STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
4601 N Monroe Street • Spokane, Washington 99205-1295 • (509)329-3400

December 22, 2017

Mr. Brian Huck
Facilities Manager
Oath Holdings Inc.
1010 Yahoo! Way
Quincy, WA 98848

Re: Approval Order 16AQ-E012 – Amendment 2

Dear Mr. Huck:

Ecology has processed your air quality permit, Notice of Construction application, for the facility name change at the Oath Data Center in Quincy.

Please review the enclosed Approval Order (Order) carefully, as you are required to comply with all of its conditions. You may appeal the Order. The appeal procedures are described in the Order.

If you have any questions, please contact me at dkni461@ecy.wa.gov or (509) 329-3469.

Sincerely,

David T. Knight
Air Quality Unit Manager
Eastern Region Office

DTW:jab

Enclosure: Approval Order No. 16AQ-E012 Amendment 2
Technical Support Document

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

IN THE MATTER OF APPROVING A NEW)	Synthetic Minor
AIR CONTAMINANT SOURCE FOR)	APPROVAL ORDER No. 16AQ-E012,
OATH HOLDINGS INC formerly known)	AMENDMENT 2
as YAHOO HOLDINGS, INC.)	
OATH DATA CENTER)	

TO: Mozan Totani, Development Manager
Oath Holdings Inc.
701 First Avenue
Sunnyvale, CA 94089

Brian Huck, Facilities Manager
Oath Holdings Inc.
1010 Yahoo! Way
Quincy, WA 98848

EQUIPMENT

The following table contains a list of equipment that was evaluated for this order of approval for the Oath Holdings Inc. Data Center (Oath or Oath Quincy Data Center) located at 1010 Yahoo! Way and 1500 M Street NE, Quincy, WA. Engine sizes listed in the tables are in megawatt (MWe) units with the "e" indicating "electrical" based on generator power ratings listed on the engine specifications. Thirteen (13) existing 2.0 MWe MTU Detroit Diesel emergency generator unit identification numbers R through 12 were approved in Notice of Construction (NOC) approval Order No. 07AQ-E241 issued on November 13, 2007. Order No. 07AQ-E241 was rescinded and replaced by NOC approval Order No. 11AQ-E399 issued on March 28, 2011. Order No. 11AQ-E399 included the original 13 engines and also ten (10) 2.0 MWe MTU Detroit Diesel emergency generator units with identification numbers 13 through R3. Twenty five (25) new emergency generator units at the facility were proposed in Yahoo's Project Genesis final NOC application submitted to Ecology on December 23, 2015 and will have capacities of 2.0 MWe (20 units) and 2.75 MWe (5 units). Yahoo's application provided Ecology with a combination of the following anticipated engine manufacturers and models to be used for the 25 new engines: Caterpillar Models 3516C, C175, and 3512C; Cummins DQKAB and DQLF; MTU 16V4000 DS2000 and 20V4000 DS2800. Oath Holdings Inc. is the successor to Yahoo, the original applicant.

Amendment 1 (dated November 6, 2017) included revisions to installation scheduling and also minor corrections for consistency with the December 23, 2015 application. Specifically, Amendment 1 addressed a request to change the following: corrections to the NO2 emission rate for existing engines; corrections to facility naphthalene emissions; and updates of installed engine serial numbers and scheduling.

Amendment 2 addresses the applicant's request to indicate transfer of the permit to a new owner/operator and corrects serial number information for 4 generators.

This approval Order covers all 48 engines (existing and proposed). Specific engine information regarding existing engines is provided in Table 1.1.

Table 1.1: Emergency Engine & Generator Serial Numbers

Phase	Unit ID	Manufacturer & Model No.	Rated MWe	Engine SN	Generator SN	Build Date* (see below)
Phase 1	R	MTU Detroit Diesel 16V4000 G83 B3	2.0	527103530	81 28288 A505	12/14/06
"	1	MTU Detroit Diesel 16V4000 G83 B3	2.0	527103852	81 28288 A205	2/16/07
"	2	MTU Detroit Diesel 16V4000 G83 B3	2.0	527103897	81 28288 A305	2/19/07
"	3	MTU Detroit Diesel 16V4000 G83 B3	2.0	527103898	81 28288 A105	2/19/07
"	4	MTU Detroit Diesel 16V4000 G83 B3	2.0	527104004	81 28288 A405	3/1/07
Phase 2	5	MTU Detroit Diesel 16V4000 G83 B3	2.0	527104645	81 28976 A404	9/12/07
"	6	MTU Detroit Diesel 16V4000 G83 B3	2.0	527104646	81 28597 A405	9/12/07
"	7	MTU Detroit Diesel 16V4000 G83 B3	2.0	527105840	81 28597 A101	8/8/08
"	8	MTU Detroit Diesel 16V4000 G83 B3	2.0	527104665	81 28597 A105	9/12/07
Phase 3	9	MTU Detroit Diesel 16V4000 G83 B3	2.0	527105203	81 28597 A505	2/1/08
"	10	MTU Detroit Diesel 16V4000 G83 B3	2.0	527105204	81 28976 A104	2/1/08
"	11	MTU Detroit Diesel 16V4000 G83 B3	2.0	527105205	81 28976 A204	2/1/08
"	12	MTU Detroit Diesel 16V4000 G83 B3	2.0	527105206	81 28976 A304	2/1/08
Phase 5	13	MTU Detroit Diesel 16V4000 G83 B3	2.0	527107949	WA-575124-1110	9/16/10
"	14	NA	NA	NA	NA	NA
"	15	MTU Detroit Diesel 16V4000 G83 B3	2.0	527107951	WA-575127-1110	9/16/10
	16	MTU Detroit Diesel 16V4000 G83 B3	2.0	527107950	WA-575140-1210	9/16/10
"	R2	MTU Detroit Diesel 16V4000 G83 B3	2.0	527107948	WA-575180-1210	2010
Phase 6	17	MTU Detroit Diesel 16V4000 G83 B3	2.0	5272011221	WA-575153-1210	Feb-13
"	18	MTU Detroit Diesel 16V4000 G83 B3	2.0	5272011219	WA-581655-0213	Feb-13
"	19	MTU Detroit Diesel 16V4000 G83 B3	2.0	5272011218	WA-581627-0213	Feb-13
"	20	MTU Detroit Diesel 16V4000 G83 B3	2.0	5272011220	WA-581653-0213	Feb-13
"	R3	MTU Detroit Diesel 16V4000 G83 B3	2.0	5272011251	WA-581631-0313	Mar-13
Genesis Phase 1	13A	Caterpillar 3516C	2.0	DD60 0870	G7F00223	1/16/17
Genesis Phase 1	13B	Caterpillar 3516C	2.0	DD60 0872	G7F00224	1/16/17
Genesis Phase 1	R4	Caterpillar C175	2.75	WYB0 1865	G7J00631	1/16/17
Genesis Phase 1	H1	Caterpillar C175	2.75	WYB0 1867	G7J00633	1/16/17
Phase	Unit ID	Manufacturer & Model No.	Rated MWe	Engine SN	Generator SN	*Build Date AND Install Date
total	48	*Upon issuance of this Amendment, Table 1.1 shall also include installation dates.				

The words "engine" or "generator" are used synonymously through the remainder of this permit to refer to the overall unit. This approval order also includes 6 Evapco Model AT 212-636 cooling towers installed under NOC 07AQ-E241 for the first 13 existing engines (engines R through 12). Cooling units dissipate heat from electronic equipment at the facility. Cooling unit information is provided in Table 1.2.

Table 1.2: Existing Cooling Towers installed under NOC 07AQ-E241			
Total Units	Total Number of Fans per Cooling Unit	Total Number of Cooling Tower Cells per Unit	Total Number of Cooling Cells
6	2	2	12

Engines 13 through R3 at Oath do not use evaporative cooling systems. According to the application, the evaporative cooling units to be used for the new Project Genesis engines do not introduce contaminants into the atmosphere.

Combined facility potential to emit (PTE) estimated emissions from all engines and cooling towers are provided in Table 1.3.

Table 1.3 Total Facility Potential To Emit (PTE) Emissions	
Criteria Pollutants (Engines)	**TPY**
NOx	95
VOC	2.8
CO	17.9
Total PM10/PM2.5 (filterable and condensable)	5.5
SO_2	0.025
Toxic Air Pollutants (Engines)	**TPY**
Primary NO_2	9.5
DEEP	1.8
CO	17.9
SO_2	0.025
Propylene	1.3E-01
Acrolein	3.5E-04
Benzene	3.5E-02
Xylenes	8.6E-03
Naphthalene	5.8E-03
1,3 Butadiene	1.8E-03
Formaldehyde	3.5E-03
Benzo(a)Pyrene	1.2E-05
Benzo(b)fluoranthene	5.0E-05
Dibenz(a,h)anthracene	1.6E-05
Cooling Tower Emissions	**TPY (or lbs/yr where listed)**
PM10/PM2.5	2.11
Cadmium	(0.00395 lb/yr)

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).

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

4. The modeled ambient concentrations of two toxic air pollutants – diesel engine exhaust particulate matter and nitrogen dioxide – exceed the Acceptable Source Impact Levels (ASILs) for those pollutants, as defined in Chapter 173-460 WAC. Ecology has evaluated the health risks associated with diesel engine exhaust particulate and nitrogen dioxide emissions from the proposed project, in accordance with WAC 173-460-090. Ecology has concluded that the health risks from the project are acceptable in accordance with WAC 173-460-090(7). The technical analysis supporting this determination is incorporated into the Technical Support Document associated with 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 Notice of Construction Approval Order No. 16AQ-E012, Amendment 1 is rescinded and replaced entirely with this Approval Order [16AQ-E012, Amendment 2]. All previous Orders remain rescinded under this Order.

