Notice of Construction Application: New Project or Modification of Existing Permit

INSTRUCTIONS

This application applies statewide for facilities under the Department of Ecology's jurisdiction. Submit this form if you want approval to construct a new project or modify an existing permit. Submit the Application for a PSD Program Applicability Determination form (ECY 070-413) if you want Ecology to determine whether your project is subject to the PSD Program. The state rules exempt specific emission units, activities, and emission rates. You don't need a permit if your project fits in these categories. Refer to WAC 173-400-110(4) and (5) for more information.

Fill out the front and back of this form. Attach a check for the initial fee to this form. Mail the form and your Notice of Construction application to: **Department of Ecology**
Cashiering Unit
P.O. Box 47611
Olympia, WA 98504-7611

For Fiscal Office Use Only:
001-NSR-216-0299-000404

Check the box that applies to your application.

☐	$1,500: Basic project initial fee covers 16 hours of review. Ecology may determine your project is complex during completeness review of your application. If your project is complex, you must pay the additional $8,500 before we will continue working on your application.
☒	$10,000: Complex project initial fee covers 106 hours of review. Submit this fee if you know your project is complex based on emissions. **$20,000 to also include Second Tier toxics review**

Check the box for the location of your proposal. For assistance, call the contact listed below:		
	Ecology Permitting Authority	**Contact**
	Chelan, Douglas, Kittitas, Klickitat, or Okanogan County Ecology Central Regional Office – Air Quality Program	Lynnette Haller (509) 457-7126 lynnette.haller@ecy.wa.gov
☒ ERO	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla or Whitman County Ecology Eastern Regional Office – Air Quality Program	Greg Flibbert **(509) 329-3452** greg.flibbert@ecy.wa.gov **4601 N. Monroe Street** **Spokane, WA 98205** **509/329-3452**
☐ NWRO	**San Juan County** Ecology Northwest Regional Office – Air Quality Program	Nick Roach (425) 649-7082 nick.roach@ecy.wa.gov

Notice of Construction Application: New Project or Modification of Existing Permit

☐ **IND**	**For actions taken at Kraft and Sulfite Paper Mills and Aluminum Smelters** Ecology Industrial Section – W2Resources Program Permit manager: ____________________	Garin Schrieve (360) 407-6916 garin.schrieve@ecy.wa.gov
☐ **NWP**	**For actions taken on the US Department of Energy Hanford Reservation** Ecology Nuclear Waste Program	Ron Skinnarland (509) 372-7924 ron.skinnarland@ecy.wa.gov

Read each statement, then check the box next to it to acknowledge what you have read.

☒	The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours exceeds the number of hours included in your initial fee, Ecology will send you a bill for that extra time.
☒	Ecology will bill you $95 per hour for each hour worked beyond the initial hours. You must pay the bill before we will issue your permit.
☒	When you get a permit, you give permission for Ecology staff to enter the premises for inspection.

Applicant Information
The applicant is the business requesting services from Ecology and is responsible for paying the costs Ecology incurs.

Name of business __Vantage Data Centers WA1, LLC____________

Physical location of project (city) _Quincy, WA____________

Name of project __Riker Data Center____________

Project Manager Information
Ecology will send this person all official correspondence.

Name, Title___Mike Duffy, Project Manager ____________

Mailing address __624 NW 54th St, ____________

City, State, Zip___Seattle, WA 98107____________

Phone, Fax, E-mail___(206) 406-9148, mduffy@vantagedatacenters.com____________

Project Billing Contact Information
Ecology will send the Project Manager the bills if there are any.
☐ If the Project Billing Contact is different from the Project Manager, check this box and provide the required information.

Name, Title____________

Mailing address ____________

City, State, Zip____________

Phone, Fax, E-mail____________

Project Consultant Information

Notice of Construction Application: New Project or Modification of Existing Permit

☒ If you hired a consultant to prepare the application (or materials), check this box and provide the required information.

Consultant Name, Title: Jim Wilder, Managing Consultant

Organization ICF International

Mailing address 710 2nd Avenue, Suite 550

City, State, Zip Seattle, WA 98104

Phone, Fax, E-mail jwilder@icfi.com

I . SIGNATURE BLOCK

I certify, based on information and belief formed after reasonable inquiry, the statements and information in this application are true, accurate, and complete.

Printed Name Mike Duffy Title Project Manager

Signature [signature] Date 10/31/11

II. COMPANY INFORMATION

1. Legal Name of Company Vantage Data Centers WA1, LLC	
2. Company Mailing Address (street, city, state, zip) 2625 Walsh Avenue Santa Clara CA 95051	
3. Company Responsible Official & Title Mike Duffy, Project Manager	
4. Company Phone Number (206) 406-9148	5.Company FAX Number mduffy@vantagedatacenters.com

III. FACILITY INFORMATION

1.Facility Name (if different from Legal Company Name above) Pending	
2. Facility Mailing Address (if different from Company Mailing Address above) Pending	
3. Facility Site Legal Description Pending	
4. Facility Contact Person (if different from Company Responsible Official above) Same for now	
5. Facility Phone Number (if different from Company Phone # above) Pending	6. Facility FAX # (if different from Company FAX # above) Pendig

Notice of Construction Application: New Project or Modification of Existing Permit

7. General Proposal for Facility (see section on next page for specific description of proposal). Computer data center, including diesel-powered backup emergency generators.	
8. Proposal Construction Starting Date October, 2011	9.Proposal Construction Completion Date August, 2012

Revised – Final Notice of Construction Support Document for Second Tier Review (Increased Emission Limits)

Vantage Data Center
Quincy, Washington

November 28, 2012

Submitted to:
Vantage Data Center
2625 Walsh Avenue
Santa Clara, CA 95051

Prepared by
ICF International
101 Lucas Valley Road, Suite 260
San Rafael, CA 94903
Contact: Sharon Douglas
+1.415.507.7108

12-056

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List of Acronyms and Abbreviations

ASIL	Acceptable Source Impact Level
BACT	Best Available Control Technology
CO	Carbon monoxide
DEEP	Diesel engine exhaust particulate
DPF	Diesel particulate filter
Ecology	Washington Department of Ecology
EPA	Environmental Protection Agency
kWe	Kilowatt (electrical)
kWm	Kilowatt (mechanical)
LAER	Lowest Achievable Emission Rate
lbs/day	Pounds per day
NAAQS	National Ambient Air Quality Standard
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NOC	Notice of Construction
PAH	Polycyclic aromatic hydrocarbon
$PM_{2.5}$	Fine particulate matter with a diameter less than 2.5 microns
PM_{10}	Particulate matter with a diameter less than 10 microns
RACT	Reasonably Available Control Technology
SO_2	Sulfur dioxide
SQER	Small Quantity Emission Rate
TAP	Toxic air pollutant
TEF	Toxic equivalency factor
VOC	Volatile organic compound
WAC	Washington Administrative Code

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Executive Summary

This Revised – Final Notice of Construction (NOC) support document is presented to the Washington State Department of Ecology (Ecology) on behalf of Vantage Data Centers, in support of the Second Tier air quality application for the proposed installation of backup electrical generators for the Vantage Data Center in Quincy, WA. This revised-final document addresses Vantage's request for increased emission limits for 10% generator load. ICF International (ICF)'s May 2012 submittal (ICF 2012a) presented the analysis that was eventually incorporated into Ecology's public review Draft Preliminary Determination. After Ecology's public review period and public hearing were completed, Vantage Data Centers requested more robust emission limits at 10% generator load. This document presents emission calculations and AERMOD modeling for the new emission limits

The following tables are taken from Ecology's public review Draft Preliminary Determination, and show the requested changes to the per-generator emission limits for diesel engine exhaust particulate (DEEP), nitrogen oxides (NO_x), and nitrogen dioxide (NO_2).

Ecology's Table 5.3: Nitrogen oxide (NOx) Emission Rate Limits

	Operating Scenario	Operating Load	Emission Limit per Engine, lbs/hr
5.3.1	Annual Step Testing	100%	10.3
5.3.2	Corrective Maintenance	100%	10.3
5.3.3	Building 1 Outage, Storm Avoidance	81% 10%	7.58 2.6
5.3.4	Buildings 2 and 3 Outage	90%	8.83
5.3.5	Building ETC Outage	93%	9.3

Ecology's Table 5.4: Nitrogen dioxide (NO2) Emission Rate Limits

	Operating Scenario	Operating Load	Emission Limit per Engine, lbs/hr
5.4.1	Annual Step Testing	100%	0.4
5.4.2	Corrective Maintenance	100%	0.4
5.4.3	Building 1 Outage, Storm Avoidance	81% 10%	0.4 1.5
5.4.4	Buildings 2 and 3 Outage	90% 10%	0.4 1.5
5.4.5	Building ETC Outage	93% 10%	0.4 1.5

Ecology Table 5.6: Diesel Engine Exhaust Particulate (DEEP) Emission Rate Limits

	Operating Scenario	Operating Load	Emission Limit per Engine, lbs/hr
5.6.1	Annual Step Testing	100%	0.48
5.6.2	Corrective Maintenance	100%	0.48
5.6.3	Building 1 Outage, Storm Avoidance	81% 10%	0.374 0.40
5.6.4	Buildings 2 and 3 Outage	90% 10%	0.425 0.40
5.6.5	Building ETC Outage	93% 10%	0.444 0.40

The Vantage data center will be constructed in phases. Phase 1 construction is expected to be completed in late 2012. The start dates for three additional phases are to be determined. This assessment covers the full buildout for all phases combined, which includes seventeen (17) 3000 kilowatt (kWe) generators (consisting of 12 primary generators and 5 reserve generators). All generators will be subject to testing. The reserve generators will idle in the event of a power outage. Vantage proposes facility-wide production limits and per-generator runtime limits for each category of generator runtime.

All generators will be equipped with catalyzed diesel particulate filters (DPFs), and Selective Catalytic Reduction (SCR) systems for control of emissions of NO_x. This equipment represents highest level of emission control technology for the proposed generators.

As directed by Ecology, the “ambient air” compliance boundary used for this project included two groups of receptors: 1) the region at or beyond the facility boundary and 2) the rooftop air intakes on each building where tenants will occupy office space. Consistent with WAC 173-460-080, air dispersion modeling was conducted to determine whether emissions from the proposed Vantage Data Center, in conjunction with known existing and approved sources, are expected to impact air quality compliance relative to National Ambient Air Quality Standards (NAAQS) established by the U.S. Environmental Protection Agency (EPA) and Acceptable Source Impact Level (ASIL) goals established by Ecology. The AERMOD model was used to examine the impacts of emissions of criteria pollutants (including coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and nitrogen dioxide (NO_2), DEEP, and toxic air pollutants (TAPs).

For the application of AERMOD, EPA’s PRIME algorithm was employed for modeling building downwash and the Plume Volume Molar Reaction Model (PVMRM) module was used for NO_2. Background concentrations included contributions of PM_{10}, $PM_{2.5}$, and NO_2 from other nearby data center facilities.

