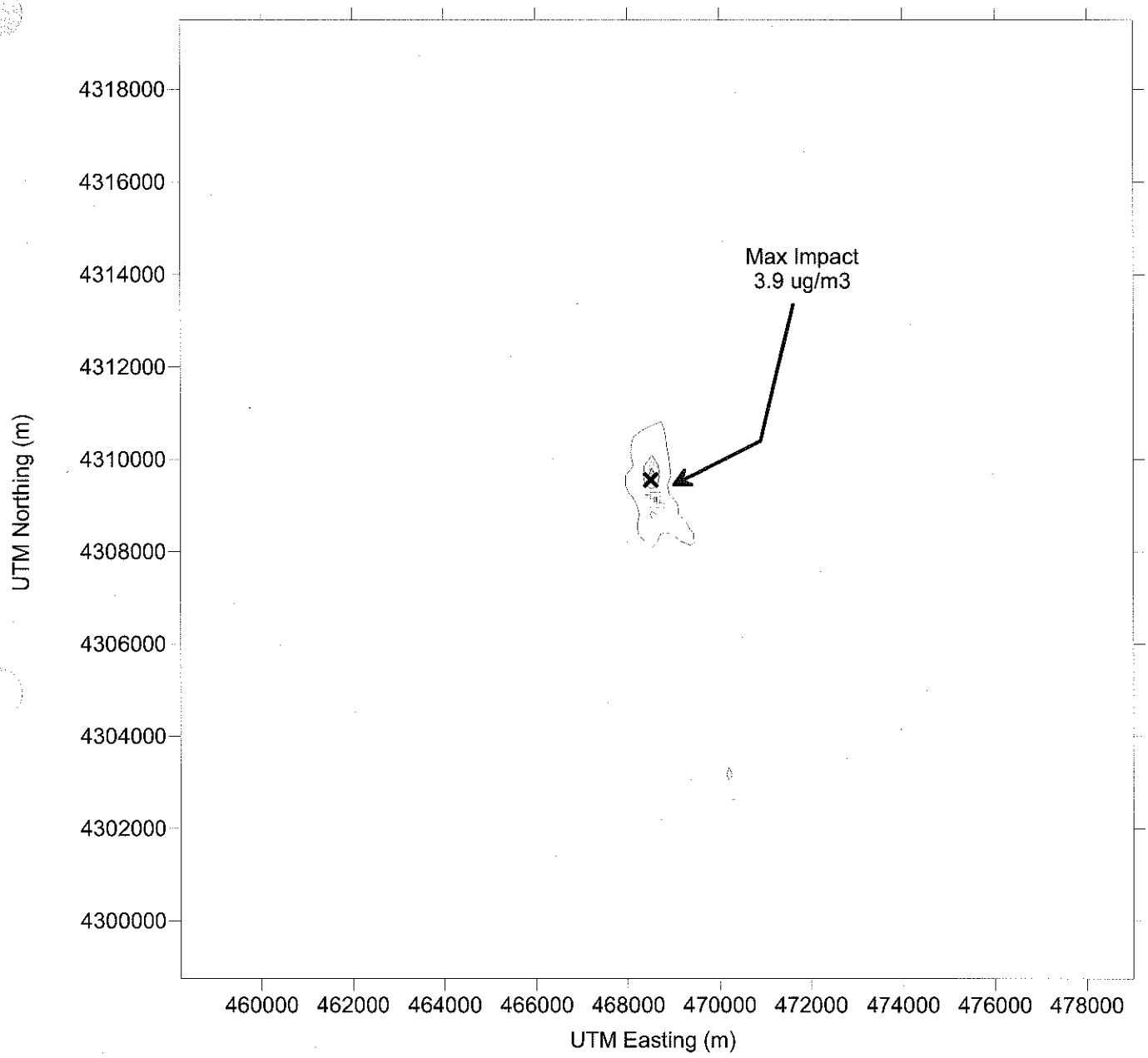
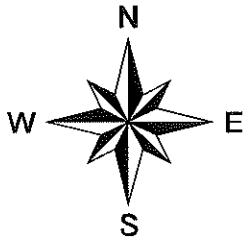
Figure 7-13: Increment PM2.5 24-hour (Starts, 2010)