1.2 Oath will provide Quincy School District administrators with the telephone number for Oath and a 24 hour contact number for an Oath manager. Oath will notify the school whenever (Ecology) approved changes occur in the maintenance testing schedule. As decided by the school administrators and Oath, an ongoing relationship shall be established to facilitate future communications.

1.3 Oath shall make available information on diesel engine exhaust health risks and emergency generator operations to existing residents and commercial and industrial facilities within 0.25 miles of Oath property boundaries. Information on diesel exhaust health risks and emergency generator operations shall be provided to the City of Quincy

Building and Planning Department for distribution to new homeowners and businesses that locate on undeveloped parcels within 0.25 miles of the Oath property boundary. The health risk information may be, or should be similar to, Ecology Focus on Diesel Exhaust Health Risks dated February 2011, Publication Number 11-02-005. A copy of the materials to be used to comply with this condition shall be provided to Ecology for review, and distributed prior to starting Project Genesis operations.

2. EQUIPMENT RESTRICTIONS

2.1 Any engine used to power the electrical generators shall be operated in accordance with applicable 40 CFR 60, Subpart IIII requirements including but not limited to: certification by the manufacturer to meet the 40 CFR 89 EPA Tier 2 emissions levels as required by 40 CFR 60.4202; and installed and operated as emergency engines, as defined in 40 CFR 60.4219. At the time of the effective date of this permit, Tier 4 interim and Tier 4 final certified engines (as specified in 40 CFR 1039.102 Table 7 and 40 CFR 1039.101 Table 1, respectively), are not required for 2.0 to 2.75 MWe electrical generators used for emergency purposes as defined in 40 CFR 60.4219 in attainment areas in Washington State. However, any engines installed at the Oath Data Center after Tier 4 or other limits are implemented by EPA for emergency generators, shall meet the applicable specifications as required by EPA at the time the emergency engines are installed.

2.2 The only engines and electrical generating units approved for operation at Oath are those listed by serial number in Table 1.1 of this Order.

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 of the engines permitted according to Conditions 3.5 and 10.1, 18 months after the issuance date of this permit 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 community impacts over those evaluated for this approval Order, or if an update to the current BACT analysis is necessary.

2.5 The forty-eight (48) engine-generators exhaust stack heights shall conform to the limitations in Conditions 2.5.1, 2.5.2, and 2.5.3:

2.5.1 The 13 existing engine stack heights (Unit ID: R through 12) shall be greater than or equal to 20 feet above ground level

2.5.2 The 10 existing stack heights (Unit ID: 13 through R3) shall be greater than or equal to 30 feet above ground level.

2.5.3 The 25 Project Genesis stack heights shall be greater than or equal to 42 feet above ground level.

2.6 This Order only applies to the forty-eight (48) engines, each with a rated full standby capacity as listed in Table 1.1, which are consistent with the engines that were evaluated in Notice of Construction applications and second tier review. New source review will not be required for engines with a rated full standby capacity of less than or equal to the ratings in Table 1.1 that comply with the engine certification requirements contained in Approval Conditions 2.1 and 5 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.

2.7 In addition to meeting EPA Tier 2 certification requirements, the source must have written verification from the engine manufacturer that each of the 48 engines of the same make, model, and rated capacity installed at the facility uses the same electronic Programmable System Parameters, i.e., configuration parameters, in the electronic engine control unit.

3. OPERATING LIMITATIONS

3.1 The fuel consumption at Oath shall be limited to a total of approximately 648,900 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 and shall conform to Conditions 3.1.1 and 3.1.2:

3.1.1 The 13 existing engines (Unit ID: R through 12) shall be limited to 143,648 gallons per year of diesel fuel averaged over a three (3) year period using monthly rolling totals.

3.1.2 The 10 existing engines (Unit ID: 13 through R3) shall be limited to 103,551 gallons per year of diesel fuel averaged over a three (3) year period using monthly rolling totals.

3.1.3 The 25 Project Genesis engines shall be limited to a maximum of 401,700 gallons per year of diesel fuel averaged over a three (3) year period using monthly rolling totals.

3.2 Except as provided in Approval Condition 3.5, the forty-eight (48) Oath engines are restricted to the annual limits in Tables 3.2.1 and 3.2.2.

Table 3.2.1 Existing Engine Operating Restrictions for Engines R through 12 (13 engines) and Engines 13 through R3 (10 engines)

Operating Activity	Hours/year per generator	Operating Electrical Loads (%)	Number of Engines Operating Concurrently (Engines R - 12)	Number of Engines Operating Concurrently (Engines 13 - R3)
Maintenance Testing	12	0	1	1
Load Testing	4	100	1	1
Electrical Bypass	36	2 at 40, or 1 at 80	2	2
Power Outage	48	8 at 90, 2 at idle*	13	10
Total	100			

*As noted in the application, potential to emit values are conservatively estimated based on 10% load because manufacturers do not publish emissions data for the idle operating condition. However, engines shall not be continuously operated at low loads (<30%) except during idle (zero load) and if needed during stack testing (10% & 25%).

Table 3.2.2 Proposed Engine Operating Restrictions for Project Genesis Engines (25 engines)			
Operating Activity	Hours/year per generator	Operating Electrical Loads (%)	Number of Engines Operating Concurrently
Maintenance Testing	12	Any random load* from zero to 100%	1
Load Testing	4	Any random load* from zero to 100%	1
Power Outage	84	Any random load* from zero to 100%	25
Total	100		

* Engines shall not be continuously operated at low loads (<30%) except during idle (zero load) and if needed during stack testing (10% & 25%).

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 zero electrical load.

3.4. The forty-eight (48) engines at Oath require periodic scheduled operation. To mitigate engine emission impacts, Oath will perform all engine testing during daylight hours. Engine testing may take place outside of these time restrictions upon coordination by Oath with other data centers in northeast Quincy to minimize engine emissions impacts to the community. Oath shall maintain records of the coordination communications with other data centers, and those communications shall be available for review by Ecology upon request.

3.5. Initial start-up (commissioning) testing for the remaining twenty-one (21) Project Genesis engines not yet installed, shall be performed in four phases (Genesis phase 1, Genesis phase 2, Genesis phase 3, and Genesis phase 4), where each engine shall be restricted to an average of 16 hours per generator averaged over all generators installed and shall comply with the following Conditions (for the purposes of scheduled phasing, initial phase engine Unit ID #14, is not a Project Genesis engine, but shall be included in the Genesis phased schedule because it was not yet installed at the time of this Amendment):

3.5.1 For Genesis phase 1, only four (4) 2.0-MW engines shall be commissioned. For Genesis phase 2, only four (4) 2.0-MW engines and one (1) 2.75-MW engines shall be commissioned. For Genesis phase 3, only four (4) 2.0-MW engines and one (1) 2.75-MW engines shall be commissioned. For Genesis phase 4, only seven (7) 2.0-MW engines and one (1) 2.75-MW engines shall be commissioned. All four phases shall comply with General Condition 10.1.

3.5.2 Except during site integration testing as specified below, only one engine shall be operated at any one time during start-up testing.

3.5.3 During a site integration test, no more than twenty five (25) engines may operate concurrently for up to four continuous hours.

3.5.4 All startup and commissioning testing shall be conducted during daylight hours.

3.5.5 Fuel use limits and emissions limits contained in Approval Conditions 3.1 and 5, remain in effect during initial start-up testing.

3.6. All of the cooling units shall comply with the following conditions:

3.6.1 Each individual cooling unit shall use a mist eliminator with a maximum drift rate of 0.001% of the circulating water flow rate. The drift rate shall be guaranteed by the unit manufacturer.

3.6.2 Chemicals containing hexavalent chromium cannot be used to pre-treat the cooling unit makeup water.

4. GENERAL TESTING AND MAINTENANCE REQUIREMENTS

4.1. Oath will follow engine-manufacturer's recommended diagnostic testing and maintenance procedures to ensure that each engine will conform to Condition 5 emission limits and Tier 2 emission specifications as listed in 40 CFR 89 throughout the life of each engine.

4.2 Oath shall measure emissions of particulate matter (PM), non-methane hydrocarbons, nitric oxide (NO), nitrogen dioxide (NO_2), carbon monoxide (CO) from engine exhaust stacks in accordance with Approval Condition 4.3. This testing will serve to demonstrate compliance with the g/kW-hr EPA Tier 2 average emission limits contained in Section 5, and as an indicator of proper operation of the engines. The selection of the engines(s) to be tested shall be in accordance with Conditions 4.2.1 and 4.2.2 and shall be defined in a source test protocol submitted to Ecology no less than 30 days in advance of any compliance-related stack sampling conducted by Oath. Additional testing as described in 40 CFR 60.8(g) may be required by Ecology at their discretion.

4.2.1 For new engines, at least one representative engine from each manufacturer and each size engine from each manufacturer shall be tested as soon as possible after commissioning and before it becomes operational. Alternatively, the engine may be tested at the manufacturer's testing cell if the following conditions are met and verified by the manufacturer in a letter to Ecology: At a minimum, the test cell shall reproduce site conditions for the following parameters: elevation, intake air temp, and humidity. The letter from the manufacturer shall verify that test conditions reproduce facility site conditions in their test cell using the same testing methods that are required for certification of the engines.

4.2.2 Every 60 months after the first testing performed in Condition 4.2.1, Oath shall test at least one engine, including the engine with the most operating hours as long as it is a different engine from that which was tested during the previous 60 month interval testing.

