Oregon Clean Energy Center

Dispersion Modeling Report

Volume 1
Mitsubishi 501GAC Turbine Scenario

Submitted By:

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Natural Gas Energy for Ohio's Future

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°F	degrees Fahrenheit
°K	degrees Kelvin
µg/m^3	micrograms per cubic meter
ACGIH	American Conference of Governmental Industrial Hygienists
AERMAP	terrain data preprocessor
AERMET	meteorological data preprocessor
AERMOD	air dispersion model
AERSURFACE	surface characteristics preprocessor
AQRV	Air Quality Related Values
Aux. Boiler	auxiliary boiler
AWMA	Air and Waste Management Association
BACT	Best Available Control Technology
BAT	Best Available Technology
BPIP	Building Profile Input Program
BPIPPRM	PRIME Version of BPIP
BP	British Petroleum
Btu	British thermal units
CAA	Clean Air Act
CCGT	combined cycle gas turbine
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2e	carbon dioxide equivalents
CTG	combustion turbine generator
DAPC	Department of Air Pollution Control
DB	duct burner
DLN	dry low NO_x

EPRI	Electric Power Research Institute
FLAG	Federal Land Managers' Air Quality Related Values Working Group
FLM	Federal Land Manager
GEP	Good Engineering Practice
GHG	greenhouse gases
$g/m^2/yr$	grams per square meter per year
g/s	grams per second
hp	horsepower
HRSG	heat recovery steam generator
HRSGN	northern heat recovery steam generator
HRSGS	southern heat recovery steam generator
H_2SO_4	sulfuric acid mist
ISO	International Organization for Standardization
km	kilometer
kV	kilovolt
kW	kilowatts
m	meters
m/s	meters per second
MAGLC	Maximum Allowable Ground Level Concentration
mg/m^3	milligrams per cubic meter
MMBtu	million British thermal units
msl	mean sea level
MW	megawatts
NAAQS	National Ambient Air Quality Standards
Nat. gas	natural gas
O_3	ozone
OCE	Oregon Clean Energy

Ohio EPA	Ohio Environmental Protection Agency
ODNR	Ohio Department of Natural Resources
NED	National Elevation Dataset
NPS	National Park Service
NWS	National Weather Service
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
Pb	lead
PM_{10}	particulate matter with a diameter equal to or less than 10 microns
$PM_{2.5}$	particulate matter with a diameter equal to or less than 2.5 microns
ppb	parts per billion
ppm	parts per million
the Project	the Oregon Clean Energy Center
PSD	Prevention of Significant Deterioration
The PSD Permit Application	The Prevention of Significant Determination Preconstruction Permit Application
SCR	selective catalytic reduction
SER	Significant Emission Rate
SIL	Significant Impact Level
SMC	Significant Monitoring Concentration
SO_2	sulfur dioxide
STG	steam turbine generator
TAP	toxic air pollutant
TES	Toledo Environmental Services Division
TLV	threshold limit value
tpy	tons per year
TSP	total suspended particulates

ULSD	ultra-low sulfur diesel
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compounds

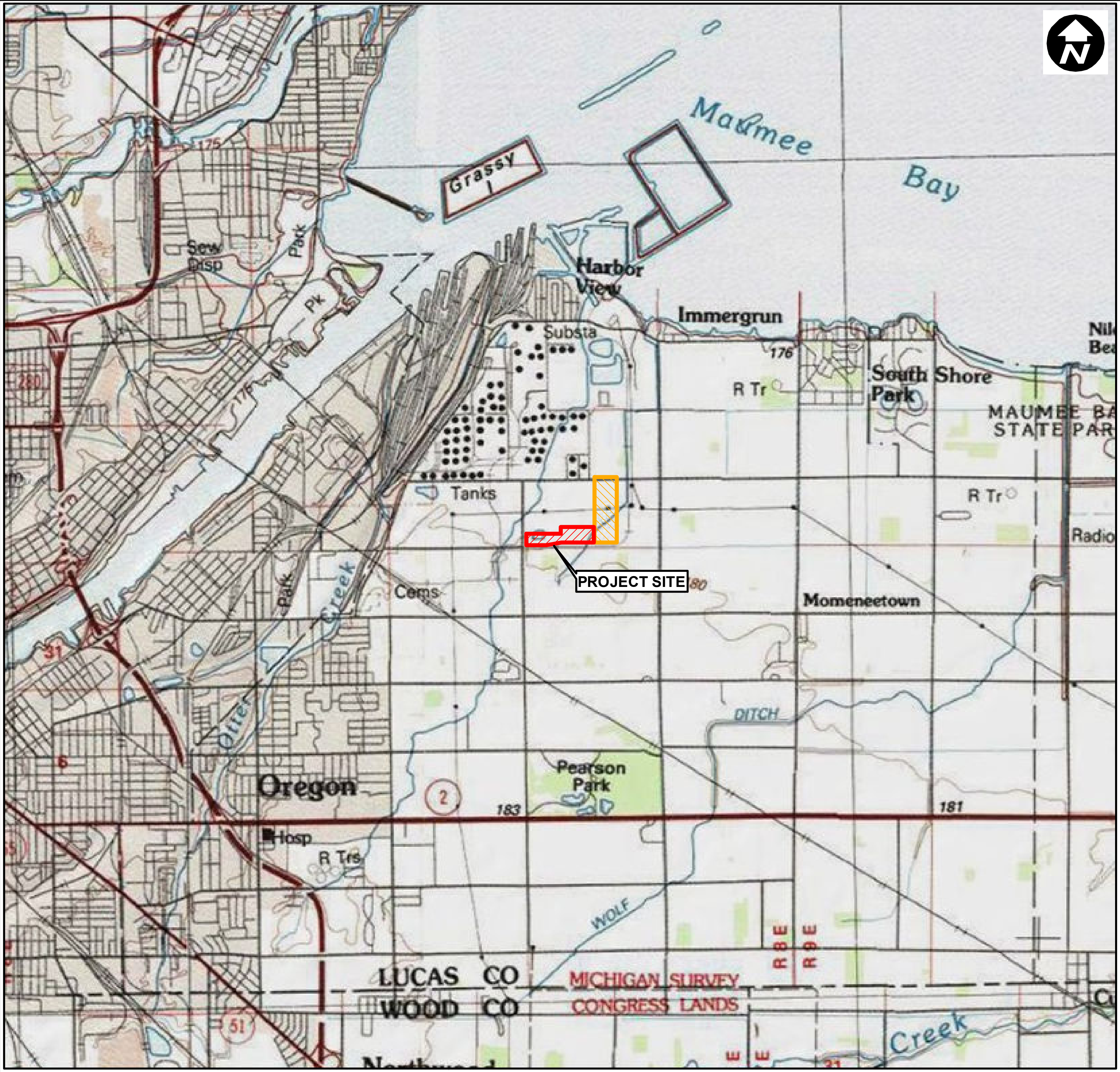
1. INTRODUCTION

Oregon Clean Energy, LLC (OCE) is proposing to construct the Oregon Clean Energy Center, a nominal 799-megawatt (MW) (unfired International Organization for Standardization [ISO] conditions) combined cycle gas turbine (CCGT) facility (the Project). OCE proposes to construct the Project within an approximately 30-acre parcel of land located entirely within Lucas County in the City of Oregon, Ohio. The general location of the Project is provided in Figure 1-1. The Project will utilize combined cycle combustion turbine technology in a 2 x 2 x 1 configuration. OCE is requesting a permit-to-install that will allow two optional plant configurations. The turbines being considered for the Project are:

- Option 1 - Two Mitsubishi M501 GAC units; or
- Option 2 - Two Siemens SGT-8000H units.

The permit application is being provided in two volumes to differentiate information associated with the two turbine engines. A two-volume application for the Prevention of Significant Deterioration (PSD) Preconstruction Permit (the PSD Permit Application) was submitted to the Ohio Environmental Protection Agency (Ohio EPA) for review by the Toledo Environmental Services Division (TES) on February 1, 2013 that included information for both Option 1 and Option 2. This document presents dispersion modeling information for the Mitsubishi turbine scenario. The PSD Permit Application (Volume 1) provides a comprehensive description of the Project and its associated emissions. The application also provides a detailed regulatory review and a Best Available Control Technology (BACT)/Best Available Technology (BAT) analysis. This document provides the modeling analyses required for those pollutants triggering PSD review.

Major Project equipment will include two combustion turbine generators (CTGs), two supplementary-fired heat recovery steam generators (HRSGs), one steam turbine generator (STG), a 16-cell mechanical draft wet cooling tower, and associated auxiliary and balance-of-plant equipment and systems. The Project is intended to operate as a base-load facility and is proposed to be available to operate up to 8,760 hours per year, incorporating a range of load conditions. The Project seeks the flexibility to operate with frequent starts in order to meet energy demands.



LUCAS COUNTY, OHIO

Legend

- Project Site
- Construction Laydown Parcel

Topographic Base Image Source: ArcGIS Online Services, Access date: 01/04/2013, via ArcGIS v10. This image is not for re-sale or distribution outside of the use of this PDF.

0 0.5 1
Miles
1 inch equals 1 miles

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FIGURE 1-1

SITE LOCATION MAP

Lucas County, Ohio	Date: 01/04/2013

City: Chicago Author: MNesta Path: C:\PROJECTS\OCE\MXD\OPSB_20130104\01-1_OCE_ProjectLocation.mxd

Air emissions from the proposed Project primarily consist of products of combustion from the combustion turbines, HRSG duct burners, and ancillary equipment. Pollutants that are regulated under federal and Ohio programs, such as PSD, include: carbon monoxide (CO); nitrogen dioxide (NO_2); sulfur dioxide (SO_2); total suspended particulates (TSP); particulate matter with a diameter equal to or less than 10 microns (PM_{10}), particulate matter with a diameter equal to or less than 2.5 microns ($PM_{2.5}$); volatile organic compounds (VOC); greenhouse gases (GHG); lead (Pb); sulfuric acid mist (H_2SO_4); and air toxics. Potential emissions from the proposed Project, on a tons per year (tpy) basis, are presented in Table 1-1.

The Project will employ BACT/BAT for emissions control. In addition to the use of dry low nitrogen oxide (NO_x) (DLN) burners, emissions of NO_x will be controlled with selective catalytic reduction (SCR). Emissions of CO and VOC will be controlled with good combustion practices and an oxidation catalyst system.

Table 1-1: Summary of Proposed Potential Emissions and Applicable Regulatory Thresholds

Pollutant	Annual Emissions (tpy)	PSD Major Source Threshold (tpy)	PSD Significant Emission Rate (tpy)	PSD Applies? (Yes/No)
NO_x	198.86	100	40[a]	Yes
VOC	113.68	100	40	Yes
CO	378.07	100	100	Yes
PM_{10}	94.1	100	15	Yes
$PM_{2.5}$	89.56	100	10	Yes
SO_2	34.24	100	40	No
H_2SO_4	10.52	100	7	Yes
GHGs[b]	2,801,030	100,000	75,000	Yes
Pb	0.00008	10	0.6	No

a. PSD significant emission rate for NO_2.
b. GHGs are expressed as carbon dioxide equivalents (CO_2e).

2. PROJECT DESCRIPTION

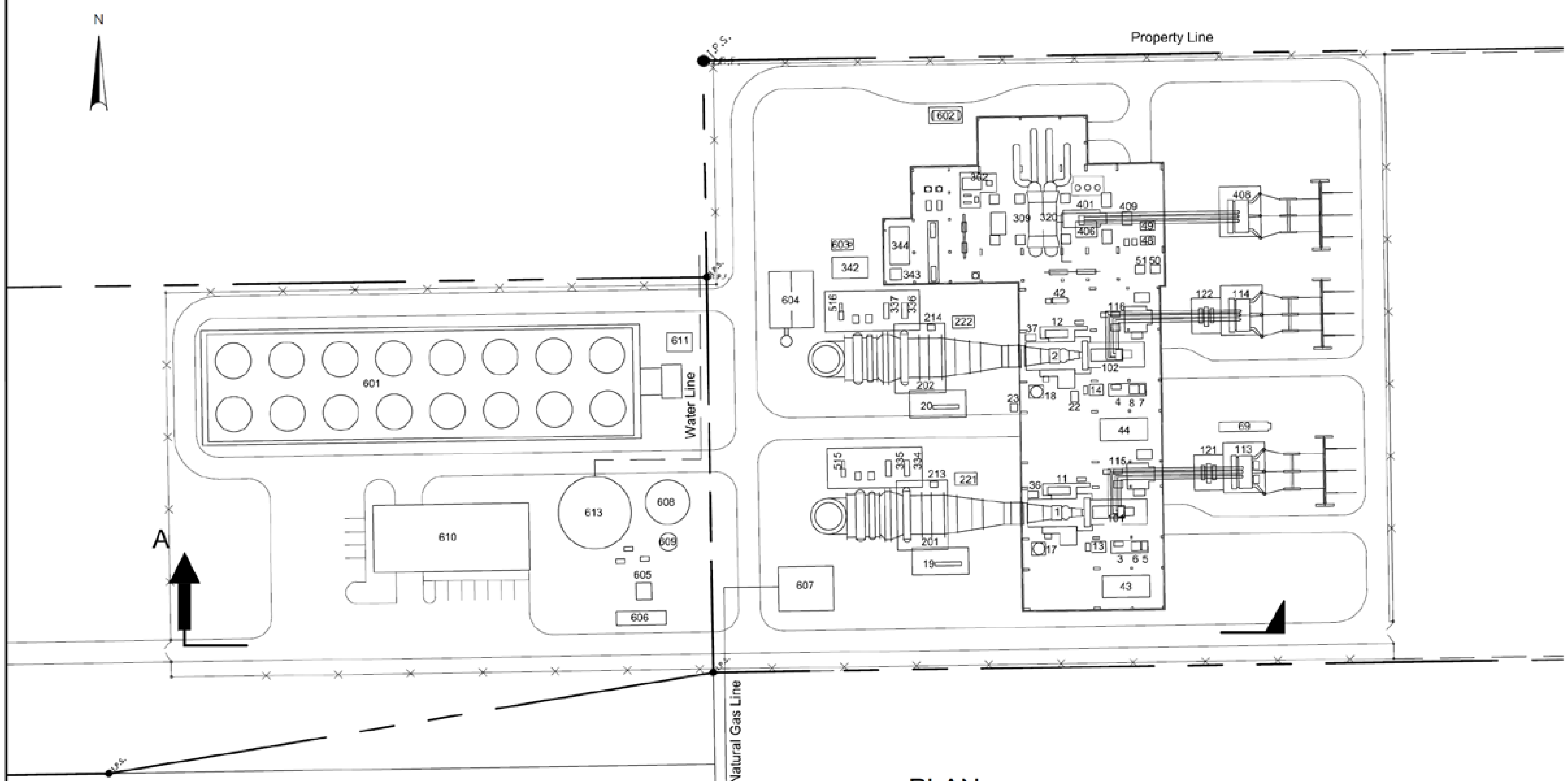
2.1 Overview

OCE proposes development of a nominal 799-MW electric generating facility (ISO conditions) at an industrially zoned site in the City of Oregon, Ohio. Figure 1-1 presents the proposed Project location on a topographic map. Figure 2-1 provides a site layout of the facility. The facility will be comprised of the following major and ancillary equipment:

- Two CTGs;
- Two HRSGs with supplemental duct firing;
- One STG;
- One 16-cell mechanical draft wet cooling tower;
- One 2,250 kilowatt (kW) emergency diesel generator using ultra-low sulfur diesel (ULSD) fuel; OCE is proposing a permit limit of 500 hours of operation per year;
- One natural gas-fired, 99-million British thermal units (MMBtu) steam production auxiliary boiler; OCE is proposing a permit limit of 2,000 hours of operation per year; and
- One 300-horsepower (hp) fire pump using ULSD fuel; OCE is proposing a permit limit of 500 hours of operation per year.

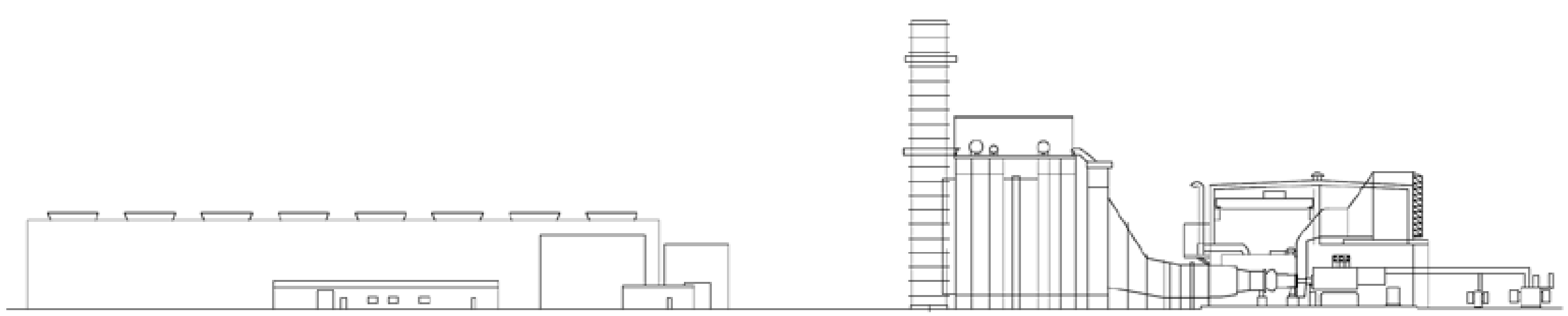
The Project will be fueled by clean-burning natural gas. A new natural gas lateral will be built and operated to connect with nearby natural gas transmission lines. Electrical interconnection will be to the 345-kilovolt (kV) FirstEnergy transmission line, located just north of the site.

The facility will utilize a 16-cell mechanical draft wet cooling tower with an average consumptive water use of 3-4 million gallons per day. Raw water from the City of Oregon is being proposed for process use. Discharge of wastewater will be to the Oregon sanitary sewer system for treatment at the wastewater treatment plant, located within 1 mile of the site. The cooling tower will be equipped with high efficiency (0.0005%) drift eliminators.



PLAN

120 60 0 120
Scale in Feet



Section A

120 60 0 120
Scale in Feet

Legend

1 No. 1 Gas Turbine
2 No. 2 Gas Turbine
3 No. 1 GT Lube Oil Reservoir
4 No. 2 GT Lube Oil Reservoir
5 No. 1 GT Lube Oil Cooler (A)
6 No. 1 GT Lube Oil Cooler (B)
7 No. 2 GT Lube Oil Cooler (A)
8 No. 2 GT Lube Oil Cooler (B)
11 No. 1 Fuel Gas Unit
12 No. 2 Fuel Gas Unit
13 No. 1 Control Oil Unit
14 No. 2 Control Oil Unit
17 No. 1 GT Cooling Air Cooler
18 No. 2 GT Cooling Air Cooler
19 No. 1 GT Fuel Gas Heater
20 No. 2 GT Fuel Gas Heater
22 GT Blade Wash Skid
23 GT Blade Washing Drain Pit
42 CO2 Fire Fighting Systems for GT
43 No. 1 GT Electrical / Control Package
44 No. 2 GT Electrical / Control Package

Legend (Cont.)

48 Plant Air Compressor (A)
49 Plant Air Compressor (B)
50 Instrument Air Receiver
51 Service Air Receiver
69 Trans Area Oil Separator
101 No. 1 GT Generator
102 No. 2 GT Generator
113 No. 1 GTG Transformer
114 No. 2 GTG Transformer
115 No. 1 GTG Exc. Transformer
116 No. 2 GTG Exc. Transformer
121 No. 1 Unit Transformer
122 No. 2 Unit Transformer
201 No. 1 Heat Recovery Steam Generator
202 No. 2 Heat Recovery Steam Generator
213 No. 1 HRSG Blow Down Tank
214 No. 2 HRSG Blow Down Tank
221 No. 1 HRSG Blow Down Pit
222 No. 2 HRSG Blow Down Pit
302 ST Lube Oil Tank
309 ST Control Oil Unit
320 Condenser
334 HP Feed Water Pump (A)
335 HP Feed Water Pump (B)
336 HP Feed Water Pump (C)
337 HO Feed Water Pump (D)
342 Sampling Equipment
343 ST Building Chemical Drain Pit
344 Chemical Dosing Equipment
401 ST Generator
408 STG Transformer
409 STG Exc. Transformer
418 STG H2 Supply Unit
515 No. 1 HRSG Ammonia Dilution Air Blower
516 No. 2 HRSG Ammonia Dilution air Blower
601 Cooling Tower
602 Aqueous Ammonia Storage Tank
603 Emergency Diesel Generator
604 Auxiliary Boiler Skid
605 Fire Pump Building
606 Water Treatment Building
607 Gas Yard
608 Raw Water and Fire Water Storage Tank
609 Demineralized Water Storage Tank
610 Control / Maintenance / Administration Building
611 Cooling Tower Motor Control House
612 Switchyard Control Building
613 Raw Water Storage Tank

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FIGURE 2-1

SITE LAYOUT

Lucas County, Ohio | Date: 02/05/2013

Created by SAIC

2.2 Site Location

The proposed site consists of an irregularly shaped parcel of land, totaling approximately 30 acres, located entirely within the City of Oregon, Lucas County, Ohio. The site is industrially zoned within the Cedar Point Development Park. Its setting is within a mixed industrial, commercial and agricultural area that is located east of North Lallendorf Road, west of farmland located at 4632 Cedar Point Road, north of the Norfolk Southern Railroad, and south of the John Gradel and Sons' Farms. Access to the site is via North Lallendorf Road. The western edge of the site is transected by Driftmeyer Ditch, while Johlin Ditch transects the eastern portion of the site. Both ditches flow north to Lake Erie, located less than 2 miles north of the site. FirstEnergy-owned transmission lines extend in an east-west direction just to the north of the site.

The site consists of farmland with associated structures, including two single-family dwellings, a garage and a barn. The majority of the parcel is in active agricultural use. Site topography is relatively flat, at an elevation of approximately 588 feet above mean sea level (msl). The final graded elevation will be approximately 590 ft msl. The Maumee River, which flows southwest to northeast to its confluence with Lake Erie, is situated approximately 2 miles northwest of the site.

