TECHNICAL SUPPORT DOCUMENT (TSD)
NOTICE OF CONSTRUCTION APPROVAL ORDER NO. 19AQ-E026
VANTAGE DATA CENTERS MANAGEMENT COMPANY, LLC
VANTAGE-QUINCY DATA CENTER
2019

1. BACKGROUND

On July 2, 2018, Vantage Data Centers (VDC) applied to make administrative changes to its data center approval order. VDC proposed in 2018 to reduce the number of approved generators from 17 to 15 and to reduce the size of new engine generators from 3.0 to 2.75 mW. Before VDC started construction on the 15 generator project, the project scope changed to include two additional engines for life-safety (building lights and services) sized at 0.5 mW. The project requiring approval, then, was required to be aggregated for permitting, or (not 15 permitted and then 2 more in a separate permitting action, but) all 12 new engine generators evaluated as one project. Comparing the approved 17 3-mW MTU engines to the new project with 5 original Tier 2 MTU engines, 10 2.75-mW CAT engines, and 2 0.5-mW CAT life safety engines results in a net reduction in capacity of 8mW (17 times 3mW = 51. 5 times 3 plus 10 times 2.75 plus 2 times 0.5 mW= 43 mW). The change requested can also be viewed as just the new equipment compared to the permitted equipment it is replacing (ignoring the 5 Tier 2, 3-mW MTU engines in building 1 that will be part of both projects): 12 3mW Tier 2 MTU engines replaced by 10 2.75mW engines and 2 0.5 mW engines. This is a reduction of from 36 mW to 28.5 mW. The reductions in power output requested are proportional to emissions, so this proposal is an emission reduction not subject to new source review in the State of Washington. Ecology is processing this request as an administrative modification of the data center approval order.

2. PROJECTED EMISSIONS:

Facility Potential-to-Emit Emissions Summary WA-11 and WA-12
Vantage Data Centers – Quincy, Washington

Pollutants	PTE Project (10 CAT @ 2.75 MW, 2 LS @ 0.5 MW)	PTE Currently Permitted, Not Installed (12 MTU @ 3.0 MW)	Difference between Project and Permitted
	Annual (TPY)	Annual (TPY)	Annual (TPY)
Criteria Pollutants			
Nitrogen oxides (NO_x)	12.59	16.51	-3.92
Carbon Monoxide (CO)	2.6	3.1	-0.53
Sulfur dioxide (SO_2)[b]	9.64E-03	1.19E-02	-2.24E-03
$PM_{2.5}$/PM_{10} (FH and BH)[c] (gens only)	0.49	0.7	-0.3
VOCs	0.29	0.53	-0.24
Toxic Air Pollutants (TAPs)			
Primary NO_2 [d]	1.26	1.65	-0.39
DEEP[e]	0.20	0.22	-0.02
CO	2.6	3.1	-0.53
SO2[b]	9.64E-03	1.19E-02	-2.24E-03

Pollutants	PTE Project (10 CAT @ 2.75 MW, 2 LS @ 0.5 MW)	PTE Currently Permitted, Not Installed (12 MTU @ 3.0 MW)	Difference between Project and Permitted
	Annual (TPY)	Annual (TPY)	Annual (TPY)
Carbon-based TAPs			
Acrolein	5.02E-05	6.19E-05	-1.17E-05
Benzene	4.94E-03	6.09E-03	-1.15E-03
Propylene	1.78E-02	2.19E-02	-4.13E-03
Toluene	1.79E-03	2.21E-03	-4.16E-04
Xylenes	1.23E-03	1.52E-03	-2.86E-04
Formaldehyde	5.03E-04	6.20E-04	-1.17E-04
Acetaldehyde	1.61E-04	1.98E-04	-3.73E-05
1,3-Butadiene	2.49E-04	3.07E-04	-5.79E-05
Polycyclic Aromatic Hydrocarbons			
Naphthalene	8.28E-04	1.02E-03	-1.93E-04
Benz(a)anthracene	3.96E-06	4.88E-06	-9.21E-07
Chrysene	9.75E-06	1.20E-05	-2.27E-06
Benzo(b)fluoranthene	7.07E-06	8.72E-06	-1.64E-06
Benzo(k)fluoranthene	1.39E-06	1.71E-06	-3.23E-07
Benzo(a)pyrene	1.64E-06	2.02E-06	-3.81E-07
Indeno(1,2,3-cd)pyrene	2.64E-06	3.25E-06	-6.13E-07
Dibenz(a,h)anthracene	2.20E-06	2.72E-06	-5.13E-07