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 Oath 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 For new engine testing, PM (filterable fraction only), non-methane hydrocarbons, NO, NO_2, and CO emissions measurement shall be conducted at five individual generator electrical loads of 100%, 75%, 50%, 25%, and 10% using weighting factor averaging according to Table 2 of Appendix B to Subpart E of 40CFR89.

4.3.2.1. For existing engine testing every 60 months, Oath may choose the following alternate to testing at all 5 loads: the data center may test at the average load operated at for that specific engine over the previous 36 months of operation to verify compliance with the manufacturers' site corrected Not to Exceed (NTE) Emission Limits at the operated load rate. Alternatively, the facility has the option of testing at the average load it expects to operate for the next 60 month period of operation, if known to be different than the previous 36 months of operation. This alternative option, must also verify compliance with the manufacturers' site corrected Not to Exceed (NTE) Emission Limits at the expected operational load rate.

4.3.3 EPA Reference Methods and test procedures from 40 CFR 60, 40 CFR 51, and/or 40 CFR 89 as appropriate for each pollutant shall be used including Method 5 or 40 CFR 1065 for PM. 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 procedure 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.

4.3.5 In the event that any source test or visual emission standard shows non-compliance with the emission limits in Condition 5, Oath shall repair or replace the engine and repeat the test on the same engine plus two additional engines of the same make and model as the engine showing non-compliance. Test reports shall be submitted to Ecology as provided in Condition 9.5 of this Order.

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 forty-eight (48) engines described in this Order shall meet the emission rate limitations contained in this section. 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 as determined according to those approval conditions.

5.2 To demonstrate compliance with 40CFR89(112 & 113) g/kW-hr EPA Tier 2 weighted average emission limits through stack testing, Oath shall conduct exhaust stack testing as described in Conditions 4.2 and 4.3 at the loads of 100%, 75%, 50%, 25% and 10% using weighted averaging according to Table 2 of Appendix B to Subpart E of 40 CFR 89, or any other applicable EPA requirement in effect at the time the engines are installed. Testing may be conducted using 40 CFR 1065.

5.3 Nitrogen oxides (NOx or NO + NO2) emissions from each of the forty-eight (48) engines shall not exceed the following emission rates at the stated loads, based on emission factors provided by the engine manufacturer:

Table 5.3: Nitrogen oxides (NOx) and non-methane hydrocarbon (NMHC) emission rate limits

	Operating Scenario	Operating Electrical Load	Emissions Limit per engine
5.3.1	Maximum Emission Rate Per Load	Maximum Rate at 100%, 75%, 50%, 25%, or 10%	44.3 lb/hr[1] (NOx) for 2.0 MWe engines[2]
			74.4 lb/hr[1] (NOx) for 2.75 MWe engines
5.3.2	Average Emission Rate Across All Loads	Weighted Average of Rates at 100%, 75%, 50%, 25%, and 10%	5-load weighted average of 6.4 g/kW-hr (NOx + NMHC)

1 Limit represents the higher value of either the Caterpillar "Not To Exceed" or EPA Tier-2 (6.12 g/kw-hr). Total engine NOx emissions shall comply with Tier 2 emissions limits in 40CFR89.
2 2.0 MWe engines installed prior to 2016 shall have an emission limit of 46.2 lb/hr.

5.4 Nitrogen dioxide (NO_2) emissions from each of the forty-eight (48) engines shall not exceed the following emission rates at the stated loads, based on emission factors provided by the engine manufacturer:

Table 5.4: Nitrogen dioxide (NO_2) emission rate limits

	Operating Scenario	Operating Electrical Load	Emissions Limit per engine
5.4.1	Maximum Emission Rate Per Load	Maximum Rate at 100%, 75%, 50%, 25%, or 10%	4.43 lb/hr[1] (NO_2) for 2.0 MWe engines[2]
			7.44 lb/hr[1] (NO_2) for 2.75 MWe engines
5.4.2	Average Emission Rate Across All Loads	Weighted Average of Rates at 100%, 75%, 50%, 25%, and 10%	5-load weighted average of 0.62 g/kW-hr

1 10% of total NOx emission limits
2 2.0 MWe engines installed prior to 2016 shall have an emission limit of 4.62 lb/hr.

5.5 Carbon monoxide emissions from each of the forty-eight (48) engines shall not exceed the following emission rates at the stated loads, based on emission factors provided by the engine manufacturer:

Table 5.5: Carbon monoxide (CO) emission rate limits			
	Operating Scenario	Operating Electrical Load	Emissions Limit per engine
5.5.1	Maximum Emission Rate Per Load	Maximum Rate at 100%, 75%, 50%, 25%, or 10%	5.02 lb/hr[1] (CO) for 2.0 MWe engines
			14.3 lb/hr[1] (CO) for 2.75 MWe engines
5.5.2	Average Emission Rate Across All Loads	Weighted Average of Rates at 100%, 75%, 50%, 25%, and 10%	5-load weighted average of 3.5 g/kW-hr

1 Limit represents the higher value of either the Caterpillar "Not To Exceed" or EPA Tier-2 (3.5 g/kw-hr). Total engine CO emissions shall comply with Tier 2 emissions limits in 40CFR89.

5.6 Diesel Engine Exhaust Particulate (DEEP) emissions from each of the forty-eight (48) engines power shall not exceed the following emission rates at the stated loads, based on emission factors provided by the engine manufacturer:

Table 5.6: Diesel Engine Exhaust Particulate (DEEP) emission rate limits			
	Operating Scenario	Operating Electrical Load	Emissions Limit per engine
5.6.1	Maximum Emission Rate Per Load	Maximum Rate at 100%, 75%, 50%, 25%, or 10%	0.88 lb/hr[1] (DEEP) for 2.0 MWe engines
			0.91 lb/hr[1] (DEEP) for 2.75 MWe engines
5.6.2	Average Emission Rate Across All Loads	Weighted Average of Rates at 100%, 75%, 50%, 25%, and 10%	5-load weighted average of 0.2 g/kW-hr

1 Limit represents the higher value of either the Caterpillar "Not-to-Exceed" data or EPA Tier-2 (0.2 g/kw-hr). Total engine PM emissions shall comply with Tier 2 emissions limits in 40CFR89.

5.7 Particulate matter emissions (filterable plus condensable) from all 48 engines combined shall not exceed 5.5 tons/yr on a 36-month rolling basis.

5.8 DEEP emissions from all 48 engines combined shall not exceed 1.8 tons/yr on a 36-month rolling basis.

5.9 Total NOx emissions from all 48 engines combined shall not exceed 95 tons/yr, on a 36-month rolling basis.

5.10 Total NO_2 emissions from all 48 engines combined shall not exceed 9.5 tons/yr, on a 36-month rolling basis.

5.11 Volatile organic compound (VOC) emissions from all 48 engines combined shall not exceed 2.8 tons/yr, on a 36-month rolling basis.

5.12 CO emissions from all 48 engines combined shall not exceed 17.9 tons/yr, on a 36-month rolling basis.

5.13 Visual emissions from each diesel electric generator exhaust stack while operating at an electrical load greater than 20 percent or less than 5 percent shall be no more than 5 percent opacity, and visible emissions during operating loads between 5 to 20 percent shall be no more than 10 percent opacity, 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

A site-specific O&M manual for Oath 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 include the manufacturers' recommended protocols for extended low-load operation. For example, for Caterpillar engines, the O&M manual shall include language to address "extended operation at reduced load (less than 30%)" which "may cause increased oil consumption and carbon buildup in the cylinders.... Extended operation at reduced load may also cause fuel to slobber through the exhaust system. This may result in a loss of power and/or poor performance." For Caterpillar engines, the O&M manual shall include the following specific language: "To maintain engine efficiency and performance, apply a full load to the engine on an hourly basis, or operate the engine at a load level that is greater than 30%. This will burn excess carbon from the cylinders. When possible, before shutting down the engine after running the engine for extended periods at low load, apply a full load for approximately 30 minutes. Running the engine at full load allows excess carbon to burn from the following components: cylinders, pistons and valves." 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 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.

6.2 Normal operating parameters and design specifications.

6.3 Operating maintenance schedule.

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

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 except as required for stack testing in Condition 8.2. 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 Fuel receipts with amount of diesel and sulfur content for each delivery to the facility.

8.2 Monthly and annual fuel usage.

8.3 Monthly and annual hours of operation for each diesel engine. The cumulative hours of operation for each engine shall be maintained for the life of the engine while at Oath, and shall include which engines have been stack tested, and the report information from Condition 9.5.

8.4 Purpose, electrical load and duration of runtime for each diesel engine period of operation.

8.5 Annual gross power generated by each independent building quadrant at the facility and total annual gross power for the facility.

8.6 Upset condition log for each engine and generator that includes date, time, duration of upset, cause, and corrective action.

8.7 Any recordkeeping required by 40 CFR Part 60 Subpart IIII.

8.8 Air quality complaints received from the public or other entity, the affected emissions units and any actions taken by Oath in response to those complaints.

9 REPORTING

9.1 Within 10 business days after entering into a binding agreement to purchase the engine/generator sets identified in Equipment Table 1.1 above, Oath shall notify Ecology in writing. The serial number, manufacturer make and model, standby capacity, and date of manufacture will be submitted prior to installation of each engine.

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 and three-year rolling total summary of fuel usage compared to Conditions 3.1, 3.1.1, 3.1.2, and 3.1.3.

