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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

4601 N Monroe Street • Spokane, Washington 99205-1295 • (509)329-3400

March 18, 2013

Mr. Jeff Kane, Vice President
Vantage Data Centers Management Company, LLC
2625 Walsh Ave
Santa Clara, CA 95051

Re: Approval Order No. 12AQ-E450

Dear Mr. Kane:

The Department of Ecology Air Quality Program has determined that the Vantage Data Centers Quincy Project will satisfy all of the requirements of Washington New Source Review. The public participation period required per Washington Administrative Code (WAC) 173-400-171, has been completed. No public comments were received that resulted in changes to the latest preliminary determination made available to the public. Enclosed is APPROVAL ORDER No. 12AQ-E450, and the associated Technical Support Document (TSD).

Ecology is committed to streamlining our permitting procedures and to maintaining a high level of staff responsiveness and assistance to permit applicants. If you would like to provide Ecology with feedback, please complete the short survey at http://www.ecy.wa.gov/programs/air/permit_register/Permitting_Feedback.htm to help us provide better service to you and our other clients.

All correspondence relating to this document should be directed to me at the Department of Ecology, Regional Air Quality Section, 4601 N. Monroe, Spokane, Washington 99205-1295. If you have any questions concerning the content of the document, please contact me at rkos461@ecy.wa.gov or (509) 329-3493.

Sincerely,

Robert Koster, P.E.
Commercial/Industrial Unit
Regional Air Quality Program

RK:lc

Certified Mail # 7011 3500 0001 8626 1531

Enclosures: Approval Order 12AQ-E450, Technical Support Document



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

IN THE MATTER OF APPROVING A NEW)
 AIR CONTAMINANT SOURCE FOR) Approval Order No. 12AQ-E450
 VANTAGE DATA CENTERS)
 MANAGEMENT COMPANY, LLC)
 VANTAGE-QUINCY DATA CENTER)

TO: Jeff Kane, Vice President
 Vantage Data Centers Management Company, LLC
 2625 Walsh Ave
 Santa Clara, CA 95051

EQUIPMENT

The list of equipment that was evaluated for this order of approval consists of 17 MTU Model 20V4000 diesel engines used to power emergency electrical generators, Model MTU 3000. The seventeen 3.0 megawatt (MWe) generators will have a combined capacity of 51 MWe. Following initial commissioning testing, build-out annual operations and emissions will be restricted to 167,205 gallons per year of fuel consumption and up to 82 hours per year of operation per engine. Each primary engine will operate for approximately 72.5 hours per year for required maintenance testing and outage operation and an additional 9.5 hours per year of no-load idle cool down. The generators will be installed in up to four phases. Phase 1 will consist of seven 3.0 MWe generators that will be installed upon approval. Phases 2, 3, and 4 will consist of a total of ten additional 3.0 MWe generators, which will be installed at the facility as independent tenant companies contract for space at the Vantage-Quincy Data Center (hereafter "Vantage").

Project Phase	DC BLDG	Unit ID	Capacity MWe	Engine SN	Generator SN	Build date
1	DC1	DC1-1P	3.0			
"	DC1	DC1-2P	3.0			
"	DC1	DC1-3P	3.0			
"	DC1	DC1-4P	3.0			
"	DC1	DC1-5P	3.0			
"	DC1	DC1-6R	3.0			
"	DC1	DC1-7R	3.0			
2	DC2	DC2-1P	3.0			
"	DC2	DC2-2P	3.0			
"	DC2	DC2-3P	3.0			
"	DC2	DC2-4R	3.0			
3	DC3	DC3-1P	3.0			
"	DC3	DC3-2P	3.0			
"	DC3	DC3-3P	3.0			
"	DC3	DC3-4R	3.0			
4	ETC	ETC-1P	3.0			
"	ETC	ETC-2R	3.0			

The Vantage Data Center will utilize non-evaporative cooling units to dissipate heat from electronic equipment at the facility, thus eliminating evaporative cooling tower emissions from the project.

PROJECT SUMMARY

The Vantage Data Center Phase 1 construction will consist of Building 1 with 5 primary engine-generators and 2 reserve engines. Phases 2, 3, and 4 construction will consist of Buildings 2, 3, and 4 ('ETC') with 10 additional engines total. The data center will be leased for occupancy by companies that require a fully supported data storage and processing facility. Vantage will own and operate the generators. Air contaminant emissions from the Vantage Data Center project have been estimated based on build-out operation of the 17 emergency generator engines. Table 2a contains criteria pollutant potential- to- emit for the Vantage Data Center project excluding emissions due to commissioning of each engine. Table 2b contains toxic air pollutant potential- to- emit for the Vantage-Quincy Data Center project excluding emissions due to commissioning of each engine.

Table 2a: Criteria Pollutant Potential to Emit for Vantage Data Center			
Pollutant	Emission Factor (EF) Reference	Emission Factors	Facility Emissions
Criteria Pollutant		Lb/hr	tons/yr
2.1.1 NOx Total			5.83
2.1.1a NOx 10% load	MTU Guarantee	3.73	na
2.1.1b NOx 93.3% load	MTU Guarantee	15.4	na
2.1.1c NOx 100% load	MTU Guarantee	17.2	na
2.1.2 CO Total	MTU Guarantee	na	1.22
2.1.2a CO 10% load	MTU Guarantee	1.41	na
2.1.2b CO 81% load	MTU Guarantee	1.93	na
2.1.2c CO 93.3% load	MTU Guarantee	2.17	na
2.1.2d CO 100% load	MTU Guarantee	2.39	na
2.1.3 SO ₂	MTU Guarantee	na	0.02
2.1.4 PM _{2.5} /DEEP Total	MTU Guarantee	na	0.22
2.1.4a DEEP 10% load	MTU Guarantee	0.400	na
2.1.4b DEEP 81% load	MTU Guarantee	0.396	na
2.1.4c DEEP 93.3% load	MTU Guarantee	0.47	na
2.1.4d DEEP 100% load	MTU Guarantee	0.512	na
2.1.5 VOC 10% Load	MTU Guarantee	0.25	0.25