Notes:

[a]Startup emissions are accounted for in the project emissions.

[b]SO_2 emissions are based on emission factor for sulfur oxides from AP-42 Section 3.4 (EPA 1995) with an assumed fuel sulfur content of 15 ppm.

[c]FH+BH (Front-half and back-half emissions) was calculated using a FH+BH scaling-factor based on actual worst-case stack test results.

[d] NO is assumed to be 10% of the NOx.

[e]Value assumed to be equal the front-half NTE particulate emissions, as reported by the vendors.

Abbreviations and Acronyms:

BH = "Back-half" condensable particulate matter
DEEP = diesel engine exhaust particulate matter
NO_x = nitrogen oxides
TPY = tons per year
VOC = volatile organic compound
WA -11 AKA DC-1
WA -12 AKA DC-2

3. BEST AVAILABLE CONTROL TECHNOLOGY and BEST AVAILABLE CONTROL TECHNOLOGY FOR TOXICS

For both BACT and t-BACT the costs for controls beyond Tier 2 designed engines remain prohibitive. A more thorough evaluation of the cost-effectiveness of Tier 4 level controls was conducted for the earlier approval for VDC (16AQ-E026). Even using the ‘Hanford’ t-BACT cost estimations, the Tier 4 cost per ton of pollutant controlled are much higher than Ecology can justify requiring as t-BACT. This has not changed in the 24 months since that evaluation was conducted.

4. AMBIENT IMPACTS ANALYSIS

This project is an emission reduction from approved project emissions. Ecology already approved the project with emissions and impacts approximately 20% greater than those resulting from the proposed project. The reduced emission rates proposed are expected to result in similar reductions in concentrations (impacts) at the maximally exposed receptor. Ecology previously approved the project with higher impacts, thus also approves this proposal.

5. CONCLUSION

Based on the above analysis, Ecology concludes that operation of the 17 generators at Vantage will not have an adverse impact on local air quality. Ecology finds that Vantage has satisfied all requirements for NOC approval.

All information following is a copy of the technical support document that accompanied Approval Order 16AQ-E026, for reference.

TECHNICAL SUPPORT DOCUMENT (TSD)
NOTICE OF CONSTRUCTION APPROVAL ORDER NO. 16AQ-E026
VANTAGE DATA CENTERS MANAGEMENT COMPANY, LLC
VANTAGE-QUINCY DATA CENTER
2017

1. BACKGROUND

Starting in about 2006, internet technology companies became interested in the City of Quincy in Grant County as a good place to build data centers. Data centers house the servers that provide e-mail, manage instant messages, and run applications for our computers. Grant County has a low-cost, dependable power supply and an area-wide fiber optic system. During 2007 and 2008, the Ecology Air Quality Program (AQP) issued approval orders to Microsoft Corporation, Sabey Intergate Inc., and Intuit Inc. that allowed them to construct and operate data centers.

In 2010, the Washington State Legislature approved a temporary sales tax exemption for data centers building in Grant County and other rural areas. To qualify for the tax exemption, the data center must have at least 20,000 square feet dedicated to servers and must have started construction before July 1, 2011. The AQP has received and approved permit applications from Microsoft Corporation and Sabey Intergate Inc. for expansion of their existing data centers in Quincy. Dell Marketing, LP and Sabey Intergate Quincy, LLC have also submitted applications for new data centers in Quincy that have been approved for construction and operation.