9.2.2 Monthly rolling annual and three year rolling total summary of all air contaminant emissions for pollutants above the WAC 173-400-110(5) and WAC 173-460-150 de minimis levels as listed in Table 1.3 of this permit.

9.2.3 Monthly rolling hours of operation with annual and three-year rolling total.

9.2.4 Monthly rolling gross power generation with annual total as specified in Approval Condition 8.4.

9.2.5 A listing 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. A record shall be maintained of Oath's action 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 Oath 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 the tenant from annual reporting of operations contained in any section of Approval Condition 9.

9.5 Stack test reports of any engine shall be submitted to Ecology within 45 days of completion of the test and shall include, at a minimum, the following information:

9.5.1 Location, unit ID, manufacturer and model number of the engine(s) tested, including the location of the sample ports.
9.5.2 A summary of test methods, results (reported in units and averaging periods consistent with the applicable emission standard or limit), field and analytical laboratory data, quality assurance/quality control procedures and documentation.
9.5.3 A summary of operating parameters for the diesel engines being tested.
9.5.4 Copies of field data and example calculations.
9.5.5 Chain of custody information.
9.5.6 Calibration documentation
9.5.7 Discussion of any abnormalities associated with the results.
9.5.8 A statement signed by the senior management official of the testing firm certifying the validity of the source test report.

10 GENERAL CONDITIONS

10.1 **Commencing/Discontinuing Construction and/or Operations:** Authorization to construct under this Approval Order shall become void if construction of Genesis phase 1 (as described in Conditions 3.5 and 3.5.1) is not completed within eighteen (18) months following the issuance date of this Approval Order, or if Genesis phase 2 is not commenced within eighteen (18) months following completion of commissioning of the final engine in Genesis phase 1, or if Genesis phase 3 is not commenced within eighteen (18) months following completion of commissioning of the final engine in Genesis phase 2, or if Genesis phase 4 is not commenced within eighteen (18) months following completion of commissioning of the final engine in Genesis phase 3. No additional engines shall be installed, if construction of all four phases are discontinued for a period of eighteen (18) months, or if operation of backup emergency diesel electric generators is discontinued at the facility for a period of eighteen (18) months, unless prior written notification is received by Ecology at the address in Condition 7 above.

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 48 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 **Quincy Community Assessment 2017:** On or before July 1, 2017, Oath shall submit to Ecology a protocol for a health risk assessment that analyzes the public health risk to Quincy residents from DEEP emissions in the Quincy area, including emissions from data center engines, highways, locomotives and other source categories. Oath shall submit the completed health risk assessment to Ecology within 90 days of Ecology's approval of the risk assessment protocol. Ecology may extend this deadline for good cause. The study shall model the locations in the community that experience the highest exposure to DEEP emissions, estimate the health risks associated with that exposure, and apportion the health risks among contributing source categories. In preparing the study Oath may collaborate with other owners of diesel engines in or near Quincy. Ecology shall review the assessment and take appropriate action based on the results.

10.7 **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.

10.8 **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 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.

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

1. Violation of any terms or conditions of this authorization;
2. 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 provisions of their circumstances 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 P.O. Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel Road SW, Suite 301 Tumwater, WA 98501	**Pollution Control Hearings Board** P.O. 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 22nd day of December 2017, at Spokane, Washington.

Prepared By:

GARY J. HUITSING
STATE OF WASHINGTON
42376
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PROFESSIONAL ENGINEER

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Science and Engineering Section
Air Quality Program
Department of Ecology
State of Washington

Approved By:

David T. Knight
Section Manager
Regional Air Quality Section
Eastern Regional Office
State of Washington

TECHNICAL SUPPORT DOCUMENT
FOR APPROVAL ORDER NO. 16AQ-E012, AMENDMENT 2

OATH HOLDINGS INC (FKA: YAHOO HOLDINGS, INC.)
OATH DATA CENTER
December 22, 2017

1. PROJECT DESCRIPTION

On October 19, 2015, the Washington State Department of Ecology (Ecology) received a Notice of Construction (NOC) application submittal from the Yahoo Holdings, Inc. Data Center (Yahoo), located at 1010 Yahoo Way, and 1500 M Street NE Quincy, WA. Yahoo (now called Oath) requesting approval for revisions to the March 28, 2011 Approval Order No. 11AQ-E399 (previous permit) which covers the existing Oath Quincy Data Center facilities. The October 19, 2015 application was for additional engines referred to as Project Genesis. Project Genesis is located adjacent to and is considered a part of the existing Oath data center structures at this location. The NOC application requested a new permit to cover existing Oath data center facilities in addition to Project Genesis. The existing oath data centers facilities and Project Genesis are referred hereafter as Oath or Oath Quincy Data Center. The NOC application was determined to be incomplete and, on November 19, 2015, Ecology issued an incompleteness letter to Oath. On December 7, 2015, Oath provided supplemental NOC and Second Tier Risk Analysis information to Ecology. Oath's NOC application and Second Tier Risk Analysis were considered complete on December 23, 2015. Ecology has concluded that this project has satisfied all requirements of a second tier analysis.

Amendment 1: Oath (then called Yahoo) submitted an administrative amendment application, received by Ecology engineers on June 13, 2017. The amended permit includes revisions to installation scheduling, updates to the facility name, and also minor corrections for consistency with the December 23, 2015 application. Specifically, Amendment 1 addressed Oath's request to change the following: corrections to the NO2 emission rate for existing engines; corrections to facility naphthalene emissions; and updates of installed engine serial numbers and scheduling. For the purposes of scheduled phasing of Project Genesis engines, initial phase engine Unit ID #14, is not a Project Genesis engine, but is included in the Genesis phased schedule because it was not yet installed at the time of the June 2017, application. The application was considered complete on July 11, 2017. A public comment period for this project was held from August 8 through September 8, 2017. Comments received are addressed in an appendix or attachment to this TSD.

Amendment 2: Ecology received an application from Oath Holdings Inc (Oath) on November 13, 2017 requesting that the permit indicate transfer of the permit to a new owner/operator from Yahoo Holdings Inc., to Oath Holdings Inc. Amendment 2 also corrects serial number information for four generators.

The primary air contaminant sources at the facility consist of a total of 23 existing and 25 new electric generators powered by diesel engines to provide emergency backup power to the facility. The existing 23 generators/engines (engines) and related facilities (cooling towers, building etc...) were permitted under Approval Order 11AQ-E399 and are incorporated into this new Approval Order along with Project Genesis. Project Genesis consists of direct evaporative cooling units, air cleaning systems, boiler heating, a 196,969 square feet building complex, along with the 25 new engines. 20 of the new engines will provide the main data center support and will be rated at 2.0 megawatt electrical capacity (MWe). The data center will also have 4 reserve engines rated at 2.75 MWe and 1 administrative support engine rated at 2.75 MWe. Upon final build-out, Oath will consist of forty-eight (48) electric generators with a total capacity of up to approximately 99.75 MWe using a combination of Caterpillar, Cummins, and MTU engine options.

The existing engines R through 12 are supported by 6 Evapco Model USS 212-636 cooling units to dissipate heat from electronic equipment at the facility. Each unit has two cooling towers and two fans. Each tower has a design recirculation rate of 2,460 gallons per minute (gpm) and an air flow rate of 290,700 cubic feet per minute (cfm). Project Genesis will also include direct evaporative cooling units or equivalents. The cooling units for engines 13 through R3 and Project Genesis are not a source of air emissions.

To avoid Title V major thresholds of Nitrogen Oxides (NOx), and Nitrogen Dioxide (NO2), this facility requested that existing generators R through 12 reduce allowable annual hours from 200 to 100 hours. The facility is considered a synthetic minor source as described in footnote k of Table 1.1.

1.1 Potential To Emit For Criteria Pollutants And Toxic Air Pollutants (TAPs)

Table 1.1 contains potential-to-emit (PTE) estimates in tons per year (TPY) by the applicant for Project Genesis and for entire Oath facility (including Project Genesis).

Table 1 Total Facility and Project Genesis(j) Potential To Emit Estimates					
Pollutant	**Emission Factor (for the engine rating listed)**			**Total Facility PTE (Project Genesis PTE)**	**References**
Criteria Pollutants	**Units = lbs/hr; except where noted**			**TPY**	**(a)**
NOx	6.12 g/kW-hr	44.34 (2.0 MWe)	74.40 (2.75 MWe)	95 (62.9)	(b),(k)
VOC	0.28 g/kW-hr	1.14 (2.0 MWe)	2.91 (2.75 MWe)	2.8 (1.9)	(b)
CO	3.5 g/kW-hr	5.02 (2.0 MWe)	14.30 (2.75 MWe)	17.9 (8.8)	(b)
Total PM10/PM2.5 (filterable and condensable)	See DEEP and cooling tower emissions for specific contributions			7.6 (3.44)	(f),(i)
SO_2	15 ppm			0.025 (0.0001)	(c)
Lead	NA			Negligible (Negligible)	(d)
Ozone	NA			NA (NA)	(e)
Toxic Air Pollutants (TAPS)	**Units = Lbs/MMbtu (except where noted)**			**TPY**	(a)
Primary NO_2	10% of NOx			9.5 (6.3)	See NOx
DEEP	0.20 g/kW-hr	0.88 lbs/hr (2.0 MWe)	0.91 lbs/hr (2.75 MWe)	1.8 (1.12)	(b),(i)