The Project is located approximately 2 miles south of First Energy's existing Bay Shore coal-fired power plant on Lake Erie. British Petroleum's (BP's) expansive Toledo Refinery is located less than 0.5 mile to the north, beyond the electric transmission corridor. Land uses east and southeast of the site are primarily agricultural, with some residences along the roads which divide the land in a grid-like fashion. A cluster of commercial/industrial uses border the site to the south-southwest, including several manufacturing and warehouse facilities. More densely developed residential areas are located about a mile southwest of the site.

Pearson Park is located approximately 1.5 miles south of the site, Collins Park is 1.5 miles west-southwest of the site, and Maumee Bay State Park is approximately 2 miles east-northeast of the site. Further east-northeast, along the shore of Lake Erie are the Mallard Club Wilderness Area and the Cedar Point National Wildlife Refuge.

2.3 Project Emissions

Potential Project emissions are summarized in Table 1-1. Emissions for the primary emission units are discussed in Section 4.4. Detailed presentations of the emissions associated with the Project are provided in the PSD Permit Application. For ease of review, supporting emissions calculations are also provided in Appendix A of this document.

3. REGULATORY APPLICABILITY EVALUATION

OCE is requesting approval to construct a nominal 799-MW (ISO conditions) combined cycle electric generating facility at an industrially zoned site in the City of Oregon, Ohio. The Project is considered a new major stationary combustion source under PSD regulations because the potential annual emissions from the facility exceed major source thresholds, as illustrated in Table 1-1.

A comprehensive regulatory review for the Project is provided in the Section 3 of the PSD Permit Application (Volume 1). This section contains an analysis of the applicability of federal and state air quality regulations to the proposed Project as they pertain to dispersion modeling requirements.

3.1 PSD New Source Review

OCE is requesting approval to construct a nominal 799-MW (ISO Conditions) combined cycle electric generating facility in the City of Oregon, Lucas County, Ohio. Lucas County is in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants and is, therefore, regulated under the PSD program.

Combined cycle power plants with potential emissions greater than 100 tpy of one or more criteria pollutants are considered new major stationary sources under the PSD program. As shown in Table 1-1, the potential emissions of at least one regulated criteria pollutant will exceed this threshold. As such, the proposed facility is subject to PSD New Source Review. Under the PSD regulations, once a major source threshold is triggered, PSD review must be completed for all pollutants whose potential emissions exceed their respective Significant Emission Rate (SER).

As presented in Table 1-1, OCE has triggered the major source threshold for at least one pollutant. As such, PSD review is required for NO_x, CO, VOC, H_2SO_4, $PM_{2.5}$, PM_{10} and GHG emissions. Of these pollutants, an ambient air quality impact analysis is required for NO_x (as NO_2), CO, $PM_{2.5}$ and $PM_{10.}$ PSD review requirements include application of BACT, an ambient air quality modeling analysis demonstrating compliance with the NAAQS and PSD increments, an analysis of potential impacts to designated PSD Class I areas, and an additional impacts analysis. Ohio has been delegated PSD review authority by the United States Environmental Protection Agency (USEPA).

3.1.1 Best Available Control Technology

Pollutants subject to PSD review are required to apply BACT for control of emissions of PSD pollutants. BACT is defined as an emission limitation based on the maximum degree of reduction, on a case-by-case basis, taking into account energy, environmental and economic considerations. A BACT analysis is presented in the PSD Permit Application.

3.1.2 Air Quality Impact Analysis

An ambient air quality impact analysis must be performed to demonstrate compliance with NAAQS and PSD increments. Proposed new sources subject to PSD review may not cause or significantly contribute to a violation of the NAAQS. As part of this demonstration, the USEPA has established Significant Impact Levels (SILs) for all of the criteria pollutants. SILs represent concentrations of pollutants that are considered to be insignificant with respect to demonstration of NAAQS compliance. Proposed new sources whose air quality impacts exceed the SILs must complete a cumulative analysis taking into consideration existing background air quality levels and contributions from other sources. In addition to demonstrating compliance with the NAAQS, new sources must comply with PSD increments, which specify the maximum allowable increase in concentration that is allowed to occur in areas meeting the NAAQS for any regulated pollutant.

Table 3-1 presents a summary of the NAAQS, SILs, and PSD increments. The air quality impact analysis for the Project is provided in Section 5 of this document.

3.1.3 PSD Class I Area Impact Analysis

PSD regulations require that proposed major sources within 100 kilometers (km) of a PSD Class I area perform an assessment of potential impacts in the PSD Class I area. PSD Class I areas are specifically designated areas of special national or regional value from a natural, scenic, recreational or historic perspective. These areas are administered by the National Park Service (NPS), United States Fish and Wildlife Service (USFWS), or the United States Forest Service (USFS). Federal Land Managers (FLMs) are responsible for evaluating proposed projects' air quality impacts in the Class I areas and may make recommendations to the permitting agency to approve or deny permit applications. The PSD Class I area impact analysis is presented in Section 6.

Table 3-1: Summary of Primary National Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS micrograms per cubic meter ($\mu g/m^3$)[a]	Class II SIL ($\mu g/m^3$)	Significant Monitoring Concentration (SMC) ($\mu g/m^3$)	Class II PSD Increments ($\mu g/m^3$)
SO_2	1-hour	196[b]	7.8	Not yet proposed	--
	3-hour	1,300	25	--	512
PM_{10}	24-hour	150[c]	5	10	30
$PM_{2.5}$	24-hour	35[d]	1.2[e]	4[e]	9
	Annual	12	0.3[e]	--	4
CO	1-hour	40,000	2,000	--	--
	8-hour	10,000	500	575	--
NO_2	1-hour	188[f]	7.52	Not yet proposed	--
	Annual/12 month	100	1	14	25
Ozone(O_3)	8-hour	160[g]	--	--	--
Pb	3-month	0.15[h]	--	--	--

a. All short-term NAAQS (1-, 3-, 8-, and 24-hr) standards except O_3, $PM_{2.5}$ and PM_{10} are not to be exceeded more than once per calendar year. Three-month and annual standards are never to be exceeded.

b. For the 1-hour SO_2 NAAQS, compliance is determined using the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor.

c. For 24-hour PM_{10}, USEPA uses the 6th highest 24-hour maximum concentration from the last three years of air quality monitoring data to determine a violation of the standards.

d. For 24-hour $PM_{2.5}$, USEPA uses the 98% percentile 24-hour maximum concentration from the last three years of air quality monitoring data to determine a violation of the standard.

e. On January 22, 2013, the United States Court of Appeals for the District of Columbia Circuit issued a ruling that remands and vacates the SILs and SMCs for 24-hour and annual $PM_{2.5}$. The USEPA has not yet issued interim guidance regarding the ruling.

f. For the 1-hour NO_2 NAAQS, compliance is determined using the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor.

g. For 8-hr ozone, USEPA uses the average of the annual 4th highest 8-hour daily maximum concentrations from each of the last three years of air quality monitoring data to determine a violation of the standard.

h. The 3-month NAAQS for Pb is a rolling average.

3.1.4 Additional Impact Analyses

Additional impact analyses are also required as part of PSD review. These additional analyses include an assessment of impacts on community growth resulting from the Project and an assessment of impacts to soils and vegetation. The additional impact analyses are presented in Section 6.

The Endangered Species Act of 1973 requires that all federal actions, such as the issuance of PSD permits, not jeopardize the existence of any endangered or threatened species or result in the destruction or adverse modification of the habitat of such species. Section 6.4 provides a discussion on endangered species considered for the Project.

3.2 Other Applicable Regulations

Other federal and state regulations applicable to the Project are described in the PSD Permit Application (Volume 1). Of relevance to the Dispersion Modeling Report, Ohio EPA's Air Toxics Policy (Ohio EPA, 1986) requires a modeling evaluation of the ambient impacts of toxic air pollutant (TAP) emissions. This analysis is provided in Section 6.5.

4. MODELING PROCEDURES

The methodology used for the modeling presented below is consistent with the guidance provided by the USEPA in the “Guideline on Air Quality Models” (USEPA, 2005); and by the Ohio EPA in “Engineering Guide 69” (Ohio EPA, 2003).

4.1 Model Selection

AERMOD (version 12345) was selected to predict ambient concentrations in simple (below stack height), complex (above plume height) and intermediate (between stack height and plume height) terrain. The AERMOD Modeling System includes preprocessor programs (AERMET, AERSURFACE, and AERMAP) to create the required input files for meteorology and receptor terrain elevations. AERMOD is the recommended model in USEPA’s Guideline on Air Quality Models (40 Code of Federal Regulations [CFR] Part 51, Appendix W) (USEPA, 2005). The regulatory default option was used in the modeling for all pollutants, which includes the following commands:

- The elevated terrain algorithms requiring input of terrain height data for receptors and emission sources;
- Stack-tip downwash (building downwash automatically overrides);
- The “calms” processing routines;
- Buoyancy-induced dispersion; and
- The missing meteorological data processing routines.

4.2 Receptors

A 5 km x 5 km Cartesian receptor grid with 100-meter (m) spacing between the receptors and a 25 km x 25 km Cartesian grid with a 1,000-m spacing between receptors was used. Fence-line receptors were placed around the property boundary at 25-m spacing.

Receptor elevations were assigned using the USEPA’s AERMAP software tool (version 06341), which is designed to extract elevations from United States Geological Survey (USGS) National Elevation Dataset (NED) data at 1/3 arc second resolution in GeoTIFF format (USGS, 2002). This represents the highest resolution digital terrain data available from the USGS for this geographic area.

AERMAP, the terrain preprocessor for AERMOD, uses interpolation procedures to assign elevations to a receptor:

- For each receptor, the program searches through the NED data index files to determine the two profiles (longitudes or eastings) that straddle the receptor.

- For each of these two profiles, the program then searches through the nodes in the index file to determine which two rows (latitudes or northings) straddle the receptor.

- The program then reads the elevations for these four points. A two-dimensional distance-weighted interpolation is then used to determine the elevation at the receptor location based on the elevations at the four nodes determined above.

The AERMAP files are provided on the compact disc in Appendix D.

4.3 Meteorological Data

The AERMOD-ready, five-year meteorological data set obtained from Ohio EPA was used for meteorological inputs. This data set includes hourly surface data from the National Weather Service (NWS) site at Toledo Express Airport and upper air observations from Detroit, Michigan for calendar years 2006 through 2010.

Land use for the area surrounding the Toledo Airport anemometer site was used to estimate surface characteristics (surface roughness, albedo and Bowen ratio). The AERSURFACE processor was used to determine seasonal surface characteristics as a function of wind direction.

4.4 Emissions Data and Stack Parameters

The modeling analyses include the following Project sources:

- Two combined cycle combustion turbines with HRSG duct burners (combusting only natural gas);
- An auxiliary boiler (combusting only natural gas); and
- A 16-cell mechanical draft wet cooling system.

The emission rates and stack exit parameters used in the modeling analyses are provided in the following tables: combined cycle units (Table 4-1), turbine start-up events (Table 4-2), and ancillary equipment (Table 4-3). Detailed emission calculations are provided in Appendix A of this report.

4.4.1 Combined Cycle Turbines

Impacts were evaluated for a representative range of steady-state turbine operating scenarios provided by the turbine supplier. The scenarios selected for modeling cover a wide range of temperature, load and supplemental duct firing conditions. The modeled operating scenarios identified in Table 4-1 were selected as being representative of the full range of proposed operating scenarios to ensure model prediction of maximum Project impacts. The minimum load at which the turbine will achieve the guaranteed emission performance varies with ambient temperature. Duct firing is proposed only at full load, with temperature at or above 90 degrees Fahrenheit (°F). Impacts for $PM_{2.5}$ and for PM_{10} were assessed for the turbines (worst case) and the cooling tower.

The auxiliary boiler will not operate when the turbines are running, aside from starts and periodic testing. Peak 1-hour impacts for CO were predicted to occur during cold starts with the auxiliary boiler operating. One-hour impacts of NO_2 during cold starts were not considered pursuant to the March 1, 2011 USEPA guidance memorandum entitled "Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS" (USEPA, 2011) which allows intermittent events (like cold starts) to be excluded from modeling for 1-hour NO_2. The worst case 1-hour operating scenario for NO_2 impacts was determined to be one turbine during a hot-start with the auxiliary boiler operating. Shutdown scenarios were not modeled, since the hot, warm, and cold start scenarios were determined to represent worst case. Emissions of PM_{10}, $PM_{2.5}$, and NO_x (annual) are highest during steady state scenarios, and impacts for those pollutants were, therefore, not evaluated for start-up and shutdown scenarios. Emissions during start-up scenarios are provided in Table 4-2.

The auxiliary boiler stack runs alongside and at the same height as the north HRSG stack. As per the USEPA criteria for merging plumes (USEPA, 1996), when the north turbine and the auxiliary boiler were both operating, those two stacks were modeled as a single stack, using the diameter, exit velocity and temperature of the HRSG stack. However, when the south turbine and the auxiliary boiler were running, the south HRSG stack and the auxiliary boiler stack were modeled as separate stacks due to their considerable separation. It was determined that the maximum impacts for 1-hour NO_2 and CO resulted from operation of the south turbine with the auxiliary boiler during start-up.

Table 4-1: Stack Parameters and Emission Rates for Each Combustion Turbine [a]

	Units	Selected Design Cases										
		Case 1	Case 3	Case 4	Case 6	Case 7	Case 10	Case 11	Case 16	Case 17	Case 20	Case 23
Fuel Type	--	Nat. gas[b]	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas	Nat. gas
Ambient Temperature	°F	-8	-8	0	0	59	59	90	90	95	105	105
Percent Load Rate	%	100	50	100	50	no	50	100	52	100	100	55
Duct Burner Operation	--	no	no	no	no	no	no	yes	no	yes	no	no
Stack Diameter	Feet	22	22	22	22	22	22	22	22	22	22	22
Stack Height	Feet	240	240	240	240	240	240	240	240	240	240	240
Stack Temperature	°K [b]	359.1	346.9	358.0	346.9	357.4	346.9	352.4	349.1	351.3	361.3	351.3
Stack Exit Velocity	m/s [b]	19.35	11.71	19.04	11.63	17.25	11.11	16.05	10.68	15.95	16.20	10.77
NO_x Emission Rate	g/s	2.85	1.72	2.84	1.68	2.52	1.54	2.62	1.44	2.62	2.30	1.41
CO Emission Rate	g/s	1.73	1.05	1.73	1.02	1.54	0.93	1.60	0.87	1.60	1.40	0.86
$PM_{10}/PM_{2.5}$ Emission Rate	g/s	1.43	0.88	1.43	0.87	1.27	0.82	1.27	0.77	1.27	1.16	0.76

a. Emission rates are provided in grams per second (g/s) because these are appropriate units for dispersion modeling inputs

b. Nat. gas = natural gas, °K = degrees Kelvin; m/s = meters per second

Table 4-2: Modeling Inputs for CTG Startup Events

Pollutant	Units	Cold Startup [a,b]	Warm Startup [a,c]	Hot Startup [a,c]
Duration	Mins	150	110	67
Stack Diameter	Feet	22	22	22
Stack Height	Feet	240	240	240
Exit Temperature	^oK	364.1	363.4	357.5
Exit Velocity	m/s	10.94	11.02	10.66
NO_x	g/s	5.49	5.33	5.92
CO	g/s	139.57	122.76	72.96

a. These events were modeled for startup of a single turbine. The exit temperature, exit velocity and grams per second (g/s) emission rates reflect the turbine startup event only. In the modeled startup events, emissions from the auxiliary boiler were also included.

b. Cold start scenario produced the worst case impacts for CO.

c. Hot start scenario produced the worst case for impacts for 1-hr average NO_2.

d. Supporting calculations are included in Appendix A.

4.4.2 Ancillary Equipment

For the cooling tower, mass emission rates for PM_{10} and $PM_{2.5}$ are presented in the PSD Permit Application (Volume 1) and were determined based on the following parameters:

- a high efficiency drift rate of 0.0005 percent;
- a maximum dissolved solids content in the recirculating water of 2,030.5 milligrams per liter;
- a water recirculation rate of 322,000 gallons per minute; and
- a particle size distribution as developed by the Electric Power Research Institute (EPRI) and presented in an Air and Waste Management Association (AWMA) publication (AWMA, 2001).

Per the direction of Ohio EPA, the emergency generator and emergency fire pump were not modeled because they operate less than 500 hours per year and are considered intermittent emissions for modeling purposes. Emissions for the ancillary equipment are provided in Table 4-3.

Table 4-3: Stack Parameters and Emission Rates for Ancillary Equipment

	Units	Auxiliary Boiler [a]	Cooling Tower [b]
Fuel Type	--	Natural Gas	--
Stack Diameter	feet	4	33
Stack Height	feet	240	66
Stack Temperature	^{o}K	366.48	Ambient + 10 ^{o}K
Stack Exit Velocity	m/s	0.17	8.45
NO_x	g/s	0.25	--
CO	g/s	0.69	--
PM_{10}	g/s	0.10	0.0082
$PM_{2.5}$	g/s	0.10	0.000032

a. The auxiliary boiler will exhaust through a separate stack adjacent to the north HRSG stack. For modeling, the south HRSG stack and the auxiliary boiler stack were modeled as separate stacks while the north turbine stack and the auxiliary boiler stack are modeled as combined stacks. The emission rates and stack temperature in this table are representative of the auxiliary boiler operating alone.
b. The cooling tower emission rates are on a per cell basis. There will be 16 cells in the cooling tower.

4.5 Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis was conducted to determine the allowable stack height credit for modeling and to provide model input information to characterize building wake effects. If a stack is sufficiently close to a large building or other structure, the plume can be entrained in the building's wake. The resulting "downwash" reduces the effective release height and leads to increased ground-level ambient concentrations. Building downwash effects must be evaluated for an AERMOD dispersion model application.

Formula GEP stack height is defined as:

$H_{GEP} = H_B + 1.5L_B$ where:

- H_{GEP} = formula GEP stack height;
- H_B = the building's height above stack base; and
- L_B = the lesser of the building's height or maximum projected width.

A second definition of GEP stack height is "regulatory" GEP stack height. Regulatory GEP stack height is either 65 m or formula GEP stack height, whichever is greater. Sources are not allowed to take credit for stack height above regulatory GEP stack height when modeling to demonstrate compliance with ambient air quality standards.

The USEPA Building Profile Input Program (BPIP) (USEPA, 1995) produces the model input information necessary to account for building wake effects, based on the dimensions of buildings in the vicinity of the stacks. The "PRIME" version of BPIP (BPIPPRM) (Schulman, et al., 1997) is used with AERMOD. The position and height of buildings relative to the stack positions must be evaluated in the GEP analysis. Figure 2-1 presents a site layout of the facility.

Building and stack locations and elevations determined from design drawings were entered into BPIPPRM (version 04274). Table 4-4 summarizes the building and stack inputs for the BPIP analysis. The controlling structures influencing the two turbine stacks are the HRSG structures; the GEP height determined based on the BPIP analysis was 293-feet for each turbine stack. The cooling tower cells were also evaluated with BPIPPRIME. The controlling structures influencing these 66-foot stacks (for most wind directions) are the cooling tower building and the north HRSG structure. The stacks and cooling towers are lower than GEP height; therefore, emissions will be subject to predicted building-wake downwash. AERMOD incorporates the effects of downwash for stacks above and below GEP height.

Table 4-4: Major Building Structures for the Oregon Clean Energy Center

Building	Height (feet)	Length (feet)	Width (feet)	Base Elevation (feet msl)	Influence Distance (feet)	Distance to Stack		
						HRSGN[a] Stack (feet)	HRSGS[b] Stack (feet)	Cooling Tower (feet)
Turbine building								
tier 1	45	450.3	127.6	590	456	83.5	173.2	263.5 to 609.3
tier 2	79	450.3	69.6	590	616.8	83.5	173.2	263.5 to 609.3
HRSGN[a]	117.5	90	50.8	590	570.9	16.5	119	223.5 to 564
HRSGS[b]	117.5	90	50.8	590	570.9	16.5	119	236.5 to 579.3
Cooling tower	60	400.3	107.5	590	506	172.7	189	0
Gas yard	15	50	40.2	590	120	187.3	43	213.6 to 535.3

a. HRSGN = Northern HRSG
b. NRSGS = Southern HRSG

4.6 Background Air Quality

The Ohio EPA collects air quality data (ambient air pollutant concentrations) at a number of monitoring locations throughout the state, including Lucas County and the surrounding area. Data collected from air quality monitoring sites are used, in part, to verify attainment of the NAAQS. As defined by the Ohio EPA, background air quality includes pollutant concentrations due to natural sources, nearby sources other than the one(s) under consideration, and unidentified sources. Therefore, background air quality is defined as the ambient air pollutant concentration that exists outside the immediate vicinity of the Project.