To build or expand, a data center company must first apply to the Washington Department of Ecology (Ecology) for a permit called a “notice of construction approval order” (NOC). Its purpose is to protect air quality. The NOC is needed because data centers use large, diesel-powered backup generators to supply electricity to the servers during power failures. Diesel engine exhaust contains both criteria and toxic air pollutants. As part of the permit review process, Ecology carefully evaluates whether the diesel exhaust from a data center’s backup generators cause health problems or contribute to national ambient air quality standard exceedances.

2. EXECUTIVE SUMMARY

Vantage Data Centers Management Company, LLC submitted a Notice of Construction (NOC) application received by Ecology on August 10, 2016, for the phased installation of the Vantage-Quincy Data Center, to be sited North West of the junction of Road 11 NW and Road O NW, Quincy, in Grant County. A legal description of the parcel is the SE 1/16 of Section 4 and the SW 1/16 of Section 3, Township 20 North, Range 24 East, Willamette Meridian. The Vantage-Quincy Data Center will be leased to independent tenants. The primary air contaminant sources at the facility consist of 17-3000 kilowatt (kWe) electric generators powered by diesel engines. The generators will have a power capacity of up to 51 MWe, and will provide emergency backup power to the facility during infrequent disruption of Grant County PUD electrical power service. The project construction will be phased (up to 4 phases, phase 1 with 7 generators) over several years depending on customer demand.

Review of the August 10, 2016 NOC application began in August and continued through December, when the toxics Tier 2 review was completed. Before the Ecology toxicologists can issue their recommendation, a preliminary determination of approval must be prepared and provided to them. Upon their agreement that BACT and t-BACT and the conditions of approval that confirm emission estimates used for the toxics and NAAQS modeling are in place, their recommendation is added to this TSD and the documents placed out for public comment. It is expected that a public hearing will be held on data center approvals in Quincy. The final draft Preliminary Determination (i.e., Proposed Decision) was forwarded to Ecology HQ for review and to facilitate completion of the second tier review. Public review began on June 8, 2017, and ended on July 17, 2017. A public hearing was held at the Quincy Community Center on July 12, 2017.

3. PROJECT DESCRIPTION

The Ecology Air Quality Program (AQP) received a Notice of Construction (NOC) application for the Vantage-Quincy Data Center on August 10, 2016. The Vantage-Quincy Data Center, hereafter referred to as Vantage, consists of phased construction of 4 data center buildings, 3 smaller structures housing generators, and a future substation. Construction will occur in phases with the first phase to be construction of a center with 5 primary generators and 2 originally described as ‘reserve’. The project was previously approved with Tier 4 emission limits and five of the seven engines of phase 1 were installed with third party (i.e. not built by the engine manufacturer) tail-pipe emission controls. Vantage found that the engines with the ELM controls could not be operated in compliance with the Tier 4 emission limits and has submitted this application to evaluate the 17 engines without the Tier 4 controls. During the original permitting, Ecology agreed that the only control that did not significantly exceed Ecology thresholds for t-BACT cost-effectiveness for these engines was an engine that satisfied Tier 2 emission limits. The cost of controlling emissions with add-on controls exceeded (and still does exceed) any cost-effectiveness criteria we have used even for t-BACT and even using the Hanford approach to estimating cost effectiveness. The cost of control beyond Tier 2 engines is prohibitive for the short run times required for power outages and maintenance and reliability testing at data centers. In addition, Vantage found their system could not meet the Tier 4 emission limits in their permit. Operating hours increased in order to test the exhaust of engines which were not achieving the limits established in the approval conditions. The timing of installation of Phases 2-4 of this data center depends on customer demand and is not yet determined. Phase 1 was operational around the end of 2013 and includes the 5 MTU 3000, three 3.0 Megawatt (MWe) electric generators powered by 4678 brake horse power MTU Model 20V4000 diesel engines. Phase 2, 3, and 4 construction are identified as Data Center 2 (phase 2 - 4 primary engine generators), Data Center 3 (phase 3 - 4 primary engine generators), and a Building described as ‘ETC’ (phase 4 - 2 engine generators). The sequence of expected construction has not been provided to Ecology. The Vantage-Quincy generators will have a total combined capacity of approximately 51 MWe upon final build out of the four Phases. The Vantage-Quincy Data Center will be leased for occupancy by independent tenant companies that require fully supported data storage and processing space although all engine/generators are expected to be owned and operated by Vantage.