CO	3.5 g/kW-hr	17.9 (8.8)	(b)
SO_2	15 ppm	0.025 (0.0001)	(c)
Propylene	2.79E-03	1.3E-01 (7.7E-02)	(g)
Acrolein	7.88E-06	3.5E-04 (2.2E-04)	(g)
Benzene	7.76E-04	3.5E-02 (2.2E-02)	(g)
Toluene	2.81E-04	1.3E-02 (7.8E-03)	(g)
Xylenes	1.93E-04	8.6E-03 (5.4E-03)	(g)
Naphthalene	1.30E-04	5.8E-03 (5.8E-03)	(g)
1,3 Butadiene	1.96E-05	1.8E-03 (1.1E-03)	(g)
Formaldehyde	7.89E-05	3.5E-03 (2.2E-03)	(g)
Acetaldehyde	2.52E-05	1.1E-03 (7.0E-04)	(g)
Benzo(a)Pyrene	2.57E-07	1.2E-05 (7.1E-06)	(g)
Benzo(a)anthracene	6.22E-07	2.8E-03 (1.7E-05)	(g)
Chrysene	1.53E-06	6.9E-05 (4.2E-05)	(g)
Benzo(b)fluoranthene	1.11E-06	5.0E-05 (3.1E-05)	(g)
Benzo(k)fluoranthene	2.18E-07	9.8E-05 (6.1E-06)	(g)
Dibenz(a,h)anthracene	3.46E-07	1.6E-05 (9.6E-06)	(g)
Ideno(1,2,3-cd)pyrene	4.14E-07	1.9E-05 (1.1E-05)	(g)
Cooling Tower Emissions	**Units = mg/liter water concentration**		
PM10/PM2.5	7,500	2.11 tpy	(h),(j)
Arsenic	0.002	0.00263 lb/yr	(h),(j)
Barium	0.013	0.0171 lb/yr	(h),(j)
Cadmium	0.003	0.00395 lb/yr	(h),(j)
Chromium III	0.0047	0.00618 lb/yr	(h),(j)
Copper	0.0032	0.00421 lb/yr	(h),(j)
Iron	0.0665	0.0875 lb/yr	(h),(j)
Lead	0.0005	0.000658 lb/yr	(h),(j)
Manganese	0.002	0.00263 lb/yr	(h),(j)
Mercury	0.0003	0.000395 lb/yr	(h),(j)

(a) The current list of EPA criteria pollutants (http://www.epa.gov/airquality/urbanair/; last updated December 22, 2014) that have related National Ambient Air Quality Standards (NAAQS) (http://www.epa.gov/air/criteria.html; last updated October 21, 2014). VOC is not a criteria pollutant but is included here per note (e). Toxic Air Pollutants (TAPs) are defined as those in WAC 173-460. Greenhouse gas is not a criteria pollutant or a TAP and is exempt from New Source Review requirements for non Prevention of Significant Deterioration (PSD) projects such as at Oath per WAC 173-400-110(5)(b).

(b) Project Genesis emission factors (EFs) based on manufacturer not-to-exceed (NTE) data and Tier 2 EFs from 40 CFR 89.112a. For NTE data, emission factors for Caterpillar, Cummins, and MTU were used, whichever is higher. For example, the VOC, PM, and CO NTE emission for the 2.75 MWe engines are based on Caterpillar NTE data of 2.91 lb/hr (10% load) and 0.91 lb/hr (25% load), and 14.3 lb/hr (75% load) respectively. Whereas for NOx, the Cummins NTE value of 74.4 lb/hr (100% load) is the highest NTE value. Tier 2 EFs are as follows: 6.4 g/kW-hr for NOx plus non-methane hydrocarbons (NMHC); 3.5 g/kW-hr for CO; and 0.20 g/kW-hr for PM. The total NOx, NMHC, CO, and PM emissions for all 48 certified engines meet the Tier 2 g/kW-hr emission factor limits listed. 2.0 MWe engines installed prior to 2016 have an emission factor of 46.2 lb/hr for NOx, and 4.62 lb/hr for NO2.

(c) Applicants estimated emissions based on fuel sulfur mass balance assuming 0.00150 weight percent sulfur fuel.

(d) EPA's AP-42 document does not provide an emission factor for lead emissions from diesel-powered engines. Lead emissions are presumed to be negligible.

(e) Ozone is not emitted directly into the air, but is created when its two primary components, volatile organic compounds (VOC) and oxides of nitrogen (NOx), combine in the presence of sunlight. *Final Ozone NAAQS Regulatory Impact Analysis EPA-452/R-08-003*, March 2008, Chapter 2.1. http://www.epa.gov/ttnecas1/regdata/RIAs/452_R_08_003.pdf

(f) PM emissions are conservatively considered to be PM10 emissions, and PM10 emissions are conservatively considered to be PM2.5. Total facility PTE emissions of particulate (including filterable PLUS condensable) for all 48 engines and cooling towers would be approximately 7.6 tpy. As noted in the application, "the cumulative NAAQS air modeling demonstration does account for condensable PM from all existing and proposed emergency generators."

(g) EPA AP-42 § 3.3 or 3.4 from: Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors http://www.epa.gov/ttn/chief/ap42/.

(h) Based on manufacturer (Evapco) cooling unit maximum recirculation rate as presented in TSD of Approval Order 11AQ-E399. Cooling tower emissions listed in previous TSD as 4,210 lbs/yr, which is approximately equivalent to 2.11 tpy.
(i) DEEP is defined in Washington Administrative Code (WAC) 173-460-150 as "Diesel Engine Exhaust, Particulate." DEEP includes only the filterable portion of PM2.5.
(j) Project Genesis emissions are only listed (in parenthesis) if they have estimated emissions for the listed pollutant or source.
(k) SM-80 Sources: Minor sources that have taken an enforceable limit to remain minor sources, called synthetic minor sources, that emit or have the potential to emit (PTE) at or above 80 percent of the Title V major source threshold (GUIDANCE ON FEDERALLY-REPORTABLE VIOLATIONS FOR CLEAN AIR ACT STATIONARY SOURCES September 2014; https://www.epa.gov/sites/production/files/2013-10/documents/caastationary-guidance.pdf).

1.2 Maximum Operation Scenarios

Oath's operation assumptions for their permit revision requests as presented in their application are listed table 2 below along with Ecology comments:

Table 2. Oath Application Revision Requests

Oath Application Assumptions/Requests	Ecology Comments
Existing Engines R through R3 and Local Background Emissions Sources: • ***Worst Case Emissions and Power Outages.*** For purposes of demonstrating compliance with the national ambient air quality standards (NAAQS) and acceptable source impact levels (ASILs), it was assumed that the Oath Data Center [excluding Project Genesis] would experience 48 hours over 2 consecutive days of power outage, and would operate with the restrictions of Table 3.2 of the permit. • ***Decreased Engine Runtime for Engines R through 12:*** Oath has requested to consolidate engines R through R3 by having them adhere to the same operation restrictions as engines 13 through R3. The implications of this request are as follows: ➢ Engines R through 12 will no longer be allowed to operate 200 hours per year but will operate 100 hours per year similar to engines 13 through R3. ➢ Engines R through 12 will no longer be allowed to operate at an average full load rate of 100%, but will operate at more restrictive loads similar to engines 13 through R3. • ***Local Background Emissions Sources:*** Local background values for PM2.5, PM10, and NO2 consisted of the ambient impacts, at Project Genesis' maximum impact location, caused by emissions from the nearby emergency generators and industrial emission sources at the existing Oath Data Center, Sabey Data Center, Vantage Data Center, Intuit Data Center, and the Celite facility. Emissions from each of these facilities were assumed to be equal to their respective permit limits. The location and date of the maximum impact caused by Project Genesis' proposed new generators were determined, and AERMOD was used to model the "local background" ambient impacts at the same location and date caused by simultaneous activity at each of the adjacent data centers and industrial facility. The modeled "local background" sources were as follows: ➢ 24-Hour PM2.5. It was assumed that the existing cooling towers in the vicinity and the Celite facility would operate at their permitted limits. ➢ 1-Hour NO2. It was assumed that the Celite facility would operate at its permitted limit. ➢ 24-hour PM10 (Power Outage). It was assumed that each nearby data center would operate at its permitted rate during a power outage on the same day that the Project Genesis facility would operate during a power outage, while the Celite facility would emit at its permitted rate.	(a),(b),(c)