Compliance with the NAAQS and ASILs was evaluated using the maximum-annual emission rates, assuming a combination of routine operation, power outages, initial commissioning testing, and triennial stack emission testing would be done in the same year. Vantage would restrict all non-emergency generator operations to the period 7 am to 7 pm. The AERMOD results indicate compliance with the NAAQS for all criteria pollutant species. The modeling results also indicate compliance with the ASIL for all but one of the toxic pollutants considered in the study. The modeled 70-year annual-average ambient concentration of DEEP at the on-site tenant building rooftops is 0.047 $\mu g/m^3$ and the maximum ground-level DEEP impact at or beyond the project boundary is 0.042 $\mu g/m^3$, with slightly higher values when scaled to represent the worst year. Both of these modeled values are greater than the DEEP ASIL value of 0.0033 $\mu g/m^3$. Based on these modeling results, Ecology requires that a second-tier risk assessment be conducted for DEEP in accordance with WAC 173-460-090. The required second-tier risk assessment has been submitted under separate cover (ICF 2012b). The risk assessment demonstrates that the estimated incremental increase in cancer risks over a 70-year period is less than 10 per million at all Reasonable Maximum Exposure (RME) receptors. The risk assessment also shows the Hazard Quotient for non-carcinogenic impacts is less than 1.0. Based on the modeling and the Risk Assessment, no third tier analysis or petition is required, pursuant to WAC 173-460-090(7).

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1 Introduction

This Notice of Construction (NOC) Support Document for Second Tier Review is presented to the Washington State Department of Ecology (Ecology) on behalf of Vantage Data Centers, in support of the air quality permit application for the proposed installation of backup electrical generators for the Vantage Data Center in Quincy, Washington.

Administrative NOC forms have been submitted under separate cover. Detailed calculations and vendor-supplied specifications are provided in the following appendices:

- Appendix A—Cold-Start Adjustment Factors
- Appendix B—Emission Calculations and AERMOD Dispersion Factors
- Appendix C—AERMOD Stack Parameters
- Appendix D—Generator Specifications and Emission Controls
- Appendix E—Stack Test Data and Vendor-Supplied Emission Data

Every generator installed at the Vantage Data Center will be equipped with a catalyzed diesel particulate filter, and a selective catalytic reduction catalyst for nitrogen oxides ($NO_{x)}$ control.

The data center will be constructed in phases. Phase 1 construction is expected to be completed in late 2012. The start dates for three additional phases are to be determined. This assessment covers the full buildout for all phases combined, which includes 17 3000 kilowatt (kWe) generators (consisting of 12 primary generators and 5 reserve generators).

Air dispersion modeling was conducted to determine whether emissions from the proposed data center are expected to have a significant impact on air quality compliance relative to National Ambient Air Quality Standards (NAAQS) established by the U.S. Environmental Protection Agency (EPA) and Acceptable Source Impact Level (ASIL) goals established by Ecology. The AERMOD model was used to examine the impacts of emissions of criteria pollutants (including coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and nitrogen dioxide (NO_2), diesel engine exhaust particulate (DEEP), and toxic air pollutants (TAPs). The modeling presents a cumulative analysis of known existing and approved sources in the vicinity of the proposed data center

Key air quality criteria considered as part of this assessment include the NAAQS for:

- 24-hour PM_{10}
  - Based on the annual 2nd highest 24-hour PM10 concentration
  - NAAQS limit (including background) is 150 micrograms per cubic meter (µg/m3)
- 24-hour $PM_{2.5}$
  - Based on the 3-year average of the 98th percentile 24-hour PM2.5 concentration for each year
  - NAAQS limit (including background) is 35 $\mu g/m^3$

- 1-hour NO_2
  - Based on the 3-year average of the 98th percentile daily maximum 1-hour NO2 concentration for each year
  - NAAQS limit (including background) is 188 µg/m3

In addition, Acceptable Source Impact Levels (ASILs), as designated by Ecology, were considered for the following:

- Annual average DEEP
  - Annual average concentration
  - ASIL is 0.00333 µg/m3
- 1-hr NO_2
  - Maximum 1-hr concentration
  - ASIL is 470 µg/m3
- Other TAPs with emission rates that exceed the Small Quantity Emission Rate (SQER) thresholds

The overall assessment examined air quality concentrations and estimated cancer risks for reasonable maximum exposure (RME) receptors within the surrounding region including the businesses (rooftops) within the project boundary, and homes, schools, churches, and businesses beyond the proposed project boundary.

This document includes a description of the emissions used for the air quality modeling and a discussion of the dispersion modeling exercises and results.

A description of the data center is provided in Section 2. This includes the location and address of the property, a description of the land use and zoning around the project site, and a site map showing the facility configuration, property boundary, and buildings such as homes, schools, and businesses beyond the project boundary.

The emission calculations for the backup generators are presented in Section 3. This is followed, in Section 4, by a demonstration that the emission controls on the generators satisfy best available control technology (BACT) for particulate matter, NO_x, carbon monoxide (CO), and volatile organic compounds (VOCs).

The methods and results of the AERMOD air quality dispersion modeling are presented in Section 5. The modeling results indicate that the maximum annual-average ambient concentration of DEEP at the project boundary would be greater than the DEEP ASIL value of 0.0033 µg/m^3. The required second-tier risk assessment is presented under separate cover (ICF 2012b).

2 Project Description

The proposed data center will be located in Quincy, Washington. An overview of the data center, a description of the location and layout of the project site, and a discussion of the demographics and land use of the surrounding area are provided in this section.

2.1 Data Center Overview

A detailed site map is presented in Figure 2-1. This site layout represents the full build of the data center and consists of four main data center buildings, three smaller structures to house the generators, and a future substation.

The data center will be constructed in phases. Phase 1 construction is expected to be completed in late 2012. Phase 1 includes five primary and two reserve generators. The construction dates for the additional phased development are to be determined. The full buildout for the data center includes 17 generators.

The proposed generators for the facility are MTU emergency diesel generators, rated at 3,000 kWe. The forecast load and emissions for each type of operating mode are summarized in Section 3. The proposed generators will use EPA Tier 4 certified equipment. Each generator will be equipped with MTU's AirClarity emission control system that includes a catalyzed diesel particulate filter (DPF) for particulate matter control and destruction of CO and unburned hydrocarbons, and a Selective Catalytic Reduction (SCR) catalyst with urea injection for control of NO_x. This combination of controls represents the highest level of available control equipment, and thereby satisfies BACT as summarized in Section 4.

2.2 Location, Demographics, and Land Use

2.2.1 Facility Address

The proposed facility is located at the intersection of Road O NW and 11 Road NW. The site is accessed by 11 Road NW to the south of the site.

2.2.2 Land Use and Zoning

Figure 2-2 shows land use as well as the locations of other data center facilities near the data center site. The project site is flat ground and zoned for industrial use. It is surrounded by agricultural land, industrial zoned land, three existing data centers (Yahoo, Sabey, and Intuit), and two existing farm houses (one at the southwest corner of the Vantage Data Center, and one at the southeast corner). Detailed zoning information for the Quincy area is displayed in Figure 2-3. The data center will be located within Quincy's urban growth boundary. The agricultural fields to the east, south, and west of the proposed facility are zoned for industrial development and are also within the urban growth boundary. The closest school (Quincy High School) is roughly 1.4 miles southwest of the Vantage Data Center.

Figure 2-1. Site Layout for the Vantage Data Center

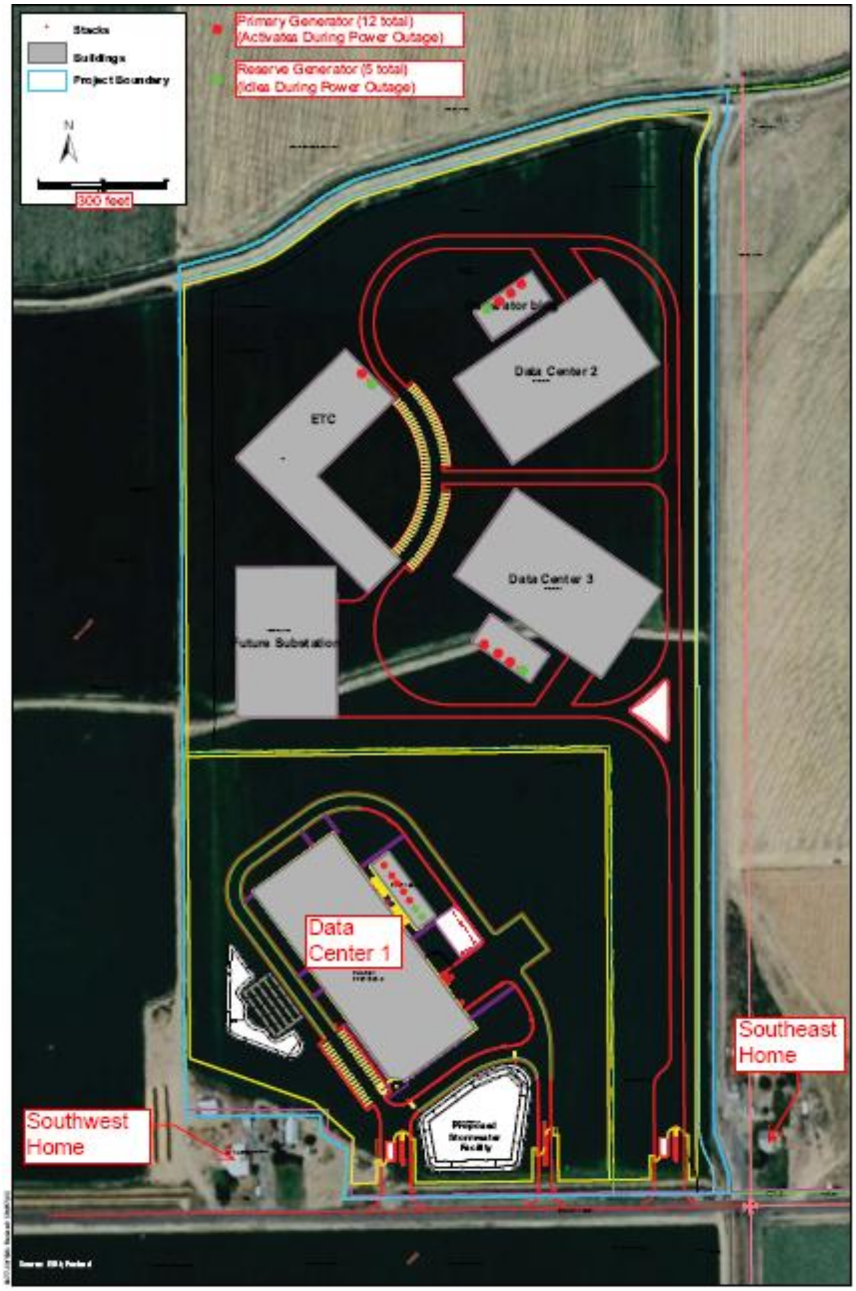


Figure 2-2. Land Use and Location of Other Data Centers in the Vicinity of the Vantage Data Center