Vantage has requested operational limitations on the Vantage-Quincy facility to reduce emissions below major source thresholds and to minimize air contaminant impacts to the community. Vantage has indicated that diesel fuel usage at Vantage-Quincy will be less than 158,355 gallons of ultra-low sulfur diesel fuel. Individual engine operating limits of 45 hours per year for the engines serving Building 1 are also implied in the application materials.

Air contaminant emissions from the Vantage-Quincy Data Center project have been calculated based entirely on operation of the emergency generators. Table 1a contains criteria pollutant potential to emit for all phases of the Vantage-Quincy Data Center project. Table 1b contains toxic air pollutant potential to emit for all phases of the Vantage-Quincy Data Center project.

Table 3a: Criteria Pollutant Maximum Year Potential to Emit for Vantage-Quincy Data Center (excluding commissioning as modeled by applicant)		
Pollutant	**Emission Factor (EF) Reference**	**Facility Emissions 17 Engines Total**
Criteria Pollutant		tons/yr
3.1.1 NOx Total	Landau Calculation	24
3.1.2 CO	Engine Not to Exceed	1.46
3.1.3 SO_2	Mass Balance	0.017
3.1.4 $PM_{2.5}$	Landau Calculation	1.06
3.1.5 VOC	Engine Not to Exceed	0.73
3.1.6 Primary NO_2	Engine Not to Exceed	2.4

Table 3b: Toxic Air Pollutant Maximum Year Potential to Emit for Vantage-Quincy Data Center		
Pollutant	**AP-42 Section 3.4 EF**	**Facility Emissions 17 Engines Total**
Organic Toxic Air Pollutants	Lbs/MMbtu	tons/yr
3.1.7 Propylene	2.79E-03	3.1E-02
3.1.8 Acrolein	7.88E-06	8.7E-05
3.1.9 Benzene	7.76E-04	8.6E-03
3.1.10 Toluene	2.81E-04	3.1E-03
3.1.11 Xylenes	1.93E-04	2.1E-03
3.1.12 Napthalene	1.30E-04	1.4E-04
3.1.13 1,3 Butadiene	3.91E-05	4.4E-04
3.1.14 Formaldehyde	7.89E-05	8.7E-04
3.1.15 Acetaldehyde	2.52E-05	2.8E-04
Poly Aromatic Hydrocarbons (PAH)		
3.1.16 Benzo(a)Pyrene	2.57E-07	2.9E-06
3.1.17 Benzo(a)anthracene	6.22E-07	6.9E-06

Table 3b: Toxic Air Pollutant Maximum Year Potential to Emit for Vantage-Quincy Data Center		
3.1.18 Chrysene	1.53E-06	1.7E-05
3.1.19 Benzo(b)fluoranthene	1.11E-06	1.2E-05
3.1.20 Benzo(k)fluoranthene	2.18E-07	2.4E-06
3.1.21 Dibenz(a,h)anthracene	3.46E-07	3.9E-06
3.1.22 Ideno(1,2,3-cd)pyrene	4.14E-07	4.6E-06
3.1.23 PAH (no TEF)	3.88E-06	4.3E-05
3.1.24 PAH (apply TEF)	4.98E-07	5.5E-06
State Criteria Pollutant Air Toxics		
3.1.25 DEEP/$PM_{2.5}$	Landau Calculation	0.229
3.1.26 Carbon monoxide	Landau Calculation	3.4
3.1.27 Sulfur dioxide	Mass Balance	0.02
3.1.28 Primary NO_2*	10% total NOx	2.4

*Assumed to be equal to 10% of the total NOx emitted.