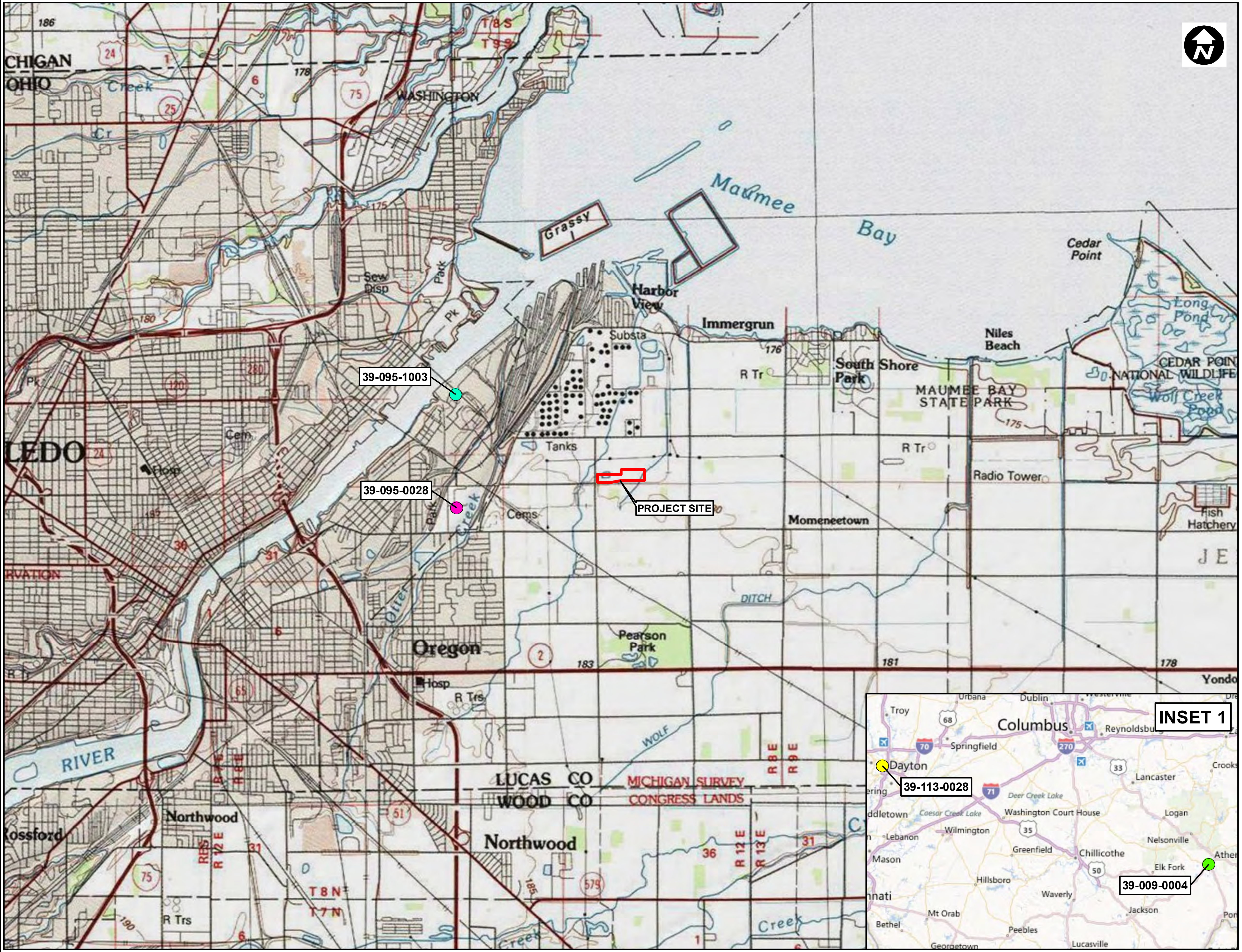
For the Project area, the most recent background concentrations for $PM_{2.5}$ and PM_{10} were obtained from the Ohio EPA Annual Air Quality Report for 2011. The background concentrations for NO_2 and CO were obtained by contacting Ohio EPA. Table 4-5 identifies the air quality monitors used, and Table 4-6 compares the monitoring data to the ambient air quality standards for the PSD pollutants modeled. Figure 4-1 shows the locations of the monitoring stations.

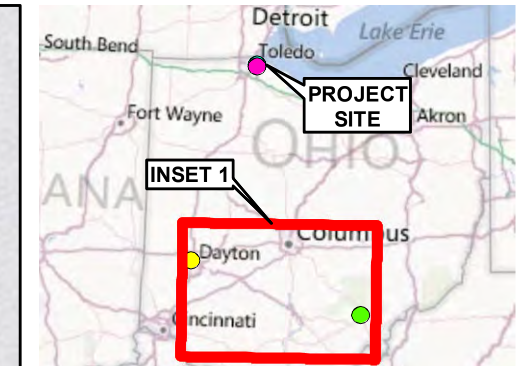
Table 4-5: Background Air Quality Monitoring Stations

Pollutant	Station Location	Station ID
PM_{10}	Lee and Front, Toledo, Lucas County	39-095-1003
$PM_{2.5}$	600 Collins Park, Toledo, Lucas County	39-095-0028
NO_2	7760 Blackburn Road, Athens, Athens County	39-009-0004
CO	901 W. Fairview, Dayton, Montgomery County	39-113-0028

Table 4-6: Background Air Quality Data

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	24-hour	86	150
$PM_{2.5}$	24-hour	29	35
	Annual	11.42	12
NO_2	Annual	5.9	99.7
	1-hour	37.79	188
CO	1-hour	1,484	40,000
	8-hour	1,142	10,000





FULL GEOGRAPHIC EXTENT OF AIR MONITORING FEATURES

Legend

Project Site

Air Quality Monitoring Stations (Elevation - ft)

- CO (957)
- NO2 (902)
- PM10 (590)
- PM2.5 (595)

(Provided by Ohio EPA, Central Office)

Topographic Base Image Source: ArcGIS Online Services, Access date: 12/26/2012, via ArcGIS v. 10. This image is not for re-sale or distribution outside of the use of this PDF.

0 1 2
Miles

1 inch equals 1 miles

ARCADIS

OREGON CLEAN ENERGY CENTER

FIGURE 4-1

BACKGROUND AIR QUALITY MONITORING STATION LOCATIONS

Lucas County, Ohio

City: Chicago Author: MNesta Path: C:\PROJECTS\OCE\MXD\OPSB_20130104\04-1_OCE_AirMonitoring2.mxd

5. MODELING RESULTS

The following sections describe the results of air quality modeling for the Project to demonstrate compliance with regulatory requirements.

5.1 Modeling to Determine Maximum-Impact Operating Conditions

Modeling of the combined cycle units was conducted for several steady-state operating conditions, spanning the range of anticipated turbine loads and ambient temperatures. Duct firing is reflected only at full load, with ambient temperature at or above 90°F. The operating scenarios that were modeled to determine worst-case impacts are presented in Table 4-1. Cold and warm-start scenarios, with the auxiliary boiler, were also modeled to assess potential peak short-term impacts.

5.2 Comparison of Predicted Impacts with Significant Impact Levels

Each scenario was modeled for the five-year meteorological period. The scenarios that yielded the highest predicted impacts for each pollutant and averaging time were identified. The maximum predicted impacts from these scenarios were evaluated relative to SILs (shown in Table 3-1), to determine whether cumulative interactive modeling was warranted for any pollutant. The maximum predicted impacts for the Project for each pollutant and averaging time are provided in Table 5-1. Table 5-1 also presents the turbine operating scenario and year of meteorological data that resulted in the worst-case predicted impact. Detailed modeling results for all operating scenarios and applicable pollutants are presented in Appendix B. Plot files depicting the annual and short-term impacts from the Project for the maximum impact scenarios are provided in Appendix C. AERMOD input and output files are provided on a compact disc included in Appendix D.

The results indicate that the maximum predicted Project impacts are below the SILs for all averaging times for all applicable PSD pollutants (CO, NO_2, PM_{10} and $PM_{2.5}$). As described previously, a demonstration that maximum impacts are less than SILs for a given pollutant indicates that the Project will not contribute significantly to any violation of the corresponding NAAQS or PSD increment. If a major source or major modification is predicted to have maximum impacts that are below the SILs, then a cumulative impact modeling analysis is generally not required.

Table 5-1: Maximum Predicted Impacts

	Averaging time	Predicted impact (μg/m³)	Controlling Scenario	Year	SIL (μg/m³)	SMC (μg/m³)	PSD Increments
NO_2	Annual	0.074	Case 17: 100%, 95°F, DB on	2007	1.0	14	25
	1-hour	6.59	Hot Start + Aux. Boiler	5-year average	7.52	Not yet proposed	--
CO	1-hour	172.72	Cold Start + Aux. Boiler	2010	2,000	--	--
	8-hour	109.80	Cold Start + Aux. Boiler	2009	500	575	--
$PM_{2.5}$	24-hour	0.47	Case 17 + Cooling Tower: 100%, 95°F, DB on	5-year average	1.2	4	9
	Annual	0.04	Case 3 + Cooling Tower: 50%, -8°F, no DB	5-year average	0.3	--	4
PM_{10}	24-hour	3.37	Case 17 + Cooling Tower: 100%, 95°F, DB on	2006	5	10	30

a. DB = Duct Burner
b. Aux. Boiler = Auxiliary Boiler

5.3 Comparison of Predicted Impacts with NAAQS

Maximum predicted impacts were added to monitored background concentrations, as presented in Section 4.6. These results are summarized in Table 5-2 and show that the sum of modeled maximum impacts and existing ambient background levels are less than the NAAQS.

Table 5-2: Maximum Predicted Impacts Added to Monitored Background Concentrations

	Averaging Time	Predicted Impact (µg/m^3)	Background Concentration (µg/m^3)	Predicted Impact plus Background (ug/m^3)	NAAQS
NO_2	Annual	0.074	5.9	5.97	99.7
	1-hour	6.59	37.79	44.38	188
CO	1-hour	172.72	1,484	1,656.72	40,000
	8-hour	109.80	1,142	1251.8	10,000
$PM_{2.5}$	24-hour	0.47	29	29.47	35
	Annual	0.04	11.42	11.46	12
PM_{10}	24-hour	3.37	86	89.37	150

5.4 Comparison with Significant Monitoring Concentrations

If a new major source or major modification can demonstrate that impacts from a project are less than the SMC (presented in Table 5-1), then the source can be exempted from preconstruction monitoring requirements that might otherwise apply under the PSD program. Modeling to determine Project impacts for comparison to SMCs was conducted as described above.

As indicated in Table 5-1, maximum predicted Project impacts are less than the SMC for NO_2, CO, PM_{10} and $PM_{2.5}$ for all relevant averaging times. Consistent with these modeling results, the Project is requesting from Ohio EPA a waiver from preconstruction monitoring requirements.

6. ADDITIONAL IMPACTS ANALYSES

6.1 PSD Class I Area Impact Analysis

PSD regulations require that proposed major sources within 100 km of a PSD Class I area perform an assessment of potential impacts in the Class I area. PSD Class I areas are specifically designated areas of special national or regional value from a natural, scenic, recreational or historic perspective. These areas are administered by the NPS, USFWS, or the USFS. FLMs are responsible for evaluating proposed projects' air quality impacts in Class I areas and may make recommendations to permitting agencies to approve or deny permit applications.

PSD Class I area impact analyses can consist of:

- An air quality impact analysis;
- A visibility impairment analysis; and
- An analysis of impacts on other air quality related values (AQRVs) such as impacts to flora and fauna, water, and cultural resources.

There are no PSD Class I areas within 100 km of the Project site. The nearest PSD Class I Areas are the Otter Creek and Dolly Sods Wilderness Areas in West Virginia, and the Mammoth Cave National Park in Kentucky both of which are over 400 km from the Project site. Ohio EPA recommends that a screening formula be used to determine if a Class I Area is close enough to warrant analysis. The screening formula, which is found in *The Federal Land Managers AQRV Workgroup (FLAG) Phase I Report – Revised* (FLAG, 2010) indicates that a PSD Class I area analysis is not required if:

$$Q/d \leq 10,$$

where:

- Q is the combined emissions increase from a source of SO_2, NO_x, PM_{10}, and H_2SO_4 in tpy based on 24-hour maximum allowable emissions (which are annualized); and

- d is the nearest distance in km to a Class I area from the source.

Table 6-1 presents results of calculations using the screening methodology presented above. The calculations show that "Q/d" is well below 10 for the nearest Class I areas to the proposed source. Accordingly, based on the level of proposed emissions from the Project, the distances to the nearest PSD Class I areas, and the screening calculations, further PSD Class I impact analysis is not required for the Project.

Table 6-1: "Q/d" Screening Analysis for PSD Class I Areas

Class I Area	d, Distance to Class I Area (km)	Criteria Pollutant Emissions (tpy)				Q, Total Emissions (tpy)	Q/d (tpy/km)
		SO_2	NO_x	PM_{10}	H_2SO_4		
Otter Creek	439	34.24	198.86	94.10	10.52	337.72	0.77
Dolly Sods	457	34.24	198.86	94.10	10.52	337.72	0.74
Mammoth Cave	548	34.24	198.86	94.10	10.52	337.72	0.62

6.2 Growth Analysis

OCE anticipates that 25 new employees will be hired to operate the proposed facility, working in shifts, which will increase long-term jobs within the community. There will be additional short-term local employment during the construction phase of the proposed Project. Short-term employment is expected to reach a peak of 400 workers over a two and half year construction effort.

6.2.1 Work Force

During the anticipated construction period associated with the Project, the majority of construction jobs will be filled by local area workers. Due to the large available labor pool in the region, supplemental short-term labor is not likely to require a significant influx of temporary workers relocating to the Oregon area during the construction phase. OCE anticipates that the additional temporary workers during the construction phase will have minimal effect on the environment, but will have a positive effect on the local economy.

For daily operation and maintenance of the Project, OCE anticipates that the required full-time staff will be mostly comprised of nearby residents, and the Project will not result in a significant increase in residential housing demand.

The resulting increase in employment is not anticipated to impact significantly the air quality of the area because the increase represents a small fraction of the regional population and is expected to be met largely from the existing labor pool. Thus, construction and operation of the proposed Project will have a positive impact on the work force in Oregon and the surrounding areas, but its net impact on the environment and to residential resource consumption is anticipated to be insignificant.

6.2.2 Industry

The Project will add a new industry to the area that will provide for economic benefit through primary and secondary effects. However, because much of the growth from the Project will be filled by existing local labor and resources, no new influx of commercial or industrial development that would increase air emissions is anticipated. In addition, the Project is intended to support existing energy needs throughout the regional electricity grid area; OCE does not anticipate any significant corresponding commercial or industrial growth as a result of the additional energy contribution of the Project. Because the commercial and industrial growth resulting from the Project is anticipated to be minimal, air quality impacts resulting from such commercial and industrial growth are also expected to be minimal.

6.3 Soils and Vegetation Analysis

PSD review requirements include an analysis to determine the potential air quality impacts on sensitive vegetation or soil types that may be present in the vicinity of a proposed project. Ambient air quality screening levels for sensitive vegetation are provided in USEPA guidance (USEPA, 1980) and in related technical publications.

Maximum predicted Project impacts are compared to relevant screening levels in Tables 6-2, 6-3, 6-4, and 6-5. All predicted Project impacts are well below the vegetation impact threshold levels. The screening analysis and USEPA guidance support the conclusion that the proposed Project will not adversely impact vegetation or soils in the Project surroundings.

Table 6-2: Predicted Air Quality Impacts Compared to NO_2 Vegetation Impact Thresholds

Averaging Period	Predicted Project Impact ($\mu g/m^3$)	Threshold for Impact to Vegetation ($\mu g/m^3$)	Applicability
1-hour	6.59 (1-hour average)	66,000[a]	Leaf Injury to plant
2-hour		1,130[b]	Affects alfalfa
Annual	0.074	100[c]	Protects all vegetation
		190[d]	Metabolic and growth impact to plants

a. "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976.

b. "Synergistic Inhibition of Apparent Photosynthesis Rate of Alfalfa by Combinations of SO_2 and NO_2" Environmental Science and Technology, vol. 8(6): p.574-576, 1975. The limit is based on a concentration in ambient air of 0.6 parts per million (ppm) NO_2 (1,130 $\mu g/m^3$) which was found to depress the photosynthesis rate of alfalfa during a 2-hour exposure.

c. Secondary NAAQS ($\mu g/m^3$) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act [CAA). These thresholds are the most stringent of those found in the literature survey.

d. "Air Quality Criteria for Oxides of Nitrogen," EPA/600/8-91/049aF-cF.3v, Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1993.

Table 6-3: Predicted Air Quality Impacts Compared to CO Vegetation Impact Thresholds

Averaging Period	Predicted Impact ($\mu g/m^3$)	Threshold for Impact to Vegetation ($\mu g/m^3$)	Applicability
1-hour	172.72	40,000[a]	Protects all vegetation
8-hour	109.80 (8-hour average)	10,000[a]	Protects all vegetation
Multiple day		10,000[b]	No known effects to vegetation
1-week		115,000[c]	Effects to some vegetation
Multiple week		115,000[d]	No effect on various plant species

a. Secondary NAAQS ($\mu g/m^3$) which are limits set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the CAA). These thresholds are the most stringent of those found in the literature survey.

b. "Air Quality Criteria for Carbon Monoxide," EPA/600/8-90/045F (NTIS PB93-167492), Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1991. Various CO concentrations were examined the lowest of these was 10,000 $\mu g/m^3$. Concentrations this low had no effects to various plant species. For many plant species, concentrations as high as 230,000 $\mu g/m^3$ caused no effects. The exception was legume seedlings which were found to experience abnormal leaf growth when exposed to CO concentrations of only 27,000 $\mu g/m^3$. Also related to this family of plants, CO concentrations in the soil of 113,000 $\mu g/m^3$ were found to inhibit nitrogen fixation. It is clear that ambient CO concentrations as low as 10,000 $\mu g/m^3$ will not affect vegetation.

c. "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976. A CO concentration of 115,000 $\mu g/m^3$ was found to affect certain plant species.

d. "Polymorphic Regions in Plant Genomes Detected by an M13 Probe," Zimmerman, P.A., et al. 1989. Genome 32: 824-828. 115,000 $\mu g/m^3$ was the lowest CO concentration included in this study. This concentration was not found to cause a reduction in growth rate to a variety of plant species.

Table 6-4: Predicted Air Quality Impacts Compared to Particulate Vegetation Impact Thresholds

Averaging Period	Predicted Impact (μg/m³)	Threshold for Impact to Vegetation (μg/m³)	Applicability
24-hour PM_{10}	3.37 (24-hour average)	150[a]	Protects all vegetation
Annual PM_{10}		50[a]	Protects all vegetation
Annual PM_{10}		579[b]	Damage to sensitive species (fir tree)

a. Secondary NAAQS (μg/m³) which are limits set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the CAA). These thresholds are the most stringent of those found in the literature survey.

b. "Responses of Plants to Air Pollution," Lerman, S.L., and E.F. Darley. 1975. "Particulates," pp. 141-158 (Chap. 7). In J.B. Mudd and T.T. Kozlowski (eds.). Academic Press. New York, NY. Results of studies conducted indicated concluded that particulate deposition rates of 365 grams per square meter per year (g/m²/yr) caused damage to fir trees, but rates of 274 g/m²/yr and 400 to 600 g/m²/yr did not cause damage to vegetation. 365 g/m²/yr translates to 579 μg/m³, using a worst-case deposition velocity of 2 centimeters per second.

Table 6-5: Predicted Air Quality Impacts Compared to Formaldehyde Vegetation Impact Thresholds

Averaging Period	Predicted Impact ($\mu g/m^3$)	Threshold for Impact to Vegetation ($\mu g/m^3$)	Applicability
Repeated 4.5 hour	0.08 (1-hour average)	18[a]	Sensitive species affected
5-hour		840[b]	Signs of injury to sensitive species (alfalfa)
5-hour		367[c]	Signs of injury to pollen tube length (lily)
Repeated 7-hour		78[d]	Stimulated shoot growth (beans)

a. "Formaldehyde-Contaminated Fog Effects on Plant Growth," Barker J.R. & Shimabuku R.A. (1992). In Proceedings of the 85th Annual Meeting and Exhibition, Air and Waste Management Association, pp. 113. 92150.01. Pittsburgh, PA. The authors examined the effects on vegetation grown in fog with formaldehyde concentrations of 18 and 54 $\mu g/m^3$. Exposure rates were 4.5 hours per night, 3 nights/week, for 40 days. The growth rate of rapeseed was found to be affected in this study. However, slash pine grown under the same conditions showed a significant increase in needle and stem growth. No effects were observed in wheat or aspen at test concentrations.

b. "Investigation on Injury to Plants from Air Pollution in the Los Angeles Area." Haagen-Smit AJ, Darley EE, Zaitlin M, Hull H, Noble WM (1952). Plant physiology, 27:18–34. The authors found a 5-hour exposure to 700 parts per billion (ppb) caused mild atypical signs of injury in alfalfa, but no injury to spinach, beets, or oats.

c. "Effects of Exposure to Various Injurious Gases on Germination of Lily Pollen." Masaru N, Syozo F, Saburo K (1976). Environmental pollution, 11:181–188. The authors found a significant reduction of the pollen tube length of lily following a 5-hour exposure to ambient formaldehyde concentrations of 367 ppb.

d. "Formaldehyde exposure affects growth and metabolism of common bean," Mutters RG, Madore M, Bytnerowicz A (1993). Journal of the Air and Waste Management Association, 43:113–116. The authors found that repeated exposure of sensitive plants to ambient formaldehyde concentrations of 78 $\mu g/m^3$ could cause plant shoots to grow faster than the roots. It is pointed out that this effect would not be a problem except for crops growing in a water-starved condition.

6.4 Endangered Species

The USFWS and the Ohio Department of Natural Resources (ODNR) were contacted regarding the potential presence of any sensitive natural communities or rare or endangered species in the vicinity of the site. The response letter from ODNR indicated that no records exist in its database of unique ecological attributes or rare or endangered species within 1 mile of the site.

Federally listed endangered and threatened species in Lucas County, Ohio include the Indiana bat (*Myotis sodalis*), Karner blue butterfly (*Lycaeides melissa samuelis*), Kirtland's warbler (*Dendroica kirtlandii*), piping plover (*Charadrius melodus*), rayed bean (*Villosa fabalis*), and the Eastern prairie fringed orchid (*Platanthera leucophaea*). No favorable habitat for these species was observed within the site.

The USFWS correspondence indicated there were no federal wilderness areas, wildlife refuges, or designated critical habitat within the vicinity of the Project area. Additionally, the USFWS indicated that it did not anticipate any impacts to federally listed endangered, threatened or candidates species or their habitats and had no objection to the Project as proposed. Correspondence related to endangered species is presented in Appendix E.

6.5 Air Toxics

Ohio EPA's Air Toxics Policy (Ohio EPA, 1986) provides guidelines for evaluating the ambient impacts of TAPs emitted from new or modified sources. The guidelines, outlined in the Department of Air Pollution Control (DAPC) document "*Option A, Review of New Sources of Air Toxic Emissions,*" are:

- Determine if a threshold limit value (TLV) exists for the specific compound, which is emitted from the source.
- Divide the TLV by ten to adjust the standard from the working population to the general public (TLV/10).
- Adjust the standard to account for the duration of the exposure (operating hours of source) of "X" hours per day and "Y" days per week from 8 hours per day and 5 days per week. The following formula is used to obtain the Maximum Acceptable Ground-Level Concentration (MAGLC) or Acceptable Incremental Impact:

$$\frac{TLV}{10} \text{ x } \frac{8}{X} \text{ x } \frac{5}{\mathrm{Y}} = 4\frac{TLV}{XY} = MAGLC$$

For continuous operation, X = 24 hours and Y = 7 days/week. Therefore,

$$\frac{TLV}{10} \text{ x } \frac{8}{24} \text{ x } \frac{5}{7} = \frac{TLV}{42} = MAGLC$$

- Compare the one-hour averaging time ambient pollutant emissions, predicted by an appropriate air dispersion model, with the corresponding MAGLC for compliance with the air toxic's policy.