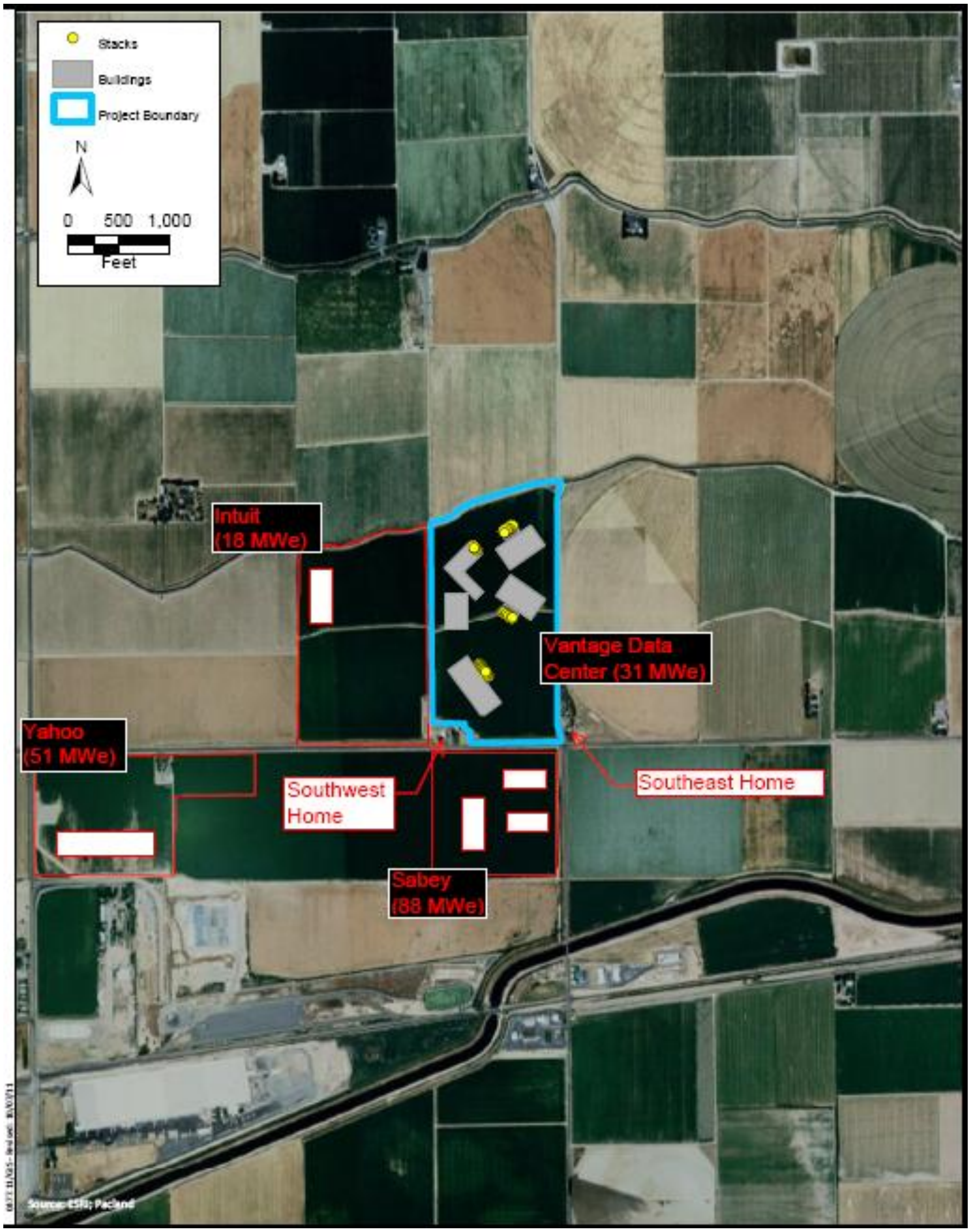
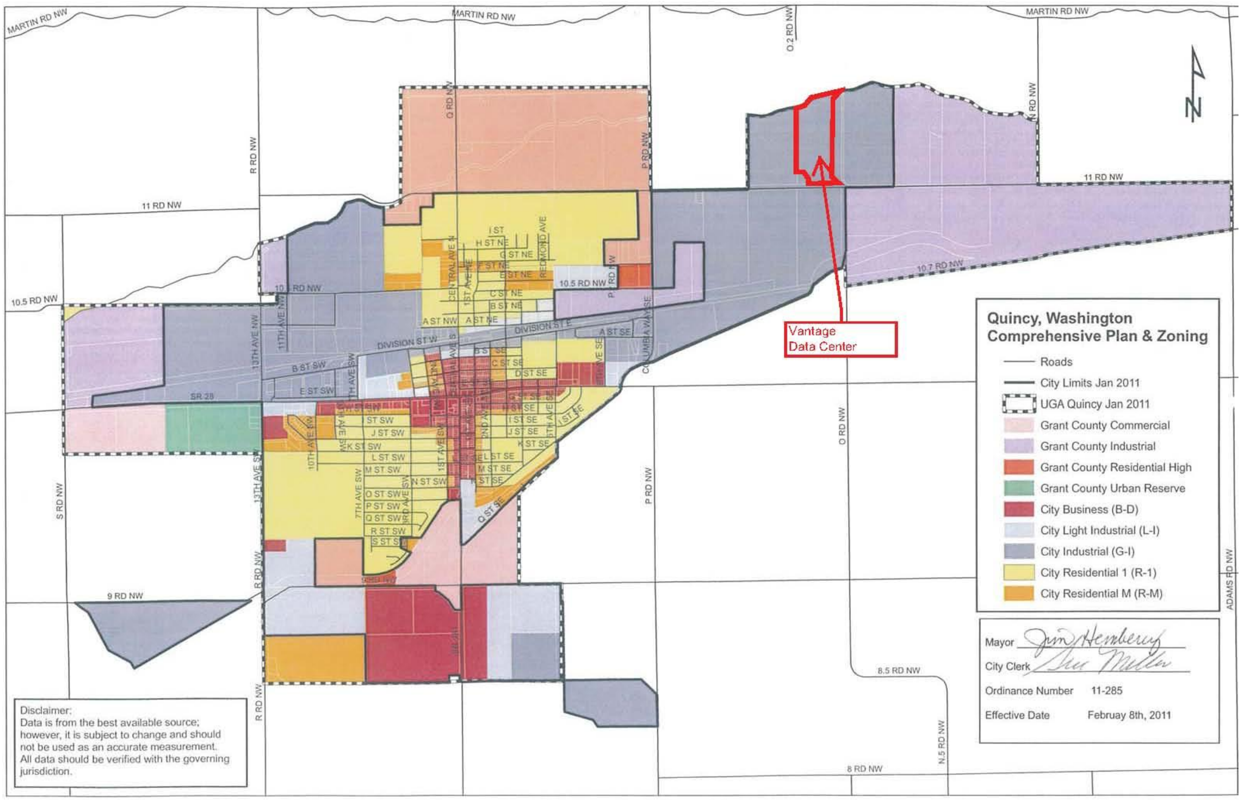


Figure 2-3. Detailed Zoning Information for the Quincy Area



3 Emissions

The Vantage Data Center backup generator usage and emissions are presented in this section.

3.1 Backup Generator Usage

The layout of the proposed Vantage Data Center generators was presented in Figure 2-1. As noted earlier, the facility will be constructed in phases and at full build-out will contain 17 MTU 3,000 kWe generators.

- Building 1 (Phase 1) will include five primary and two reserve MTU 3,000 kWe generators. In the event of a power outage, all will power on, but the two reserve generators will power off once it is determined that all other generators are sufficient to carry the load. However for the air quality permit application, the reserve generator is assumed to run at the lower load for the duration of the outage.
- Buildings 2 and 3 will both include four MTU 3,000 kWe generators each. As with the Building 1 generators, in the event of a power outage, all will power on, but one reserve generator from each phase will cycle off once it is deemed that the remaining three generators (for each building) are running properly and carrying the load. However for the air quality permit application, the reserve generator is assumed to run at the lower load for the duration of the outage.
- The Enterprise Technology Center (ETC) building will include one primary and one reserve MTU 3,000 kWe generator. As for the other buildings, in the event of a power outage, the two ETC generators will power on.
- There will be no wet mechanical-draft cooling towers used for the project.
- Each generator will have its own exhaust stack extending approximately 12 feet above the roof of each generator building, with a resulting stack height of 41 feet above ground.
- Vantage will not install any other diesel engines larger than 500 horsepower for use as fire pumps or for building safety generators.

3.1.1 Commissioning and initial Startup Testing

Each generator will be tested on-site after it is installed but before it is accepted to provide backup emergency power to the data center. Startup and commissioning testing generally consists of a series of intermittent tests conducted over a week or more. These tests are expected to require up to 40 hours of runtime per generator. The forecast emissions and fuel usage required for initial startup and commissioning testing are described in Chapter 3 of this report.

Detailed calculations for the forecast emission rates from commissioning testing are provided in Table B-2 of Appendix B. The emissions generated by commissioning testing have been added to the maximum annual emission rates used for annual NAAQS compliance, annual ASIL compliance, and 70-year average DEEP cancer risk calculations.

3.1.2 Compliance Emission Testing

Vantage understands that Ecology will likely require compliance emission testing within 12 months after the generators are commissioned, and periodic compliance testing might be required every five years. Depending on the pollutants that must be tested, compliance testing is expected to require a total of 10-24 hours of runtime for each generator.

Vantage requests that the runtime required for Ecology-required compliance emission testing should not be counted against the facility's allowable runtime limits for routine operations.

Detailed calculations for the forecast emission rates from triennial emission testing are provided in Table B-2 of Appendix B. The emissions generated by emission testing have been added to the maximum annual emission rates used for NAAQS compliance, ASIL compliance, and 70-year average DEEP cancer risk calculations.

3.1.3 Diagnostic Testing and Maintenance

Table 3-1 lists the requested potential-to-emit generator runtime for the 17 backup generators. All will be subjected to five types of scheduled diagnostic testing. The operating parameters for the testing of the generators will be as follows:

- Twenty hours per year per generator of weekly testing. Weekly testing will be done on one pod of three generators at a time. Each generator will be subjected to weekly testing which will consist of running each pod of three engines at idle load (modeled at 10% load) for up to 30 minutes. To provide a conservatively high emission estimate the emissions during idle load testing were calculated by assuming the engine operates at 10% load, which is the lowest load for which MTU was able to provide emission data. Tests will be limited to two pods per hour, with all facility-wide weekly tests being completed in one day.
- Three hours per year per generator of monthly testing. Monthly testing will be done on one pod of three generators in a single building at a time. Each generator will be subjected to monthly testing which will consist of running each pod of three engines, at idle load (10% load), for up to 30 minutes. To provide a conservatively high emission estimate the emissions during idle load testing were calculated by assuming the engine operates at 10% load, which is the lowest load for which MTU was able to provide emission data. Monthly testing displaces the weekly testing for that week.
- Three hours per year of quarterly testing. All generators in one building will be run simultaneously for up to 45 minutes at outage loads, followed by cool down at 10% idle. Each building will be tested on a separate day. Quarterly testing displaces the monthly testing for four months per year.
- Six hours per year per generator of annual load testing. All generators in one single building will be run simultaneously for up to 6 hours at full outage load, followed by cooldown at 10% idle. For the air quality permit, 6 hours duration was assumed. Annual load bank testing displaces monthly testing for one month per year.