Goodman Energy Center and Inventory Sources

Modeled Concentrations (μg/m³)

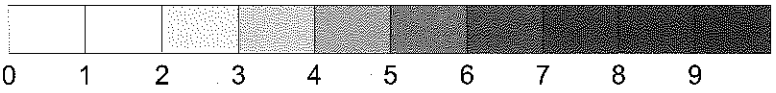


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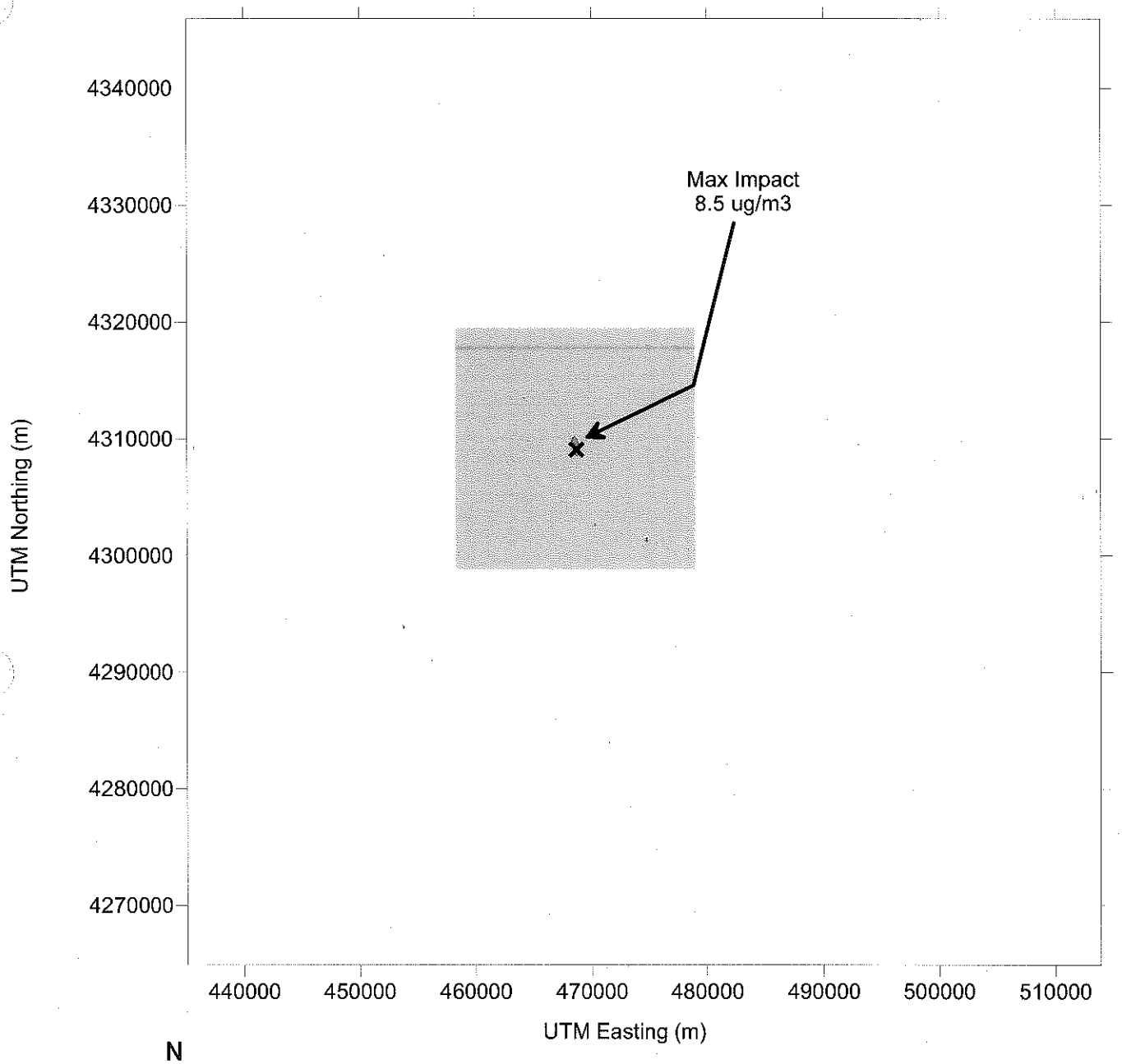
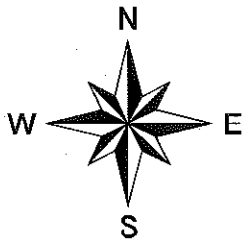
Figure 7-14: NAAQS PM2.5 Annual With Background (40% Load, 5 years)