Table 2b: Toxic Air Pollutant Potential to Emit for Vantage Data Center		
Pollutant	AP-42 Section 3.4 EF	Facility Emissions
Organic Toxic Air Pollutants	Lbs/MMbtu	tons/yr
2.1.6 Propylene	2.79E-03	6.8E-03
2.1.7 Acrolein	7.88E-06	1.92E-05
2.1.8 Benzene	7.76E-04	1.89E-03
2.1.9 Toluene	2.81E-04	6.85E-4
2.1.10 Xylenes	1.93E-04	4.71E-04
2.1.11 Napthalene	1.30E-04	1.96E-03
2.1.11 1,3 Butadiene	1.96E-05	4.77E-05
2.1.12 Formaldehyde	7.89E-05	1.92E-04
2.1.13 Acetaldehyde	2.52E-05	6.14E-05
2.1.14 Benzo(a)Pyrene	1.29E-07	2.98E-07
2.1.15 Benzo(a)anthracene	6.22E-07	1.44E-06
2.1.16 Chrysene	1.53E-06	3.55E-06
2.1.17 Benzo(b)fluoranthene	1.11E-06	2.58E-06
2.1.18 Benzo(k)fluoranthene	1.09E-07	2.53E-07
2.1.19 Dibenz(a,h)anthracene	1.73E-07	4.02E-07
2.1.20 Ideno(1,2,3-cd)pyrene	2.07E-07	4.81E-07
2.1.21 PAH (no TEF)	3.88E-06	9.01E-06
2.1.22 PAH (apply TEF)	4.98E-07	1.16E-06
State Criteria Pollutant Air Toxics		
2.1.23 DEEP/PM _{2.5}	MTU Guarantee	0.19
2.1.24 Carbon monoxide	MTU Guarantee	1.13
2.1.25 Sulfur dioxide	MTU Guarantee	0.02
2.1.26 Primary NO ₂ *	10% total NO _x	0.6
2.1.27 Ammonia	15 ppmv at 15%O ₂	0.36

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

DETERMINATIONS

In relation to this project, the State of Washington Department of Ecology (Ecology), pursuant to Revised Code of Washington (RCW) 70.94.152, Washington Administrative Code (WAC) 173-460-040, and WAC 173-400-110, makes the following determinations:

1. The project, if constructed and operated as herein required, will be in accordance with applicable rules and regulations, as set forth in Chapter 173-400 WAC, and Chapter 173-460 WAC, and the operation thereof, at the location proposed, will not emit pollutants in concentrations that will endanger public health.

2. The proposed project, if constructed and operated as herein required, will utilize best available control technology (BACT) as defined below:

Table 3: Best Available Control Technology Requirements	
Pollutant(s)	BACT Determination
Particulate matter (PM), carbon monoxide and volatile organic compounds (VOC)	<ul style="list-style-type: none"> 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; or applicable emission standards found in 40 CFR Part 89.112 Table 1 and 40 CFR Part 1039.102 Tables 6 and 7 if Model Year 2011 or later engines are installed and operated as non-emergency engines; b. Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart III; and
Nitrogen oxides (NO _x)	<ul style="list-style-type: none"> 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; or applicable emission standards found in 40 CFR Part 89.112 Table 1 and 40 CFR Part 1039.102 Tables 6 and 7 if Model Year 2011 or later engines are installed and operated as non-emergency engines; b. Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart III; and
Sulfur dioxide	Use of ultra-low sulfur diesel fuel containing no more than 15 parts per million by weight of sulfur.

3. The proposed project, if constructed and operated as herein required, will utilize best available control technology for toxic air pollutants (tBACT) as defined below:

Table 4: Best Available Control Technology for Toxics Requirements	
Toxic Air Pollutant(s)	tBACT Determination
Acetaldehyde, carbon monoxide, acrolein, benzene, benzo(a)pyrene, 1,3-butadiene, diesel engine exhaust particulate, formaldehyde, propylene, toluene, total PAHs, xylenes	Compliance with the VOC, CO, PM BACT requirement.
Nitrogen dioxide	Compliance with the NO _x BACT requirement.
Sulfur dioxide	Compliance with the SO ₂ BACT requirement.

4. The modeled ambient concentration of one toxic air pollutant – diesel engine exhaust particulate matter – exceeds the Acceptable Source Impact Level (ASIL) for that pollutant, as defined in Chapter 173-460 WAC. Ecology has reviewed the health risks associated with diesel engine exhaust particulate from the proposed project, in accordance with WAC 173-460-090. Ecology has concluded that the health risks from the project are acceptable as defined in WAC 173-460-090(7). A summary of the technical analysis supporting this determination is hereby incorporated into this Notice of Construction Approval Order.

THEREFORE, IT IS ORDERED that the project as described in the Notice of Construction application and more specifically detailed in plans, specifications, and other information submitted to Ecology is approved for construction and operation, provided the following are met:

APPROVAL CONDITIONS

1. ADMINISTRATIVE CONDITION

- 1.1. The engine generators approved for operation by this order are to be used solely for those purposes described in application materials as further limited by the conditions of this Order. There shall be no operation of this equipment to produce power for demand-response arrangements, peak shaving arrangements, nor to provide power as part of a financial arrangement with another entity, nor to supply power to the grid.

2. EQUIPMENT RESTRICTIONS

- 2.1. Any engine used to power the electrical generators shall be certified by the manufacturer to meet 40 CFR 60 Tier II emission levels or other specifications as required by the EPA at the time the engines are installed. Each engine to be installed must be permanently labeled by the manufacturer as an emergency engine in accordance with 40 CFR § 60.4210(f), and must be equipped with CO, VOC, PM, and NO_x control equipment at least as effective as that evaluated in this NOC approval. Each engine approved in this Order must operate as an emergency engine as defined at 40 CFR 60, Subpart IIII or 40 CFR 63, Subpart ZZZZ.

- 2.2. The only engines and electrical generating units approved for operation at the Vantage Data Center are those listed by serial number in Table 1 above.
- 2.3. Replacement of failed engines with identical engines (same manufacturer and model) requires notification prior to installation but will not require new source review unless there is an increase in emission rates or community impacts.
- 2.4. The installation of any new engines after July 1, 2014 will require notification to Ecology that includes engine manufacturer's specification sheets. Ecology will decide whether new source review is required based on various factors including whether the new engines will have either an increased emission rate or result in an emission concentration that may increase impacts over those evaluated for this approval Order, or if an update to the current BACT analysis is necessary.
- 2.5. The seventeen (17) MTU Model 20V4000 engines exhaust stack heights shall be greater than or equal to 41 feet above ground level for engines providing power to Buildings 1,2, and 3, and 43.8 feet for engines serving Building ETC, and will be no more than 26 inches in diameter. All engines that may be used for this project shall be required to verify that exhaust stack parameters such as diameter, height, and exhaust rate and velocity do not result in community emissions impacts greater than what was evaluated for this project.
- 2.6. The manufacture and installation of the seventeen (17) engine/generator sets proposed for Building 1, Building 2, Building 3, and Building ETC of the project shall occur by July 1, 2014. If the manufacture and installation of the engines has not been completed by the above date, new source review may be required prior to additional installation, and community impacts will be re-evaluated if new source review is required. Vantage may request an extension of this time schedule, and Ecology may approve of an extension without revision to this Order.
- 2.7. This Order only applies to the seventeen (17) MTU Model 20V4000 engines, each with a rated full standby capacity of 4678 hp that were evaluated in the Notice of Construction application and second tier review. New source review will not be required for engines with a rated full standby capacity of less than 4678 hp that comply with the engine certification requirements and control equipment requirements contained in Approval Condition 2.1 unless there is an increase in community emission impacts. On a case-by-case basis, Ecology may require additional ambient impacts analyses prior to installation of smaller engines.