- Thirty minutes per year per generator of annual step testing. Each generator will be run sequentially for a 15 minute total duration, stepped from idle up to 100% load. This will be followed by cool down at 10% idle. For the air quality permit, a duration of 30 minutes at 100% load, followed by cool down is assumed. Annual step testing displaces monthly testing for one month per year.

In addition to the planned maintenance testing, two additional maintenance regimes are accounted for in the air quality permit application. These two regimes are:

- Eight hours per year per generator of unscheduled corrective generator maintenance. This maintenance would only be required if a faulty generator is discovered during other scheduled testing. It is assumed that each generator would be tested once each year, individually, in one day. Most likely, the test would only require 4 hours, stepped from idle up to 100% load, but for the air quality permit, eight hours have been included for the duration (at 100% load), followed by cool down.
- Eight hours per year per generator of “de-energized” building transformer testing. This maintenance would require all generators in one single building to be run simultaneously at power outage loads, in one building at a time. For the air quality permit, 8 hours duration is assumed followed by cool down.

These forecast engine runtime regimes are equivalent to a maximum annual runtime of 32.5 hours per year per generator of scheduled testing, 16 hours of maintenance, plus an additional 24 hours per year per generator of unplanned power outages and storm avoidance. In addition, 9.5 hours of cool down time is accounted for.

3.1.4 Storm Avoidance and Unplanned Outages

All generators at the facility will activate simultaneously in the unusual circumstance of a power outage or impending severe weather:

- During an unplanned facility-wide power outage, all 17 generators will activate at the outage loads listed in Table 3-1. Based on Grant County Public Utility District’s excellent performance for the substations serving the industrial area, Vantage estimates there will be no more than 8 hours per year of utility outages per year, averaged over a 3-year rolling period. After each outage event, each generator will then cool down by running for 15 minutes at idle speed. The runtime limit does not apply to the idle-load cooldown period.
- In the event of impending severe weather, Vantage may conduct pre-emptive storm avoidance by temporarily activating all generators at the facility at the outage loads listed in Table 3-1. Vantage will be limited to no more than 5 calendar days per year and 16 runtime hours per year at outage loads for storm avoidance, with both limits averaged over a 3-year rolling period. After each outage event, each generator will then cool down by running for 15 minutes at idle speed. The runtime limit does not apply to the idle-load cooldown period.

3.1.5 Runtime Regimes Used to Model Compliance with Air Quality Standards

The ambient air quality compliance boundary for the Vantage Data Center is defined as all locations beyond the project boundary.

Table 3-1. Generator Runtime Regimes

Phase	Generator Type	# of Gens	Scheduled Testing							
			Weekly				Monthly			
			% Load	Hrs/ test	Tests/ yr	Hrs/ yr	% Load	Hrs/ test	Tests/ yr	Hrs/ yr
1	Primary	5	10	0.5	40	20	10	0.5	6	3
	Reserve	2	10	0.5	40	20	10	0.5	6	3
	Cooldown	7	0	0	0	0	10	0	0	0
2	Primary	3	10	0.5	40	20	10	0.5	6	3
	Reserve	1	10	0.5	40	20	10	0.5	6	3
	Cooldown	4	0	0	0	0	10	0	0	0
3	Primary	3	10	0.5	40	20	10	0.5	6	3
	Reserve	1	10	0.5	40	20	10	0.5	6	3
	Cooldown	4	0	0	0	0	10	0	0	
ETC	Primary	1	10	0.5	40	20	10	0.5	6	3
	Reserve	1	10	0.5	40	20	10	0.5	6	3
	Cooldown	2	0	0	0	0	10	0	0	0
1	Primary	5	81.3	0.75	4	3	81.3	6	1	6
	Reserve	2	10	0.75	4	3	10	6	1	6
	Cooldown	7	10	0.5	4	2	10	0.5	1	0.5
2	Primary	3	90.0	0.75	4	3	90.0	6	1	6
	Reserve	1	10	0.75	4	3	10	6	1	6
	Cooldown	4	10	0.5	4	2	10	0.5	1	0.5
3	Primary	3	90.0	0.75	4	3	90.0	6	1	6
	Reserve	1	10	0.75	4	3	10	6	1	6
	Cooldown	4	10	0.5	4	2	10	0.5	1	0.5
ETC	Primary	1	93.3	0.5	4	3	93.3	6	1	6
	Reserve	1	10	0.5	4	3	10	6	1	6
	Cooldown	2	10	0.5	4	2	10	0.5	1	0.5

Table 3-1. Generator Runtime Regimes (Continued)

Phase	Generator Type	# of Gens	Scheduled Testing (Continued)				
			Annual-Step Testing				Total Scheduled Testing
			% Load	Hrs/test	Tests/yr	Hrs/yr	Hrs/yr
1	Primary	5	100	0.5	1	0.5	32.5
	Reserve	2	100	0.5	1	0.5	32.5
	Cooldown	7	10	0.5	1	0.5	3
2	Primary	3	100	0.5	1	0.5	32.5
	Reserve	1	100	0.5	1	0.5	32.5
	Cooldown	4	10	0.5	1	0.5	3
3	Primary	3	100	0.5	1	0.5	32.5
	Reserve	1	100	0.5	1	0.5	32.5
	Cooldown	4	10	0.5	1	0.5	3
ETC	Primary	1	100	0.5	1	0.5	32.5
	Reserve	1	100	0.5	1	0.5	32.5
	Cooldown	2	10	0.5	1	0.5	3

Table 3-1. Generator Runtime Regimes (Concluded)

Bldg	Generator Type	# of Gens	Unscheduled Maintenance					Power Outage and Storm Avoidance				
			Corrective Generator Maintenance		De-energized Building Transformer Maintenance				Storm Avoid-ance	Outage	Total Discre-tionary	Facility Total
			% Load	H/ yr	% Load	Hrs/ yr	Total Maint. Hrs/ yr	% Load	Hrs/ yr	Hrs/ yr	Hrs/ yr	Hrs/ yr
1	Primary	5	100	8	81.3%	8	16	81.3	16	8	64.5	72.5
	Reserve	2	100	8	10%	8	16	10	16	8	64.5	72.5
	Cooldown	7	10	1	10%	0.5	1.5	10%	4	1	8.5	9.5
2	Primary	3	10	8	90%	8	16	90%	16	8	64.5	72.5
	Reserve	1	100	8	10%	8	16	10%	16	8	64.5	72.5
	Cooldown	4	10	1	10%	0.5	1.5	10%	4	1	8.5	9.5
3	Primary	3	100	8	90%	8	16	90%	16	8	64.5	72.5
	Reserve	1	100	8	10%	8	16	10%	16	8	64.5	72.5
	Cooldown	4	10	1	10%	0.5	1.5	10%	4	1	8.5	9.5
ETC	Primary	1	100	8	93.3%	8	16	93.3%	16	8	64.5	72.5
	Reserve	1	100	8	10%	8	16	10%	16	8	64.5	72.5
	Cooldown	2	10	1	10%	0.5	1.5	10%	4	1	8.5	9.5

3.1.6 "Ambient Air" Compliance Boundary Used to Model Compliance with Air Quality Standards

The ambient air quality compliance boundary for the Vantage Data Center is defined as all locations beyond the project boundary, and at the rooftop air intakes that feed air to office space within the tenant-leased buildings within the Vantage property.

3.2 Backup Generator Emissions

This section describes the estimated emission rates from the generators.

Detailed information on how the generator emission rates were calculated is provided in the following spreadsheets in Appendix B:

- Table B-1 lists the emission rates in lbs/hour for each generator load. This table shows MTUs Not-To-Exceed values that are the proposed emission testing limits, and it shows the cold-start, catalyst-delay emission values that were used for AERMOD modeling.
- Table B-2 shows the maximum-year emission rates and the 70-year average emission rates for initial commissioning testing and triennial stack testing.
- Table B-3 shows how the emission rates were adjusted to account for catalyst delay after a cold start.
- Table B-4 shows how the facility-wide controlled emission rates were calculated.

3.2.1 Emission Factors

Table 3-2 lists the emission factors used for the AERMOD dispersion modeling for this analysis. The methods used to derive the emission factors are described below.

For any given pollutant, the emission factors for a diesel engine depend on the engine load. NO_x emission factors generally increase with higher engine load, while the emission factors for products of incomplete combustion (particulate matter, CO, hydrocarbons, and organic toxic air pollutants) generally decrease with higher engine load

MTU provides guaranteed "not to exceed" emission factors for NO_x, $PM_{2.5}$, VOC, and CO. Emission rates for all criteria pollutants and each engine load are based on the vendor guaranteed emission limits. The vendor-guaranteed emission rates for particulate matter include both the front-half and back-half values based on Method 5 and Method 202 sampling methods. In using the MTU data, we assumed that all of the particulate matter emissions guaranteed by MTU constitute diesel particulate matter or DEEP. For the toxic air pollutants other than DEEP, we used EPA AP-42 emission factors from AP-42 Sections 3.3 and 3.4.

Ammonia would be emitted from each generator as "ammonia slip" from the urea-based SCR used for NOx control, as a result of a small fraction of the injected urea failing to react with the nitrogen compounds in the gas stream and being emitted as ammonia gas. Vantage would maintain ammonia concentrations to less than 15 parts per million by volume (ppmv) at an oxygen reference concentration of 15%.

Table 3-2. Assumed Diesel Generator Emission Factors (After Catalyst Delay)