+ Goodman Energy Center and Inventory Sources

Modeled Concentrations (μg/m³)

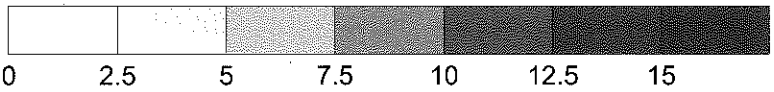


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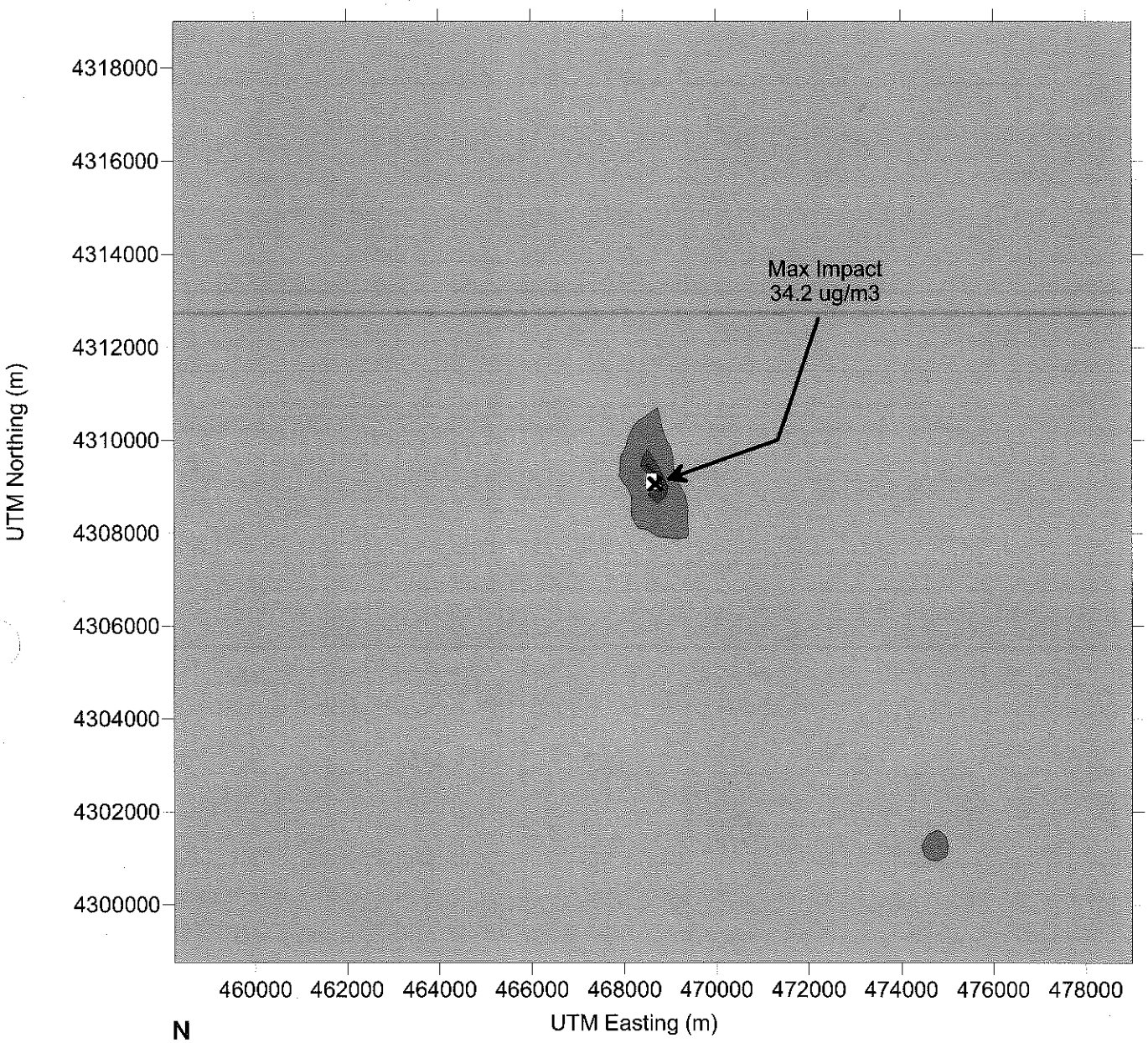
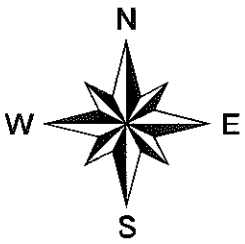
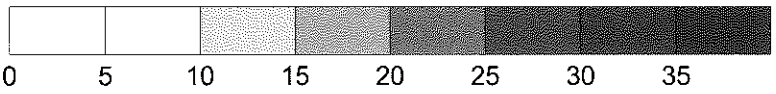
Figure 7-15: NAAQS PM2.5 24-hour With Background (40% Load, 5 years)