The American Conference of Governmental Industrial Hygienists (ACGIH) publishes and continuously updates TLVs for a broad range of pollutants. The guidelines in Ohio EPA's Air Toxics Policy were used to evaluate the potential ambient impacts of regulated pollutants from the Project.

Air toxics were modeled only for steady-state turbine operating scenarios. The air toxic emissions were multiplied by modeled normalized concentrations (assuming 1 g/s emission rates). The modeling results and supporting calculations are provided in Appendix B. The auxiliary boiler is operated only during turbine start-up and, therefore, was not included in the modeling. Table 6-6 provides the calculations for determining theMAGLC. The air toxic modeling results are presented in Table 6-7. The resultant ambient impacts of air toxics are well below the MAGLC for each pollutant.

Table 6-6: MAGLC Calculations for Air Toxics

Pollutant	Molecular Weight	ACGIH TLV			MAGLC (TLV/42) (µg/m^3)
		ppm	Milligram per cubic meter (mg/m^3)	µg/m^3	
H_2SO_4	98.079	--	0.2	200	4.76
Ammonia	17.031	25	17	17,000	404.8
Formaldehyde	30.03	--	0.27	272.7	6.5
Toluene	92.14	20	75	75,000	1,786
Xylenes	106.16	100	434	434,000	10,333

Table 6-7: Air Toxics Modeling Results

Pollutant	Averaging Time	Maximum Predicted Impact (μg/m^3)	Controlling Scenario	MAGLC (μg/m^3)
H_2SO_4	1-hr	0.329	Case 17: 100%, 95°F, DB on	4.76
Ammonia	1-hr	5.295	Case 17: 100%, 95°F, DB on	404.8
Formaldehyde	1-hr	0.080	Case 4: 100%, 0°F, no DB	6.5
Toluene	1-hr	0.094	Case 4: 100%, 0°F, no DB	1,786
Xylenes	1-hr	0.046	Case 4: 100%, 0°F, no DB	10,333

7. REFERENCES

AWMA, 2001. Abstract No 216, Session No. AM-1b, Orlando, 2001.

FLAG, 2010. *The Federal Land Managers AQRU Workgroup (FLAG) Phase I Report, Revised 2010*.

Ohio EPA, 2003. Engineering Guide 69.

Ohio EPA, 1986. Air Toxics Policy. "Option A, Review of New Sources of Air Toxic Emissions."

Schulman, et al., 1997. "The PRIME Plume Rise and Building Downwash Model," Addendum to ISC3 User's Guide. November 1997.

USEPA, 1980. "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals." EPA 450/2-81-078. December 12, 1980.

USEPA, 1995. *User's Guide To The Building Profile Input Program,* EPA-454/R-93-038. Revised February 8, 1995.

USEPA, 1996. *"Maximum Stack Separation for Merging Plumes."* Model Clearinghouse Information Storage and Retrieval System Record Details. October 29, 1996.

USEPA, 2005. Guideline on Air Quality Models. November 2005.

USEPA, 2011. Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS. March 1, 2011.

USGS, 2002. The National Map – Elevation, Fact Sheet 106-02. http://egsc.usgs.gov/isb/pubs/factsheets/fs10602.html, U.S. Department of the Interior. November 2002.

Appendix A: Emissions Calculations and Other Supporting Documentation

Summary of Annual Emissions
Oregon Clean Energy

1/31/2013

Max Annual Emissions - facility wide (including startup and shutdown)

number of CTs	*2*	NOx	CO	VOC	SO2	PM10	PM2.5	NH3	H2SO4	Pb	CO2	CO2e
combustion turbines	tpy	189.50	367.86	112.05	34.16	88.48	88.48	169.07	10.51	0.00E+00	2784983.20	2,788,117
ancillary equipment	tpy	9.36	10.21	1.637	0.08	1.06	1.06	0.00	0.01	8.13E-05	12837.66	12,913
cooling tower	tpy	0.00	0.00	0.00	0.00	4.56	0.02	0.00	0.00	0.00E+00	0.00	0.00
TOTAL	**TPY**	**198.86**	**378.07**	**113.684**	**34.24**	**94.10**	**89.56**	**169.07**	**10.52**	**8.13E-05**	**2797820.86**	**2,801,030**

Summary of Annual Emissions
Oregon Clean Energy

1/31/2013

Overall Assumptions

number of CTs	2	
duct burning hours	8760	hrs/yr
steady state hours per unit	8760	

Steady State Emissions Data

Emission from Mitsubishi issued on 11/16/2012
Emissions without DuctBurning Case 7 (100% load, 59 F)
Emissions with DuctBurning Case 11 (100% load, 90 F)
NOx emissions assume SCR
CO and VOC assume oxidation catalyst
SO2 emissions assume no conversion to SO3 and 0.5 grains/100 SCF
H2SO4 emissions provided by vendor and assume 0.5 grains/100 SCF

Each Turbine

		NOx	CO	VOC	SO2	PM10/PM2.5	NH3	H2SO4	CO2	CO2e
Emissions - (Case 7) - No DB	lb/hr	20	12.2	7.0	3.70	10.1	18.5	1.1	305607	305786
Emissions - (Case 11) - w/DB	lb/hr	20.8	12.7	7.3	3.90	10.1	19.3	1.2	317920	318278
Emissions from DB	lb/hr	0.8	0.5	0.3	0.2	0	0.8	0.1	12313.3	12492.4
Facility operating hours	hr/yr	8760	8760	8760	8760	8760	8760	8760	8760	8760
operating hours no DB	hrs/yr	0	0	0	0	0	0	0	0	0
operating hours with DB	hrs/yr	8760	8760	8760	8760	8760	8760	8760	8760	8760
steady state emissions per turbine	tpy	91.104	55.626	31.974	17.082	44.238	84.534	5.26	1392492	1394059

Both Turbines

number of turbines		2	2	2	2	2	2	2	2	2
total plant emissions emissions - steady state	tpy	182.21	111.25	63.95	34.16	88.48	169.07	10.51	2784983.2	2788117.0

Plant gross output (case 7)	MW	820.9	820.9	820.9	820.9	820.9	820.9	820.9	820.9	
Plant net output (case 7)	MW	817.7	817.7	817.7	817.7	817.7	817.7	817.7	817.7	
lbs CO2 per MW-hr gross (case 7)	lb/MW hr								745	
lbs CO2 per MW-hr gross (case 7) + 12.8% margin	lb/MW hr								839.9	

Summary of Annual Emissions
Oregon Clean Energy

1/31/2013

Overall Assumptions

SU/SD information from Mitsubishi Budgetary Proposal Dated September 2012

cold starts/unit	50	number/yr	2.50	hours/event	60	minimum hours downtime with event	150	minutes per event
hot starts/unit	250	number/yr	1.12	hours/event	0	minimum hours downtime with event	67	minutes per event
warm starts/unit	0	number/yr	1.83	hours/event	8	minimum hours downtime with event	110	minutes per event

Emissions

		NOx	CO	VOC	SO2	PM10/PM2.5
Emissions per cold start	lbs	108.9	2766.8	848.5		9.2
Emissions per hot start	lbs	52.4	646	122.1		3.8
Emissions per warm start	lbs	77.5	1784.6	575.8		6.6
cold start - duration of event (include downtime)	hrs	62.50	62.50	62.50	62.50	62.50
hot start - duration of event (include downtime)	hrs	1.12	1.12	1.12	1.12	1.12
warm start - duration of event (include downtime)	hrs	9.83	9.83	9.83	9.83	9.83
cold start - avg hourly emissions (including downtime)	lb/hr	1.74	44.27	13.58	0.00	0.147
hot start - avg hourly emissions (including downtime)	lb/hr	46.93	578.51	109.34	0.0	3.403
warm start - avg hourly emissions (including downtime)	lb/hr	7.88	181.48	58.56	0.00	0.67
steady state average hourly		20.80	12.70	7.30	3.90	10.10
cold start - self correcting?	-	yes	no	no	yes	yes
hot start - self correcting?	-	no	no	no	yes	yes
warm start - self correcting?	-	yes	no	no	yes	yes

Dispersion Modeling Parameters (per turbine)

	Exhaust Flow	Temp	Temp	Stack Diameter	Exit Velocity	Exit Velocity
	acfm	F	K	ft	ft/min	m/s
Cold Start	818955.86	195.93	364.1	22	2154	10.94
Hot Start	797898.24	184.17	357.5	22	2099	10.66
Warm Start	824918.16	194.68	363.4	22	2170	11.02

Dispersion Modeling Emissions (per turbine)

		NOx	CO
Cold Start	g/s	5.49	139.57
Hot Start	g/s	5.92	72.96
Warm Start	g/s	5.33	122.76

Emissions From Ancillary Equipment
Oregon Clean Energy

Total Emissions from Ancillary Equipment (tpy)

		NOx	CO	VOC	TSP	SO2	PM10/ PM2.5	lead (Pb)	H2SO4	CO2	CO2e
Auxilliary Boiler	tpy	1.98	5.45	0.59	0.52	0.07	0.79	0.00	5.41E-03	11880.00	11952.2997
Emergency Generator	tpy	6.95	4.34	0.98	0.22	0.008	0.25	0.00007391	1.64E-04	871.04	874.1
Emergency Fire Pump	tpy	0.43	0.43	0.06	0.022	0.0008	0.025	0.00000735	1.63E-05	86.63	86.9
TOTAL	tpy	**9.36**	**10.21**	**1.64**	**0.77**	**0.08**	**1.06**	**0.0000813**	**5.59E-03**	**12,837.66**	**12,913.33**

Emissions (lb/hr)

		NOx	CO	VOC	TSP	SO2	PM10/ PM2.5	lead (Pb)
Auxilliary Boiler		1.980	5.445	0.594	0.792	0.071	0.79	0.00E+00
Emergency Generator		27.791	17.346	3.927	0.882	0.032	0.99	2.96E-04
Emergency Fire Pump		1.727	1.725	0.244	0.088	0.003	0.10	2.94E-05

Emissions for Modeling (g/s) - annual average

		NOx	CO	VOC	SO2	PM10/ PM2.5								
Auxilliary Boiler		0.057	0.157	0.0171	0.002036	0.022804	*diameter:*	4.0 ft	*exhaust flow:*	12,634 acfm	*temperature:*	200 F	*stack height:*	same as HRSG stack

Emissions for Modeling (g/s) - hourly average

		NOx	CO	VOC	SO2	PM10/ PM2.5								
Auxilliary Boiler		0.25	0.69	0.07	0.00892	0.10	*diameter:*	4.0 ft	*exhaust flow:*	12,634 acfm	*temperature:*	200 F	*stack height:*	same as HRSG stack

Auxilliary Boiler

		NOx	CO	VOC	TSP	SO2	PM10/ PM2.5		H2SO4	CO2	CH4	N2O	CO2e
Maximum Input Capacity	MMBtu/hr	99	99	99	99	99	99		99	99	99	99	
Emission Factor	lb/MMscf					0.714				120000			
Emission Factor	lb/MMBtu	0.020	0.055	0.006	0.008	0.0007	0.008		0.00005	120.00	0.0023	0.0022	
Operating Hours per Years	hrs/yr	2000	2000	2000	2000	2000	2000		2000	2000	2000	2000	
Potential Emissions	lb/hr	1.98	5.45	0.59	0.79	0.07	0.79		0.005	11880.000	0.228	0.218	11952.2997
Potential Emissions	**tpy**	**1.98**	**5.45**	**0.59**	**0.79**	**0.07**	**0.79**		**0.005**	**11880.0**	**0.228**	**0.218**	**11952.2997**

emission factors for NOx, CO, VOC, PM10/PM2.5 based on information provided by NTE Energy (12/15/2012)
emissions of SO2 assume a sulfur content in NG of 0.5 gr/100 dscf
emissions of H2SO4 assumes a 5% conversion of SO2 --> SO3 (on a molar basis)
CO2 Emission Factor from AP-42 Table 1.4-2 (provided in lb/MMscf and converted to lb/MMBtu)

Emissions From Ancillary Equipment
Oregon Clean Energy

Emergency Generator

		NOx	CO	VOC	TSP	SO2	PM10/ PM2.5	lead (Pb)	H2SO4	CO2	CH4	N2O	CO2e
Power rating	kW	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250.0	2250.0	
Power rating	hp	3016.6	3016.6	3016.6	3016.6	3016.6	3016.6	3016.6	3016.6	3016.6	3016.5750	3016.5750	
emission factor	g/kW hr	5.61	3.5	0.79	0.18		0.2						
emission factor	lb/MMBtu							1.40E-05	3.10E-05	165.00	8.10E-03	0.0013216	
emission factor	g/bhp hr					0.0048		4.45E-05	9.85E-05	5.24E+02	2.57E-02	4.20E-03	
emissions	lb/hr	27.791	17.346	3.927	0.882	0.032	0.991	0.0003	6.55E-04	3484.144	0.171	0.028	3496.387
operating hours per year	hrs/yr	500	500	500	500	500	500	500	500.00	500.00	500.00	500.00	
Potential Emissions	**tpy**	**6.95**	**4.34**	**0.98**	**0.22**	**0.0079**	**0.25**	**7.39E-05**	**0.0001636**	**871.0**	**0.0428**	**0.0070**	**874.1**

emission factors for NOx, CO, VOC and PM10/PM2.5 based on Tier 2 emission standards provided in 40 CFR 89 Subpart B - Table 1.

*The Tier 2 emission factor for NOx and VOC (non methane hydrocarbons (NMHC)) provided in Subpart B - Table 1 is provided as a combined factor (NOx+NMHC). The breakdown of NOx and NMHC in this total factor was estimated using the Tier 1 factors provided in 40 CFR 89 Subpart B Table 1. For example, the NOx emission factor was determined via the following equation: 6.4 * (9.2/(9.2+1.3))*

TSP emission factor = 89% of PM-10 emission factor, based on AP-42, Table 3.4-2 distribution of particulate emissions for stationary diesel engines.

emission factor for SO2 based on ULSD fuel oil (sulfur content of 15 ppmw or 0.0015 lb/MMBtu) and fuel input ratio of 7000 Btu/hp hr (AP-42 Section 3.3)

emission factor for Pb based on AP-42 Section 3.1 (1.4e-5 lb/MMBtu) and fuel input of 7000 Btu/hp hr (AP-42 Section 3.3)

emission factor for H2SO4 (0.000031 lb/MMBTu) from Page 276 of Toxic air pollutant emission factors - a compilation for selected compounds and sources (EPA, 1990) and fuel input ratio of 7000 Btu/hp

emission factor for CO2 (165 lb/MMBtu) from AP-42 Table 3.4-1

emission factor for CH4 (0.0081 lb/MMBtu) from AP-42 Table 3.4-1

emission factor for N2O (0.6 g/MMBtu) from Climate Registry General Reporting Protocol (GRP) (Emission Factors by Fuel Type and Sector)

Emergency Fire Pump

		NOx	CO	VOC	TSP	SO2	PM10/ PM2.5	lead (Pb)	H2SO4	CO2	CH4	N2O	CO2e
Power rating	hp	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	
Power rating	kW	223.8	223.8	223.8	223.8	223.8	223.8	223.8	223.8	223.8	223.8	223.8	
emission factor	g/kW hr	3.50	3.5	0.50	0.18		0.2						
	lb/MMBtu							1.40E-05	3.10E-05	165.00	8.10E-03	0.0013216	
emission factor	g/bhp hr					0.0048		4.45E-05	9.85E-05	5.24E+02	2.57E-02	4.20E-03	
emissions	lb/hr	1.727	1.725	0.244	0.088	0.003	0.099	2.94E-05	6.51E-05	3.47E+02	1.70E-02	2.78E-03	347.7175624
operating hours per year	hrs/yr	500	500	500	500	500	500	500	500	500	500	500	
Potential Emissions	**tpy**	**0.43**	**0.43**	**0.06**	**0.022**	**0.0008**	**0.025**	**7.35E-06**	**1.63E-05**	**86.625**	**0.0042525**	**0.0006938**	**86.9**

emission factors for NOx, CO, VOC and PM10/PM2.5 based on post -2009 emission standards provided in 40 CFR 60 Subpart IIII - Table 4

*The post-2009 emission factor for NOx and VOC (non methane hydrocarbons (NMHC)) provided in Subpart IIII - Table 4 is provided as a combine factor (NOx+NMHC). The breakdown of NOx and NMHC in this total factor was estimated using the Tier 1 factors provided in 40 CFR 89 Subpart B Table 1. For example, the NOx emission factor was determined via the following equation: 0.4 * (9.2/(9.2+1.3))*

TSP emission factor = 89% of PM-10 emission factor, based on AP-42, Table 3.4-2 distribution of particulate emissions for stationary diesel engines.

emission factor for SO2 based on ULSD fuel oil (sulfur content of 15 ppmw or 0.0015 lb/MMBtu) and fuel input ratio of 7000 Btu/hp hr (AP-42 Section 3.3)

emission factor for Pb based on AP-42 Section 3.1 (1.4e-5 lb/MMBtu) and fuel input of 7000 Btu/hp hr (AP-42 Section 3.3)

emission factor for H2SO4 (0.000031 lb/MMBTu) from Toxic air pollutant emission factors - a compilation for selected compounds and sources (EPA, 1990) and fuel input ratio of 7000 Btu/hp

emission factor for CO2 (165 lb/MMBtu) from AP-42 Table 3.4-1

emission factor for CH4 (0.0081 lb/MMBtu) from AP-42 Table 3.4-1

emission factor for N2O (0.6 g/MMBtu) from Climate Registry General Reporting Protocol (GRP) (Emission Factors by Fuel Type and Sector)

Emission Factors by Fuel Type and Sector

Fuel Type	Sector	CO_2 Emission Factor	CH_4 Emission Factor	N_2O Emission Factor
Natural Gas	Industrial	0.054 kg/scf	1 g/MMBtu	0.1 g/MMBtu
Coal	Industrial	2,054.32 kg/short ton	11 g/MMBtu	1.6 g/MMBtu
Distillate Fuel	Commercial	10.13 kg/gallon	11 g/MMBtu	0.6 g/MMBtu

Estimated Emissions from Cooling Tower
Oregon Clean Energy
based on NTE Energy information (12/15/12)

Emissions

		PM10	PM2.5
recirculating water flow	gpm	322000	322000
drift eliminator efficiency	%	0.0005%	0.0005%
TDS in recirculating water	mg/l	2030.5	2030.5
particle size distribution	%	63.0%	0.21%
estimated emissions	lb/hr	1.040	0.0040
estimated emissions	tpy	4.56	0.018
number of cells	-	16	16
estimated emissions per cell	lb/hr	0.07	0.000
estimated emissions per cell	g/s	0.0082	0.0000

Dispersion Modeling Parameters (per cell)

diameter	m	10
diameter	ft	33.0
exhaust temperature	K	ambient + 10 K
exhaust flow rate	acfm	1422426.25
exit velocity	ft/min	1663.1
exit velocity	m/s	8.45

PRELIMINARY/FOR INFORMATION ONLY

Mitsubishi - Expected Performance and Steady State Emissions for Combined Cycle Power Plant