The Vantage Center will rely on cooling systems to dissipate heat from electronic equipment at the facility. Cooling systems will be limited by conditions of approval to those emitting no air contaminants (indirect evaporative).

4. APPLICABLE REQUIREMENTS

The proposal by Vantage Data Center qualifies as a new source of air contaminants as defined in Washington Administrative Code (WAC) 173-400-110 and WAC 173-460-040, and requires Ecology approval. The installation and operation of the Vantage-Quincy Data Center is regulated by the requirements specified in:

4.1 Chapter 70.94 Revised Code of Washington (RCW), Washington Clean Air Act,
4.2 Chapter 173-400 Washington Administrative Code (WAC), General Regulations for Air Pollution Sources,
4.3 Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants, and
4.4 Title 40 CFR Part 60 Subpart IIII

All state and federal laws, statutes, and regulations cited in this approval shall be the versions that are current on the date the final approval order is signed and issued.

5. BEST AVAILABLE CONTROL TECHNOLOGY

Best Available Control Technology (BACT) is defined[1] as "*an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under chapter 70.94 RCW emitted from or which results from any new or modified stationary source, which the*

[1] RCW 70.94.030(7) and WAC 173-400-030(12)

permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of the "best available control technology" result in emissions of any pollutants which will exceed the emissions allowed by any applicable standard under 40 CFR Part 60 and Part 61…."

For the first approval, Vantage proposed installation of engines with diesel particulate filters (DEEP Control) treated to also serve as oxidation catalysts (VOC and CO control) and selective catalytic reduction (NOx Control). With these proposed controls, Vantage avoided the formal process of a "top-down" approach for determining BACT for the proposed diesel engines. After having found the filter and catalytic controls could not be made to work as advertised, Vantage is requesting that Ecology review the project again with the 17 engines with just Tier 2 controls.

The proposed diesel engines will emit the following regulated pollutants which are subject to BACT review: nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM, PM_{10} and $PM_{2.5}$) and sulfur dioxide.

5.1 BACT ANALYSIS FOR NOx

5.1.1 ***Selective Catalytic Reduction.*** The SCR system functions by injecting a liquid reducing agent, such as urea, through a catalyst into the exhaust stream of the diesel engine. The urea reacts with the exhaust stream converting nitrogen oxides into nitrogen and water. The use of ultra-low sulfur (10-15 ppmw S) fuel is required to achieve good NOx destruction efficiencies. SCR can reduce NOx emissions by up to 90-95 percent.

For SCR systems to function effectively, exhaust temperatures must be high enough (about 200 to 500^{o}C) to enable catalyst activation. For this reason, SCR control efficiencies are expected to be relatively low during the first 20 to 30 minutes after engine start up, especially during maintenance, and testing loads. There are also complications of managing and controlling the excess ammonia (ammonia slip) from SCR use.

This application suggests a cost per ton of $370,000 for SCR, which is considerably higher than the $12,000 cost per ton that would allow Ecology to require it as BACT.

5.2 <u>BACT determination for NOx</u>

Ecology determines that BACT for NOx is:

a. Use of EPA Tier 2 certified engines, if the engines are installed and operated as emergency engines, as defined at 40 CFR§60.4219; and
b. Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII.

5.3 BACT ANALYSIS FOR PARTICULATE MATTER, CARBON MONOXIDE AND VOLATILE ORGANIC COMPOUNDS

5.3.1 ***Diesel particulate filters (DPFs)***. These add-on devices include passive and active DPFs, depending on the method used to clean the filters (i.e., regeneration). Passive filters rely on a catalyst while active filters typically use continuous heating with a fuel burner to clean the filters. The use of DPFs to control diesel engine exhaust particulate emissions has been demonstrated in multiple engine installations worldwide. Particulate matter reductions of up to 85% or more have been reported. Therefore, this technology was identified as the top case control option for diesel engine exhaust particulate emissions from the proposed engines.

Vantage initially proposed installation and operation of DPFs on each of the proposed diesel engines as BACT. The July 16, 2012 supplemental analysis of BACT retracted this proposal, and instead proposed that Tier 2 engines should be considered BACT for these engines. Ecology accepts this option as BACT for these engines.