Pollutant	Emission Factor		
	Factor	Units	Source
NOx - 10% load	3.73	lbs/hr	MTU guaranteed w/catalyst delay time
NOx - 81% load	12.5	lbs/hr	MTU guaranteed w/catalyst delay time
NOx - 90% load	14.6	lbs/hr	MTU guaranteed w/catalyst delay time
NOx – 93.3% load	15.4	lbs/hr	MTU guaranteed w/catalyst delay time
NOx – 100% load	17.2	lbs/hr	MTU guaranteed w/catalyst delay time
PM2.5 – 10% load	0.422	lbs/hr	MTU guaranteed w/catalyst delay time
PM2.5 – 81% load	0.396	lbs/hr	MTU guaranteed w/catalyst delay time
PM2.5 – 80% load	0.45	lbs/hr	MTU guaranteed w/catalyst delay time
PM2.5 – 93.3% load	0.47	lbs/hr	MTU guaranteed w/catalyst delay time
PM2.5 – 100% load	0.512	lbs/hr	MTU guaranteed w/catalyst delay time
DEEP	Same as PM2.5		
CO – 10% load	1.41	lbs/hr	MTU guaranteed w/catalyst delay time
CO – 81% load	1.93	lbs/hr	MTU guaranteed w/catalyst delay time
CO – 90% load	2.11	lbs/hr	MTU guaranteed w/catalyst delay time
CO – 93.3% load	2.17	lbs/hr	MTU guaranteed w/catalyst delay time
CO – 100% load	2.39	lbs/hr	MTU guaranteed w/catalyst delay time
VOC – 10%load	0.39	lbs/hr	MTU guaranteed w/catalyst delay time
SO2	Fuel sulfur mass balance		
NO2 - 10% load	1.19	lbs/hr	MTU guaranteed w/catalyst delay time
NO2 - 81% load	0.95	lbs/hr	MTU guaranteed w/catalyst delay time
NO2- 90% load	1.06	lbs/hr	MTU guaranteed w/catalyst delay time
NO2 – 93.3% load	1.10	lbs/hr	MTU guaranteed w/catalyst delay time
NO2 – 100% load	1.72	lbs/hr	MTU guaranteed w/catalyst delay time
Ammonia (slip from SCR control system)	Ammonia slip would be limited to 15 ppmv at 15% oxygen.		
Benzene	7.76E-04	lbs/MMBTU	AP-42 Sec 3.4
Toluene	2.81E-04	lbs/MMBTU	AP-42 Sec 3.4
Xylene	1.93E-04	lbs/MMBTU	AP-42 Sec 3.4
1,3-Butadiene	1.96E-05	lbs/MMBTU	AP-42 Sec 3.3
Formaldehyde	7.89E-05	lbs/MMBTU	AP-42 Sec 3.4
Acetaldehyde	2.52E-05	lbs/MMBTU	AP-42 Sec 3.4
Acrolein	7.88E-06	lbs/MMBTU	AP-42 Sec 3.4
Benzo(a)pyrene	1.29E-07	lbs/MMBTU	AP-42 Sec 3.4
Naphthalene	1.30E-04	lbs/MMBTU	AP-42 Sec 3.4
Propylene	2.79E-03	lbs/MMBTU	AP-42 Sec 3.4
Total PAHs (simple sum, no TEFs)	**3.88E-06**	**lbs/MMBTU**	**AP-42 Sec 3.4**
Total PAHs (Applying TEFs)	**4.98E-07**	**lbs/MMBTU**	**AP-42 Sec 3.4**

Notes: NOX= nitrogen oxide, PM2.5 = particulate matter less than 2.5 microns in size, DEEP=diesel engine exhaust particulate, CO= carbon monoxide, VOC=volatile organic compound (Assumed to – HC (hydrocarbon value), SO2=sulfur dioxide, NO2=nitrogen dioxide, PAH=polycyclic aromatic hydrocarbon, TEF=toxic equivalency factor.

3.2.2 Cold-Start Adjustment Factors and Catalyst Delay Time Adjustments

The MTU NTE vendor guaranteed emission limits are based on steady state generator operation after the unit has stabilized. The NTE vendor-guaranteed emission rates were adjusted upward to account for cold-start conditions, as described below.

Each of the generators will be equipped with jacket heaters to maintain the engine block temperature at 120 °F while the generators are inactive, even during cold weather conditions. Regardless, during the 5-10 second period when the generator starts from a dead stop, its fuel injectors will temporarily feed more fuel to the cylinders than can be combusted efficiently. Therefore, during each brief startup period the generator commonly emits an opaque puff of smoke. The emission rates for products of incomplete combustion (carbon monoxide and unburned hydrocarbons) remain elevated for roughly 10-20 seconds, until the generator’s turbocharger activates and the engine core temperature stabilizes.

For this analysis the magnitude of the temporary emission increases during the initial 20-second period of each startup were estimated using measured data collected on a representative diesel generator by the California Energy Commission in their report *Air Quality Implications of Backup Generators in California, Volume Two: Emission Measurements from Controlled and Uncontrolled Backup Generators* (California Energy Commission 2005). The temporary spike in emissions during a cold start was accounted for by applying a “cold start factor” to the vendor-guaranteed emission rates (which were derived from measurements taken on warmed-up generators). Details on the derivation of the cold start factors are provided in Appendix A. The uncontrolled emission rates for DEEP, CO, and VOC were adjusted upward by a “cold start factor” of 1.058, to simulate the average emissions during a one-hour period after a cold start. That factor is the same used previously for the Dell-Quincy Data Center.

The particulate matter cold-start factor of 1.058 was calculated based on a 1-hour runtime duration, and it was applied to all generator runtime modes with durations ranging from 30 minutes to 8 hours. As shown in Table B-6 in Appendix B, the use of a constant cold-start factor applied to all runtime durations results in a conservatively high estimate of annual-average DEEP emission rates.

There is a cold-start delay time before the catalyzed DPF and SCR catalysts reach activation temperature and perform at vendor-guaranteed removal efficiency. The SCR is designed to operate nominally at 900 °F; however, NO_x conversion can be achieved from 300 to 1,000 degrees. Due to the possibility of forming ammonia salts at lower temperatures, aqueous urea solution will only be injected at 425 °F or higher. Should the temperatures exceed 1000 °F, the system will alarm as temperatures higher than this can result in catalyst degradation and possible destruction of the honeycomb material. Based on test results for the 20v4000 engine, it was assumed for modeling purposes that the urea-NO_x scrubbers and the catalyzed DPF for CO/VOC removal 1) will activate in 10 minutes at mid-to-high generator loads, and 2) will require 20 minutes to activate at 10% engine load.

The DPF will reduce PM at all times but should be regenerated when one of the following conditions is met:

- After back pressure readings have reached the maximum allowable backpressure per manufacturers specifications (27" W.C.)

- After 24 idle cold starts of 30 minutes or less and no regeneration has been performed between the cold starts.
- After operation below the recommended regeneration temperature of 300°C for a consecutive period of 720 minutes.

Regeneration is accomplished by bringing the engine load level required to achieve a minimum 300 °C exhaust gas temperature at the filter inlet and holding for a minimum period of 30-minutes. In testing with the 20v4000 engine, the filters should regenerate at 10% load unless ambient temperatures are extremely low. Should the soot loading reach a high level before cold start maximum is reached, the DPF differential pressure sensor will read a high backpressure and the system will alarm. Should the system reach 24 cold starts without reaching the maximum backpressure, the system will alarm and alert the user for the need to regenerate the DPF elements.

The DPF will activate immediately upon startup, with no cold-start delay time. The resulting cold-start emission rates for particulate matter are listed in Table 3-3.

Table 3-3. Cold-Start Adjusted PM Emission Rates (Controlled by DPF)

Electrical Load	NTE Controlled PM Emission Rate (lbs/hr)	1-Hour Cold Start Factor	Cold-Start Controlled PM Emission Rate (lbs/hr)
10%	0.40	1.058	0.423
81.3%	0.374	1.058	0.396
90%	0.425	1.058	0.450
93.3%	0.444	1.058	0.470
100%	0.484	1.058	0.512

The urea-SCR catalyst and the catalyzed DPF are assumed to require 20 minutes of runtime before they reach activation temperature at low load (10% load), and they are assumed to require 10 minutes of runtime before they reach activation temperature at medium-to-high load (higher than 10% load). As shown in Table 3-4, the controlled NO_X emission rates used for AERMOD modeling are a weighted average of the uncontrolled condition and the catalyst-controlled rates. For NO_2 emissions at all engine loads, this analysis followed the approach outlined by Ecology and assumed that the primary NO_x emissions consist of 10% NO_2 and 90% NO.

Table 3-4. Cold-Start NO_X Emissions Accounting for SCR Delay Time (1-hour Runtime Event)

Load	Uncontrolled NOX, lbs/hr	Minutes SCR Delay Per Hour After Cold Start	NTE Controlled NOX, lbs/hr	Minutes Full SCR Control Per Hour After Cold Start	Overall Controlled 1-Hour NOX Emission Rate, lbs/hr	Overall Cold Start % NOX Removal Efficiency
10%	5.7	20	2.6	40	3.73	35%
81.3%	37.2	10	7.58	50	12.51	66%
90%	43.6	10	8.83	50	14.62	66%
93.3%	46.1	10	9.30	50	15.44	67%
100%	51.5	10	10.30	50	17.17	67%

A similar approach was used to calculate the weighted-average cold-start one-hour emission factors for NO2, CO, and hydrocarbons. That calculation accounted for the catalyzed DPF delay time and cold-start factor for the initial spike in uncontrolled CO and VOC emission rate after a cold start. Emission calculations showing how the cold-start factor and the catalyst delay time factor were applied are shown in Appendix B.

3.2.3 DPF Regeneration

Information on the DPF regeneration cycle is provided in Appendix D. The catalyzed DPF will passively regenerate anytime the exhaust temperature to the inlet of the DPF reaches at least 300 °C, which is expected to occur when the generator load exceeds 10%. The DPF must be regenerated after no more than 24 cold starts. The frequency for the regularly scheduled quarterly testing is adequate to regenerate the DPFs. Therefore, no special regeneration runtime is required.

3.2.4 Facility-Wide Emission Rates

Annual average emission rates for the combined expansion generators are listed in Table 3-5. Detailed information on the emission calculations is provided in Appendix B.

Table 3-5. Backup Generator Emission Rates Including Annual Stack Testing and Initial Commissioning Testing

Pollutant	Annual Emissions (tons/year) from Routine Operations (Excluding Commissioning and Compliance Stack Testing)	Annualized 70-Year Emissions (Tons/year) Used for Cancer Risk Assessment	Maximum Annual Emissions (Tons/Year) Used for Annual NAAQS, Annual ASIL Compliance, and Annual Chronic Non-Cancer Risk Assessment
NO_X	5.93	6.49	7.59
PM (DEEP)	0.289	0.306	0.348
CO	1.22	1.27	1.46
VOC	0.36	0.37	0.40
SO_2	1.78E-02	1.9E-02	2.3E-02
Primary Nitrogen Dioxide (NO_2)	0.667	0.707	0.844
Benzene	1.89-03	1.93E-03	2.09E-03
Toluene	6.85-04	7.01E-04	7.58E-04
Xylene	4.71E-04	4.82E-04	5.21E-04
1,3-Butadiene	4.77E-05	4.88E-05	5.28E-05
Formaldehyde	1.92E-04	1.96E-04	2.12E-04
Acetaldehyde	6.14E-05	6.28E-05	6.79E-05
Acrolein	1.92E-04	1.96E-04	2.12E-04
Benzo(a)Pyrene	2.98E-07	3.20E-07	3.77E-07
Benzo(a)anthracene	1.44R-06	1.54E-06	1.82E-06
Chrysene	3.55E-05	3.81E-05	4.49E-05
Benzo(b)fluoranthene	2.58E-06	2.77E-06	3.26E-06
Benzo(k)fluoranthene	2.53E-07	2.71E-07	3.20E-07
Dibenz(a,h)anthracene	4.02E-07	4.31E-07	5.09E-07
Ideno(1,2,3-cd)pyrene	4.81E-07	5.16E-07	6.09E-07
Naphthalene	3.17E-04	3.40E-04	4.01E-04
Propylene	6.80E-03	7.30E-03	8.60E-03
Total PAHs (simple sum, no TEFs)	**9.01E-06**	**9.67E-06**	**1.14E-05**
Total PAHs (applying TEFs)	**1.16E-06**	**1.24E-06**	**1.47E-06**

Notes: NO_X= nitrogen oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in size, DEEP=diesel engine exhaust particulate, CO= carbon monoxide, VOC=volatile organic compound, SO_2=sulfur dioxide, NO_2=nitrogen dioxide, PAH=polycyclic aromatic hydrocarbon, TEF=toxic equivalency factor.