Fuel Heat Input	Btu/lb - LHV	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9	20443.9		
Fuel Heat Input	Btu/lb - HHV	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8	22697.8		
CONDITION		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Ambient Dry Bulb Temperature	oF	-8	-8	-8	0	0	0	59	59	59	59	90	90	90	90	90	90	95	105	105	105	105	105	105		
Barometric Pressure	psia	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39	14.39		
Relative Humidity	%	100	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	50.0	40.0	40.0	40.0	40.0	40.0	40.0		
Evap Cooler Status	On/Of	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	OFF		
Duct Burner Status	On/Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	OFF	OFF		
GT Load	%	100%	75%	50%	100%	75%	50%	100%	100%	75%	50%	100%	100%	100%	100%	75%	52%	100%	100%	100%	100%	100%	75%	55%		
GT Heat Input	MMBtu/h - LHV	2,652	2,143	1,607	2,653	2,090	1,573	2,357	2,315	1,817	1,435	2,192	2,118	2,192	2,118	1,690	1,342	2,181	2,147	2,009	2,147	2,009	1,616	1,328		
Duct Burner Heat Input (per HRSG)	MMBtu/h - LHV	0	0	0	0	0	0	0	0	0	0	253	253	0	0	0	0	264	264	264	0	0	0	0		
GT Heat Input	MMBtu/h - HHV	2944.4	2379.3	1784.2	2945.5	2320.4	1746.4	2616.9	2570.2	2017.3	1593.2	2433.7	2351.5	2433.7	2351.5	1876.3	1490.0	2421.5	2383.7	2230.5	2383.7	2230.5	1794.2	1474.4		
Duct Burner Heat Input (per HRSG)	MMBtu/h - HHV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	280.9	280.9	0.0	0.0	0.0	0.0	293.1	293.1	293.1	0.0	0.0	0.0	0.0		
CC EXHAUST CONDITIONS @ Stack (per Stack)		2,944	2379.3	1784.2	2945.5	2320.4	1746.4	2616.9	2570.2	2017.3	1593.2	2714.6	2632.4	2433.7	2351.5	1876.3	1490.0	2714.6	2676.8	2523.6	2383.7	2230.5	1794.2	1474.4	2,945	
CC Exhaust Flow	kpph	5,372	4,621	3,363	5,303	4,578	3,341	4,798	4,742	4,018	3,183	4,509	4,420	4,497	4,408	3,716	3,029	4,494	4,442	4,277	4,430	4,264	3,587	3,034		
CC Exhaust Gas Temperature	oF	187	187	165	185	185	165	184	183	180	165	175	174	188	187	180	169	173	177	175	191	189	182	173		
CC EMISSIONS @ STACK (per Stack)																										
NOx (abated)	ppmvd@15% O 2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
NOx (abated)	lb/h	22.6	18.2	13.6	22.5	17.7	13.3	20	19.7	15.4	12.2	20.8	20.2	18.6	18	14.3	11.4	20.8	20.5	19.3	18.2	17	13.7	11.2		
CO (abated)	ppmvd@15% O 2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
CO (abated)	lb/h	13.7	11.1	8.3	13.7	10.8	8.1	12.2	12	9.4	7.4	12.7	12.3	11.3	11	8.7	6.9	12.7	12.5	11.8	11.1	10.4	8.3	6.8		
VOC (abated)	ppmvd@15% O 2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
VOC (abated)	lb/h	7.9	6.3	4.7	7.9	6.2	4.7	7	6.9	5.4	4.2	7.3	7	6.5	6.3	5	4	7.3	7.2	6.7	6.4	5.9	4.8	3.9		
SO2 @ actual O2	lb/h	4.2	3.4	2.5	4.2	3.3	2.5	3.7	3.7	2.9	2.3	3.9	3.7	3.5	3.4	2.7	2.1	3.9	3.8	3.6	3.4	3.2	2.6	2.1		
SO2 @ actual O2	lb/MMBtu - HHV	1.43E-03	1.43E-03	1.43E-03	1.43E-03	1.43E-03	1.43E-03	1.43E-03	1.43E-03	1.43E-03	1.43E-03	1.42E-03	1.42E-03	1.43E-03	1.43E-03	1.43E-03	1.43E-03	1.42E-03	0.00142	1.42E-03	1.43E-03	1.43E-03	1.43E-03	1.43E-03		
Sulfur Mist (H2SO4)	lb/h	1.2	1	0.7	1.2	1	0.7	1.1	1.1	0.8	0.7	1.2	1.2	1	1	0.8	0.6	1.2	1.2	1.1	1	0.9	0.7	0.6		
Sulfur Mist (H2SO4)	lb/MMBtu - HHV	4.13E-04	4.13E-04	4.13E-04	4.13E-04	4.13E-04	4.13E-04	4.13E-04	4.13E-04	4.13E-04	4.13E-04	4.39E-04	4.39E-04	4.13E-04	4.13E-04	4.13E-04	4.13E-04	4.39E-04	4.39E-04	4.39E-04	4.13E-04	4.13E-04	4.13E-04	4.13E-04		
Particulates (PM10 Total)	lb/h	11.3	9.5	7	11.3	9.4	6.9	10.1	9.9	8.1	6.5	10.1	9.9	9.3	9.1	7.5	6.1	10.1	10	9.5	9.2	8.7	7.2	6		
Particulates (PM10 Total)	lb/MMBtu - HHV	3.85E-03	4.00E-03	3.92E-03	3.82E-03	4.03E-03	3.96E-03	3.84E-03	3.86E-03	4.04E-03	4.05E-03	3.73E-03	3.75E-03	3.83E-03	3.87E-03	4.00E-03	4.06E-03	3.72E-03	3.72E-03	3.77E-03	3.84E-03	3.91E-03	4.02E-03	4.09E-03		
Ammonia Slip (NH 3)	ppmvd@15% O 2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
Ammonia Slip (NH 3)	lb/h	20.9	16.8	12.6	20.9	16.4	12.3	18.5	18.2	14.3	11.3	19.3	18.7	17.2	16.7	13.3	10.5	19.3	19	17.9	16.9	15.8	12.7	10.4		
ARCADIS ADDED CALCULATIONS																										
CO2 Emission Factor- turbine	lb/MMBtu (40 cfr 98)	116.784141	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841	116.7841		
CO2 Emission Factor- duct burner	lb/MMBtu (AP-42)	120	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000	120.0000		
CH4 Emission Factor - turbine	lb/MMBtu (40 CFR 98)	0.00220264	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022		
CH4 Emission Factor - duct burner	lb/MMBtu (AP-42)	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023		
N2O Emission Factor - turbine	lb/MMBtu (40 CFR 98)	0.00022026	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002		
N2O Emission Factor - duct burner	lb/MMBtu (AP-42)	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022		
CO2 Emissions	**lb/hr**	**343857**	**277860**	**208363**	**343986**	**270988**	**203954**	**305607**	**300161**	**235591**	**186061**	**317920**	**308326**	**284213**	**274619**	**219124**	**174003**	**317960**	**313551**	**295658**	**278379**	**260486**	**209530**	**172188**		
CH4 Emissions	lb/hr	6.5	5.2407	3.9299	6.4879	5.1111	3.8467	5.7640	5.6613	4.4434	3.5093	6.0065	5.8256	5.3605	5.1795	4.1329	3.2818	6.0077	5.9246	5.5871	5.2504	4.9130	3.9519	3.2476		
N2O Emissions	lb/hr	0.6	0.5241	0.3930	0.6488	0.5111	0.3847	0.5764	0.5661	0.4443	0.3509	1.1540	1.1359	0.5360	0.5180	0.4133	0.3282	1.1782	1.1699	1.1361	0.5250	0.4913	0.3952	0.3248		
CO2e Emissions	**lb/hr**	**344058**	**278022**	**208484**	**344187**	**271147**	**204073**	**305786**	**300337**	**235729**	**186170**	**318278**	**308678**	**284380**	**274779**	**219252**	**174105**	**318325**	**313914**	**296011**	**278541**	**260638**	**209652**	**172288**		
formaldehyde emission factor - turbine (lb/MMBtu) (CARB- CATEF)		0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011		
formaldehyde emission factor - DB (lb/MMBtu) (AP-42, 1.4-3)		7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05	7.89E-05		
toluene emission factor - turbine (lb/MMBtu) (AP-42, 3.1-3)		0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013		
toluene emission factor - DB (lb/MMBtu) (AP-42, 1.4-3)		3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06		
xylene emission factor - turbine (lb/MMBtu) (AP-42, 3.1-3)		0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064	0.000064		
xylene emission factor - DB (lb/MMBtu) (AP-42, 1.4-3)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
formaldehyde emissions (lb/hr)		0.324	0.262	0.196	0.324	0.255	0.192	0.288	0.283	0.222	0.175	0.290	0.281	0.268	0.259	0.206	0.164	0.289	0.285	0.268	0.262	0.245	0.197	0.162		
toluene emissions (lb/hr)		0.383	0.309	0.232	0.383	0.302	0.227	0.340	0.334	0.262	0.207	0.317	0.307	0.316	0.306	0.244	0.194	0.316	0.311	0.291	0.310	0.290	0.233	0.192		
xylene emissions (lb/hr)		0.188	0.152	0.114	0.189	0.149	0.112	0.167	0.164	0.129	0.102	0.156	0.150	0.156	0.150	0.120	0.095	0.155	0.153	0.143	0.153	0.143	0.115	0.094		
																									w/o DB	**w/DB**
NOx (lb/MMBtu)		0.0077	0.0076	0.0076	0.0076	0.0076	0.0076	0.0076	0.0077	0.0076	0.0077	0.0077	0.0077	0.0076	0.0077	0.0076	0.0077	0.0077	0.0077	0.0076	0.0076	0.0076	0.0076	0.0076	**0.00768**	**0.00767**
CO (lb/MMBtu)		0.0047	0.0047	0.0047	0.0047	0.0047	0.0046	0.0047	0.0047	0.0047	0.0046	0.0047	0.0047	0.0046	0.0047	0.0046	0.0046	0.0047	0.0047	0.0047	0.0047	0.0047	0.0046	0.0046	**0.0047**	**0.0047**
VOC (lb/MMBtu)		0.0027	0.0026	0.0026	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0026	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0026	0.0027	0.0026	**0.0027**	**0.0027**
SO2 (lb/MMBtu)		0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	**0.0014**	**0.0014**
H2SO4 (lb/MMBtu)		0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	**0.0004**	**0.0004**
PM10/PM2.5 (lb/MMBtu)		0.0039	0.0040	0.0039	0.0038	0.0040	0.0040	0.0038	0.0039	0.0040	0.0041	0.0037	0.0038	0.0038	0.0039	0.0040	0.0041	0.0037	0.0037	0.0038	0.0038	0.0039	0.0040	0.0041	**0.0039**	**0.0038**
NH3 (lb/MMBtu)		0.0071	0.0071	0.0071	0.0071	0.0071	0.0070	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0070	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	**0.0071**	**0.0071**

PRELIMINARY/FOR INFORMATION ONLY

Mitsubishi - Expected Performance and Steady State Emissions for Combined Cycle Power Plant

NOTES:
1.) All performance data are based on New & Clean conditions.
2.) All supplied values are estimations and not guaranteed.
3.) A tolerance of 0.75% on Power Output and 1.0% on Heat Rate shall apply to the above values.
4.) Fuel gas composition (mol%): 96.8% CH4, 1.1% C2H6, 0.1% C3H8, 0.0% n-C4H10, 0.0% i-C4H10, 0.0% n-C5H12, 0.0% i-C5H12, 0.0% C6H14, 0.2% N2, 1.7% CO2, 0.0% H2O, 0.0% O2
5.) 0.5 gr/100scf of sulfur and 0% fuel bound nitrogen (FBN) are considered in the fuel.
6.) Fuel must be in compliance with MPSA's fuel specification.
7.) Gross power output is at the generator terminals minus excitation losses.
8.) Balance of plant design (condenser, piping losses, etc.) shall be based on MPSA estimations.
9.) Assumed Site Conditions: Frequency 60 Hz, Generator Power Factor 0.85, HRSG Drum blowdown 0%, wet condenser cooling water circuit.
10.) Since this data is based on estimated and/or assumed values, Customer shall confer with MPSA prior to including in any air permit application or contract guarantees.
11.) Emissions shall be tested in accordance with the following EPA methods: NOx: 20, CO: 10, VOC: 25/18, NH 3: CTM-027, PM10: Non-condensables using Method 201 or 201A and condensables using Method 202.
12.) Data included in any air permit application or Environmental Impact Study is strictly the Customer's responsibility.
13.) Emission values are net emissions generated from MPSA's equipment, unless otherwise stated.
14.) VOC's are expressed as non-methane and non-ethane basis assuming equivalent molecular weight of methane.
15.) Values given are as measured at the HRSG stack outlet with the applicable emission control equipment in place.

ISSUED ON: 12/18/2012

Oregon Clean Energy
Dispersion Modeling Parameters (per turbine)

developed by ARCADIS based on Mitsubishi Data (as provided below)

SITE CONDITIONS:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LOAD LEVEL	100%	75%	50%	100%	75%	50%	100%	100%	75%	50%	100%	100%	100%	100%	75%	52%	100%	100%	100%	100%	100%	75%	55%
AMBIENT DRY BULB TEMPERATURE, °F	-8	-8	-8	0	0	0	59	59	59	59	90	90	90	90	90	90	105	105	105	105	105	105	105
exhaust flow rate (scfm) (@77 F)	1,201,744	1,034,096	752,578	1,186,309	1,024,824	747,655	1,076,284	1,063,358	901,315	714,009	1,015,639	994,906	1,013,634	992,889	837,306	682,508	1,012,609	1,001,582	963,049	999,911	960,784	808,518	683,871
stack gas temperature (K)	359.1	359.1	346.9	358.0	358.0	346.9	357.4	356.9	355.2	346.9	352.4	351.9	359.7	359.1	355.2	349.1	351.3	353.6	352.4	361.3	360.2	356.3	351.3
stack gas temperature (F)	187	187	165	185	185	165	184	183	180	165	175	174	188	187	180	169	173	177	175	191	189	182	173
exhaust flow rate (acfm)	1,447,912	1,245,922	875,906	1,424,896	1,230,934	870,176	1,290,740	1,273,257	1,074,193	831,016	1,200,988	1,174,619	1,223,156	1,196,274	997,907	799,437	1,193,634	1,188,097	1,138,801	1,212,183	1,161,171	966,608	806,127
stack diameter (ft)	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
stack exit velocity (ft/min)	3809	3278	2304	3748	3238	2289	3395	3350	2826	2186	3159	3090	3218	3147	2625	2103	3140	3125	2996	3189	3055	2543	2121
stack exit velocity (m/s)	19.35	16.65	11.71	19.04	16.45	11.63	17.25	17.02	14.36	11.11	16.05	15.70	16.35	15.99	13.34	10.68	15.95	15.88	15.22	16.20	15.52	12.92	10.77
NOx emissions (g/s)	2.85	2.30	1.72	2.84	2.23	1.68	2.52	2.48	1.94	1.54	2.62	2.55	2.35	2.27	1.80	1.44	2.62	2.59	2.43	2.30	2.14	1.73	1.41
CO emissions (g/s)	1.73	1.40	1.05	1.73	1.36	1.02	1.54	1.51	1.19	0.93	1.60	1.55	1.43	1.39	1.10	0.87	1.60	1.58	1.49	1.40	1.31	1.05	0.86
SO2 emissions (g/s)	0.53	0.43	0.32	0.53	0.42	0.32	0.47	0.47	0.37	0.29	0.49	0.47	0.44	0.43	0.34	0.26	0.49	0.48	0.45	0.43	0.40	0.33	0.26
PM10/PM2.5 emissions (g/s)	1.43	1.20	0.88	1.43	1.19	0.87	1.27	1.25	1.02	0.82	1.27	1.25	1.17	1.15	0.95	0.77	1.27	1.26	1.20	1.16	1.10	0.91	0.76
formaldehyde emissions (g/s)	0.0408	0.0330	0.0248	0.0409	0.0322	0.0242	0.0363	0.0357	0.0280	0.0221	0.0366	0.0354	0.0338	0.0326	0.0260	0.0207	0.0365	0.0360	0.0339	0.0331	0.0309	0.0249	0.0205
toluene emissions (g/s)	0.0483	0.0390	0.0293	0.0483	0.0380	0.0286	0.0429	0.0421	0.0331	0.0261	0.0400	0.0387	0.0399	0.0386	0.0308	0.0244	0.0398	0.0392	0.0367	0.0391	0.0366	0.0294	0.0242
xylene emissions (g/s)	0.0238	0.0192	0.0144	0.0238	0.0187	0.0141	0.0211	0.0207	0.0163	0.0129	0.0196	0.0190	0.0196	0.0190	0.0151	0.0120	0.0195	0.0192	0.0180	0.0192	0.0180	0.0145	0.0119

Oregon Clean Energy

Summary of HAP Emissions

Mitsubishi Turbines

Max Individual HAP	**2.78**
Total HAPs	**9.38**

Summary of HAP Emissions (tpy)

Pollutant	HAPs	Turbines + DB	Aux Boiler	Fire Engine	Emer. Gen	Total	Total HAP
1,3-Butadiene	HAP	0.009	0.00	0.00	0.00	0.01	0.009
2-Methylnaphthalene	0	0.00	0.00	0.00	0.00	0.00	0.000
Acetaldehyde	HAP	0.85	0.00	0.00	0.00	0.86	0.857
Acrolein	HAP	0.14	0.00	0.00	0.00	0.14	0.137
Anthracene	HAP	0.00	0.00	0.00	0.00	0.00	0.000
Ammonia	0	169.07	0.00	0.00	0.00	169.07	0.000
Benzene	HAP	0.26	0.00	0.00	0.00	0.27	0.267
Benzo(a)anthracene	HAP	0.00	0.00	0.00	0.00	0.00	0.000
Benzo(a)pyrene	HAP	0.00	0.00	0.00	0.00	0.00	0.000
Butane	0	5.44	0.22	0.00	0.00	5.66	0.000
Chrysene	0	0.00	0.00	0.00	0.00	0.00	0.000
Dibenz(a,h)anthracene	0	0.00	0.00	0.00	0.00	0.00	0.000
Ethane	0	8.03	0.32	0.00	0.00	8.35	0.000
Ethylbenzene	HAP	0.68	0.00	0.00	0.00	0.68	0.682
Formaldehyde	HAP	2.54	0.01	0.00	0.01	2.55	2.554
Hexane	HAP	0.01	0.00	0.00	0.00	0.01	0.012
Naphthalene	HAP	0.03	0.00	0.00	0.00	0.03	0.030
Pentane	0	6.73	0.27	0.00	0.00	7.01	0.000
Phenanthrene	0	0.00	0.00	0.00	0.00	0.00	0.000
PAH	HAP	0.05	0.00	0.00	0.00	0.05	0.048
Propane	0	4.14	0.17	0.00	0.00	4.31	0.000
Propylene	0	0.00	0.00	0.00	0.00	0.00	0.000
Propylene Oxide	HAP	0.62	0.00	0.00	0.00	0.62	0.618
Pyrene	0	0.00	0.00	0.00	0.00	0.00	0.000
Sulfuric Acid	0	10.51	0.00	0.00	0.00	10.51	0.000
Toluene	HAP	2.78	0.00	0.00	0.00	2.78	2.783
Xylene (Total)	HAP	1.36	0.00	0.00	0.00	1.37	1.366
Arsenic	HAP	0.00	0.00	0.00	0.00	0.00	0.001
Barium	0	0.01	0.00	0.00	0.00	0.01	0.000
Beryllium	HAP	0.00	0.00	0.00	0.00	0.00	0.000
Cadmium	HAP	0.00	0.00	0.00	0.00	0.00	0.003
Chromium	HAP	0.00	0.00	0.00	0.00	0.00	0.004
Cobalt	HAP	0.00	0.00	0.00	0.00	0.00	0.000
Copper	0	0.00	0.00	0.00	0.00	0.00	0.000
Manganese	HAP	0.00	0.00	0.00	0.00	0.00	0.001
Mercury	HAP	0.00	0.00	0.00	0.00	0.00	0.001
Molybdenum	0	0.00	0.00	0.00	0.00	0.00	0.000
Nickel	HAP	0.01	0.00	0.00	0.00	0.01	0.006
Selenium	HAP	0.00	0.00	0.00	0.00	0.00	0.000
Vanadium	0	0.01	0.00	0.00	0.00	0.01	0.000
Zinc	0	0.08	0.00	0.00	0.00	0.08	0.000

Oregon Clean Energy

Summary of Air Toxic Emissions

Mitsubishi Turbines

Summary of Ohio Air Toxic Emissions (tpy)

Pollutant	Ohio Air Toxics	Turbines + DB	Aux Boiler	Fire Pump	Emer. Gen
1,3-Butadiene	OH	0.009	0.00E+00	2.01E-05	2.08E-04
2-Methylnaphthalene	0	0.000	0.00E+00	0.00E+00	0.00E+00
Acetaldehyde	OH	0.853	0.00E+00	3.94E-04	4.07E-03
Acrolein	OH	0.136	0.00E+00	4.75E-05	4.91E-04
Anthracene	0	0.000	0.00E+00	0.00E+00	0.00E+00
Ammonia	OH	169.068	0.00E+00	0.00E+00	0.00E+00
Benzene	OH	0.261	2.19E-04	4.79E-04	4.95E-03
Benzo(a)anthracene	0	0.000	0.00E+00	0.00E+00	0.00E+00
Benzo(a)pyrene	0	0.000	0.00E+00	0.00E+00	0.00E+00
Butane	0	0.000	0.00E+00	0.00E+00	0.00E+00
Chrysene	0	0.000	0.00E+00	0.00E+00	0.00E+00
Dibenz(a,h)anthracene	0	0.000	0.00E+00	0.00E+00	0.00E+00
Ethane	0	0.000	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	OH	0.682	0.00E+00	0.00E+00	0.00E+00
Formaldehyde	OH	2.539	7.82E-03	6.06E-04	6.26E-03
Hexane	OH	0.012	4.79E-04	0.00E+00	0.00E+00
Naphthalene	OH	0.029	6.36E-05	4.36E-05	4.50E-04
Pentane	0	0.000	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	0	0.000	0.00E+00	0.00E+00	0.00E+00
PAH	OH	0.047	9.83E-06	8.63E-05	8.92E-04
Propane	0	0.000	0.00E+00	0.00E+00	0.00E+00
Propylene	0	0.000	0.00E+00	0.00E+00	0.00E+00
Propylene Oxide	OH	0.618	0.00E+00	0.00E+00	0.00E+00
Pyrene	0	0.000	0.00E+00	0.00E+00	0.00E+00
Sulfuric Acid	OH	10.512	0.00E+00	2.16E-05	0.00E+00
Toluene	OH	2.780	3.54E-04	2.10E-04	2.17E-03
Xylene (Total)	OH	1.364	0.00E+00	1.46E-04	1.51E-03
Arsenic	OH	0.001	2.08E-05	0.00E+00	0.00E+00
Barium	OH	0.011	4.59E-04	0.00E+00	0.00E+00
Beryllium	OH	0.000	1.25E-06	0.00E+00	0.00E+00
Cadmium	OH	0.003	1.15E-04	0.00E+00	0.00E+00
Chromium	OH	0.004	1.46E-04	0.00E+00	0.00E+00
Cobalt	OH	0.000	8.75E-06	0.00E+00	0.00E+00
Copper	0	0.000	0.00E+00	0.00E+00	0.00E+00
Manganese	OH	0.001	3.96E-05	0.00E+00	0.00E+00
Mercury	OH	0.001	2.71E-05	0.00E+00	0.00E+00
Molybdenum	OH	0.003	1.15E-04	0.00E+00	0.00E+00
Nickel	OH	0.005	2.19E-04	0.00E+00	0.00E+00
Selenium	OH	0.000	2.50E-06	0.00E+00	0.00E+00
Vanadium	0	0.000	0.00E+00	0.00E+00	0.00E+00
Zinc	0	0.000	0.00E+00	0.00E+00	0.00E+00

Oregon Clean Energy

Air Toxic Emissions

Natural Gas Fired Combustion Turbines

	Units		ISO with DB Case 11	ISO no DB Case 7	short term worst case Case 1
Ambient Temperature	^oF		59	59	-8
CTG Percent Load Rate	%		100%	100%	100%
CTG Heat Input Capacity	MMBtu/hr, HHV		2,434	2,617	2,944
Duct Burner Input			281	0	0
HHV of natural gas	BTU/SCF		950	950	950
number of turbines			2	2	2
annual hours of operation			8,760	0	n/a