3. OPERATING LIMITATIONS

- 3.1 Following commissioning/start-up testing, the fuel consumption at the Vantage Data Center facility at build-out (4 buildings with a total of 12 primary and 5 reserve engines) shall be limited to a total of 167,205 gallons per year of diesel fuel equivalent to on-road specification No. 2 distillate fuel oil (less than 0.00150 weight percent sulfur). Total annual fuel consumption by the facility may be averaged over a three (3) year period using monthly rolling totals.
- 3.2 Except as provided in Approval Condition 3.5, the seventeen (17) Vantage Data Center engines are limited to the following average hours of operation, and averaging periods:

- 3.2.1 Each primary engine serving Building 1 shall not exceed 82 hours of operation (at any load, for any purpose) per year, on a rolling monthly 3-year average.
- 3.2.2 Each reserve engine serving Building 1 shall not exceed 62 hours of operation (at any load, for any purpose) per year, on a rolling monthly 3-year average.
- 3.2.3 Following start-up and commissioning, the engines serving Building 1 shall not exceed an annual fuel consumption of 65,907 gallons, averaged over a 3 year period using monthly rolling totals.
- 3.2.4 Operation of the two Building 1 reserve engines shall not exceed 10% load except for 8.5 hours at 100% load for corrective maintenance and step testing. The reserve engines may also provide outage (8 hours) or storm avoidance (16 hours) power in the event of the failure of a primary engine. These hours may be averaged over a three (3) year period using monthly rolling totals.
- 3.2.5 Operation of the five primary engines serving Building 1 shall not exceed 10% load except for 8.5 hours per year at 100% load for step testing and corrective maintenance, and 41 hours per year at 81.3% load for building transformer maintenance, storm avoidance, and power outages. These hours may be averaged over a three (3) year period using monthly rolling totals.
- 3.2.6 Each primary engine serving Building 2, 3 and ETC shall not exceed 66 hours of operation (at any load, for any purpose) per year, on a rolling monthly 3-year average. A total of 16 hours per year of 'storm avoidance' operation may be added to the above total without amendment of this approval upon satisfactory demonstration to Ecology that these hours are a necessity for the tenants of these buildings.
- 3.2.7 Operation of each of the Building 2 and Building 3 and ETC Building reserve engines (one at each building) shall not exceed 10% load except for 8.5 hours at 100% load for corrective maintenance and step testing. The reserve engines may also provide outage power in the event of the failure of a primary engine. These hours may be averaged over a three (3) year period using monthly rolling totals.
- 3.2.8 Operation of the six primary engines serving Building 2 (3) and Building 3 (3) shall not exceed 10% load except for 8.5 hours at 100% load for corrective maintenance and step testing, and 25 hours per year at 90% load for building transformer maintenance and power outages. These hours may be averaged over a three (3) year period using monthly rolling totals.
- 3.2.9 Operation of the primary engine serving Building ETC shall not exceed 10% load except for 8.5 hours at 100% load for corrective maintenance and step testing, and 25 hours per year at 93% load for building transformer maintenance and power outages. These hours may be averaged over a three (3) year period using monthly rolling totals.

- 3.3 A load bank will be used for electrical energy dissipation whenever prescheduled monthly maintenance testing, corrective testing or annual load bank testing occurs above idle.
- 3.4 The seventeen (17) MTU Model 20V4000 engines at the Vantage Data Center require periodic scheduled operation. To mitigate engine emission impacts, Vantage Data Center will perform all scheduled engine maintenance testing, bypass operations, and load testing during daylight hours. The Vantage Data Center shall develop an operating schedule that shall be available for review by Ecology upon request. Changes to the operating schedule will not trigger revision or amendment of this Order if approved in advance by Ecology.
- 3.5 Initial start-up (commissioning) testing for the seventeen (17) MTU Model 20V4000 engines at the Vantage Data Center shall not exceed an average of 40 hours per generator and 8,692 gallons of fuel per generator, averaged over all generators installed during any consecutive 3 year period.
 - 3.5.1 Except during site integration testing as specified below, only one engine shall be operated at any one time during start-up testing.
 - 3.5.2 During a site integration test, no more than seven (7) generator engines may operate concurrently for no more than four continuous hours.
 - 3.5.3 All startup and commissioning testing shall be conducted during daylight hours.
 - 3.5.4 Fuel use limits contained in Approval Conditions 3.1 and emission limits contained in Approval Conditions 5, are not applicable to initial commissioning testing of each engine.
 - 3.5.5 Following start-up and conditioning testing, the number of hours each engine has run, the fuel consumed during the testing, and the date shall be recorded. These data shall be provided to Ecology on request.

4. GENERAL TESTING AND MAINTENANCE REQUIREMENTS

- 4.1. The Vantage Data Center will follow engine-manufacturer's recommended diagnostic testing and maintenance procedures to ensure that each engine will conform to the emission limits in Condition 5 of this approval throughout the life of each engine.
- 4.2. Within 12 months of the first engine installation and every 36 months thereafter, the Vantage Data Center shall measure emissions of particulate matter (PM), Volatile Organic Compounds (VOC), nitric oxide (NO), nitrogen dioxide (NO₂), carbon monoxide (CO), Ammonia (NH₃), and oxygen (O₂) from at least one representative primary and one representative reserve engine's exhaust stack in accordance with Approval Condition 4.3. This testing will serve to demonstrate compliance with the emission limits contained in Section 5, and as an indicator of proper operation of the engines. The selection of the engine(s) to be tested shall be subject to prior approval by Ecology and shall be defined in

the source test protocol submitted to Ecology no less than 30 days in advance of any compliance- related stack sampling conducted by Vantage.

- 4.3. The following procedure shall be used for each test for the engines as required by Approval Condition 4.2 unless an alternate method is proposed by the Vantage Data Center and approved in writing by Ecology prior to the test:
 - 4.3.1. Periodic emissions testing should be combined with other pre-scheduled maintenance testing and annual load bank engine testing. Additional operation of the engines for the purpose of emissions testing beyond the operating hours allowed in this Order must be approved by Ecology in writing.
 - 4.3.2. PM including the condensible fraction, NO, NO₂, VOC, CO and ammonia emissions measurement shall be conducted for each engine tested at the proposed maximum engine load that corresponds to scheduled engine operating scenarios in Approval Conditions 3.2.
 - 4.3.3. EPA Reference Methods from 40 CFR 60, 40 CFR 51, BAAQMD ST-1B (for ammonia) and/or 40 CFR 89 as appropriate for each pollutant shall be used for at least one (representative) engine at this data center. A test plan will be submitted for Ecology approval at least 30 days before any testing is conducted and must include the criteria used to select the engine for testing, as well as any modifications to the standard test procedures contained in the above references.
 - 4.3.4. The F-factor method, as described in EPA Method 19, may be used to calculate exhaust flow rate through the exhaust stack. The fuel meter data, as measured according to Approval Condition 4.5, shall be included in the test report, along with the emissions calculations.
- 4.4. Each engine shall be equipped with a properly installed and maintained non-resettable meter that records total operating hours.
- 4.5. Each engine shall be connected to a properly installed and maintained fuel flow monitoring system that records the amount of fuel consumed by that engine during operation.