Goodman Energy Center and Inventory Sources

Modeled Concentrations (μg/m³)



Burns & McDonnell
SINCE 1898

APPENDIX G
MODELING FILES

VISCREEN
Level I

Visual Effects Screening Analysis for
Source: Goodman Energy Center Expansion Project
Class I Area: Cedar Bluff State Park

*** Level-1 Screening ***

Input Emissions for

Particulates	28.40	TON/YR
NOx (as NO2)	36.70	TON/YR
Primary NO2	0.00	TON/YR
Soot	0.00	TON/YR
Primary SO4	0.00	TON/YR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	39.50 km
Min. Source-Class I Distance:	39.50 km
Max. Source-Class I Distance:	39.50 km
Plume-Source-Observer Angle:	11.25 degrees

Stability: 6
Wind Speed: 1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	39.5	84.	2.00	0.156	0.05	0.002
SKY	140.	84.	39.5	84.	2.00	0.046	0.05	-0.001
TERRAIN	10.	84.	39.5	84.	2.00	0.125	0.05	0.001
TERRAIN	140.	84.	39.5	84.	2.00	0.021	0.05	0.001

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	0.	1.0	168.	2.00	0.232	0.05	0.002
SKY	140.	0.	1.0	168.	2.00	0.038	0.05	-0.002
TERRAIN	10.	0.	1.0	168.	2.00	0.290	0.05	0.003
TERRAIN	140.	0.	1.0	168.	2.00	0.085	0.05	0.003

Visual Effects Screening Analysis for
Source: Goodman Energy Center Expansion Project
Class I Area: Hays Regional Airport

*** Level-1 Screening ***

Input Emissions for

Particulates	28.40	TON/YR
NOx (as NO2)	36.70	TON/YR
Primary NO2	0.00	TON/YR
Soot	0.00	TON/YR
Primary SO4	0.00	TON/YR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	12.50 km
Min. Source-Class I Distance:	12.50 km
Max. Source-Class I Distance:	12.50 km
Plume-Source-Observer Angle:	11.25 degrees

Stability: 6
Wind Speed: 1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	12.5	84.	2.01	0.367	0.05	0.004
SKY	140.	84.	12.5	84.	2.00	0.149	0.05	-0.003
TERRAIN	10.	84.	12.5	84.	2.00	0.870	0.05	0.007
TERRAIN	140.	84.	12.5	84.	2.00	0.108	0.05	0.003

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	1.	1.0	168.	2.00	2.625*	0.05	0.026
SKY	140.	1.	1.0	168.	2.00	0.615	0.05	-0.022
TERRAIN	10.	1.	1.0	168.	2.00	3.889*	0.05	0.046
TERRAIN	140.	1.	1.0	168.	2.00	0.854	0.05	0.034

Visual Effects Screening Analysis for
Source: Goodman Energy Center Expansion Project
Class I Area: Wilson State Park