The values in Table 3-5 incorporate emissions for initial startup and commissioning testing as well as triennial compliance stack testing. Consequently, the Vantage-only impacts described in this report include the routine operational emissions after full buildout, first-year commissioning testing that will be conducted on each generator, and triennial compliance stack testing that will be required for each generator. For purposes of estimating maximum-annual emissions, it was assumed the final five generators would be commissioned early in the year and the full facility would immediately commence routine operation. The commissioning emissions were added to the routine operational emissions plus the maximum annual stack testing emissions.

For purposes of calculating long-term cancer risks, the 70-year average DEEP impacts were calculated by annualizing the initial commissioning emissions from the combined 17 generators over the assumed 70-year exposure period. Similarly, the 70-year average annual average emissions from triennial stack testing were calculating by annualizing each stack test over a 3-year averaging period. The overall 70-year average emissions are the sum of the routine operational emissions, annualized commissioning emissions, and the annualized compliance stack testing emissions. For AERMOD modeling it was assumed all commissioning testing and compliance testing would be restricted to the period 7:00 a.m. to 7:00 p.m., and the 70-year average emissions from those activities were modeled by distributing them evenly across every generator at the facility.

4 Best Available Control Technology Assessment

As requested by Ecology, a detailed top-down BACT assessment was conducted in July 2012. The full report on this assessment is provided in Appendix D. The top-down BACT assessment concluded that BACT should use EPA Tier-2 certified engines, with rigorous generator maintenance as required by the federal New Source Performance Standards (NSPS) Subpart IIII.

For this November 2012 resubmittal, the calculated BACT cost-effectiveness values are unchanged from the previous July 2012 values, because the previous July 2012 BACT assessment used emission rates that were based on the "nominal-uncontrolled" and "nominal-controlled" emission rates, neither of which have been revised for this update.

For the Vantage Data Center project, all generators will be equipped with diesel particulate filters (DPFs), SCR systems for control of emissions of NO_x, and diesel oxidation catalysts for control of emissions of CO and VOC using the AirClarity™ 3000 Emissions Control System for 3000-XC6DT2 engines. The controlled emissions are expected to be lower than uncontrolled emissions by more than 87% for PM, and by more than 90% for NO_x, CO, and VOC. This proposed equipment for the Vantage Data Center is more costly and provides better emission control than is required for BACT for the proposed generators.

1.1. Overview of the AirClarity Control Equipment

The diesel emission control strategy the AirClarity utilizes highly oxidizing precious metal particulate matter filters to control PM, VOC, and CO and a Selective Catalytic Reducer coupled with an airless DEF injection system. The injection system includes reductant tank level monitoring, return and supply flow metering, DPF temperature, SCR temperature (pre and post), DPF backpressure, system backpressure, and SCR outlet NOx sensor. All parameters are logged and will produce alarms should the system operate out of specifications. A relative humidity sensor will also be utilized in the system, as humidity has been known to affect engine-out NO_x by as much as 15% depending on ambient conditions.

The EnviCat® 2055 DPF is a wall-flow ceramic Diesel Particulate Filter coated with a Süd-Chemie proprietary precious metal based coating on a cordierite ceramic substrate. The device is designed to filter and passively reduce >95% diesel particulate matter mass found in diesel engine exhaust. Furthermore, carbon monoxide and hydrocarbon emissions in the exhaust are reduced by means of catalytic oxidation in the catalyzed DPF. This device does not employ zone coating. The catalyzed DPF is also responsible for reducing hydrocarbons by almost 96%, as well as carbon monoxide reductions of greater than 99% (reductions based on engine baseline and emissions testing at 5-mode average). The EnviCat® 20019 SCR is a flow through ceramic substrate coated with a Süd-Chemie proprietary SCR coating. The SCR is designed to reduce engine out NO_x emissions across a broad range of engine operating conditions.

Vendor-guaranteed removal efficiencies are as follows:

- NOx >90%
- CO >90%
- VOC >90%
- PM >87%

Information on how the DPF will be passively regenerated is provided in Appendix D. The passive regeneration will be accomplished during the routinely-scheduled quarterly generator testing. No special generator runtime is required to regenerate the DPFs.

Stack test data are provided in Appendix D, and CARB certification is in progress.

The vendor-estimated purchase price of emission control equipment is estimated to be $400,000 per generator more than Tier 2 equipment. A detailed BACT cost-effectiveness analysis for Vantage's proposed emission control system is provided in Appendix D.

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5 Ambient Air Pollutant Concentrations

The methods and results for the ambient dispersion modeling are discussed in this section.

5.1 AERMOD Dispersion Modeling Methodology

Air quality impacts were estimated using EPA's AERMOD dispersion model. AERMOD is a steady-state Gaussian dispersion model designed to simulate the local-scale dispersion of pollutants from low-level or elevated sources in simple or complex terrain. It is an EPA "preferred" model (40 CFR Part 51, Appendix W, *Guideline on Air Quality Models*). For this application, EPA's PRIME algorithm for building downwash was employed. In addition, in accordance with current Ecology guidelines, the Plume Volume Molar Reaction Model (PVMRM) module was used for NO_2. The following data and assumptions were used in the application of AERMOD:

- Meteorological inputs were generated using the AERMET meteorological processor. Input data for to AERMET included five years of sequential hourly surface meteorological data (2004–2008) from Moses Lake, WA and twice-daily upper air data from Spokane. The upper-air sounding data were used to define mixing heights.
- Digital topographical data (in the form of Digital Elevation Model (DEM) files) for the vicinity were obtained from the Micropath Corporation.
- All 17 generator stacks were modeled with an inside stack diameter of 26 inches.
- The generator stacks at Building 1, Building 2 and building 3 were set at a height of 41 feet above local finished grade. The generator stacks on the ETC building were set at a height of 43.8 feet above local finished grade.
- The planned data center buildings were included to account for building downwash. The building heights are 45 feet (ft) for the office building and 28.8 ft for the generator buildings.
- Dispersion modeling is sensitive to the assumed stack parameters (i.e., flow rate and exhaust temperature). The stack temperature and stack exhaust velocity at each generator stack were set to values corresponding to the engine loads for each type of testing and power outage (see Table 3-2). Stack parameters and other emissions related inputs are provided in Appendix C.
- For purposes of modeling compliance with the NAAQS, it was assumed the entire data center would experience a total 24 hours of power outage or storm avoidance per year (nominally 8 hours of power outage and 16 hours of storm avoidance) and that this would involve 5 calendar days per year of storm avoidance, during which time all backup engines were assumed to operate for their assigned times and at their assigned loads for power outage conditions (see Table 3-2).
- 1-hour NO_2 concentrations were modeled using the PVMRM module, with the following default concentrations: 40 parts per billion (ppb) of ozone, and a NO_2/NO_X ambient ratio of 90%. For purposes of modeling NO_2 impacts, the primary NO_X emissions at each generator load were adjusted to assume a distinct "primary NO_2 ratio" based on the permitted emission limits at each load. For purposes of modeling NO_2 impacts, the NO_2-to-NO_x ratio varied according to load. The percent of

NO_2 by mass was approximately 32% for a 10% load, and 7.6, 7.3 and 7.1%, respectively, for 81, 90 and 93% loads.

- Based on the AERMOD modeling results that assigned individual stack parameters for each stack, facility-wide "dispersion factors" were calculated for purposes of forecasting the ambient impacts for the simple pollutants whose modeled impacts are much lower than regulatory limits. The "dispersion factors" have units of $\mu g/m^3$ per grams/second of facility-wide emission rate.
- The 1st-highest maximum-annual emission rates used to evaluate compliance with the annual-average NAAQS and ASILs include commissioning testing and triennial stack emission testing during the same year as the full-buildout routine operations and power outages. Emissions from commissioning testing and stack emission testing are equal to 27% of the emissions from full-buildout routine testing plus power outages. For our January 2012 NOC Support Document ICF used AERMOD to model the ambient impacts caused by emissions from routine testing plus power outages. For this revised analysis, the worst-year annual-average impacts were estimated by manually scaling the previous annual-average AERMOD results by a factor of 1.27.
- The 70-year average emission rates for commissioning tests and compliance stack testing were restricted to the period 7 am to 7 pm, and were evenly distributed across every generator at the facility.

Two receptor types were used for AERMOD modeling:

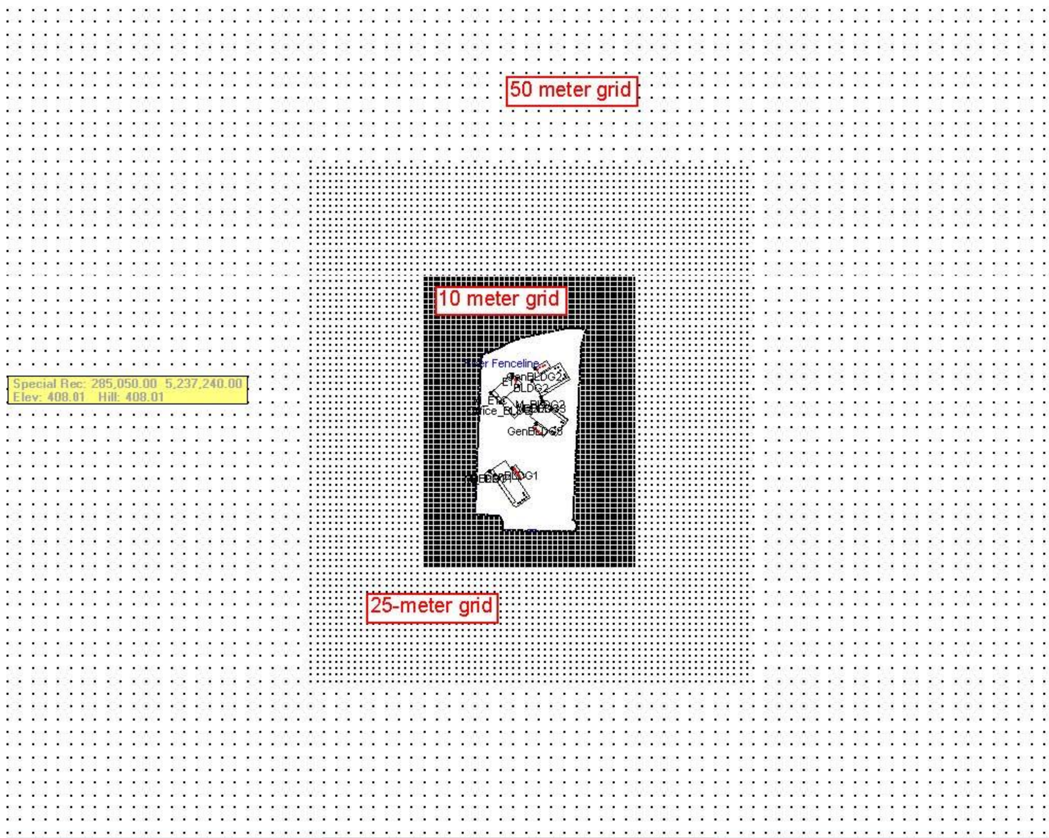
- Ecology ruled the tenants inside the data center buildings within the Vantage property must be considered "ambient air." Therefore, discrete receptors were placed on the rooftops of all occupied buildings, at the locations where rooftop air intakes will feed air to office space inside the buildings.
- A Cartesian grid of receptors, to represent public areas at and beyond the facility boundary.