Worst Case Turbines and Duct Burner

	lb/MMBTU	lb/MMBTU	ISO - case 11 lb/hr per turbine	ISO - Case 7 lb/hr per turbine	WC - Case 1 lb/hr per turbine			
Air Toxic	**Turbine Emission Factor**	**DB Emission Factor**	**case 11 - lb/hr per turbine**	**case 7 - lb/hr per turbine**	**case 1 - lb/hr per turbine**	**based on ISO - tons/yr**	**HAP**	**HAP tons/yr**
1,3-Butadiene	4.30E-07	0.00E+00	0.00	0.00	0.00127	0.01	HAP	0.01
2-Methylnaphthalene	0.00E+00	2.53E-08	0.00	0.00	0.00000	0.00	0.00	0.00
Acetaldehyde	4.00E-05	0.00E+00	0.10	0.10	0.11776	0.85	HAP	0.85
Acrolein	6.40E-06	0.00E+00	0.02	0.02	0.01884	0.14	HAP	0.14
Anthracene	0.00E+00	2.53E-09	0.00	0.00	0.00000	0.00	HAP	0.00
Ammonia	emissions from vendor data		19.30	18.50	20.90000	169.07	0.00	0.00
Benzene	1.20E-05	2.21E-06	0.03	0.03	0.03533	0.26	HAP	0.26
Benzo(a)anthracene	0.00E+00	1.89E-09	0.00	0.00	0.00000	0.00	HAP	0.00
Benzo(a)pyrene	0.00E+00	1.26E-09	0.00	0.00	0.00000	0.00	HAP	0.00
Butane	0.00E+00	2.21E-03	0.62	0.00	0.00000	5.44	0.00	0.00
Chrysene	0.00E+00	1.89E-09	0.00	0.00	0.00000	0.00	0.00	0.00
Dibenz(a,h)anthracene	0.00E+00	1.26E-09	0.00	0.00	0.00000	0.00	0.00	0.00
Ethane	0.00E+00	3.26E-03	0.92	0.00	0.00000	8.03	0.00	0.00
Ethylbenzene	3.20E-05	0.00E+00	0.08	0.08	0.09421	0.68	HAP	0.68
Formaldehyde	1.10E-04	7.89E-05	0.29	0.29	0.32384	2.54	HAP	2.54
Hexane	0.00E+00	4.84E-06	0.00	0.00	0.00000	0.01	HAP	0.01
Naphthalene	1.30E-06	6.42E-07	0.00	0.00	0.00383	0.03	HAP	0.03
Pentane	0.00E+00	2.74E-03	0.77	0.00	0.00000	6.73	0.00	0.00
Phenanthrene	0.00E+00	1.79E-08	0.00	0.00	0.00000	0.00	0.00	0.00
PAH	2.20E-06	9.93E-08	0.01	0.01	0.00648	0.05	HAP	0.05
Propane	0.00E+00	1.68E-03	0.47	0.00	0.00000	4.14	0.00	0.00
Propylene	0.00E+00	0.00E+00	0.00	0.00	0.00000	0.00	0.00	0.00
Propylene Oxide	2.90E-05	0.00E+00	0.07	0.08	0.08538	0.62	HAP	0.62
Pyrene	0.00E+00	5.26E-09	0.00	0.00	0.00000	0.00	0.00	0.00
Sulfuric Acid	emissions from vendor data		1.20	1.10	1.20000	10.51	0.00	0.00
Toluene	1.30E-04	3.58E-06	0.32	0.34	0.38272	2.78	HAP	2.78
Xylene (Total)	6.40E-05	0.00E+00	0.16	0.17	0.18842	1.36	HAP	1.36
Arsenic	0.00E+00	2.11E-07	0.00	0.00	0.00000	0.00	HAP	0.00
Barium	0.00E+00	4.63E-06	0.00	0.00	0.00000	0.01	0.00	0.00
Beryllium	0.00E+00	1.26E-08	0.00	0.00	0.00000	0.00	HAP	0.00
Cadmium	0.00E+00	1.16E-06	0.00	0.00	0.00000	0.00	HAP	0.00
Chromium	0.00E+00	1.47E-06	0.00	0.00	0.00000	0.00	HAP	0.00
Cobalt	0.00E+00	8.84E-08	0.00	0.00	0.00000	0.00	HAP	0.00
Copper	0.00E+00	8.95E-07	0.00	0.00	0.00000	0.00	0.00	0.00
Manganese	0.00E+00	4.00E-07	0.00	0.00	0.00000	0.00	HAP	0.00
Mercury	0.00E+00	2.74E-07	0.00	0.00	0.00000	0.00	HAP	0.00
Molybdenum	0.00E+00	1.16E-06	0.00	0.00	0.00000	0.00	0.00	0.00
Nickel	0.00E+00	2.21E-06	0.00	0.00	0.00000	0.01	HAP	0.01
Selenium	0.00E+00	2.53E-08	0.00	0.00	0.00000	0.00	HAP	0.00
Vanadium	0.00E+00	2.42E-06	0.00	0.00	0.00000	0.01	0.00	0.00
Zinc	0.00E+00	3.05E-05	0.01	0.00	0.00000	0.08	0.00	0.00

Oregon Clean Energy

Air Toxic Emissions

Natural Gas Fired Auxilliary Boiler

	Units		Value
Boiler Heat Input	MMBtu/hr, HHV		99
number of boilers			1
annual hours of operation			2,000
HHV of natural gas	BTU/SCF		950

Emissions Auxilliary Boiler

	Emission Factor	Emission Factor				
Air Toxic	**lb/MMSCF**	**lb/MMBtu**	**lb/hr**	**ton/yr**	**HAPs**	**HAP ton/yr**
1,3-Butadiene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
2-Methylnaphthalene	2.40E-05	2.53E-08	2.50E-06	2.50E-06	0	0.00E+00
Acetaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Acrolein	0.00E+00	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Anthracene	2.40E-06	2.53E-09	2.50E-07	2.50E-07	HAP	2.50E-07
Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Benzene	2.10E-03	2.21E-06	2.19E-04	2.19E-04	HAP	2.19E-04
Benzo(a)anthracene	1.80E-06	1.89E-09	1.88E-07	1.88E-07	HAP	1.88E-07
Benzo(a)pyrene	1.20E-06	1.26E-09	1.25E-07	1.25E-07	HAP	1.25E-07
Butane	2.10E+00	2.21E-03	2.19E-01	2.19E-01	0	0.00E+00
Chrysene	1.80E-06	1.89E-09	1.88E-07	1.88E-07	0	0.00E+00
Dibenz(a,h)anthracene	1.20E-06	1.26E-09	1.25E-07	1.25E-07	0	0.00E+00
Ethane	3.10E+00	3.26E-03	3.23E-01	3.23E-01	0	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Formaldehyde	7.50E-02	7.89E-05	7.82E-03	7.82E-03	HAP	7.82E-03
Hexane	4.60E-03	4.84E-06	4.79E-04	4.79E-04	HAP	4.79E-04
Naphthalene	6.10E-04	6.42E-07	6.36E-05	6.36E-05	HAP	6.36E-05
Pentane	2.60E+00	2.74E-03	2.71E-01	2.71E-01	0	0.00E+00
Phenanthrene	1.70E-05	1.79E-08	1.77E-06	1.77E-06	0	0.00E+00
PAH	9.43E-05	9.93E-08	9.83E-06	9.83E-06	HAP	9.83E-06
Propane	1.60E+00	1.68E-03	1.67E-01	1.67E-01	0	0.00E+00
Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Propylene Oxide	0.00E+00	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Pyrene	5.00E-06	5.26E-09	5.21E-07	5.21E-07	0	0.00E+00
Sulfuric Acid	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Toluene	3.40E-03	3.58E-06	3.54E-04	3.54E-04	HAP	3.54E-04
Xylene (Total)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Arsenic	2.00E-04	2.11E-07	2.08E-05	2.08E-05	HAP	2.08E-05
Barium	4.40E-03	4.63E-06	4.59E-04	4.59E-04	0	0.00E+00
Beryllium	1.20E-05	1.26E-08	1.25E-06	1.25E-06	HAP	1.25E-06
Cadmium	1.10E-03	1.16E-06	1.15E-04	1.15E-04	HAP	1.15E-04
Chromium	1.40E-03	1.47E-06	1.46E-04	1.46E-04	HAP	1.46E-04
Cobalt	8.40E-05	8.84E-08	8.75E-06	8.75E-06	HAP	8.75E-06
Copper	8.50E-04	8.95E-07	8.86E-05	8.86E-05	0	0.00E+00
Manganese	3.80E-04	4.00E-07	3.96E-05	3.96E-05	HAP	3.96E-05
Mercury	2.60E-04	2.74E-07	2.71E-05	2.71E-05	HAP	2.71E-05
Molybdenum	1.10E-03	1.16E-06	1.15E-04	1.15E-04	0	0.00E+00
Nickel	2.10E-03	2.21E-06	2.19E-04	2.19E-04	HAP	2.19E-04
Selenium	2.40E-05	2.53E-08	2.50E-06	2.50E-06	HAP	2.50E-06
Vanadium	2.30E-03	2.42E-06	2.40E-04	2.40E-04	0	0.00E+00
Zinc	2.90E-02	3.05E-05	3.02E-03	3.02E-03	0	0.00E+00

Oregon Clean Energy

Air Toxic Emissions

	Units	Fire Pump
Maximum Fuel Flow	gal/hr	15
Heating Value Diesel Fuel	Btu/gal	137,000
Maximum Heat Input	MMBtu/hr	2.06
number of engines		1
annual hours of operation		500

Emissions Fire Pump

Air Toxic	Emission Factor lb/MMBtu	lb/hr	ton/yr	HAPs	HAP ton/yr
1,3-Butadiene	3.91E-05	8.04E-05	2.01E-05	HAP	2.01E-05
2-Methylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Acetaldehyde	7.67E-04	1.58E-03	3.94E-04	HAP	3.94E-04
Acrolein	9.25E-05	1.90E-04	4.75E-05	HAP	4.75E-05
Anthracene	1.87E-06	3.84E-06	9.61E-07	HAP	9.61E-07
Ammonia	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Benzene	9.33E-04	1.92E-03	4.79E-04	HAP	4.79E-04
Benzo(a)anthracene	1.68E-06	3.45E-06	8.63E-07	HAP	8.63E-07
Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Butane	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Chrysene	3.53E-07	7.25E-07	1.81E-07	0	0.00E+00
Dibenz(a,h)anthracene	5.83E-07	1.20E-06	3.00E-07	0	0.00E+00
Ethane	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Formaldehyde	1.18E-03	2.42E-03	6.06E-04	HAP	6.06E-04
Hexane	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Naphthalene	8.48E-05	1.74E-04	4.36E-05	HAP	4.36E-05
Pentane	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Phenanthrene	2.94E-05	6.04E-05	1.51E-05	0	0.00E+00
PAH	1.68E-04	3.45E-04	8.63E-05	HAP	8.63E-05
Propane	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Propylene	2.58E-04	5.30E-04	1.33E-04	0	0.00E+00
Propylene Oxide	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Pyrene	4.78E-06	9.82E-06	2.46E-06	0	0.00E+00
Sulfuric Acid	from vendor info	8.62E-05	2.16E-05	0	0.00E+00
Toluene	4.09E-04	8.40E-04	2.10E-04	HAP	2.10E-04
Xylene (Total)	2.85E-04	5.86E-04	1.46E-04	HAP	1.46E-04
Arsenic	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Barium	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Beryllium	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Cadmium	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Chromium	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Cobalt	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Copper	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Manganese	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Mercury	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Molybdenum	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Nickel	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Selenium	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Vanadium	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Zinc	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00

Oregon Clean Energy
Air Toxic Emissions

	Units	
Maximum Fuel Flow	gal/hr	155
Heating Value Diesel Fuel	Btu/gal	137,000
Maximum Heat Input	MMBtu/hr	21.24
number of engines		1
annual hours of operation		500

Emissions Emergency Generator

	Emission Factor				
Air Toxic	**lb/MMBtu**	**lb/hr**	**ton/yr**	**HAPs**	**HAP ton/yr**
1,3-Butadiene	3.91E-05	8.30E-04	2.08E-04	HAP	2.08E-04
2-Methylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Acetaldehyde	7.67E-04	1.63E-02	4.07E-03	HAP	4.07E-03
Acrolein	9.25E-05	1.96E-03	4.91E-04	HAP	4.91E-04
Anthracene	1.87E-06	3.97E-05	9.93E-06	HAP	9.93E-06
Ammonia	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Benzene	9.33E-04	1.98E-02	4.95E-03	HAP	4.95E-03
Benzo(a)anthracene	1.68E-06	3.57E-05	8.92E-06	HAP	8.92E-06
Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Butane	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Chrysene	3.53E-07	7.50E-06	1.87E-06	0	0.00E+00
Dibenz(a,h)anthracene	5.83E-07	1.24E-05	3.10E-06	0	0.00E+00
Ethane	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Ethylbenzene	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Formaldehyde	1.18E-03	2.51E-02	6.26E-03	HAP	6.26E-03
Hexane	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Naphthalene	8.48E-05	1.80E-03	4.50E-04	HAP	4.50E-04
Pentane	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Phenanthrene	2.94E-05	6.24E-04	1.56E-04	0	0.00E+00
PAH	1.68E-04	3.57E-03	8.92E-04	HAP	8.92E-04
Propane	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Propylene	2.58E-04	5.48E-03	1.37E-03	0	0.00E+00
Propylene Oxide	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Pyrene	4.78E-06	1.02E-04	2.54E-05	0	0.00E+00
Sulfuric Acid	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Toluene	4.09E-04	8.69E-03	2.17E-03	HAP	2.17E-03
Xylene (Total)	2.85E-04	6.05E-03	1.51E-03	HAP	1.51E-03
Arsenic	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Barium	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Beryllium	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Cadmium	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Chromium	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Cobalt	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Copper	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Manganese	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Mercury	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Molybdenum	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Nickel	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Selenium	0.00E+00	0.00E+00	0.00E+00	HAP	0.00E+00
Vanadium	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00
Zinc	0.00E+00	0.00E+00	0.00E+00	0	0.00E+00

Oregon Clean Energy

Air Toxic Emission Factors

Sources:

CTGs:	*AP-42 - Background Document for Section 3.1 - Table 3.1-3 (factors including CO catalyst control*
CTGs:	*CARB - CATEF Formaldehyde Emission Factor Database for Natural Gas Fired Turbines with SCI*
Duct Burner/Aux Boiler:	*AP-42 Compilation of Emission Factors - Table 1.4-3 and Table 1.4-4*
Duct Burner/Aux Boiler:	*Ventura County AB2588 combustion emission factor for external combustion equipment - hexane*
Emergency Fire Pump and Emergency Generator:	*AP-42 Compilation of Emission Factors - Table 3.3-2*

	AP-42 Full Load Emission Factor lb/MMBtu	AP-42 Emission Factor lb/MMSCF	AP-42 Emission Factor lb/MMBtu		
Air Toxic	**Full Load CTGs**	**duct burner/ boiler**	**emer. fire pump & emer. generator**	**HAP**	**PAH or POM**
1,3-Butadiene	4.30E-07		3.91E-05	HAP	
2-Methylnaphthalene		2.40E-05			POM
Acetaldehyde	4.00E-05		7.67E-04	HAP	
Acrolein	6.40E-06		9.25E-05	HAP	
Anthracene		2.40E-06	1.87E-06	HAP	PAH
Ammonia					
Benzene	1.20E-05	2.10E-03	9.33E-04	HAP	
Benzo(a)anthracene		1.80E-06	1.68E-06	HAP	PAH
Benzo(a)pyrene		1.20E-06		HAP	PAH
Butane		2.10E+00			
Chrysene		1.80E-06	3.53E-07		PAH
Dibenz(a,h)anthracene		1.20E-06	5.83E-07		PAH
Ethane		3.10E+00			
Ethylbenzene	3.20E-05			HAP	
Formaldehyde	1.10E-04	7.50E-02	1.18E-03	HAP	
Hexane		4.60E-03		HAP	
Naphthalene	1.30E-06	6.10E-04	8.48E-05	HAP	PAH
Pentane		2.60E+00			
Phenanthrene		1.70E-05	2.94E-05		PAH
PAH	2.20E-06	9.43E-05	1.68E-04	HAP	
Propane		1.60E+00			
Propylene			2.58E-04		
Propylene Oxide	2.90E-05			HAP	
Pyrene		5.00E-06	4.78E-06		PAH
Sulfuric Acid					
Toluene	1.30E-04	3.40E-03	4.09E-04	HAP	
Xylene (Total)	6.40E-05		2.85E-04	HAP	
Arsenic		2.00E-04		HAP	
Barium		4.40E-03			
Beryllium		1.20E-05		HAP	
Cadmium		1.10E-03		HAP	
Chromium		1.40E-03		HAP	
Cobalt		8.40E-05		HAP	
Copper		8.50E-04			
Manganese		3.80E-04		HAP	
Mercury		2.60E-04		HAP	
Molybdenum		1.10E-03			
Nickel		2.10E-03		HAP	
Selenium		2.40E-05		HAP	
Vanadium		2.30E-03			
Zinc		2.90E-02			

Appendix B: Modeling Results

Turbine Stack Parameters Modeled by Operating Case

Source Parameters									Emission Rate (g/s) (1)
Source ID	Source Description	Easting (m)	Northing (m)	Base Elevation (m)	Stack Height (ft)	Temperature (F)	Exit Velocity (m/s)	Stack Diameter (ft)	All Pollutants (1)
HRSGS_C1	South Turbine Stack - Case 1	296573.04	4615718.10	179.832	240	187	19.350	22	1
HRSGN_C1	NorthTurbine Stack - Case 1	296572.42	4615761.83	179.832	240	187	19.350	22	1
HRSGS_C3	South Turbine Stack - Case 3	296573.04	4615718.10	179.832	240	165	11.705	22	1
HRSGN_C3	NorthTurbine Stack - Case 3	296572.42	4615761.83	179.832	240	165	11.705	22	1
HRSGS_C4	South Turbine Stack - Case 4	296573.04	4615718.10	179.832	240	185	19.042	22	1
HRSGN_C4	NorthTurbine Stack - Case 4	296572.42	4615761.83	179.832	240	185	19.042	22	1
HRSGS_C6	South Turbine Stack - Case 6	296573.04	4615718.10	179.832	240	165	11.629	22	1
HRSGN_C6	NorthTurbine Stack - Case 6	296572.42	4615761.83	179.832	240	165	11.629	22	1
HRSGS_C7	South Turbine Stack - Case 7	296573.04	4615718.10	179.832	240	184	17.249	22	1
HRSGN_C7	NorthTurbine Stack - Case 7	296572.42	4615761.83	179.832	240	184	17.249	22	1
HRGS_C10	South Turbine Stack - Case 10	296573.04	4615718.10	179.832	240	165	11.105	22	1
HRGN_C10	NorthTurbine Stack - Case 10	296572.42	4615761.83	179.832	240	165	11.105	22	1
HRGS_C11	South Turbine Stack - Case 11	296573.04	4615718.10	179.832	240	175	16.050	22	1
HRGN_C11	NorthTurbine Stack - Case 11	296572.42	4615761.83	179.832	240	175	16.050	22	1
HRGS_C16	South Turbine Stack - Case 16	296573.04	4615718.10	179.832	240	169	10.683	22	1
HRGN_C16	NorthTurbine Stack - Case 16	296572.42	4615761.83	179.832	240	169	10.683	22	1
HRGS_C17	South Turbine Stack - Case 17	296573.04	4615718.10	179.832	240	173	15.951	22	1
HRGN_C17	NorthTurbine Stack - Case 17	296572.42	4615761.83	179.832	240	173	15.951	22	1
HRGS_C20	South Turbine Stack - Case 20	296573.04	4615718.10	179.832	240	191	16.199	22	1
HRGN_C20	NorthTurbine Stack - Case 20	296572.42	4615761.83	179.832	240	191	16.199	22	1
HRGS_C23	South Turbine Stack - Case 23	296573.04	4615718.10	179.832	240	173	10.773	22	1
HRGN_C23	NorthTurbine Stack - Case 23	296572.42	4615761.83	179.832	240	173	10.773	22	1

Notes:

(1) Modeling is performed at an emission rate of 1 g/s to obtain "unified" modeling impacts.

Turbine Operation Worst-Case Analysis - Results

Source Parameters		Emission Rate (g/s)								Unified Modeled Impacts (ug/m3)[1]				Scaled Impacts (ug/m3)[1,2]							
Source ID	Source Description	PM10/ PM2.5	NOx	CO	H2SO4	NH3	Formaldehyde	Toulene	Xylene	1-hr	8-hr	24-hr	Annual	PM2.5/ PM10 24-hr	PM2.5/ PM10 Annual	NOx Annual	H2SO4 1-hr	NH3 1-hr	Formaldehyde 1-hr	Toulene 1-hr	Xylene 1-hr
HRSGS_C1	South Turbine Stack - Case 1	1.43	2.85	1.73	0.15	2.64	0.04	0.05	0.02	0.967	0.401	0.220	0.011	0.626	0.0312	0.062	0.292	5.080	0.079	0.093	0.046
HRSGN_C1	NorthTurbine Stack - Case 1	1.43	2.85	1.73	0.15	2.64	0.04	0.05	0.02	0.960	0.404	0.220	0.011								
HRSGS_C3	South Turbine Stack - Case 3	0.88	1.72	1.05	0.09	1.59	0.02	0.03	0.01	1.288	0.786	0.382	0.020	0.695	0.0364	0.071	0.227	4.080	0.064	0.075	0.037
HRSGN_C3	NorthTurbine Stack - Case 3	0.88	1.72	1.05	0.09	1.59	0.02	0.03	0.01	1.279	0.832	0.406	0.021								
HRSGS_C4	South Turbine Stack - Case 4	1.43	2.84	1.73	0.15	2.64	0.04	0.05	0.02	0.982	0.409	0.225	0.011	0.639	0.0320	0.064	0.295	5.145	0.080	0.094	0.046
HRSGN_C4	NorthTurbine Stack - Case 4	1.43	2.84	1.73	0.15	2.64	0.04	0.05	0.02	0.970	0.413	0.224	0.011								
HRSGS_C6	South Turbine Stack - Case 6	0.87	1.68	1.02	0.09	1.55	0.02	0.03	0.01	1.297	0.780	0.384	0.020	0.699	0.0360	0.069	0.228	4.010	0.063	0.074	0.036
HRSGN_C6	NorthTurbine Stack - Case 6	0.87	1.68	1.02	0.09	1.55	0.02	0.03	0.01	1.288	0.828	0.419	0.021								
HRSGS_C7	South Turbine Stack - Case 7	1.27	2.52	1.54	0.14	2.33	0.04	0.04	0.02	1.039	0.446	0.247	0.012	0.626	0.0316	0.063	0.284	4.784	0.074	0.088	0.043
HRSGN_C7	NorthTurbine Stack - Case 7	1.27	2.52	1.54	0.14	2.33	0.04	0.04	0.02	1.012	0.475	0.244	0.012								
HRGS_C10	South Turbine Stack - Case 10	0.82	1.54	0.93	0.09	1.43	0.02	0.03	0.01	1.361	0.824	0.402	0.021	0.685	0.0356	0.067	0.239	3.864	0.060	0.071	0.035
HRGN_C10	NorthTurbine Stack - Case 10	0.82	1.54	0.93	0.09	1.43	0.02	0.03	0.01	1.351	0.874	0.434	0.022								
HRGS_C11	South Turbine Stack - Case 11	1.27	2.62	1.60	0.15	2.43	0.04	0.04	0.02	1.095	0.495	0.276	0.014	0.697	0.0357	0.073	0.327	5.257	0.079	0.086	0.042
HRGN_C11	NorthTurbine Stack - Case 11	1.27	2.62	1.60	0.15	2.43	0.04	0.04	0.02	1.065	0.560	0.271	0.014								
HRGS_C16	South Turbine Stack - Case 16	0.77	1.44	0.87	0.08	1.32	0.02	0.02	0.01	1.383	0.826	0.407	0.022	0.657	0.0339	0.063	0.209	3.649	0.057	0.067	0.033
HRGN_C16	NorthTurbine Stack - Case 16	0.77	1.44	0.87	0.08	1.32	0.02	0.02	0.01	1.373	0.869	0.447	0.022								
HRGS_C17	South Turbine Stack - Case 17	1.27	2.62	1.60	0.15	2.43	0.04	0.04	0.02	1.103	0.502	0.280	0.014	0.707	0.0363	0.075	0.329	5.295	0.079	0.087	0.043
HRGN_C17	NorthTurbine Stack - Case 17	1.27	2.62	1.60	0.15	2.43	0.04	0.04	0.02	1.073	0.562	0.275	0.014								
HRGS_C20	South Turbine Stack - Case 20	1.16	2.30	1.40	0.13	2.13	0.03	0.04	0.02	1.054	0.461	0.255	0.013	0.587	0.0294	0.058	0.262	4.432	0.069	0.081	0.040
HRGN_C20	NorthTurbine Stack - Case 20	1.16	2.30	1.40	0.13	2.13	0.03	0.04	0.02	1.026	0.496	0.251	0.013								
HRGS_C23	South Turbine Stack - Case 23	0.76	1.41	0.86	0.08	1.31	0.02	0.02	0.01	1.341	0.826	0.395	0.021	0.624	0.0322	0.060	0.202	3.505	0.055	0.065	0.032
HRGN_C23	NorthTurbine Stack - Case 23	0.76	1.41	0.86	0.08	1.31	0.02	0.02	0.01	1.331	0.864	0.430	0.022								

Notes:

(1) Impacts based on modeling at an emission rate of 1 g/s for each turbine stack. The unified impacts are multiplied with the actual emission rates to obtain scaled impacts. See example below:

$PM_{2.5}/PM_{10}$ 24-hour Scaled Impacts for Operating Case 1: (1.43 g/s x 0.220 ug/m3) + (1.43 x 0.220 ug/m3) = 0.626 ug/m3

(2) Shaded results represent the maximum impacts for the pollutant/averaging period.