5. EMISSION LIMITS

- 5.1 The seventeen (17) engines shall meet the emission rate limitations contained in this section. The limits are for an engine operating in a steady-state mode (warm) and do not include emission rates during initial commissioning testing of the engines. The annual limits may be averaged over a rolling monthly three year period. Unless otherwise approved by Ecology in writing, compliance with emission limits for those pollutants that are required to be tested under Approval Conditions 4.2 and 4.3 shall be based on emissions test data determined according to those approval conditions.
- 5.2 If required to demonstrate compliance with the g/kW-hr EPA Tier IV average emission limits through stack testing, the Vantage Data Center shall conduct exhaust stack testing

and average emission rates for 5 individual operating loads (10%, 25%, 50%, 75% and 100%) according to 40 CFR §89.410, Table 2 of Appendix B, 40 CFR Part 89, Subpart E, and/or 40 CFR Part 60, Subpart IIII, or any other applicable EPA requirement in effect at the time the engines are installed.

- 5.3 Nitrogen oxide (NO_x) emissions from each of the seventeen (17) MTU Model 20V4000 engines rated at 4678 brake horse power shall not exceed the following emission rates at the stated loads, based on not-to-exceed emission rates stated in application materials:

Table 5.3: Nitrogen oxide (NO_x) emission rate limits			
	Operating Scenario	Operating Load	Emissions Limit per engine in lb/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

- 5.4 Nitrogen dioxide (NO₂) emissions from each of the seventeen (17) MTU Model 20V4000 engines rated at 4678 brake horse power shall not exceed the following emission rates at the stated loads, based on not-to-exceed emission rates stated in application materials:

Table 5.4: Nitrogen dioxide (NO₂) emission rate limits			
	Operating Scenario	Operating Load	Emissions Limit per engine in lb/hr
5.4.1	Annual Step Testing	100%	1.50
5.4.2	Corrective Maintenance	100%	1.50
5.4.3	Building 1 Outage, Storm Avoidance	81% 10%	0.40 1.50
5.4.4	Buildings 2 and 3 Outage	90% 10%	0.40 1.50
5.4.5	Building ETC Outage	93% 10%	0.40 1.50

- 5.5 Carbon monoxide emissions from each of the seventeen (17) MTU Model 20V4000 engines rated at 4678 brake horse power shall not exceed the following emission rates at the stated loads, based on not-to-exceed emission rates stated in application materials:

Table 5.5: Carbon monoxide (CO) emission rate limits			
	Operating Scenario	Operating Load	Emissions Limit per engine in lb/hr
5.5.1	Annual Step Testing	100%	1.35
5.5.2	Corrective Maintenance	100%	1.35
5.5.3	Building 1 Outage, Storm Avoidance	81%	1.05
		10%	0.60
5.5.4	Buildings 2 and 3 Outage	90%	1.19
		10%	0.60
5.5.5	Building ETC Outage	93%	1.24
		10%	0.60

5.6 Diesel Engine Exhaust Particulate (DEEP) emissions (Total PM after control on these engines) from each of the seventeen (17) MTU Model 20V4000 engines rated at 4678 brake horse power shall not exceed the following emission rates at the stated loads, based on not-to-exceed emission rates stated in application materials:

Table 5.6: Diesel Engine Exhaust Particulate (DEEP) emission rate limits			
	Operating Scenario	Operating Load	Emissions Limit per engine in lb/hr
5.6.1	Annual Step Testing	100%	0.484
5.6.2	Corrective Maintenance	100%	0.484
5.6.3	Building 1 Outage, Storm Avoidance	81%	0.374
		10%	0.400
5.6.4	Buildings 2 and 3 Outage	90%	0.425
		10%	0.400
5.6.5	Building ETC Outage	93%	0.444
		10%	0.400

5.7 Volatile Organic Compound (VOC) emissions from each of the seventeen (17) MTU Model 20V4000 engines rated at 4678 brake horse power shall not exceed the following emission rates at the stated loads, based on not-to-exceed emission rates stated in application materials:

Table 5.7: Volatile Organic Compound (VOC) emission rate limits

	Operating Scenario	Operating Load	Emissions Limit per engine in lb/hr
5.7.1	Annual Step Testing	100%	0.22
5.7.2	Corrective Maintenance	100%	0.22
5.7.3	Building 1 Outage, Storm Avoidance	81%	0.22
		10%	0.25
5.7.4	Buildings 2 and 3 Outage	90%	0.22
		10%	0.25
5.7.5	Building ETC Outage	93%	0.22
		10%	0.25

- 5.8 Total Particulate Matter (PM) emissions from all 17 engines combined shall not exceed 0.22 tons/yr (440 lbs/yr). All PM emissions shall be considered diesel engine exhaust particulate (DEEP) and PM_{2.5} emissions.
- 5.9 Nitrogen dioxide (NO₂) emissions from all 17 engines combined shall not exceed 18.1 lbs/hr and 0.6 tons/yr.
- 5.10 Volatile organic compound (VOC) emissions from all 17 engines combined shall not exceed 0.37 tons/yr (740 lbs/yr).
- 5.11 Carbon Monoxide (CO) emissions from all 17 engines combined shall not exceed 1.22 tons per year (2440 lbs/yr).
- 5.12 Ammonia emissions from any of the 17 engines at the Vantage Center shall not exceed 15 ppmvd at 15%O₂, nor 0.64 pounds per hour.
- 5.13 Sulfur dioxide emissions from all 17 engines combined shall not exceed 0.020 tons/yr (40 lbs/yr).
- 5.14 Visual emissions from each diesel electric generator exhaust stack shall be no more than 5 percent, with the exception of a two (2) minute period after unit start-up. Visual emissions shall be measured by using the procedures contained in 40 CFR 60, Appendix A, Method 9.

6. OPERATION AND MAINTENANCE MANUALS

- 6.1 A site-specific O&M manual for the Vantage Data Center facility equipment shall be developed and followed. Manufacturers' operating instructions and design specifications for the engines, generators, and associated equipment shall be included in the manual. The O&M manual shall be updated to reflect any modifications of the equipment or its operating procedures. Emissions that result from failure to follow the operating procedures contained in the O&M manual or manufacturer's operating instructions may be considered proof that

the equipment was not properly installed, operated, and/or maintained. The O&M manual for the diesel engines and associated equipment shall at a minimum include:

- 6.1.1. Manufacturer's testing and maintenance procedures that will ensure that each individual engine will conform to the EPA Tier Emission Standards appropriate for that engine throughout the life of the engine.
- 6.1.2. Normal operating parameters and design specifications.
- 6.1.3. Operating and maintenance schedules.