A Cartesian, rectangular receptor grid (the primary receptor grid) was used to model the property line and beyond for all AERMOD applications. In addition to the fenceline receptors (10-meter spacing), the receptor grid was established using a 10-meter grid spacing extending to a distance of 350 meters from the generators to north, south, east and west; a 25-meter grid spacing extending to a distance of 800 meters from the generators to north, south, east; and a 50-meter grid spacing extending to a distance of 2000 meters from the generators to north, south, east and west. In addition, 25 rooftop receptors were located near proposed air intakes on the datacenter buildings. The receptor categories and number of receptors for each category are as follows:

Fenceline receptors in 10-meter (m) spacing	237
Receptors in 10-m spacing out to 350 m from the sources	6,765
Receptors in 25-m spacing out to 800 m from the sources	4,176
Receptors in 50-m spacing out to 2000 m from the sources	5,952
Rooftop receptors	25
Total number of the receptors	17,155

The primary receptor grid is illustrated in Figure 5-1.

Figure 5-1. Primary AERMOD Receptor Grid for the Vantage Data Center.



As shown in Figure 2-2, the project site is surrounded by unoccupied/agricultural land, other existing data centers, other commercial businesses, and a few homes residential neighborhoods. Several of the surrounding buildings were identified as Reasonable Maximum Exposure (RME) receptors for the categories business and home.

5.2 Assumed Background Concentrations

Background concentrations for all species were provided by Ecology (Bowman 2010). These are:

PM_{10} (24-hour average)	60 µg/m^3
$PM_{2.5}$ (98^{th} percentile 24-hour average)	21 µg/m^3
NO_2 (98^{th} percentile 1-hour value)	29 µg/m^3
DEEP (annual average)	0.103 µg/m^3

These regional values do not include "local background" caused by industrial facilities near the proposed Vantage data center which include the existing Sabey, Yahoo, and Intuit data centers and the Celite manufacturing plant. The local background impacts were modeled separately, as described below.

The regional background ozone concentration, which is used for the PVMRM modeling of NO_2 impacts, was set to 40 ppb and that background value was assumed to occur 365 days per year and 24 hours per day.

In addition, contributions of PM_{10}, $PM_{2.5}$, and NO_2 to the "local background" from other nearby data center and manufacturing facilities (the existing Sabey, Yahoo, and Intuit data centers and the Celite manufacturing plant) were estimated using the AERMOD model and were added to the area-wide background value to assess compliance with the NAAQS. For background PM10 it was assumed each data center was experiencing a power outage, with each generator operating and emitting at its permit limits for particulate matter. For background NO2 it was assumed the CELITE facility emitted at its annual permit limit, and it was assumed the Yahoo and Intuit background data centers were conducting their own annual generator test at the same hour (one generator at a time at each data center, running at 100% load, emitting at its permitted limit), and it was assumed the Sabey background data center was conducting its monthly testing at the same hour (3 generators, each at 10% load). Emissions from the nearby background facilities were set at their permit limits and were modeled using the same meteorological conditions (same date and time) that resulted in the maximum Vantage-only concentrations applicable for comparison with the NAAQS, and were modeled only at the receptor corresponding to the maximum Vantage-only impact point during that day or hour. These local contributions at the Vantage-only maximum impact point are:

PM_{10} (24-hour average)	0.002 µg/m^3
$PM_{2.5}$ (24-hour average)	0.08 µg/m^3
NO_2 (1-hour average)	0.02 µg/m^3

5.3 Criteria Air Pollutant Impacts

A summary of NAAQS compliance for all species is provided in Table 5-1.

Note, the annual impacts listed in Table 5-1 are the maximum-annual values that account for full-buildout operations, initial commissioning testing, and triennial stack testing during the same year of operation. In addition, note that the annual PM values include a factor of 1.27 to account for commissioning testing. The maximum annual ambient PM impacts given in the table were calculated by scaling the routine annual results by the 1.27 scale factor.

Table 5-1. NAAQS Compliance at Facility Boundary and Tenant Rooftops (No Background).

Pollu-tant	Scenario	Modeled Increment (µg/m^3)					Allowable Concentration (µg/m^3)					Fraction of Allowed (%)	Avg Time
		1-hr	3-hr	8-hr	24-hr	Annual	1-hr	3-hr	8-hr	24-hr	Annual		
PM_{10}	Outage (24-hr); All tests + outage (Annual)				30.0 [1]	0.060[2]				150[3]	50[4]	20 %	24-hr
$PM_{2.5}$	Full building maintenance (24-hr); All tests + outage (Annual)				7.1 [5]	0.060[2]				35[6]	15[4]	20 %	24-hr
NO_2	30-minute test for weekly or monthly testing	110[7]					188[8]					59 %	1-hr
CO	Outage (1 & 8-hr)	203[1]		113[1]			4E4[9]		1E4[9]			1.1%	8-hr
SO_2	Outage (1, 3 & 24-hr); All tests + outage (Annual)	3.6[1]	2.9[1]		1.5[1]	2.3E-8[2]	319[10]	1300[9]		365[9]	80[4]	1.1%	1-hr

Notes:

[1] 2nd high.

[2] Annual average.

[3] Not to be exceeded more than once per year on average over 3 years.

[4] Annual average must not exceed this value.

[5] 3-year average of the of the 98th percentile 24-hour average concentrations.

[6] The 3-year average of the 98th percentile 24-hour average concentration must not exceed this value.

[7] 3-year average of the 98th percentile of the daily maximum 1-hour average

[8] The 3-year average of the 98th percentile of the daily maximum 1-hour average is not to exceed this value

[9] Not to be exceeded more than once per year.

[10] The 3-year average of the 99th percentile of the daily maximum 1-hour average must not exceed this standard.

Additional analysis for PM_{10}, $PM_{2.5}$ and NO_2 that includes the background concentrations follows. The results focus on the fenceline concentrations. Concentrations at rooftop receptors were consistently lower than concentrations at the fenceline and so are not discussed further.

5.3.1 PM_{10} Impacts during Full Power Outage

For 24-hour PM_{10}, AERMOD was used to simulate the effects of a full power outage or storm avoidance (the hourly emissions are the same for both), lasting for a full calendar day. This is a worst case scenario that assumes that both of these occur on a single day and is the scenario with the highest emissions for

PM_{10}. The runtimes, loads, and resulting emissions for the outage scenario are presented in Section 3. All days were modeled with these worst-case PM_{10} emissions using a worst-case screening scenario, whereby a facility-wide power outage affecting all 17 generators was assumed to last 365 days per year and 24 hours per day, and the AERMOD model selected the second-highest 24-hour impact at any receptor for each modeling year.

The PM_{10} NAAQS considers the second-highest 24-hour PM_{10} value per year. The second-highest modeled PM_{10} concentration for this scenario was examined and compared to the NAAQS. For the May 2012 application, the allowable emission factors resulted in a maximum daily emission rate of 148 lbs/day for the power outage scenario, and based on that emission rate the AERMOD simulated second-highest highest 24-hour PM_{10} value for any year was 22.2 µg/m^3. That maximum impact occurred at the rooftop air intakes on Building 1, during a period when the generators in Building 1 and throughout the data center were operating during a facility-wide power outage.

For this November 2012 application, the allowable PM emission rates were increased for some generator loads, which slightly increased the facility-wide PM emission rate to 172 lbs/day (a 16% emission increase compared to the previous May 2012 value). To account for that 16% emission increase, AERMOD was rerun. The resulting Vantage-only PM_{10} impact at the rooftop of Building 1 is 28.4 µg/m^3. This value was then scaled by 1.058 to account for the cold-start adjustment factor. The adjusted value is 30.0 µg/m^3. After accounting for regional background and local background from other nearby data centers experiencing a power outage at the same time, the second highest PM_{10} impact at or beyond the project boundary during a full power outage is 88.4 µg/m^3, and is lower than the NAAQS:

Parameter	Concentration (µg/m3)
Second highest 24-hour PM10 increment at tenant rooftop (no background)	30.0
Regional background	60.0
Local background (all data centers experiencing a power outage)	0.002
PM10: Increment plus background	90.0
NAAQS Limit	150

5.3.2 $PM_{2.5}$ Impacts during De-Energized Full Building Maintenance

For 24-hour $PM_{2.5}$, AERMOD was used to simulate the effects of de-energized full building maintenance of the generators. Under this testing scenario, all generators in a single building are activated at outage loads for 8 hours in a single day. This scenario has the highest 24-hour $PM_{2.5}$ emissions of any maintenance or testing scenario, and the second highest $PM_{2.5}$ emissions overall (the full power outage scenario exhibits the highest daily PM emission rate). In accordance with planned maintenance procedures, AERMOD was applied twice—once for Building 1 and once for Buildings 2. Buildings 3 and ETC were not included here, since the generators for the different buildings would not be run at the same hour and Building 1 is the nearest to the fenceline, especially considering the prevailing westerly and southwesterly winds. The runtimes, loads, and resulting emissions for the annual maintenance scenario are presented in Section 3. All days were modeled with these emissions using a worst-case screening approach, whereby all generators are activated for 365 days per year, 12 hours per day, and the AERMOD model selects the first-highest 24-hour impact at any receptor. The maximum simulated value, which occurred as a result of emissions from Building 1, was used in the comparison with the NAAQS.

The $PM_{2.5}$ NAAQS considers the three-year average of the 98^{th} percentile 24-hour $PM_{2.5}$ value per year. Using EPA's standard postprocessing software, this is the eighth-highest modeled value per year. To account for the possibility of higher concentrations at the maximum receptor location during a power outage or storm avoidance procedures (and assuming that these occur on five days per year and cause an ambient impact on 5 days per year) the third-highest $PM_{2.5}$ value corresponding to the annual maintenance scenario should be used. However, since the annual testing only occurs once per year the highest value per year was extracted and a 3-year average was calculated for comparison to the NAAQS. This results in a very conservative estimate.

Using this approach, for the original May 2012 application the AERMOD-derived highest three-year average 98^{th} percentile value at any receptor location was 4.3 µg/m^3, which was a small fraction of the NAAQS. That modeled AERMOD impact corresponded to a facility-wide PM emission rate of 4.91 lbs/day during the annual full-building test. For this November 2012 revision, the PM emission factors at some generator loads were increased, and the resulting facility-wide PM emission rate increased by 34% to a new value of 6.59 pounds per day (lbs/day). Therefore, the ambient $PM_{2.5}$ impact was re-modeled using the increased emission rate. The resulting highest 24-hour Vantage-only $PM_{2.5}$ impact is 6.7 µg/m^3. This value was then scaled by 1.058 to account for the cold-start adjustment factor. The adjusted value is 7.1 µg/m^3. After accounting for regional background and local background assuming the other nearby data centers are doing their own generator testing at the same time as Vantage, the $PM_{2.5}$ impact at or beyond the project boundary during annual maintenance is 28.2 µg/m^3 and is lower than the NAAQS:

Parameter	Concentration (µg/m3)
Three-year average of the highest 24-hour PM2.5 increment at Building 1 rooftop (no background)	7.1
Regional background	21.0
Local background	0.08
PM2.5: Increment plus background	28.2
NAAQS Limit	35

The maximum impact is associated with emissions from Building 1. The highest 24-hour impact of 7.1 µg/m^{-3} was modeled to occur at the rooftop air intakes for Building 1, during the time when the generators at Building 1 are undergoing full-building maintenance. The magnitude of the maximum impact at the facility boundary is slightly lower (3.9 µgm^{-3}). The location of the maximum property line impact is on the southwestern portion of the boundary of the property, less than 100 meters from the southwest corner of the property. The corresponding value for Building 2 is lower (24.0 μgm^{-3}), including regional and local background).