Modeling Inputs and Results - PM10, PM2.5, and NOx (Annual)

Stack Parameters									Emission Rate (g/s)				
Source ID	Source Description	Easting (m)	Northing (m)	Base Elevation (m)	Stack Height (ft)	Temperature (F)	Exit Velocity	Stack Diameter	$PM_{2.5}$ (24-hr)	$PM_{2.5}$ (Annual)	PM_{10} (24-hr)	PM_{10} (Annual)	NOx (Annual)
HRGS_C17	South Turbine Stack - Case 17	296573.04	4615718.10	179.832	240	173	15.95	22	1.27	--	1.27	--	2.62
HRGN_C17	NorthTurbine Stack - Case 17	296572.42	4615761.83	179.832	240	173	15.95	22	1.27	--	1.27	--	2.62
HRSGS_C3	South Turbine Stack - Case 3	296573.04	4615718.10	179.832	240	165	11.71	22	--	0.88	--	0.88	--
HRSGN_C3	NorthTurbine Stack - Case 3	296572.42	4615761.83	179.832	240	165	11.71	22	--	0.88	--	0.88	--
HRSGS_C4	South Turbine Stack - Case 4	296573.04	4615718.10	179.832	240	185	19.04	22	--	--	--	--	--
HRSGN_C4	NorthTurbine Stack - Case 4	296572.42	4615761.83	179.832	240	185	19.04	22	--	--	--	--	--
CELL1	Cooling Tower Cells 1 through 16	296405.82	4615764.07	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL2		296420.83	4615764.07	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL3		296435.52	4615764.07	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL4		296450.21	4615764.07	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL5		296465.23	4615764.07	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL6		296479.72	4615764.07	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL7		296494.23	4615764.07	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL8		296509.24	4615764.07	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL9		296509.57	4615748.67	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL10		296494.90	4615748.67	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL11		296479.72	4615748.67	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL12		296465.07	4615748.67	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL13		296450.25	4615748.67	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL14		296435.43	4615748.67	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL15		296420.85	4615748.67	179.832	66	77	8.45	33	3.15E-05		0.0082		--
CELL16		296405.71	4615748.67	179.832	66	77	8.45	33	3.15E-05		0.0082		--

Results

Pollutant	Averaging Period	Maximum Impact (ug/m3)	SIL (ug/m3)
$PM_{2.5}$	24-hr	0.47	1.2
	Annual	0.04	0.3
PM_{10}	24-hr	3.37	5
	Annual	0.60	1
NOx	Annual	0.07	1

*PM2.5 impacts shown are maximum 1st highest 24-hr and maximum annual results averaged over 5 years

Startup Controlling Case Analysis

Stack Parameters									Emission Rate (g/s)			Unified Impacts (ug/m3)				Scaled Impacts (ug/m3)			
Source ID	Source Description	Easting (m)	Northing (m)	Base Elevation (m)	Stack Height (ft)	Temperature (F)	Exit Velocity (m/s)	Stack Diameter (ft)	CO	PM10/ PM2.5	NOx	1-hr	8-hr	24-hr	Annual	CO 1-hr	CO 8-hr	PM10/ PM2.5 24-hr	NOx 1-hr
HRSGS_HS	South Turbine Stack - Hot Start	296573.04	4615718.10	179.832	240	184.17	10.663	22	72.96	0.43	5.92	1.276	0.809	0.380	0.020	93.08	59.00	0.163	7.550
HRSGN_HS	NorthTurbine Stack - Hot Start	296572.42	4615761.83	179.832	240	184.17	10.663	22	72.96	0.43	5.92	1.267	0.823	0.423	0.020	92.46	60.07	0.182	7.500
HRSGS_WS	South Turbine Stack - Warm Start	296573.04	4615718.10	179.832	240	194.68	11.024	22	122.76	0.45	5.33	1.224	0.755	0.351	0.018	150.30	92.64	0.159	6.527
HRSGN_WS	North Turbine Stack - Warm Start	296572.42	4615761.83	179.832	240	194.68	11.024	22	122.76	0.45	5.33	1.190	0.785	0.372	0.019	146.12	96.39	0.169	6.345
HRSGS_CS	South Turbine Stack - Cold Start	296573.04	4615718.10	179.832	240	195.93	10.944	22	139.57	0.46	5.49	1.225	0.753	0.351	0.018	170.99	105.06	0.163	6.730
HRSGN_CS	North Turbine Stack - Cold Start	296572.42	4615761.83	179.832	240	195.93	10.944	22	139.57	0.46	5.49	1.191	0.783	0.367	0.019	166.23	109.27	0.170	6.543

Notes:

(1) Shaded results represent the maximum impacts for the pollutant/averaging period.

CO Modeling Stack Parameters and Results

Source Parameters									Emission Rate (g/s) [1]
Stack ID	Source Description	Easting (m)	Northing (m)	Base Elevation (m)	Stack Height (ft)	Temperature (F)	Exit Velocity (m/s)	Stack Diameter (ft)	CO
HRSGS_CS	South Turbine Stack - Cold Start	296573.04	4615718.10	179.832	240	195.93	10.94	22	139.57
HRSGN_CS	NorthTurbine Stack - Cold Start	296572.42	4615761.83	179.832	240	195.93	10.94	22	140.26
AUXBLR	Auxilliary Boiler	296572.42	4615761.83	179.832	240	200	5.107	4	0.69

Notes:

(1) Auxilliary boiler emissions are added to the north turbine stack (HRSGN_CS)

Results

Pollutant	Averaging Period	Maximum Impact (ug/m3)	SIL (ug/m3)
CO	1-hr	172.72	2,000
	8-hr	109.80	500

*Only one turbine will start-up at anytime.

**South turbine stack and the auxilliary boiler stack are modeled as separate stacks; North turbine stack and the auxilliary boiler stack are modeled as combined stacks.

NOx 1-hr Modeling Stack Parameters and Results

Stack Parameters									Emission Rate (g/s) (1)
Source ID	**Source Description**	**Easting (m)**	**Northing (m)**	**Base Elevation (m)**	**Stack Height (ft)**	**Temperature (F)**	**Exit Velocity (m/s)**	**Stack Diameter (ft)**	**NOx**
HRSGS_HS	South Turbine Stack - Hot Start	296573.04	4615718.10	179.832	240	184.17	10.66	22	5.92
HRSGN_HS	NorthTurbine Stack - Hot Start	296572.42	4615761.83	179.832	240	184.17	10.66	22	6.17
AUXBLR	Auxilliary Boiler	296572.42	4615761.83	179.832	240	200	5.107	4	0.25

Notes:

(1) Auxilliary boiler emissions are added to the north turbine stack (HRSGN_HS)

Results

Pollutant	Averaging Period	Maximum Impact (ug/m3)	SIL (ug/m3)
NOx	1-hr	6.59	7.54

*Only one turbine will start-up at anytime.

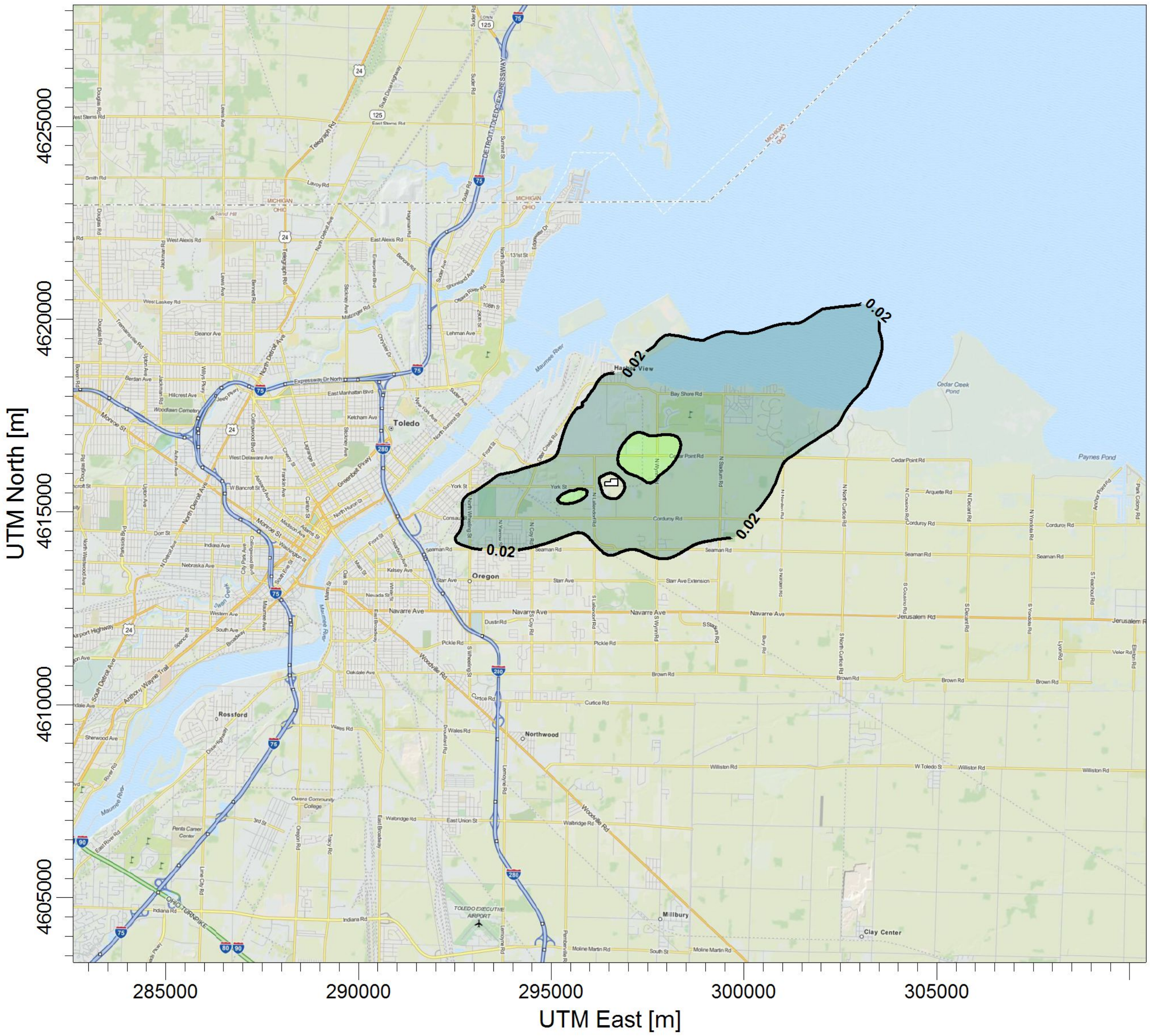
**South turbine stack and the auxilliary boiler stack are modeled as separate stacks; North turbine stack and the auxilliary boiler stack are modeled as combined stacks.

***Maximum 1st-Highest 1-hr Results Averaged over 5 Years

Appendix C: Plots of Maximum-Impact Cases

PROJECT TITLE:

Worst Case Annual NO2 Average Impact
Annual Average



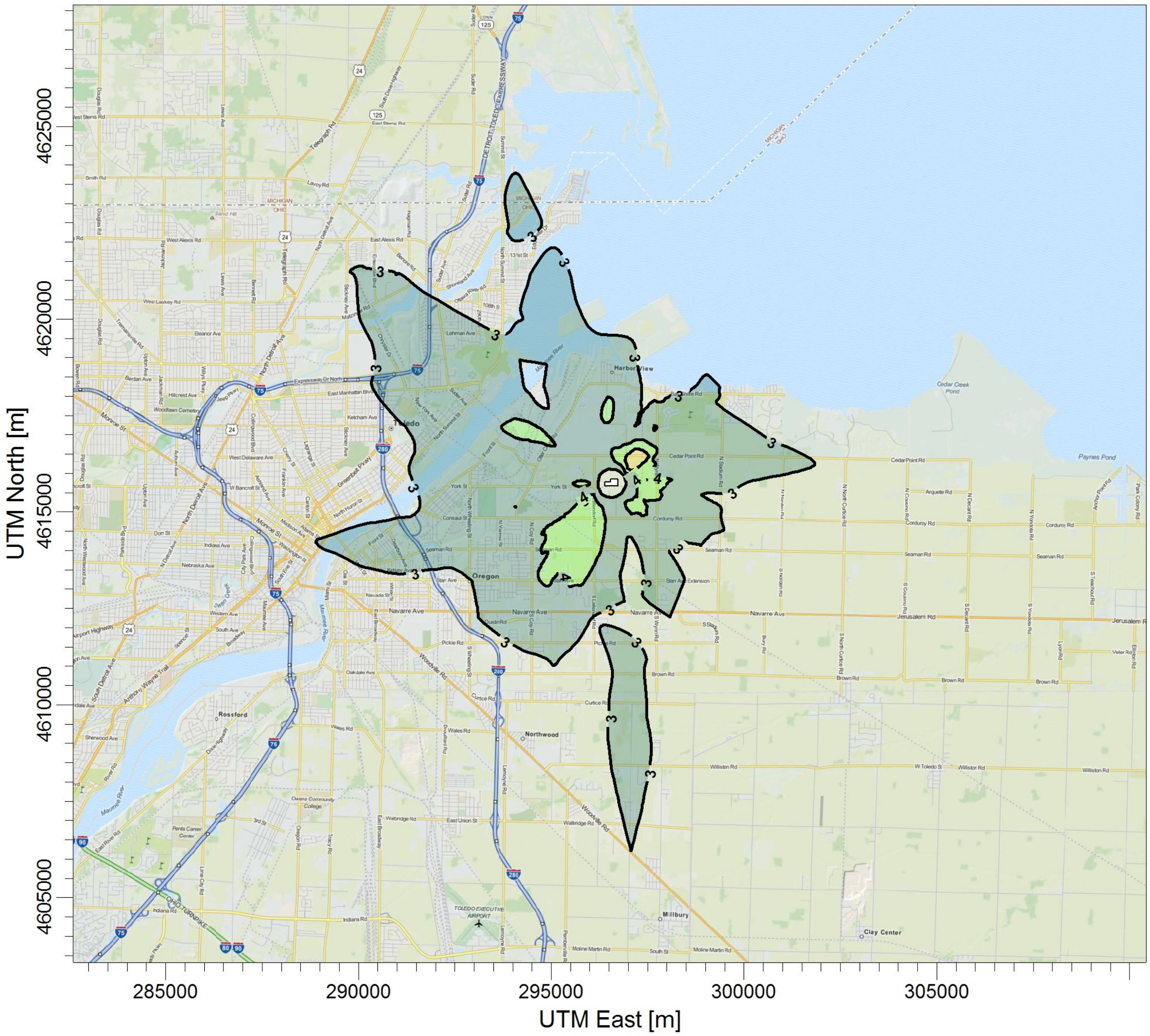
PLOT FILE OF ANNUAL VALUES FOR SOURCE GROUP: ALL — ug/m^3

0.02 — 0.05 — 0.10 — 1.00

COMMENTS:	SOURCES:	COMPANY NAME:	
Mitsubishi Layout 2007 SIL: 1.0 ug/m3 Case 17 (100 percent load with duct firing at 95 deg F) with Cooling Tower.	**21**	**OREGON CLEAN ENERGY CENTER**	
	RECEPTORS: **3324**	MODELER: **RLK**	ARCADIS
	OUTPUT TYPE: **Concentration**	SCALE: 1:175,000 0 — 5 km	
	MAX: **0.07436 ug/m^3**	DATE: **2/6/2013**	PROJECT NO.:

PROJECT TITLE:

Worst Case 1-Hour NO2 Impact
1st Highest Maximum Daily 1-Hour Values Averaged Over 5 Years



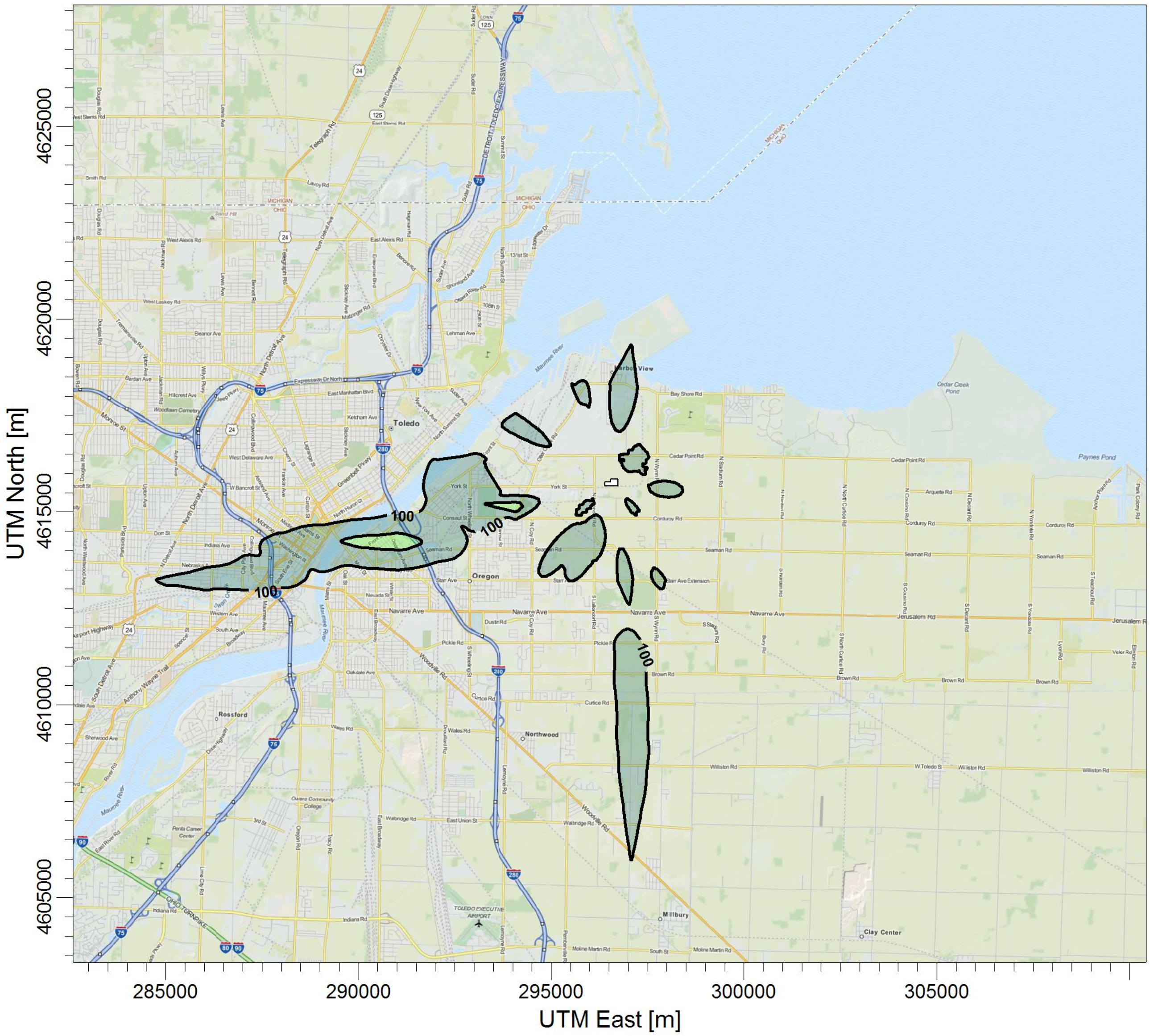
PLOT FILE OF 1ST-HIGHEST MAX DAILY 1-HR VALUES AVERAGED OVER 5 YEARS FOR SOURCE GROUP: HRSGN_AB ug/m^3