5.3.2 ***Diesel oxidation catalysts***. This method utilizes metal catalysts to oxidize carbon monoxide, particulate matter, and hydrocarbons in the diesel exhaust. Diesel oxidation catalysts (DOCs) are commercially available and reliable for controlling particulate matter, carbon monoxide and hydrocarbon emissions from diesel engines. While the primary pollutant controlled by DOCs is carbon monoxide (approximately 90% reduction), DOCs have also been demonstrated to reduce up to 30% of diesel engine exhaust particulate emissions, and more than 50% of hydrocarbon emissions.

5.4 <u>BACT Determination for Particulate Matter, Carbon Monoxide and Volatile Organic Compounds</u>

Ecology determines BACT for particulate matter, carbon monoxide and volatile organic compounds is:

a. Use of EPA Tier 2 certified engines if the engines are installed and operated as emergency engines, as defined at 40 CFR§60.4219; and
b. Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII.

5.5 BACT ANALYSIS FOR SULFUR DIOXIDE

5.5.1 Vantage/Landau did not find any add-on control options commercially available and feasible for controlling sulfur dioxide emissions from diesel engines. Vantage Quincy's proposed BACT for sulfur dioxide is the use of ultra-low sulfur diesel fuel (maximum of 15 ppm by weight of sulfur). Using this control measure, sulfur dioxide emissions would be limited to 0.020 tons per year.

5.6 <u>BACT Determination for Sulfur Dioxide</u>

Ecology determines that BACT for sulfur dioxide is the use of ultra-low sulfur diesel fuel containing no more than 15 parts per million by weight of sulfur.

5.7 BEST AVAILABLE CONTROL TECHNOLOGY FOR TOXICS

Best Available Control Technology for Toxics (tBACT) means BACT, as applied to toxic air pollutants.[2] The procedure for determining tBACT follows the same procedure used above for determining BACT. Under state rules, tBACT is required for all toxic air pollutants for which the increase in emissions will exceed de minimis emission values as found in WAC 173-460-150.

For the proposed project, tBACT must be determined for each of the toxic air pollutants listed in Table 2 below. As indicated in Table 2, Ecology has determined that compliance with BACT, as determined above, satisfies the tBACT requirement.

Table 2. tBACT Determination

Toxic Air Pollutant	tBACT
Acetaldehyde	Compliance with the VOC BACT requirement
Acrolein	Compliance with the VOC BACT requirement
Benzene	Compliance with the VOC BACT requirement
Benzo(a)pyrene	Compliance with the VOC and PM BACT requirement
1,3-Butadiene	Compliance with the VOC BACT requirement
Carbon monoxide	Compliance with the CO BACT requirement
Diesel engine exhaust particulate	Compliance with the PM BACT requirement
Formaldehyde	Compliance with the VOC BACT requirement
Nitrogen dioxide	Compliance with the NOx BACT requirement
Sulfur dioxide	Compliance with the SO_2 BACT requirement
Toluene	Compliance with the VOC BACT requirement
Total PAHs	Compliance with the VOC an PM BACT requirement
Xylenes	Compliance with the VOC BACT requirement

6. AMBIENT IMPACTS ANALYSIS

Vantage obtained the services of Landau Consultants to conduct air dispersion modeling for Vantage Data Center's generators to demonstrate compliance with ambient air quality standards and acceptable source impact levels. Each generator was modeled as a point source. Landau used EPA's AERMOD dispersion model to determine ambient air quality impacts caused by emissions from the proposed generators at the property line and beyond, and at the rooftops of

[2] WAC 173-460-020

the proposed data center buildings to be occupied by tenants. The ambient impacts analysis indicates that no National Ambient Air Quality Standards (NAAQS) are likely to be exceeded.

6.1 AERMOD Dispersion Modeling Methodology

AERMOD is an EPA "preferred" model (40 CFR Part 51, Appendix W, Guideline on Air Quality Models) for simulating local-scale dispersion of pollutants from low-level or elevated sources in simple or complex terrain.