*** Level-1 Screening ***

Input Emissions for

Particulates	28.40	TON/YR
NOx (as NO2)	36.70	TON/YR
Primary NO2	0.00	TON/YR
Soot	0.00	TON/YR
Primary SO4	0.00	TON/YR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	75.00 km
Min. Source-Class I Distance:	75.00 km
Max. Source-Class I Distance:	75.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability: 6	
Wind Speed: 1.00 m/s	

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

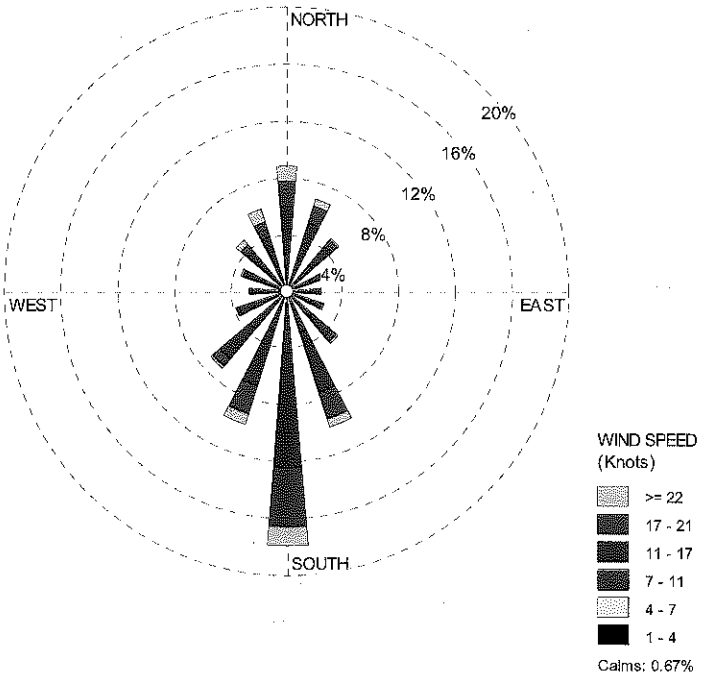
					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	75.0	84.	2.00	0.041	0.05	0.000
SKY	140.	84.	75.0	84.	2.00	0.008	0.05	0.000
TERRAIN	10.	84.	75.0	84.	2.00	0.014	0.05	0.000
TERRAIN	140.	84.	75.0	84.	2.00	0.003	0.05	0.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

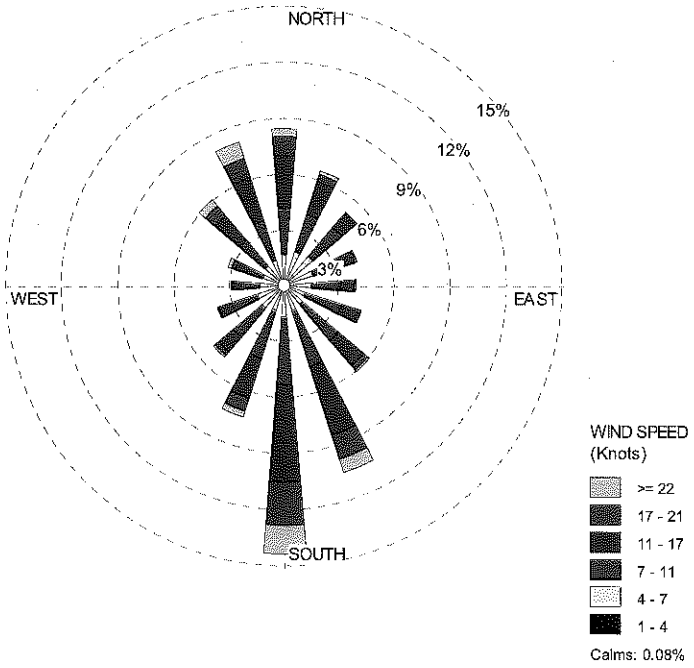
					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	45.	63.8	124.	2.00	0.045	0.05	0.000
SKY	140.	45.	63.8	124.	2.00	0.008	0.05	0.000
TERRAIN	10.	50.	65.5	119.	2.00	0.019	0.05	0.000
TERRAIN	140.	50.	65.5	119.	2.00	0.004	0.05	0.000