For Project Genesis Engines: During a power outage at the site, 20 2.0-MW emergency generators and one 2.75-MW generator will activate in order to supplement power to the server system and the administrative building. If there is a problem with one or more of the 2.0-MW generators, one or more of the "reserve" 2.75-MW generators will engage the load. • ASIL considerations with 1-hour and 24-hour averaging periods: Impacts were modeled for the worst-case screening scenario of a power outage lasting 24 hours per day for 365 days per year for 5 years, with AERMOD automatically selecting the highest 1-hour and 24-hour [TAP] impacts. The annual [TAP] impacts were modeled based on the maximum requested generator runtimes and generator loads. • Emissions considerations for modeling of pollutants (including TAPs with annual averaging periods): assumed (per engine) 84 hours (3.5 days) of power outages. Emission rates were calculated for criteria pollutants and TAPs based on peak hourly (worst-case maximum) and long-term (annual maximum) operating scenarios. • Worst-case 1-hour considerations for modeling to determine the worst-case ambient impacts for carbon monoxide (CO) and sulfur dioxide (SO2), each with a 1-hour averaging period. Twenty five generators were modeled as if operating 24 hours per day, 365 days per year, based on conservative consideration that an outage could occur at any time of day or night and any time of year. This scenario also took into account cold start emission factors. • Worst-case 3-hour, 8-hr, and 24-hr considerations for modeling to determine the worst-case ambient impacts for CO, SO2, and PM10. Twenty five generators were modeled as if operating 24 hours per day, 365 days per year and assumed a worst-case unplanned power outage scenario (3.5 days). This scenario also took into account cold start emission factors. • PM2.5 (see below) • NO2 (see below)	(b),(f)
PM2.5 24-Hour NAAQS Modeling Setup: The PM2.5 24-hour NAAQS is based on the 98th percentile of ambient impacts during a 3-year rolling average period. The worst-case modeling setup assumes testing 2.75-MW engines for 8 hours (one at a time) operating during daylight hours (7:00 a.m. to 7:00 p.m.). Eight cold start events are assumed to occur per day for this simulation event. The 8-hour emissions total for this event was divided by 12 hours to develop the hourly emission rate input into AERMOD.	(e)
NO2 1-hour NAAQS Modeling Setup: The NO2 1-hour NAAQS is based on the 98th percentile of the daily highest 1-hour ambient impacts during a 3-year rolling average period. The same screening-level approach, as described for evaluation of the PM2.5 24-hour NAAQS, was used to evaluate the NO2 1-hour NAAQS. Table 13 lists and ranks each of the 1-hour operating regimes for NO2 emissions from the Project Genesis site. The ranked 8th-highest hour would also be during an annual load bank or monthly maintenance testing event. Emissions from a single cold-start event were included in the input emission rate and the air dispersion model was set up as if operating during daylight hours (7:00 a.m. to 7:00 p.m.). ➢ The ambient NO2 concentrations were modeled using the Plume Volume Molar Ratio Method (PVMRM) option to demonstrate compliance with the 1-hour and annual NAAQS and ASIL for NO2. This AERMOD option calculated ambient NO2 concentrations surrounding the site by applying a default NO2/NOx equilibrium ratio of 0.90 and a NO2/NOx in-stack ratio of 0.1. ➢ The estimated ambient ozone concentration of 49 parts per billion was the AERMOD input level for all corresponding NO2 modeling setups. This value was taken from the NW AIRQUEST 2009-2011 design value of criteria pollutants website, provided by the Washington State University's Northwest International Air Quality Environmental Science and Technology Consortium, for the Quincy, Washington area (WSU website 2015).	(e)
Cold start/black puff factors: As noted in Oath's application: "emissions of criteria pollutants (PM, CO, NOx, and total VOCs) and volatile TAPs associated with cold-startup were scaled up using a 'black puff' emission factor in order to account for slightly higher cold-start emissions during the first minute of each scheduled cold-start. These 'black puff' factors are based on short-term concentration trends for VOC, CO, and NOx emissions immediately following cold-start by a large diesel backup generator that were measured by the California Energy Commission in its document,	(d)

Air Quality Implications of Backup Generators in California (CEC 2005)." The 60-second cold start/black puff factors used for this application are: PM+HC factor = 4.3; NOx factor = 0.94, CO factor = 9.0.	

(a) Ecology accepts the more restrictive operation limits for engines R through 12 requested by Oath.
(b) Ecology accepts this approach because it is conservatively based on worst-case scenarios.
(c) Existing engine power outage information based on TSD of Approval Order 11AQ-E399.
(d) Ecology accepts the cold start black puff factors derived for this project.
(e) Emission impact estimates via modeling are based on the 98th percentile 3-yr average, which is consistent with the NAAQS standard.
(f) For the NO2 annual NAAQS, which are not based on 3-year averages, if all emissions occurred in 1-year, within a three-year period, the NAAQS standard would still be met because annual ambient NO^2 impacts (13 ug/m^3) are more than three times less than the NO2 annual NAAQS (100 ug/m^3).

2. APPLICABLE REQUIREMENTS

The proposal by Oath 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 Oath Data Center is regulated by the requirements specified in:

- Chapter 70.94 Revised Code of Washington (RCW), Washington Clean Air Act,
- Chapter 173-400 Washington Administrative Code (WAC), General Regulations for Air Pollution Sources,
- Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants
- 40 CFR Part 60 Subpart IIII and 40 CFR 63 Subpart ZZZZ* (* See section 3.4.2)

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.

2.1 Support for permit Approval Condition 2.1 regarding applicability of 40CFR Part 60 Subpart IIII:

As noted in the applicability section of 40CFR1039 (part 1039.1.c), that regulation applies to non-road compression ignition (diesel) engines and; *(c) The definition of nonroad engine in 40 CFR 1068.30 excludes certain engines used in stationary applications.* According to the definition in 40CFR1068.30(2)(ii): *An internal combustion engine is not a nonroad engine if it meets any of the following criteria: The engine is regulated under 40 CFR part 60, (or otherwise regulated by a federal New Source Performance Standard promulgated under section 111 of the Clean Air Act (42 U.S.C. 7411)).* Because the engines at Oath are regulated under 40CFR60 subpart IIII (per 40CFR60.4200), they are not subject to 40CFR1039 requirements except as specifically required within 40CFR60.

Some emergency engines with lower power rating are required by 40CFR60 to meet 40CFR1039 Tier 4 emission levels, but not emergency engines with ratings that will be used at Oath (approximately 2.0 MWe to 2.75 MW). Instead, 40CFR60 requires the engines at Oath to meet the Tier 2 emission levels of 40CFR89.112. The applicable sections of 40CFR60 for engine owners are pasted below in italics with bold emphasis on the portions requiring Tier 2 emission factors for emergency generators such as those at Oath:

> *§60.4205 What emission standards must I meet for emergency engines if I am an owner or operator of a stationary CI internal combustion engine?*

(b) Owners and operators of 2007 model year and later emergency stationary CI ICE with a displacement of less than 30 liters per cylinder that are not fire pump engines must comply with the emission standards for new nonroad CI engines in §60.4202 (see below), *for all pollutants, for the same model year and maximum engine power for their 2007 model year and later emergency stationary CI ICE.*

Based on information provided by the applicant, Oath is either using or will use the following engines discussed in Sections 2.1.1 through 2.1.7 with 2.0 MWe or 2.75 MWe sizes. Sections 2.1.1 through 2.1.6 cover 2007 and later model year engines and section 2.1.7 covers pre-2007 model year engines. Based on these specifications, each engine's displacement per cylinder were calculated and compared to subpart (b) of §60.4205 as follows:

2.1.1 Caterpillar Engine Model 3516C rated 2.0 MWe

Displacement is not listed among the manufacturer specifications for this engine. However, displacement can be calculated by multiplying the volume of a cylinder by the number of cylinders as follows:

$$\text{Displacement} = (\text{cross-sectional area of cylinder} = \pi r^2) \times (\text{cylinder height}) \times (\#\ \text{cylinders})$$

The bore of an engine represents the cylinder diameter and the stroke represents the cylinder height. Substituting bore/2 for radius, and the stroke height, the equation for calculating the volume of an engine cylinder is: [Cylinder Volume = $\pi/4 \times (\text{bore})^2 \times (\text{stroke})$][1]

Simplifying and using a metric units conversion factor, the equation for total displacement becomes:

$$\text{Displacement} = 0.7854 \times \text{bore(cm)}^2 \times \text{stroke(cm)} \times (\#\ \text{cylinders}) \times (1\ \text{Liter}/1000\ \text{cm}^3)$$

Using this equation, and plugging in the manufacturer specifications for bore (170mm), stroke (190mm), and 16 cylinders, this engine's total displacement and displacement per cylinder are calculated as follows:

$$\text{Total Displacement} = 0.7854 \times (170/10)^2 \times (190/10) \times 16\ \text{cylinders} \times (1/1000)$$

$$\text{Total Displacement} = 69.0\ \text{Liters.}$$

$$\text{Displacement per cylinder} = 0.7854 \times (170/10)^2 \times (190/10) \times (1/1000)$$

$$\text{Displacement per cylinder} = 4.31\ \text{liters/cylinder.}$$

2.1.2 Caterpillar Engine Model C175-16 rated 2.75 MWe

The specification sheet for this engine lists displacement as 84.67 liters, with 16 cylinders total. The single cylinder displacement for this engine is therefore 5.29 liters/cylinder.

[1] HPBooks Auto Math Handbook., Lawlor, John., The Berkeley Publishing Group, A division of Penguin Putnam Inc. (www.penguinputnam.com), 1992, p. 2.

2.1.3 Cummins Engine DQKAB rated 2.0 MWe

According to the specification sheet for this engine, it has 16 cylinders total. Using this equation above, and plugging in the manufacturer specifications for bore (159mm), stroke (190mm), and 16 cylinders, this engine's total displacement and displacement per cylinder are calculated as follows:

$$\text{Total Displacement} = 0.7854 \times (159/10)^2 \times (190/10) \times 16 \text{ cylinders} \times (1/1000)$$

$$\text{Total Displacement} = 60.4 \text{ Liters.}$$

The single cylinder displacement for this engine is therefore 3.76 liters/cylinder.

2.1.4 Cummins Engine DQLF rated 2.75 MWe

According to the specification sheet for this engine, it has 18 cylinders total. Using this equation above, and plugging in the manufacturer specifications for bore (170 mm), stroke (190 mm), and 18 cylinders, this engine's total displacement and displacement per cylinder are calculated as follows:

$$\text{Total Displacement} = 0.7854 \times (170/10)^2 \times (190/10) \times 18 \text{ cylinders} \times (1/1000)$$

$$\text{Total Displacement} = 77.6 \text{ Liters.}$$

The single cylinder displacement for this engine is therefore 4.31 liters/cylinder.

2.1.5 MTU Engine 16V4000 DS2000 rated 2.0 MWe

The specification sheet for this engine lists displacement as 76.3 liters, with 16 cylinders total. The single cylinder displacement for this engine is listed as 4.77 liters/cylinder.