7. SUBMITTALS

All notifications, reports, and other submittals shall be sent to:

Washington State Department of Ecology
Air Quality Program
4601 N. Monroe Street
Spokane, WA 99205-1295

8. RECORDKEEPING

- 8.1 All records, Operations and Maintenance Manual, and procedures developed under this Order shall be organized in a readily accessible manner and cover a minimum of the most recent 60-month period. Any records required to be kept under the provisions of this Order shall be provided within 30 days to Ecology upon request. The following records are required to be collected and maintained:
 - 8.1.1. Fuel receipts with amount of diesel and sulfur content for each delivery to the facility.
 - 8.1.2. Monthly and annual hours of operation for each diesel engine.
 - 8.1.3. Purpose, electrical load and duration of runtime for each diesel engine during any periods of operation.
 - 8.1.4. Annual gross power generated by or for each independent tenant at the facility and total annual gross power for the facility.
 - 8.1.5. Upset condition log for each engine and generator that includes date, time, duration of upset, cause, and corrective action.
 - 8.1.6. Any recordkeeping required by 40 CFR Part 60 Subpart IIII.
 - 8.1.7. Air quality complaints received from the public or other entity, and the affected emissions units.

9. REPORTING

- 9.1 Within 10 business days after entering into a binding agreement with a new tenant, Vantage shall notify Ecology of such agreement. The serial number, manufacturer make and model, standby capacity, and date of manufacture of engines proposed will be submitted prior to installation of engines in the Building 2, 3, and ETC phases of this project.

- 9.2 The following information will be submitted to the AQP at the address in Condition 7 above by January 31 of each calendar year. This information may be submitted with annual emissions information requested by the AQP.
- 9.2.1 Monthly rolling annual total summary of air contaminant emissions,
 - 9.2.2 Monthly rolling hours of operation with annual total,
 - 9.2.3 Monthly rolling gross power generation with annual total as specified in Approval Condition 8.1.4,
 - 9.2.4 A log of each start-up of each diesel engine that shows the purpose, fuel usage, and duration of each period of operation.
- 9.3 Any air quality complaints resulting from operation of the emissions units or activities shall be promptly assessed and addressed. Vantage shall maintain a record of the action taken to investigate the validity of the complaint and what, if any, corrective action was taken in response to the complaint. Ecology shall be notified within three (3) days of receipt of any such complaint.
- 9.4 Vantage shall notify Ecology by e-mail or in writing within 24 hours of any engine operation of greater than 60 minutes if such engine operation occurs as the result of a power outage or other unscheduled operation. This notification does not alleviate Vantage from annual reporting of operations contained in any section of Approval Condition 9.

10. GENERAL CONDITIONS

- 10.1 Commencing/Discontinuing Construction and/or Operations:** This approval shall become void if construction of the facility is not begun within 18 months of permit issuance or if facility operation is discontinued for a period of eighteen (18) months or more. In accordance with WAC 173-400-111(7)(c), each phase must commence construction within 18 months of the projected and approved construction dates in this Order.
- 10.2 Compliance Assurance Access:** Access to the source by representatives of Ecology or the EPA shall be permitted upon request. Failure to allow such access is grounds for enforcement action under the federal Clean Air Act or the Washington State Clean Air Act, and may result in revocation of this Approval Order.
- 10.3 Availability of Order and O&M Manual:** Legible copies of this Order and the O & M manual shall be available to employees in direct operation of the diesel electric generation station, and be available for review upon request by Ecology.
- 10.4 Equipment Operation:** Operation of the 17 MTU Model 20V4000 diesel engines used to power emergency electrical generators and related equipment shall be conducted in compliance with all data and specifications submitted as part of the NOC application and in accordance with the O&M manual, unless otherwise approved in writing by Ecology.

- 10.5 Modifications:** Any modification to the generators or engines and their related equipment's operating or maintenance procedures, contrary to information in the NOC application, shall be reported to Ecology at least 60 days before such modification. Such modification may require a new or amended NOC Approval Order.
- 10.6 Activities Inconsistent with the NOC Application and this Approval Order:** Any activity undertaken by the permittee or others, in a manner that is inconsistent with the NOC application and this determination, shall be subject to Ecology enforcement under applicable regulations.
- 10.7 Obligations under Other Laws or Regulations:** Nothing in this Approval Order shall be construed to relieve the permittee of its obligations under any local, state or federal laws or regulations.

All plans, specifications, and other information submitted to the Department of Ecology relative to this project and further documents and any authorizations or approvals or denials in relation thereto shall be kept at the Eastern Regional Office of the Department of Ecology in the "Air Quality Controlled Sources" files, and by such action shall be incorporated herein and made a part thereof.

Nothing in this approval shall be construed as obviating compliance with any requirement of law other than those imposed pursuant to the Washington Clean Air Act and rules and regulations thereunder.

Authorization may be modified, suspended or revoked in whole or part for cause including, but not limited to the following:

- a. Violation of any terms or conditions of this authorization;
- b. Obtaining this authorization by misrepresentation or failure to disclose fully all relevant fact.

The provisions of this authorization are severable and, if any provision of this authorization, or application of any provision to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this authorization, shall not be affected thereby.

YOUR RIGHT TO APPEAL

You have a right to appeal this Approval Order to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this Approval Order. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do the following within 30 days of the date of receipt of this Approval Order:

- File your appeal and a copy of this Approval Order with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Approval Order on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

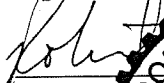
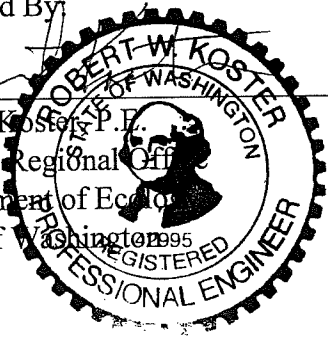
Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	Department of Ecology Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel RD SW STE 301 Tumwater, WA 98501	Pollution Control Hearings Board PO Box 40903 Olympia, WA 98504-0903

For additional information visit the Environmental Hearings Office Website:
<http://www.eho.wa.gov>

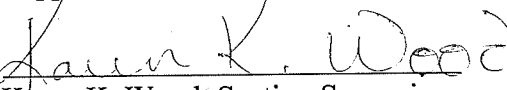
To find laws and agency rules visit the Washington State Legislature Website:
<http://www1.leg.wa.gov/CodeReviser>

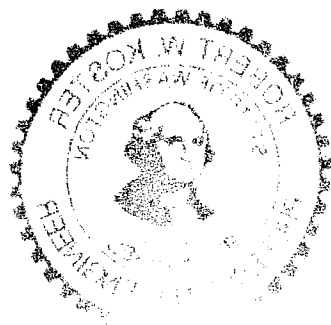
DATED this 18th day of March, 2013 at Spokane, Washington.