5.3.3 NO_2 Impacts during Testing/Maintenance

For 1-hour NO_2, AERMOD was used to simulate the effects of routine quarterly, monthly, and weekly testing of the generators. The emission scenario for monthly and weekly testing assumes three generators in a single building are tested simultaneously (one building at a time) at idle load for up to 30 minutes. The emission scenario for quarterly testing assumes all generators in one single building are operated simultaneously at power outage loads, for up to 30 minutes. All scheduled testing would be restricted to the period between 7 am to 7 pm. The quarterly testing scenarios have the highest 1-hour NO_2 emissions but the weekly/monthly testing scenarios (they have the same emissions) occur more frequently and were also considered. In accordance with planned maintenance procedures, for the original May 2012 application AERMOD was applied three times—once for Building 1, Building 2, and Building 3. The simulated values were higher for Building 3 weekly/monthly testing and were used in the comparison with the NAAQS. The ETC building was not included here, since the generators for the different buildings would not be run at the same hour and Building 3 is the nearest to the fenceline, especially considering the prevailing westerly and southwesterly winds. The run times, loads, and resulting NO_x emissions for the quarterly, monthly, and weekly testing scenarios are presented in Section 3. For modeling purposes, the emission rate for 30 minute testing was increased to account for catalyst delay time. All days were modeled using worst-case screening assumptions. For each testing scenario it was assumed the testing is done continuously for 12 hours per day for 365 days per year, and the AERMOD/PVMRM model automatically selected the highest through eighth-highest 1-hour impacts at the maximum receptor.

The $NO_{2.}$ NAAQS considers the 3-year average of the 98th percentile daily maximum 1-hour NO_2 value per year. Using EPA's standard postprocessing software, this is the eighth-highest modeled value per year. However, in any given year there might be numerous planned and unplanned events (e.g., power outages and storm avoidance) that emit more NOx than do quarterly generator testing, and it is possible those events could trigger some of the first through seventh-highest daily ambient impacts. To account for this possibility, it was assumed 5 days of combined power outages and storm avoidance emissions would cause the first through fifth–highest daily NO_2 impacts at the maximum receptor location. Then, the third-highest daily 1-hour NO_2 value caused by quarterly generator testing at Building 2 was extracted and a three year average was calculated for comparison to the 98th-percentile NAAQS.

For this revision, the generator testing at Building 2 and Building 3 were analyzed using the revised emission rates. Using this approach, the AERMOD-derived highest 3-year average of the third-highest value at any receptor location is 110 μg/m^3, during weekly/monthly testing at Building 3 (30-minute test duration). After accounting for regional background and local background assuming the nearby data centers are doing their scheduled testing at the same time as Vantage, the NO_2 impact at or beyond the project boundary during generator testing, is 139 μg/m^3 and is lower than the NAAQS:

Parameter	Concentration (µg/m3)
Bldg 3 weekly/monthly tests (30-minute tests). Three-year average of the 2nd highest daily 1-hour NO2 increment (no background)	110
Regional background	29.0
Local background (all local data centers conducting monthly or annual testing at same time)	0.02
NO2: Increment plus background	139
NAAQS Limit	188

The maximum impact is associated with emissions from Building 3. The location of the impact is on the eastern boundary of the property, and almost due east of Building 3. ICF also evaluated the impacts caused by monthly and weekly testing at Building 2, and the 1-hour NO2 impacts were slightly lower than for Building 3.

5.3.4 First Tier Screening: Toxic Air Pollutant Impacts

Ecology requires facilities to conduct a first-tier screening analysis of toxic air pollutant impacts by modeling the first-highest 1-hour, first -highest 24-hour, and annual impacts at the project boundary, then comparing the modeled values to the ASILs (WAC 173-460-080). The 1-hour and 24-hour impacts were modeled for the worst-case screening scenario of a facility-wide power outage lasting 24 hours per day for 365 days per year for 5 years, with AERMOD automatically selecting the highest 1-hour and 24-hour impacts for each of the 5 modeling years. The annual impacts were modeled based on the maximum requested generator runtimes and loads listed in Table 3-1. Since the model had been run previously to identify the maximally impacted locations, only those receptors were included in the final run. The first-tier screening analysis is summarized in Table 5-2. The impacts for all toxic air pollutants other than DEEP are less than the respective ASILs. The maximum annual DEEP impact occurs at the rooftop air intakes at Building 1 inside the Vantage property line.

Note, the annual impacts listed in Table 5-2 are the maximum-annual values that account for full-buildout operations, initial commissioning testing, and triennial stack testing during the same year of operation.

Table 5-2. ASIL Compliance at Facility Boundary and Tenant Rooftops.

Toxic Air Pollutant	Scenario	Modeled Concentration ($\mu g/m^3$)			ASIL ($\mu g/m^3$)			Fraction of Allowable (%)	Averaging Time
		1-Hr	24-Hr	Annual	1-Hr	24-Hr	Annual		
DEEP (Annual average)	Worst-year, outage	—	—	0.060	—	—	0.00333	1,800 %	Annual
NO_2 (Max 1-hr)	Max day, outage	345	—	—	470			73 %	1-hr
CO	Max day, outage	1169			23000			5.1%	1-hr
Ammonia	Max day, outage	56	23	—	—	70.8	—	32%	24-hour
Benzene	Worst annual	—	—	4.2E-04	—	—	0.0345	1.2%	Annual
Toluene	Max day, outage	—	0.057	—	—	5000	—	0.001	24-hr
Xylene	Max day outage		0.039	—	—	221	—	0.02	24-hr
1,3-Butadiene	Worst year, outage	—	—	1.1E-05	—	—	0.0059	0.2	Annual
Formaldehyde	Worst year, outage	—	—	4.2E-05	—	—	0.167	0.03	Annual
Acetaldehyde	Worst year, outage	--	--	1.4E-5	—	—	0.37	0.004	Annual
Acrolein	Max day, outage	0.0037	0.0016	—	—	0.06	—	3	24-hr
Benzo(a) Pyrene	Worst year, outage	—	—	7.5E-08	—	—	9.1E-04	0.008	Annual
Benzo(a) anthracene	Worst year, outage	—	—	3.6E-07	—	—	9.1E-03	0.004	Annual
Chrysene	Worst year, outage	—	—	9.0E-07	—	—	9.1E-02	0.001	Annual
Benzo(b) fluoranthene	Worst year, outage	—	—	6.5E-07	—	—	9.1E-03	0.007	Annual
Benzo(k) fluoranthene	Worst year, outage	—	—	6.4E-08	—	—	9.1E-03	0.001	Annual
Dibenz(a,h) anthracene	Worst year, outage	—	—	1.0E-07	—	—	9.1E-04	0.011	Annual
Ideno(1,2,3-cd) pyrene	Worst year, outage	—	—	1.2E-07	—	—	9.1E-03	0.001	Annual
Naphthalene	Worst year, outage	—	—	8.0E-05	—	—	2.9E-02	0.272	Annual
Propylene	Max day, outage	—	0.57	--	—	3000	—	0.02	24-hr

5.3.5 Annual-Average DEEP Impacts

The DEEP analysis was conducted by assuming all 17 generators at the facility operate at the requested maximum runtimes and generator loads listed in Table 3-1. For various testing modes, as well as for the outage scenario, modeling at idle load was included to account for cool-down of the generators after operation. Cool-down is assumed to be at 10% idle. The maximum modeled annual-average ambient concentrations of DEEP at the project boundary (and at the on-site tenant rooftops) for the full power outage scenario are as follows:

- Maximum DEEP impact at tenant rooftop air intakes on Building 1: 0.047 $\mu g/m^3$
- Maximum ground-level impact at or beyond facility boundary: 0.042 $\mu g/m^3$, at unoccupied farmland at the eastern data center boundary.
- Maximum impact at off-site structure: 0.018 $\mu g/m^3$, at the existing house southwest of the data center.

For this revised analysis, the worst-year annual-average impacts, accounting for commissioning, were estimated by manually scaling the annual-average AERMOD results by a factor of 1.27, and are as follows:

- Maximum DEEP impact at tenant rooftop air intakes on Building 1: 0.060 $\mu g/m^3$
- Maximum ground-level impact at or beyond facility boundary: 0.053 $\mu g/m^3$, at unoccupied farmland at the eastern data center boundary.
- Maximum impact at off-site structure: 0.023 $\mu g/m^3$, at the existing house southwest of the data center.

The modeled maximum annual impacts at each of the above key receptors exceed the DEEP ASIL value of 0.0033 $\mu g/m^3$. This represents the greatest estimated DEEP impacts anywhere within the modeled receptor area.

Therefore, a second-tier risk assessment for DEEP has been prepared and submitted to Ecology under separate cover (ICF 2012b). The risk assessment demonstrates the estimated incremental increase in cancer risks over a 70-year period is less than 10 per million at all RME receptors, including on-site commercial tenants and off-site dwellings. The risk assessment also demonstrates that the hazard quotient for non-cancer risks is less than 1.0. According to Ecology's regulations, no third-tier analysis is required (WAC 173-460-090(7)).

5.3.6 NO_2 Impacts during Full Power Outage

A worst-case screening analysis was conducted to demonstrate compliance with the ASIL for NO_2. The AERMOD/PVMRM model was set to assume the entire data center experiences a facility-wide power outage (all 17 generators activated at outage loads) for 365 days per year and 24 hours per day, and the model selected the 1st-highest 1-hour NO_2 impact for each of the five modeling years. The maximum Vantage-only, 1-hour modeled ambient concentration of NO_2 at the project boundary for the full power outage scenario is 345 $\mu g/m^3$, which is less than the NO_2 ASIL value of 470 $\mu g/m^3$. This represents the greatest NO_2 impact anywhere within the modeled receptor area. The modeled worst-case impact occurs near the southwest corner of the property at unpopulated agricultural fields. The maximum modeled 1-hr NO2 impact at the rooftop air intakes of the tenant buildings is less than 345 $\mu g/m^{3.}$

Therefore, ASIL compliance for NO_2 is confirmed using the first-tier screening analysis. No second-tier risk assessment for NO_2 is required.

6 References

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Appendix A

Cold-Start Adjustment Factors

Appendix B
Emission Calculations
and AERMOD Dispersion Factors

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Appendix C
AERMOD Stack Parameters

Appendix D
Generator Specifications and Emission Controls

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Appendix E
Stack Test Data
and Vendor-Supplied Emission Data