The following data and assumptions were used in the application of AERMOD:

- Input data for the AERMET meteorological processor included five years of sequential hourly surface meteorological data (2004–2008) from Moses Lake, WA and twice-daily upper air data from Spokane.

- Digital topographical data for the vicinity were obtained from the Micropath Corporation.

- The five existing generator stacks were set at a height of 43 feet above local finished grade. The remaining Building 1 generator stacks (two) and the ten additional engines generator stacks (Buildings 2, 3, and ETC) were set at a height of 48 feet above local finished grade.

- The planned data center buildings were included to account for building downwash. EPA's PRIME algorithm was used for simulating building downwash.

- For this application, Ecology required that emissions be estimated using worst-case conditions for each pollutant, so that the engine load during any hour need not be known and so that compliance could be determined from the hours operated. An exception was made for DEEP which has highest emissions at loads lower than Vantage will run (below 30%). For purposes of modeling compliance with the NAAQS and to conservatively model for the ASILs, it was assumed the entire three-year amount of worst case emissions occurred in a single year.

- One-hour NO2 concentrations were modeled using the Plume Volume Molar Reaction Model (PVMRM) module, with the following default concentrations: 40 parts per billion (ppb) of ozone, and a NO2/NOX ambient ratio of 90%. For purposes of modeling NO2 impacts, the primary NOX emissions were assumed to be 10% NO2 and 90% nitric oxide (NO) by mass.

- Emissions from commissioning testing and stack emission testing are equal to 27% of the emissions from full-buildout routine testing plus power outages. The worst-year annual-average impacts were estimated by manually scaling the previous annual-average AERMOD results by a factor of 1.27.

- For the Health Impacts Assessment modeling conducted for DEEP, the emissions from all modes of operation other than power outages were assumed to occur between 7 am to 7 pm.

- A Cartesian, rectangular receptor grid whose density diminished with distance, was used to model the property line and beyond for all AERMOD applications. In addition, fenceline receptors (10-meter spacing) and discrete receptors where rooftop air intakes are located, were also used. 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

6.2 Assumed Background Concentrations

Background concentrations for all species were obtained from Ecology's Air Monitoring Network website (WSU website 2015). These are:

PM10 (24-hour average) 62 $\mu g/m^3$
PM2.5 (98th percentile 24-hour average) 21 $\mu g/m^3$
NO2 (98th percentile 1-hour value) 16 $\mu g/m^3$

These regional values do not include "local background" caused by industrial facilities near the proposed Vantage data center, namely the existing Sabey, Yahoo, and Intuit data centers and the Imrys manufacturing plant. The local background impacts were modeled separately, assuming a mixture of permit limits, a full area-wide power outage or maximum emitting test modes. The predicted total ambient impact at the receptor that is maximally impacted by Vantage-only emissions are:

PM10 (24-hour average) 139 $\mu g/m^3$ National Ambient Air Quality Standard: 150 $\mu g/m^3$
PM2.5 (24-hour average) 33 $\mu g/m^3$ National Ambient Air Quality Standard: 35 $\mu g/m^3$
NO2 (1-hour average) 149 $\mu g/m^3$ National Ambient Air Quality Standard: 188 $\mu g/m^3$

The Vantage engines in Building 1 are certified to a very high reliability standard (Tier 3 Uptime Certificate). To achieve this reliability rating, the initial commissioning testing includes significant and enhanced testing not necessary at less critical data centers. Table 3 lists the run-time required for this level of reliability. It is unknown if this certification will be desired for Buildings after Building 1, and because Building 1 has only two more engines (6 of 7 and 7 of 7) the 40 hours of commissioning are included in the 45 hours allowed per engine generator per year. Future phases of the Vantage project will likely require new source review to examine emissions and necessary runtime for the desired level of reliability.