Prepared By:


Robert W. Koster, P.E.
Eastern Regional Office
Department of Ecology
State of Washington


Approved By:


Karen K. Wood, Section Supervisor
Eastern Regional Office
Department of Ecology
State of Washington



**TECHNICAL SUPPORT DOCUMENT (TSD)
NOTICE OF CONSTRUCTION APPROVAL ORDER NO. 12AQ-E450
VANTAGE DATA CENTERS MANAGEMENT COMPANY, LLC
VANTAGE-QUINCY DATA CENTER
MARCH 18, 2013**

This TSD and the Approval Order and application(s) have been made available for public review during two 30 day public comment periods. Between the two periods, the documents were the subject of a public hearing conducted in Quincy. Many comments were received during this extended public participation process. Ecology has responded to the comments and compiled the responses and comments in a Document No. 13-02-001 which can be accessed by its link: <https://fortress.wa.gov/ecy/publications/SummaryPages/1302001.html> The comments did not result in revisions to the preliminary determination of approval, thus Ecology is issuing the Approval No. 12AQ-E450 on this date: March 18, 2013.

On October 22, 2012, Vantage resubmitted application materials to correct errors in its low load emission rates. Emission limits presented previously for the operating condition of 'idle to 10% load' were lower than those determined from emission testing conducted following the original submittal and original preliminary determination Ecology made available to the public. This amendment describes the October 22, 2012 submittal and Ecology's review of those materials. The unmodified May-June-July 2012 TSD follows this amendment.

The determination that emission rates were higher than proposed at low loads resulted in modifications to the Vantage proposal including reducing allowable hours of operation at low load, and removing some of the 'safety factor' in emission limits and run times for high loads. The application materials were incompletely revised, retaining or generating a number of inconsistencies as follows:

- Page 3, Paragraph 4, 3rd, 4th, and 5th sentences: "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 NOx. This combination of controls represents the highest level of available control equipment, and thereby satisfies BACT as summarized in Section 4."

These sentences are misleading. There is no analysis in the application demonstrating EPA Tier 4 emission levels will be satisfied. The last sentence suggests some connection of the proposed control equipment to BACT. Vantage has insisted that Tier 2 engines (no add-on control) are the highest level of control Ecology can require as BACT. The references to Tier 4 and BACT should be removed from this paragraph.

- Page 7, 6th bullet: "Vantage will not install any other diesel engines larger than 500 horsepower for use as fire pumps or for building safety generators."

The 500 horsepower New Source Review (NSR) exemption alluded to by this statement is not applicable to this project. Only the MTU 3,000 kWe engines have been reviewed and approved (preliminarily). Project equipment not identified in this application must

be approved by Ecology prior to installation. Additional diesel engines of any size supporting this project are subject to NSR.

- Page 8, 'Compliance Emission Testing', Paragraph 2: "Vantage requests that the run-time required for Ecology-required compliance emission testing should (sic) not be counted against the facility's allowable run-time limits for routine operations."

Ecology has limited all run-time hours in the preliminary determination. Compliance emission testing will be accomplished without additional run-time hours.

- Pages 11 and 12, Table 3-1: These run-time hours are not consistent with Table AA2. Table AA2, apparently used as modeling inputs, has been used to establish run-time limits in the current preliminary determination.
- Page 14, Table 3-2: This Table is not consistent with Table BB2 and Table BB2 is not consistent with Table AA2. Again, Table AA2 was used to establish run-time limits in the current preliminary determination.
- Consistent with the first bullet above, Page 20, 21: " Vendor-guaranteed removal efficiencies are as follows:
 - NO_x > 90%
 - CO > 90%
 - VOC > 90%
 - PM > 87%"

Vantage has provided no documentation of these control efficiencies. It is misleading to include them in this document. Actual control levels are closer to an average of 60%.

The present preliminary determination includes run-times and emission limits using the lowest of those presented where there are inconsistencies. Other determinations remain as outlined in the original TSD as follows:

1. BACKGROUND

Starting in 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 start construction before July 1, 2011. The AQP has received 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.

2. EXECUTIVE SUMMARY

Vantage Data Centers Management Company, LLC submitted a Notice of Construction (NOC) application received by Ecology on February 10, 2012, 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 February 10, 2012 NOC application began on February 11, 2012, and a notification that more information was necessary was issued on February 22, 2012 by the Department of Ecology under the supervision of the Eastern Regional Office Section Manager (Wood). Partial response to the request for additional information was received by Ecology on March 19, 2012. The NOC application was considered complete as of May 1, 2012. 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 notice of the availability of the Preliminary Determination was published on June 27, 2012 in the Columbia Basin Herald. Vantage and its consultant, ICF, found that the emission limits resulting from use of the BACT analyses in the application submittals (the stack test emission limits in Condition 5 of the Preliminary Determination) would be difficult to achieve, and submitted a supplemental BACT analysis received by Ecology on July 16, 2012. Ecology’s evaluation of this BACT submittal follows at the end of this TSD. Public review began on approximately , and ended on .

3. PROJECT DESCRIPTION

The Ecology Air Quality Program (AQP) received a Notice of Construction (NOC) application for the Vantage-Quincy Data Center on February 10, 2012. 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 described as ‘reserve’. The timing of Phases 2-4 depends on customer demand and is not yet determined. Phase 1 is expected to be operational around the end of 2012 and includes the 5 primary and 2 reserve generators all of which are to be 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 - 3 primary engine generators, plus 1 reserve), Data Center 3 (phase 3 - 3 primary engine generators, plus 1 reserve), and a Building described as 'ETC' (phase 4 - 1 primary engine generator plus 1 reserve). The sequence of expected construction was not described. 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 169,500 gallons of ultra-low sulfur diesel fuel. Individual engine operating limits of 85 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. It should be noted that some of the emissions included in Tables 1a and 1b are not approved by this preliminary determination: the preliminary determination requires that stack testing be included in with other approved run-times, and that 'storm avoidance' hours be approved prior to each of phases 2-4 of this project. Table 1b contains toxic air pollutant potential to emit for all phases of the Vantage-Quincy Data Center project.

Table 1a: Criteria Pollutant Maximum Year Potential to Emit for Vantage-Quincy Data Center (including commissioning and stack testing as modeled by applicant)		
Pollutant	Emission Factor (EF) Reference	Facility Emissions
Criteria Pollutant		tons/yr
2.1.1 NO _x Total	Engine NTE* + PC** Vendor Guarantee	7.58
2.1.2 CO	Engine NTE* + PC** Vendor Guarantee	1.46
2.1.3 SO ₂	Engine NTE* + PC** Vendor Guarantee	0.023
2.1.4 PM _{2.5} /DEEP	Engine NTE* + PC** Vendor Guarantee	0.280
2.1.5 VOC	Engine NTE* + PC** Vendor Guarantee	0.40
2.1.6 Primary NO ₂	Assumed 10% of NO _x	0.76
Table 1b: Toxic Air Pollutant Maximum Year Potential to Emit for Vantage-Quincy Data Center		
Pollutant	AP-42 Section 3.4 EF	Facility Emissions
Organic Toxic Air Pollutants	Lbs/MMbtu	tons/yr
2.1.7 Propylene	2.79E-03	8.6E-03