VISCREEN
Level II

Dodge City Regional Airport (WBAN #13985)
Wind Speed and Wind Direction for years 1987 to 1991



Russell Municipal Airport (WBAN # 93997)
Wind Speed and Wind Direction for years 2008 to 2012



Burns & McDonnell
SINCE 1898

Midwest Energy - Goodman Energy Center Expansion Project
Viscreen Level 2 - Hays Regional Airport

X (km)
12.5

Wind Direction Lower Bound (degrees)
135

Wind Direction Upper Bound (degrees)
145

			Probability							
			0 -6 hr		7-12 hr		13-18 hr		19-24 hr	
Class	$\sigma_y\sigma_z u$	Transport Time (hr)	Frequency	Cumulative Frequency	Frequency	Cumulative Frequency	Frequency	Cumulative Frequency	Frequency	Cumulative Frequency
F,1	1.94E+04	6.9	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
F,2	3.88E+04	2.3	0.01	0.01	0.00	0.01	0.02	0.02	0.00	0.00
E,1	4.74E+04	6.9	0.00	0.01	0.00	0.01	0.00	0.02	0.00	0.00
F,3	5.82E+04	1.4	0.01	0.02	0.07	0.08	0.05	0.06	0.08	0.08
E,2	9.47E+04	2.3	0.00	0.02	0.00	0.08	0.00	0.06	0.00	0.08
D,1	1.08E+05	6.9	0.01	0.03	0.00	0.08	0.00	0.06	0.00	0.08
E,3	1.42E+05	1.4	0.02	0.05	0.01	0.09	0.05	0.12	0.02	0.10
E,4	1.89E+05	1.0	0.05	0.09	0.16	0.25	0.10	0.22	0.13	0.23
D,2	2.16E+05	2.3	0.01	0.10	0.00	0.25	0.00	0.22	0.01	0.24
E,5	2.37E+05	0.8	0.17	0.27	0.31	0.56	0.21	0.43	0.16	0.39
D,3	3.25E+05	1.4	0.06	0.34	0.01	0.57	0.02	0.45	0.01	0.40
D,4	4.33E+05	1.0	0.21	0.55	0.05	0.62	0.02	0.47	0.01	0.41
D,5	5.41E+05	0.8	0.24	0.79	0.06	0.68	0.05	0.52	0.03	0.44
D,6	6.49E+05	0.6	0.42	1.21	0.16	0.85	0.09	0.61	0.17	0.61
D,7	7.58E+05	0.5	0.51	1.72	0.43	1.28	0.22	0.83	0.26	0.87
D,8	8.66E+05	0.5	0.25	1.96	0.43	1.71	0.26	1.10	0.19	1.06

Visual Effects Screening Analysis for
Source: Goodman Energy Center Expansion Project
Class I Area: Hays Regional Airport

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	28.40	TON/YR
NOx (as NO2)	36.70	TON/YR
Primary NO2	0.00	TON/YR
Soot	0.00	TON/YR
Primary SO4	0.00	TON/YR

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	12.50 km
Min. Source-Class I Distance:	12.50 km
Max. Source-Class I Distance:	12.50 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	4
Wind Speed:	6.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	12.5	84.	5.49	0.020	0.09	0.000
SKY	140.	84.	12.5	84.	2.00	0.008	0.09	0.000
TERRAIN	10.	84.	12.5	84.	4.03	0.049	0.09	0.000
TERRAIN	140.	84.	12.5	84.	2.00	0.006	0.09	0.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	1.	1.0	168.	2.00	0.208	0.05	0.002
SKY	140.	1.	1.0	168.	2.00	0.050	0.05	-0.002
TERRAIN	10.	1.	1.0	168.	2.00	0.320	0.05	0.004
TERRAIN	140.	1.	1.0	168.	2.00	0.067	0.05	0.003

There are document(s) that can't be scanned due to size, media, etc. which have been saved and are available for viewing. To view the document(s), please see the physical file in the file room.

Thank you

CD: PSD Air Construction Permit Application Appendix G - Modeling files
Dated: November 2013
For: Goodman Energy Center Expansion Project.