2.1.6 MTU Engine 20V4000 DS2800 rated 2.75 MWe

The specification sheet for this engine lists displacement as 95.4 liters, with 20 cylinders total. The single cylinder displacement for this engine is listed as 4.77 liters/cylinder.

Thus, because Oath Project Genesis will use engines with a displacement of less than the *§60.4205 (b)* limit of 30 liters per cylinder, and are for emergency purposes only, the engines are therefore required to meet *§60.4202* manufacturer requirements listed below.

> *§60.4202 What emission standards must I meet for emergency engines if I am a stationary CI internal combustion engine manufacturer?*
>
> > *(a) Stationary CI internal combustion engine manufacturers must certify their 2007 model year and later emergency stationary CI ICE with a maximum engine power* ***less than or equal to 2,237 KW*** *(3,000 HP) and a displacement of less than 10 liters per cylinder that are not fire pump engines to the emission standards specified in paragraphs (a)(1) through (2) of this section.*

(1) For engines with a maximum engine power less than 37 KW (50 HP):

(i) The certification emission standards for new nonroad CI engines for the same model year and maximum engine power in 40 CFR 89.112 and 40 CFR 89.113 for all pollutants for model year 2007 engines, and

(ii) The certification emission standards for new nonroad CI engines in 40 CFR 1039.104, 40 CFR 1039.105, 40 CFR 1039.107, 40 CFR 1039.115, and table 2 to this subpart, for 2008 model year and later engines.

(2) For engines with a maximum engine power greater than or equal to 37 KW (50 HP), the certification emission standards for new nonroad CI engines for the same model year and maximum engine power in 40 CFR 89.112 and 40 CFR 89.113 for all pollutants beginning in model year 2007.

2.1.7 MTU Detroit Diesel 16V4000 G83 B3

The existing engines R through R3 use MTU Detroit Diesel 16V4000 G83 B3 engines. The specification sheet for this engine lists displacement as 76.3 liters, with 16 cylinders total. The single cylinder displacement for this engine is listed as 4.77 liters/cylinder.

Some of these engines have manufacture dates as early as December 2006, which pre-dates the Tier 2 requirement date of January 1, 2007 mentioned in 40CFR60 above. However, the 1/1/2007 date was intended as a harmonization date for all stationary and non-road regulations. Table 1 of 40CFR89.112 shows the same tier 2 engine requirements for model year 2006 engines as engines manufactured after January 1, 2007. Footnote 1 on Table 1 of 40CFR89.112 states the following: *"The model years listed indicate the model years for which the specified tier of standards take effect."* Therefore, in accordance with table 1 of 40CFR89.112 which shows tier 2 requirements for model year 2006, Ecology is requiring the existing pre-2007 engine at Oath to follow current Tier 2 requirements (6.4 g/kW-hr for NOx plus NMHC; 3.5 g/kW-hr for CO; and 0.20 g/kW-hr for PM).

2.1.8 Tier 2 Emission Requirements Summary

Thus, based on the power ratings listed in *40 CFR 60.4202(a),* the Tier 2 engine requirements in 40CFR89.112 for 2006 and later engines, and because the engines to be used at Oath will also have less than 10 liters per cylinder displacement, the 48 engines at Oath are required to meet the 40CFR89.112 Tier 2 emission standards.

2.2 Support for complying with 40 CFR 63 Subpart ZZZZ from Section 3 of TSD.

According to section 40 CFR 63 Subpart ZZZZ section 636590 part (c) and (c)(1), sources such as this facility, are required to meet the requirements of 40 CFR 60 IIII and *"no further requirements apply for such engines under this* (40 CFR 63 Subpart ZZZZ) *part."*

3. SOURCE TESTING

Source testing requirements are outlined in Sections 4 of the Approval Order. The five-mode stack testing in Condition 4 of the permit is required to demonstrate compliance with 40CFR89(112 & 113) g/kW-hr EPA Tier 2 average emission limits via the 5 individual operating loads (10%, 25%, 50%, 75% and 100%) according to Table 2 of Appendix B to Subpart E of 40CFR89, or according to any other applicable EPA requirement in effect at the time the engines are installed. For this permit, engine selection testing will be determined as follows:

3.1 NEW ENGINE STACK TESTING:

Because Oath can utilize multiple engine manufacturer and make options, Conditions 4.2 and 4.3 require testing of at least one engine from each manufacturer and each size engine from each manufacturer, immediately after commissioning any new proposed engine. These conditions apply in addition to the testing Oath has performed on existing engines already installed at the time of this permit. Alternatively, the engine may be tested at the manufacturer's testing cell if certain conditions in the permit are met.

3.2 PERIODIC STACK TESTING:

Every 60 months after the first testing performed starting with engines tested after the date of this permit, Oath shall test at least one engine, including the engine with the most operating hours as long as it is a different engine from that which was tested during the previous 60 month interval testing. To reduce potentially unnecessary stack testing emissions for engine categories that have already been tested under "new engine stack testing" requirements, Ecology is allowing and alternative to testing at all 5 loads as described in the permit.

3.3 AUDIT SAMPLING

According to Condition 4.2, audit sampling per 40 CFR 60.8(g), may be required by Ecology at their discretion. Ecology will not require audit samples for test methods specifically exempted in 40 CFR 60.8(g) such as Methods, 7E, 10, 18, 25A, and 320. For non-exempted test methods, according to 40 CFR 60.8(g):

"The compliance authority responsible for the compliance test may waive the requirement to include an audit sample if they believe that an audit sample is not necessary."

Although Ecology believes that audit sampling is not necessary for certified engines, Ecology may choose at any time to require audit sampling for any stack tests conducted. Audit sampling could include, but would not necessarily be limited to, the following test methods: Methods 5, 201A, or 202.

4. SUPPORT FOR BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

BACT is defined[2] 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,*

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

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. If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.

For this project, Ecology is implementing the "top-down" approach for determining BACT for the proposed diesel engines. The first step in this approach is to determine, for each proposed emission unit, the most stringent control available for a similar or identical emission unit. If that review can show that this level of control is not technically or economically feasible for the proposed source (based upon the factors within the BACT definition), then the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.[3] The "top-down" approach shifts the burden of proof to the applicant to justify why the proposed source is unable to apply the best technology available. The BACT analysis must be conducted for each pollutant that is subject to new source review.

The proposed diesel engines and/or cooling towers 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_{10} and $PM_{2.5}$), and sulfur dioxide. BACT for toxics (tBACT) is included in Section 4.5.

4.1 BACT ANALYSIS FOR NOx FROM DIESEL ENGINE EXHAUST

Oath reviewed EPA's RACT/BACT/LAER Clearinghouse (RBLC) database to look for controls recently installed on internal combustion engines. The RBLC provides a listing of BACT determinations that have been proposed or issued for large facilities within the United States, Canada and Mexico.

4.1.1 BACT Options for NOx

Oath's review of the RBLC found that urea -based selective catalytic reduction (SCR) was the most stringent add-on control option demonstrated on diesel engines, and was therefore considered the top-case control technology and evaluated for technical feasibility and cost-effectiveness. The most common BACT determination identified in the RBLC for NOx control was compliance with EPA Tier 2 standards using engine design, including exhaust gas recirculation (EGR) or fuel injection timing retard with turbochargers. Other NOx control options identified by Ecology through a literature review include: selective non-catalytic reduction (SNCR), non-selective catalytic reduction

[3] J. Craig Potter, EPA Assistant Administrator for Air and Radiation memorandum to EPA Regional Administrators, "Improving New Source Review (NSR) Implementation", December 1, 1987.

(NSCR), water injection, as well as emerging technologies. Ecology reviewed these options and addressed them below.

4.1.1.1 ***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. SCR can reduce NOx emissions by approximately 90 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 initial minutes after engine start up, especially during maintenance, testing and storm avoidance loads. Minimal amounts of the urea-nitrogen reducing agent injected into the catalyst does not react, and is emitted as ammonia. Optimal operating temperatures are needed to minimize excess ammonia (ammonia slip) and maximize NOx reduction. SCR systems are costly. Most SCR systems operate in the range of 290°C to 400°C. Platinum catalysts are needed for low temperature range applications (175°C – 290°C); zeolite can be used for high temperature applications (560°C); and conventional SCRs (using vanadium pentoxide, tungsten, or titanium dioxide) are typically used for temperatures from 340°C to 400°C.

Oath has evaluated the cost effectiveness of installing and operating SCR systems on each of the proposed diesel engines by taking into account direct costs (equipment, sales tax, shipping, installation, etc…) and indirect costs (startup, performance tests, etc..). Annual operation and maintenance cost estimates to account for urea, fuel for pressure drop, increased inspections, and periodic OEM visits based on EPA manual EPA/452/B-02-001, would cost approximately $14,400 per ton of NOx removed from the exhaust stream each year. If SCR is combined with a Tier 4 capable integrated control system, which includes SCR, as well as control technologies for other pollutants such PM, CO, and VOC (see section 4.3), the cost estimate would be approximately $25,200 for NOx alone or $22,300 per ton of combined pollutants removed per year.

Ecology concludes that while SCR is a demonstrated emission control technology for diesel engines, and preferred over other NOx control alternatives described in subsection 4.1.1.3., it is not economically feasible for this project. Furthermore, although NOx is a criteria pollutant, the only NOx that currently have NAAQS is NO2. Cost per ton removal of NO2 is an order of magnitude more expensive than for NOx, and is addressed under tBACT in section 4.5.