2.1.8 Acrolein	7.88E-06	2.12E-04
2.1.9 Benzene	7.76E-04	2.09E-03
2.1.10 Toluene	2.81E-04	7.58E-04
2.1.11 Xylenes	1.93E-04	5.21E-04
2.1.12 Napthalene	1.30E-04	4.01E-04
2.1.13 1,3 Butadiene	1.96E-05	5.28E-05
2.1.14 Formaldehyde	7.89E-05	2.12E-04
2.1.15 Acetaldehyde	2.52E-05	6.79E-05
Poly Aromatic Hydrocarbons (PAH)		
2.1.16 Benzo(a)Pyrene	1.29E-07	3.77E-07
2.1.17 Benzo(a)anthracene	6.22E-07	1.82E-06
2.1.18 Chrysene	1.53E-06	4.49E-05
2.1.19 Benzo(b)fluoranthene	1.11E-06	3.26E-06
2.1.20 Benzo(k)fluoranthene	1.09E-07	3.20E-07
2.1.21 Dibenz(a,h)anthracene	1.73E-07	5.09E-07
2.1.22 Ideno(1,2,3-cd)pyrene	2.07E-07	6.09E-07
2.1.23 PAH (no TEF)	3.88E-06	1.14E-05
2.1.24 PAH (apply TEF)	4.98E-07	1.47E-06
State Criteria Pollutant Air Toxics		
2.1.25 DEEP/PM _{2.5}	NTE + PC Guarantee	0.280
2.1.26 Carbon monoxide	NTE + PC Guarantee	1.46
2.1.27 Sulfur dioxide	NTE + PC Guarantee	0.023
2.1.28 Primary NO ₂ ***	10% total NO _x	0.76
2.1.29 Ammonia	Maximum 10 ppmv	0.36

* Engine Manufacturer 'Not To Exceed'

** Pollution Control Equipment Vendor Guarantee

*** Assumed to be equal to 10% of the total NO_x 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 (non-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 III

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 defined¹ 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 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 this project, 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 (NO_x Control). With these proposed controls, Vantage avoided the formal process of a “top-down” approach for determining BACT for the proposed diesel engines. Vantage also established a control cost criteria for future data center diesel engines at a budget-level estimate of \$47,714 per ton of combined pollutants controlled.

The proposed diesel engines will emit the following regulated pollutants which are subject to BACT review: nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM, PM₁₀ and PM_{2.5}) and sulfur dioxide.

5.1 BACT ANALYSIS FOR NO_x

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.

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

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°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.

5.1.6 **BACT determination for NOx**

Ecology determines that BACT for NOx is:

- a. Use of urea-based SCR with ammonia slip no greater than 15 ppmv at 15% O₂;
- b. Use of EPA Tier 2 certified engines, pre-control, if the engines are installed and operated as emergency engines, as defined at 40 CFR§60.4219; or applicable emission standards found in 40 CFR Part 89.112 Table 1 and 40 CFR Part 1039.102 Tables 6 and 7 if Model Year 2011 or later engines are installed and operated as non-emergency engines; and
- c. Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart III.

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

5.2.1 ***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.

5.2.2 ***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.

5.2.4 **BACT Determination for Particulate Matter, Carbon Monoxide and Volatile Organic Compounds**

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

- a. Use of EPA Tier 2 certified engines pre-control if the engines are installed and operated as emergency engines, as defined at 40 CFR§60.4219; or applicable emission standards found in 40 CFR Part 89.112 Table 1 and 40 CFR Part 1039.102 Tables 6 and 7 if Model Year 2011 or later engines are installed and operated as non-emergency engines; and
- b. Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart III.

5.3 BACT ANALYSIS FOR SULFUR DIOXIDE

5.3.1 Vantage/ICF 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.

5.3.2 **BACT Determination for Sulfur Dioxide**

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.

5.4 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 BACT requirement
1,3-Butadiene	Compliance with the VOC BACT requirement
Carbon monoxide	Compliance with the CO BACT requirement

² WAC 173-460-020

Diesel engine exhaust particulate	Compliance with the PM BACT requirement
Formaldehyde	Compliance with the VOC BACT requirement
Nitrogen dioxide	Compliance with the NO _x BACT requirement
Sulfur dioxide	Compliance with the SO ₂ BACT requirement
Toluene	Compliance with the VOC BACT requirement
Total PAHs	Compliance with the VOC BACT requirement
Xylenes	Compliance with the VOC BACT requirement

6. AMBIENT IMPACTS ANALYSIS

Vantage obtained the services of ICF 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. ICF 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 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 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.
- All 17 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. EPA's PRIME algorithm was used for simulating building downwash.
- 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 be spread over 5 calendar days per year, during which time all backup engines were assumed to operate for their assigned times and at their assigned loads for power outage conditions.

- 1-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/NO_X ambient ratio of 90%. For purposes of modeling NO₂ impacts, the primary NO_X 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 DPM, 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 provided by Ecology (Bowman, 2010). These are:

PM ₁₀ (24-hour average)	60 $\mu\text{g}/\text{m}^3$
PM _{2.5} (98th percentile 24-hour average)	21 $\mu\text{g}/\text{m}^3$
NO ₂ (98th percentile 1-hour value)	29 $\mu\text{g}/\text{m}^3$
DEEP (annual average)	0.103 $\mu\text{g}/\text{m}^3$

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 Celite 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. Their combined contributions at the receptor that is maximally impacted by Vantage-only emissions are:

PM ₁₀ (24-hour average)	0.002 $\mu\text{g}/\text{m}^3$
PM _{2.5} (24-hour average)	0.08 $\mu\text{g}/\text{m}^3$
NO ₂ (1-hour average)	0.02 $\mu\text{g}/\text{m}^3$

Table 3 provides a summary of the modes of operation of the diesel engines proposed by Vantage. Table 4 is a summary of annual emissions after full buildout of the Vantage project. It should be noted that not all of these hours or emissions have been approved. Stack testing is required to be performed during periods when the engines are run for other testing unless approved by Ecology. Storm avoidance run-time is not pre-approved for any but the phase 1 generators. When each engine is installed, a commissioning test sequence occurs, described in Table 5. The impacts of the emissions anticipated from this project were modeled using worst case scheduling of these activities. The results of the modeling and a comparison to the NAAQS are shown in Table 6 for criteria pollutants. Table 7 provides the impacts modeled for Toxic Air Pollutants (TAPs) whose emission rates exceeded the Small Quantity Emission Rate (SQER) in WAC 173-460. TAPs with emission rates that exceed the SQER must be evaluated further and trigger a Tier 2 Health Impact Assessment if modeling shows the emission rates result in impacts above the ASIL.