3.00 4.00 5.00 7.52

COMMENTS:	SOURCES:	COMPANY NAME:	
Mitsubishi Layout 2006 - 2010 SIL: 7.52 ug/m3 Hot Start on northern stack with auxiliary boiler.	**21**	**OREGON CLEAN ENERGY CENTER**	
	RECEPTORS: **3324**	MODELER: **RLK**	ARCADIS
	OUTPUT TYPE: **Concentration**	SCALE: 1:175,000 0 5 km	
	MAX: **6.58764 ug/m^3**	DATE: **2/5/2013**	PROJECT NO.:

PROJECT TITLE:

Worst Case 1-Hour CO Impact
1st Highest 1-Hour Average



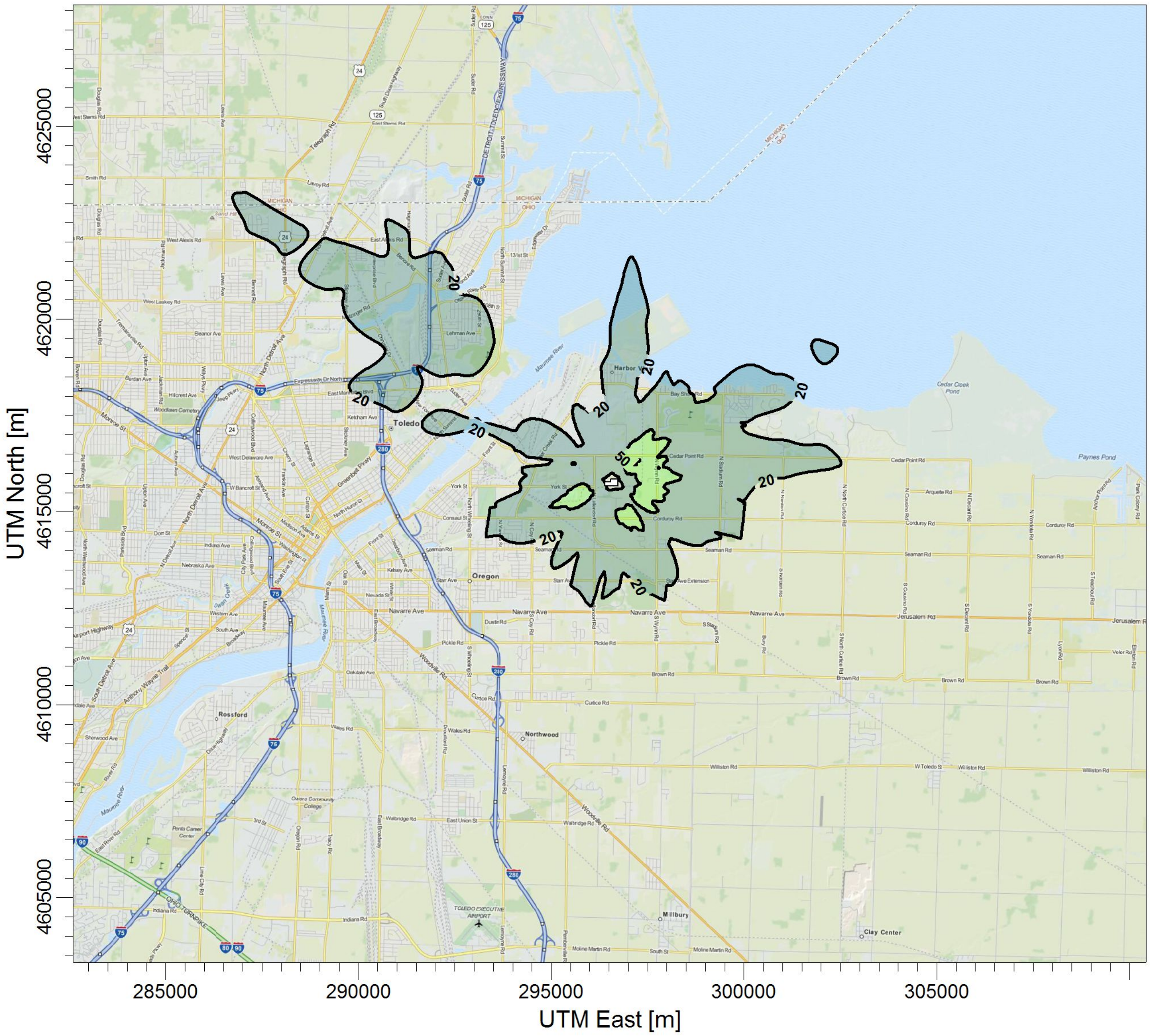
PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: HRSGS_AB — ug/m^3

100 | 150 | 200 | 2000

COMMENTS:	SOURCES:	COMPANY NAME:	
Mitsubishi Layout 2010 SIL: 2,000 ug/m3 Cold start on southern stack with auxiliary boiler.	**21**	**OREGON CLEAN ENERGY CENTER**	
	RECEPTORS: **3324**	MODELER: **RLK**	ARCADIS
	OUTPUT TYPE: **Concentration**	SCALE: 1:175,000 0 — 5 km	
	MAX: **172.7191 ug/m^3**	DATE: **2/5/2013**	PROJECT NO.:

PROJECT TITLE:

Worst Case 8-Hour CO Impact
1st Highest 8-Hour Average



PLOT FILE OF HIGH 1ST HIGH 8-HR VALUES FOR SOURCE GROUP: HRSGN_AB

ug/m^3

20 | 50 | 100 | 500

COMMENTS:

Mitsubishi Layout
2008
SIL: 500 ug/m3

Cold start on northern stack with auxiliary boiler.

SOURCES:

21

COMPANY NAME:

OREGON CLEAN ENERGY CENTER

RECEPTORS:

3324

MODELER:

RLK

ARCADIS

OUTPUT TYPE:

Concentration

SCALE: 1:175,000

0 5 km

MAX:

109.80346 ug/m^3

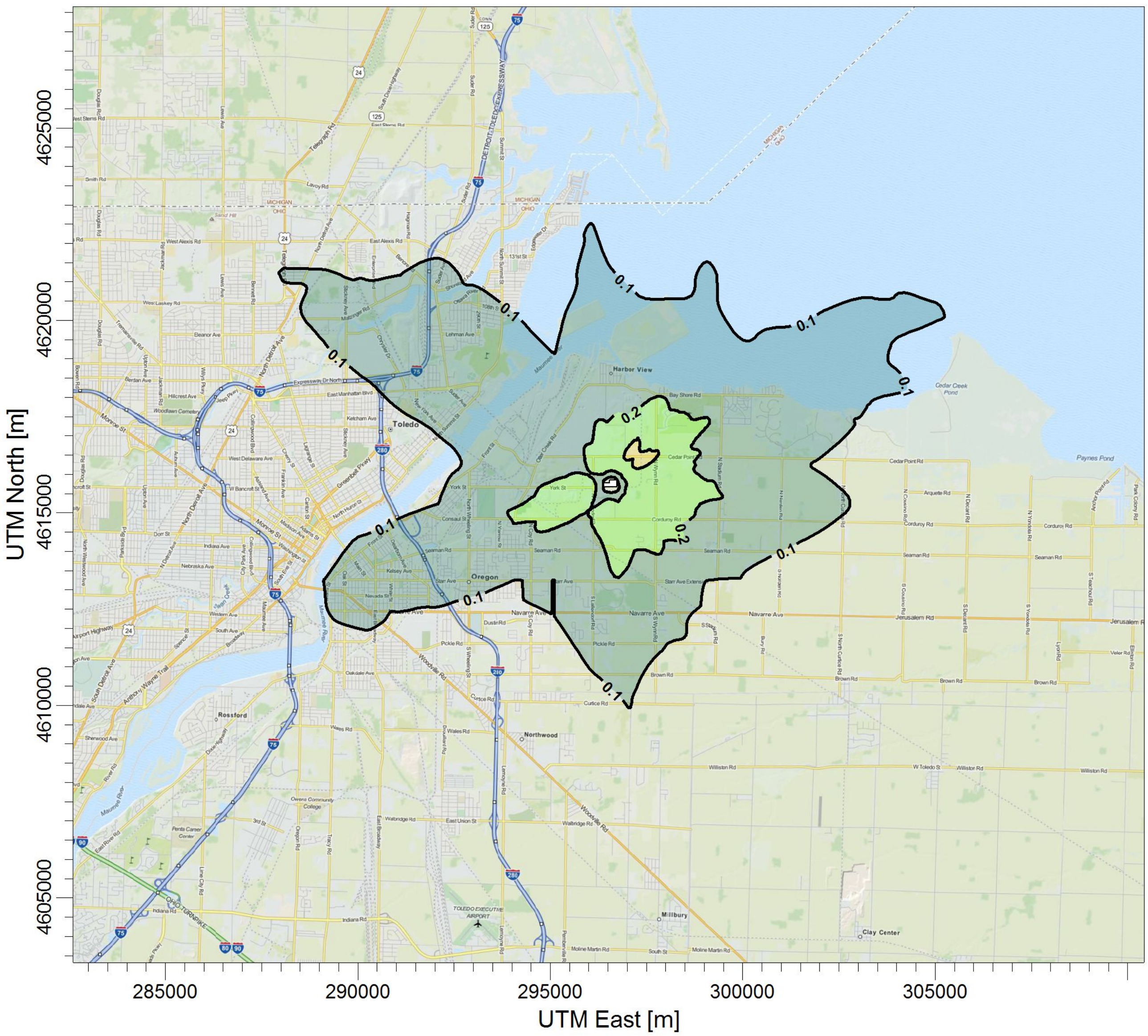
DATE:

2/5/2013

PROJECT NO.:

PROJECT TITLE:

Worst Case 24-Hour PM2.5 Average Impact
1st Highest Maximum 24-Hour Average Impact Over 5 Years



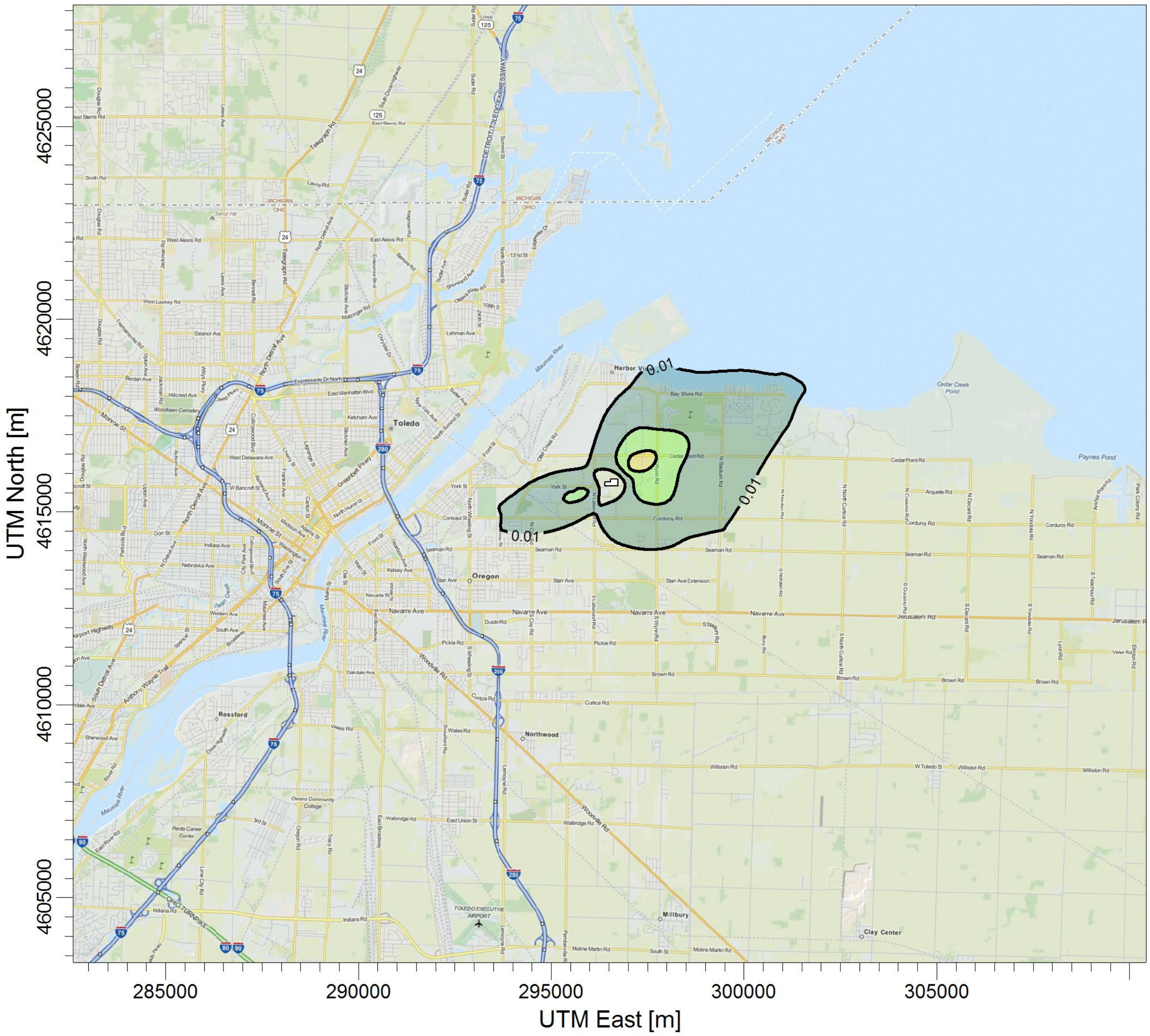
PLOT FILE OF 1ST-HIGHEST MAX DAILY 24-HR VALUES AVERAGED OVER 5 YEARS FOR SOURCE GROUP: ALL_1 ug/m^3

0.1 0.2 0.4 1.2

COMMENTS:	SOURCES:	COMPANY NAME:	
Mitsubishi Layout 2006 - 2010 SIL: 1.2 ug/m3 Case 17 (100 percent load with duct firing at 95 deg F) with Cooling Tower.	**21**	**OREGON CLEAN ENERGY CENTER**	
	RECEPTORS: **3324**	MODELER: **RLK**	ARCADIS
	OUTPUT TYPE: **Concentration**	SCALE: 1:175,000 0 — 5 km	
	MAX: **0.47212 ug/m^3**	DATE: **2/6/2013**	PROJECT NO.:

PROJECT TITLE:

Worst Case Annual PM2.5 Average Impact
5 Year Average of Annual Impacts



PLOT FILE OF ANNUAL VALUES FOR SOURCE GROUP: ALL_2 ug/m^3

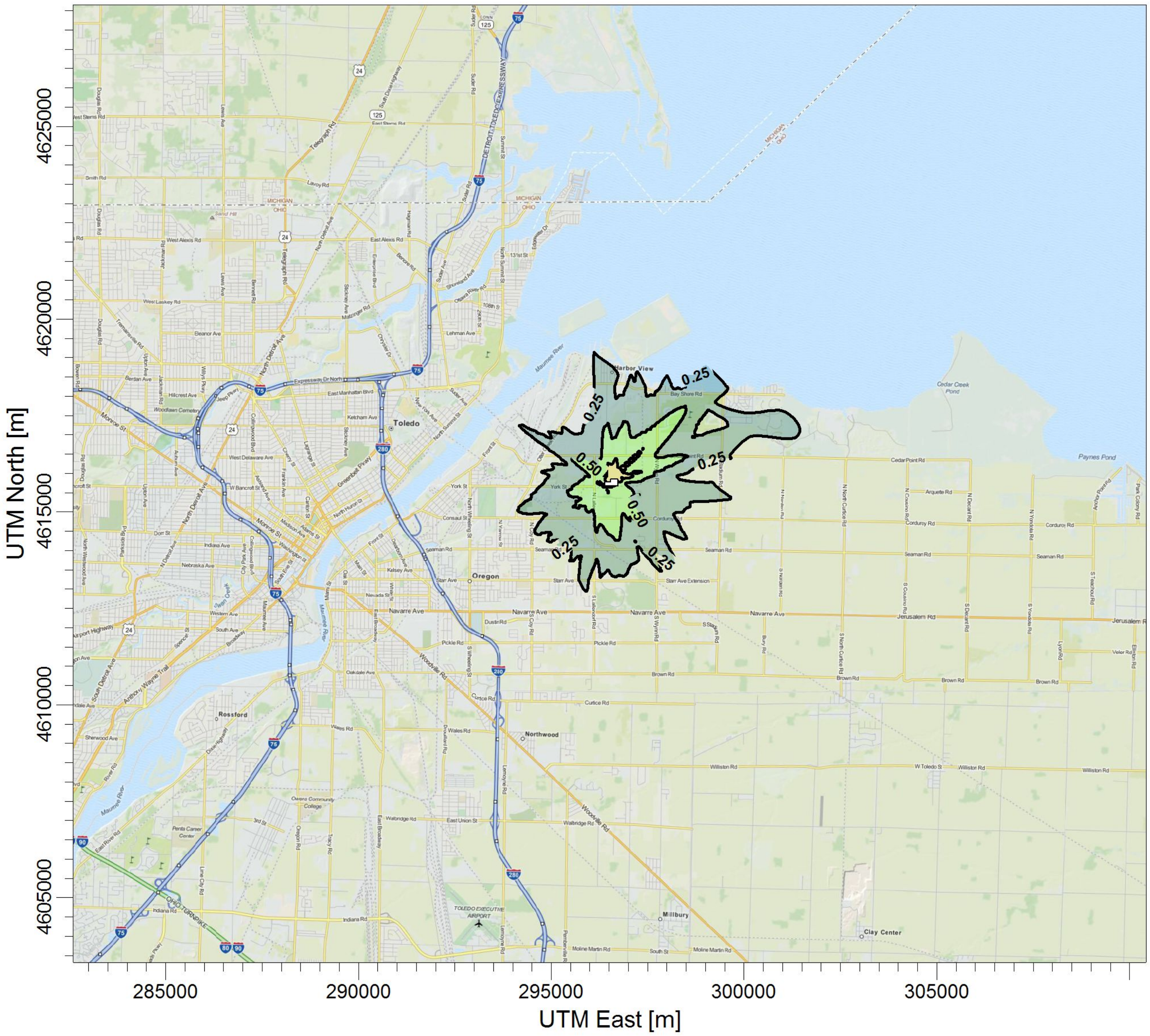
0.01 | 0.02 | 0.03 | 0.30

COMMENTS: Mitsubishi Layout 2006 - 2010 SIL: 0.3 ug/m3 Case 3 (50 percent load without duct firing at -8 deg F) with Cooling Tower.	SOURCES: **21**	COMPANY NAME: **OREGON CLEAN ENERGY CENTER**
	RECEPTORS: **3324**	MODELER: **RLK**
	OUTPUT TYPE: **Concentration**	SCALE: 1:175,000 0 5 km
	MAX: **0.03515 ug/m^3**	DATE: **2/6/2013**
		PROJECT NO.:

ARCADIS

PROJECT TITLE:

Worst Case 24-Hour PM10 Average Impact
1st Highest Maximum 24-Hour Impact



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL_1 — ug/m^3

0.25 | 0.50 | 1.00 | 5.00

COMMENTS:	SOURCES:	COMPANY NAME:	
Mitsubishi Layout 2006 SIL: 5.0 ug/m3 Case 17 (100 percent load with duct firing at 95 deg F) with Cooling Tower.	**21**	**OREGON CLEAN ENERGY CENTER**	
	RECEPTORS: **3324**	MODELER: **RLK**	ARCADIS
	OUTPUT TYPE: **Concentration**	SCALE: 1:175,000 0 — 5 km	
	MAX: **3.36544 ug/m^3**	DATE: **2/5/2013**	PROJECT NO.:

Appendix D: Modeling Files

Appendix E: Agency Correspondence

Ohio Division of Wildlife
Scott Zody, Chief
2045 Morse Rd., Bldg. G
Columbus, OH 43229-6693
Phone: (614) 265-6300

September 17, 2012

Lynn Gresock
ARCADIS U.S., Inc.
One Executive Drive, Suite 303
Chelmsford, MA, 01824

Dear Ms. Gresock

After reviewing the Natural Heritage Database, I find the Division of Wildlife has no records of rare or endangered species in the Oregon Clean Energy Center project area, including a one mile radius, at 816 Lallendorf Road, in the City of Oregon, Lucas County, Ohio. We are unaware of any unique ecological sites, geologic features, animal assemblages, scenic rivers, state wildlife areas, nature preserves, parks or forests, national wildlife refuges, parks or forests or other protected natural areas within a one mile radius of the project area.

Our inventory program has not completely surveyed Ohio and relies on information supplied by many individuals and organizations. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. Although we inventory all types of plant communities, we only maintain records on the highest quality areas.

This letter only represents a review of rare species and natural features data within the Ohio Natural Heritage Database. It does not fulfill coordination under the National Environmental Policy Act (NEPA) or the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S. C. 661 et seq.) and does not supersede or replace the regulatory authority of any local, state or federal agency nor relieve the applicant of the obligation to comply with any local, state or federal laws or regulations.

Please contact me at 614-265-6452 if I can be of further assistance.

Sincerely,

Greg Schneider

Greg Schneider, Administrator
Ohio Natural Heritage Program

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / FAX (614) 416-8994

October 11, 2012

ARCADIS U.S., Inc.
Attn: Lynn Gresock
1 Executive Drive, Suite 303
Chelmsford, Massachusetts 01824

Reference: Oregon Clean Energy Project – City of Oregon in Lucas County, Ohio

Dear Ms. Gresock,

TAILS # 03E15000-2012-TA-1444

We have received your recent correspondence requesting information about the subject proposal. There are no Federal wilderness areas, wildlife refuges or designated critical habitat within the vicinity of the project area. Based on the information you have provided, at this time we have no objection to the proposed project.

ENDANGERED SPECIES COMMENTS: Due to the project type, size, and location, we do not anticipate any impact on federally listed endangered, threatened, or candidate species, or their habitats. Should the project design change, or during the term of this action, additional information on listed or proposed species or their critical habitat become available, or if new information reveals effects of the action that were not previously considered, consultation with the Service should be initiated to assess any potential impacts.

If you have additional questions or require further assistance with your project proposal, please contact me at the following number (614) 416-8993, x12. I would be happy to discuss the project in further detail with you and provide additional assistance if necessary. In addition, you can find more information on natural resources in Ohio, and a county list of federally threatened and endangered species in Ohio, by visiting our homepage at: http://www.fws.gov/midwest/ohio.

Sincerely,

Jeromy M. Gg[illegible]

for Mary Knapp, Ph.D.
Field Supervisor