Table 3. Runtime Scenario for Initial Startup and Commissioning Tests

Day of Test	Test Description	No. of Typical Hours	Average Load
Manufacturer Tests			
Day 1	8 hours at full load, 1 generator any given day	8	100%
Day 2	12 hours at 75%, 1 generator any given day	12	75
Functional Performance Tests			
Day 3	20 hours, Full (100%) Load, 1 generator any given day	20	100%
Summary of Per-Engine Startup Quantities			
Calendar Days of Testing (Each Generator)			3-4
Runtime Hours Each Generator			40
kWm-hrs During Testing (Each Generator)			111,000
Fuel Usage During Testing (Each Generator- gals)			8,692
NOx Emissions Each Generator			614 lbs
DPM Emissions During Testing (Each Generator)			18.6 lbs

Table 4:
Modeled Concentrations of Criteria Pollutants (with background) and comparison to Ambient Air Quality Standards

Pollutant	Time Frame	Background plus Modeled Concentration – ug/m^3	National Ambient Air Quality Standard - ug/m^3	Percent of Standard
PM_{10}	24 Hour	139	150	93%
PM_{10}	Annual	1.3	50	3%
$PM_{2.5}$	24 Hour	33	35	94%
$PM_{2.5}$	Annual	8	15	53%
NO_2	1- Hour	149	188	79.3%
CO	1-Hour	7,775	40,000	19.4%
CO	8-Hour	4,381	10,000	43.8%
SO_2	1-Hour	18.8	200	9.4%
SO_2	3-Hour	14.3	1310	1.1%
SO_2	24 Hour	7.5	-	-
SO_2	Annual	0.27	-	-

Table 5:
Modeled Concentrations of Toxic Air Pollutants and Comparison to Acceptable Source Impact Levels (ASILs)

Pollutant	Time Frame	Modeled Concentration – ug/m3	Acceptable Source Impact Level – ASIL ug/m^3	Comparison of Modeled to ASIL
DEEP	Annual	0.24	0.0033	7272%
NO_2	Hour	1,410	470	300%

As is indicated in Tables 4 and 5, Diesel Engine Exhaust Particulate (DEEP) and NO_2 exceeded the regulatory trigger level (the ASIL) for that pollutant. At these concentrations, DEEP and NO_2 are required to be further evaluated in a Second Tier Toxics Review in accordance with WAC 173-460-90.

7. SECOND TIER REVIEW FOR DIESEL ENGINE EXHAUST PARTICULATE AND NITROGEN DIOXIDE EMISSIONS

Proposed emissions of diesel engine exhaust particulate (DEEP) and nitrogen dioxide (NO_2) from the 17 Vantage engines exceed the regulatory trigger level for toxic air pollutants (also called an Acceptable Source Impact Level, (ASIL)). A second tier review is required for DEEP and NO_2 in accordance with WAC 173-460-090.

Large diesel-powered backup engines emit DEEP, which is a high priority toxic air pollutant in the state of Washington. In light of the potential rapid development of other data centers in the Quincy area, and recognizing the potency of DEEP emissions, Ecology evaluated Vantage's proposal on a community-wide basis. The community-wide evaluation approach considers the cumulative impacts of DEEP emissions resulting from Vantage's project, and includes consideration of prevailing background emissions from existing permitted data centers and other DEEP sources in Quincy. This evaluation was conducted under the second tier review requirements of WAC 173-460-090.

Under WAC 173-460-090, Vantage was required to prepare a health impact assessment. The HIA presents an evaluation of both non-cancer hazards and increased cancer risk attributable to Vantage's increased emissions of DEEP and NO_2. Vantage also reported the cumulative risks associated with Vantage and prevailing sources in their HIA document. This cumulative DEEP related risk estimate was based on the latest cumulative air dispersion modeling work performed by Ecology. The Vantage HIA document along with a brief summary of Ecology's review will be available on Ecology's website.

8. CONCLUSION

Based on the above analysis, Ecology concludes that operation of the 17 generators at Vantage will not have an adverse impact on local air quality. Ecology finds that Vantage has satisfied all requirements for NOC approval.