Table 3. Summary of Diesel Generator Operating Modes

Generator 3000 kW _e MTU	Weekly Testing		Monthly Testing		Quarterly Testing		Annual Full Building		Annual Step		Unscheduled Maintenance				Outage and Storm Avoidance			
	% Load	Hrs/test	% Load	Hrs/test	% Load	Hrs/test	% Load	Hrs/test	% Load	Hrs/test	Corrective Generator Maintenance	Transformer Maintenance	% Load	Hrs/yr	Storm Avoidance	Outage Hrs/yr		
DC1-1P DC1	10	0.5	20	1	6	81.3	3	81.3	6	100	0.5	0.5	8	81.3	8	81.3	16	8
DC1-2P DC1	10	0.5	20	1	6	81.3	3	81.3	6	100	0.5	0.5	8	81.3	8	81.3	16	8
DC1-3P DC1	10	0.5	20	1	6	81.3	3	81.3	6	100	0.5	0.5	8	81.3	8	81.3	16	8
DC1-4P DC1	10	0.5	20	1	6	81.3	3	81.3	6	100	0.5	0.5	8	81.3	8	81.3	16	8
DC1-5P DC1	10	0.5	20	1	6	81.3	3	81.3	6	100	0.5	0.5	8	81.3	8	81.3	16	8
DC1-6R DC1	10	0.5	20	1	6	10	3	10	6	100	0.5	0.5	8	10	8	10	16	8
DC1-7R DC1	10	0.5	20	1	6	10	3	10	6	100	0.5	0.5	8	10	8	10	16	8
DC2-1P DC2	10	0.5	20	1	6	90	3	90	6	100	0.5	0.5	8	90	8	90	16	8
DC2-2P DC2	10	0.5	20	1	6	90	3	90	6	100	0.5	0.5	8	90	8	90	16	8
DC2-3P DC2	10	0.5	20	1	6	90	3	90	6	100	0.5	0.5	8	90	8	90	16	8
DC2-4R DC2	10	0.5	20	1	6	10	3	10	6	100	0.5	0.5	8	10	8	10	16	8
DC3-1P DC3	10	0.5	20	1	6	90	3	90	6	100	0.5	0.5	8	90	8	90	16	8
DC3-2P DC3	10	0.5	20	1	6	90	3	90	6	100	0.5	0.5	8	90	8	90	16	8
DC3-3P DC3	10	0.5	20	1	6	90	3	90	6	100	0.5	0.5	8	90	8	90	16	8
DC3-4R DC3	10	0.5	20	1	6	10	3	10	6	100	0.5	0.5	8	10	8	10	16	8
ETC-1P ETC	10	0.5	20	1	6	93.3	3	93.3	6	100	0.5	0.5	8	93.3	8	93.3	16	8
ETC-2R ETC	10	0.5	20	1	6	10	3	10	6	100	0.5	0.5	8	10	8	10	16	8
Cool Down at 10% Load, Each Engine, Primary and Reserve:																4	1	

Table 4. Summary of Facility-Wide Emission Rates for Full Buildout Scenario

Pollutant	Weekly, Monthly, Quarterly Testing & Cool Down	Annual Facility-wide and Step Tests	Storm Avoidance & Unplanned Outage (24 hrs/yr)	De-energized Building and Transformer and Corrective Testing	Total Emissions
	(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)
PM2.5 (DPM) Normal Year	0.07	0.021	0.07	0.025	0.19
NOX	1.2	0.71	2.17	1.89	5.97
CO	0.36	0.1	0.38	0.29	1.13
VOC	0.19	0.02	0.1	0.06	0.37
SO2	0.0	0.0	0.0	0.0	0.02
Primary Nitrogen Dioxide (NO2)	0.12	0.07	0.22	0.189	0.6

Table 5. 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 6:
 Modeled Concentrations of Criteria Pollutants (with background) and comparison to
 Ambient Air Quality Standards**

Pollutant and Time Frame	Background plus Modeled Concentration – ug/m ³	National Ambient Air Quality Standard - ug/m ³	Percent of Standard
PM ₁₀ 24 Hour	82.2	150	55%
PM ₁₀ Annual	0.056	50	0.1%
PM _{2.5} 24 Hour	26.1	35	74%
PM _{2.5} Annual	0.056	15	0.4%
NO ₂ 1- Hour	166	188	88.3%
CO 1-Hour	203	40,000	0.5%
CO 8-Hour	113	10,000	1.1%
SO ₂ 1-Hour	3.6	319	1.1%
SO ₂ 3-Hour	2.9	1300	0.2%
SO ₂ 24 Hour	1.5	365	0.4%
SO ₂ Annual	2.3E-8	80	3E-8%

Table 7: Modeled Concentrations of Toxic Air Pollutants and Comparison to Acceptable Source Impact Levels (ASILs)

Pollutant and Time Frame	Modeled Concentration – ug/m3	Acceptable Source Impact Level – ASIL ug/m ³	Comparison of Modeled to ASIL
DEEP Annual	0.0335	0.0033	1015%
NO ₂ 1-Hour	334.5	470	71.2%
Acrolein 24 Hour	0.0016	0.06	3%
Ammonia 24 Hour	23	70.8	32%

As is indicated in Tables 6 and 7, only Diesel Engine Exhaust Particulate (DEEP) exceeded the regulatory trigger level (the ASIL) for that pollutant. At this concentration, DEEP is required to be further evaluated in a Second Tier Toxics Review in accordance with WAC 173-460-90.

7. STORM AVOIDANCE HOURS

As indicated in Table 3, there are 16 hours per year assigned for operating the engine generators in ‘storm avoidance’ mode. This is a mode of operation not allowed for the four data centers already approved in the Quincy area. Vantage has proposed to demonstrate the necessity of these hours for its first of four buildings (first seven engine-generators). This demonstration will be required for each new tenant or phase of engine installation at the data center facility. The approval order allows these hours for the first building, but eliminates them for the following phases of the project without demonstration satisfactory to Ecology that these run-time hours are a necessity.

8. SECOND TIER REVIEW FOR DIESEL ENGINE EXHAUST PARTICULATE EMISSIONS

Proposed emissions of diesel engine exhaust particulate (DEEP) from the seventeen (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 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 decided to evaluate 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. 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.

9. CONCLUSION

Based on the above analysis, Ecology concludes that operation of the seventeen (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.

******END OF VANTAGE JULY TSD ******

In Federal guidance regarding the process of determining BACT-level control, the applicant is assigned responsibility for presenting and defending a preferred control system (see, for instance, BNA Policy and Practice Series, Air Pollution Control, 10-91, Page 181:152). When Ecology indicated to Vantage and ICF that the BACT proposal in the application materials submitted on February 10, 2012, was incomplete, Vantage/ICF forwarded a cost-effectiveness summary for the catalysed DPF and SCR systems they propose to use. The application materials also indicated that those systems were guaranteed to reduce uncontrolled engine emissions of PM by 87%, and NO_x, VOC, and CO by 90%. Ecology accepted this proposal as BACT for the Vantage project engines, and then calculated emission limits using uncontrolled engine emission data provided in the application, and using the above emission reduction percentages. These limits were significantly lower than those proposed by Vantage/ICF, for reasons that the applicant has not explained. Instead, Vantage/ICF forwarded a more comprehensive BACT analysis proposing that Tier 2 engines be considered BACT, and that the not-to-exceed (NTE) values they were proposing as emission limits be considered voluntary limits not connected to the BACT determination. This is acceptable to Ecology. The preceding section on BACT in this technical support document has been modified to reflect the BACT supplemental submittal received July 16, 2012.

******END OF VANTAGE JULY TSD ******