Therefore, Ecology agrees with the applicant that this NOx control option can be excluded as BACT (both as SCR alone and as part of Tier 4 capable integrated control system, which includes a combination of SCR with other control technologies for other pollutants).

4.1.1.2. ***Combustion Controls, Tier 2 Compliance, and Programming Verification.*** Diesel engine manufacturers typically use proprietary combustion control methods to achieve the overall emission reductions needed to meet applicable EPA tier standards. Common general controls include fuel injection timing retard, turbocharger, a low-temperature aftercooler, use of EPA Tier-2 certified engines operated as emergency engines as defined in

40 CFR§60.4219, and compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII. Although it may lead to higher fuel consumption, injection timing retard reduces the peak flame temperature and resulting NOx emissions. While good combustion practices are a common BACT approach, for the Oath engines however, a more specific approach, based on input from Ecology inspectors after inspecting similar data centers, is to obtain written verification from the engine manufacturer that each engine of the same make, model, and rated capacity installed at a facility use the same electronic Programmable System Parameters, i.e., configuration parameters, in the electronic engine control unit. These BACT options are considered further in section 4.1.2.

4.1.1.3. ***Other Control Options***. Other NOx control options listed in this subsection were considered but rejected for the reasons specified:

4.1.1.3.1. ***Selective Non-Catalytic Reduction (SNCR)***: This technology is similar to that of an SCR but does not use a catalyst. Initial applications of Thermal DeNOx, an ammonia based SNCR, achieved 50 percent NOx reduction for some stationary sources. This application is limited to new stationary sources because the space required to completely mix ammonia with exhaust gas needs to be part of the source design. A different version of SNCR called NOxOUT, uses urea and has achieved 50-70 percent NOx reduction. Because the SNCR system does not use a catalyst, the reaction between ammonia and NOx occurs at a higher temperature than with an SCR, making SCR applicable to more combustion sources. Currently, the preferred technology for back-end NOx control of reciprocating internal combustion engine (RICE) diesel applications, appears to be SCR with a system to convert urea to ammonia.

4.1.1.3.2. ***Non-Selective Catalytic Reduction (NSCR):*** This technology uses a catalyst without a reagent and requires zero excess air. The catalyst causes NOx to give up its oxygen to products of incomplete combustion (PICs), CO and hydrocarbons, causing the pollutants to destroy each other. However, if oxygen is present, the PICs will burn up without destroying the NOx. While NSCR is used on most gasoline automobiles, it is not immediately applicable to diesel engines because diesel exhaust oxygen levels vary widely depending on engine load. NSCR might be more applicable to boilers. Currently, the preferred technology for back-end NOx control of reciprocating internal combustion engine (RICE) diesel applications appears to be SCR with a system to convert urea to ammonia. See also Section 4.2.1.3 (Three-Way Catalysts).

4.1.1.3.3. ***Water Injection:*** Water injection is considered a NOx formation control approach and not a back-end NOx control technology. It works by reducing the peak flame temperature and therefore reducing NOx formation. Water injection involves emulsifying the fuel with water and increasing the size of the injection system to handle the mixture. This technique has minimal affect on CO emissions but can increase hydrocarbon emissions. This technology is rejected because there is no indication that it is commercially available and/or effective for new large diesel engines.

4.1.1.3.4. ***Other Emerging Technologies***: Emerging technologies include: NOx adsorbers, RAPER-NOx, ozone injection, and activated carbon absorption.

- ***NOx Adsorbers:*** NOx adsorbing technologies (some of which are known as SCONOx or EMx^{GT}) use a catalytic reactor method similar to SCR. SNONOx uses a regenerated catalytic bed with two materials, a precious metal oxidizing catalyst (such as platinum) and potassium carbonate. The platinum oxidizes the NO into NO2 which can be adsorbed onto the potassium carbonate. While this technology can achieve NOx reductions up to 90% (similar to an SCR), it is rejected because it has significantly higher capital and operating costs than an SCR. Additionally, it requires a catalyst wash every 90 days, and has issues with diesel fuel applications, (the GT on EMx^{GT} indicates gas turbine application). A literature search did not reveal any indication that this technology is commercially available for stationary backup diesel generators.
- ***Raper-NOx:*** This technology consists of passing exhaust gas through cyanic acid crystals, causing the crystals to form isocyanic acid which reacts with the NOx to form CO2, nitrogen and water. This technology is considered a form of SNCR, but questions about whether stainless steel tubing acted as a catalyst during development of this technology, could make this another form of SCR. To date, it appears this technology has never been offered commercially.
- ***Ozone Injection:*** Ozone injection technologies, some of which are known as LoTOx or BOC, use ozone to oxidize NO to NO2 and further to NO3. NO3 is soluble in water and can be scrubbed out of the exhaust. As noted in the literature, ozone injection is a unique approach because while NOx is in attainment in many areas of the United States (including Quincy, WA), the primary reason to control NOx is because it is a precursor to ozone. Due to high additional costs associated with scrubbing, this technology is rejected.
- ***Activated Carbon Absorption with Microwave Regeneration.*** This technology consists of using alternating beds of activated carbon by conveying exhaust gas through one carbon bed, while regenerating the other carbon bed with microwaves. This technology appears to be successful in reducing NOx from diesel engine exhaust. However, it is not progressing to commercialization and is therefore rejected.

*4.1.2. **BACT determination for NOx***

Ecology determines that BACT for NOx is the use of EPA Tier-2 certified engines operated as emergency engines as defined in 40 CFR§60.4219, and compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII. In addition, Approval Condition 2.7 in the permit requires that the source must have written verification from the engine manufacturer that each engine of the same make, model, and rated capacity installed at the facility uses the same electronic Programmable System Parameters, i.e., configuration parameters, in the electronic engine control unit. "Installed at the facility" could mean at the manufacturer or at the data farm because the engine manufacturer service technician sometimes makes the operational parameter modification/correction to the electronic engine controller at the data farm. Oath will install engines consistent with this BACT determination. Ecology believes this is a reasonable approach in that this BACT requirement replaces a more general, common but related BACT requirement of "good combustion practices."

Note: Because control options for PM, CO, and VOCs, are available as discussed in BACT section 4.2., which are less costly per ton than the Tier 4 capable integrated control system option for those pollutants, both the SCR-only option as well as the Tier 4 capable integrated control system option are not addressed further within BACT.

4.2 BACT ANALYSIS FOR PM, CO AND VOC FROM DIESEL ENGINE EXHAUST

Oath reviewed the available published literature and the RBLC and identified the following demonstrated technologies for the control of particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOC) emissions from the proposed diesel engines:

4.2.1. BACT Options for PM, CO, and VOC from Diesel Engine Exhaust

4.2.1.1 ***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.

Oath has evaluated the cost effectiveness of installing and operating DPFs on each of the proposed diesel engines. The analysis indicates that the use of DPFs would cost approximately $123,600 per ton of engine exhaust particulate removed from the exhaust stream at Oath each year. Catalyzed DPFs, which include a diesel oxidation catalyst, also remove CO and VOCs. However, for this project, DPFs and DOCs were evaluated separately (see Section 4.2.1.2 for DOC BACT).

Ecology concludes that use of DPF is not economically feasible for this project. Therefore, Ecology agrees with the applicant that this control option can be rejected as BACT.

4.2.1.2. ***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, DOCs have also been demonstrated to reduce diesel engine exhaust particulate emissions, and also hydrocarbon emissions.

Oath has evaluated the cost effectiveness of installing and operating DOCs on each of the proposed diesel engines. The following DOC BACT cost details are provided as an example of the BACT and tBACT cost process that Oath followed for engines within this application (including for SCR-only, DPF-only, and Tier 4 capable integrated control system technologies).

- Oath obtained the following recent DOC equipment costs: $32,000 and $54,000 for stand-alone catalyzed DOC per single 2.0 MWe and 2.75 MWe generators respectively (plus $3,667/generator for parts). For thirty two (5) 2.0 MWe, and 20 2.75 MWe generators, this amounts to $1,001,667. According to the applicant, DOC control efficiencies for this unit are CO, HC, and PM are 85%, 80%, and 20% respectively.
- The subtotal becomes $1,416,858 after accounting for shipping ($50,083), WA sales tax ($65,108), and direct on-site installation ($300,000).
- After adding indirect installation costs, the total capital investment amounts to: $1,634,668. Indirect installation costs include but are not limited to: startup fees, contractor fees, and performance testing.
- Annualized over 25 years and included with direct annual costs based on EPA manual EPA/452/B-02-001, the total annual cost (capital recovery and direct annual costs) is estimated to be $170,025.
- At the control efficiencies provided, the annual tons per year of emissions for CO (8.79 tpy), HC (1.88 tpy), and PM (3.44 tpy) become 7.47 tpy, 1.5 tpy, and 0.69 tpy removed respectively.
- The last step in estimating costs for a BACT analysis is to divide the total annual costs by the amount of pollutants removed ($170,025 divided by 7.47 tpy for CO, etc..).

The corresponding annual DOC cost effectiveness value for carbon monoxide destruction alone is approximately $22,800 per ton. If particulate matter and hydrocarbons are individually considered, the cost effectiveness values become $113,000 and $247,100 per ton of pollutant removed annually, respectively. If the cost effectiveness of using DOC is evaluated using the total amount of carbon monoxide, particulate matter and hydrocarbons reduced, the cost estimate would be approximately $17,600 per ton of combined pollutants removed per year.

These annual estimated costs (for DOC use alone) provided by Oath are conservatively low estimates that take into account installation, tax, shipping, and other capital costs as mentioned above, but assume low range CARB estimates for operational, labor and maintenance costs, which could be up to $28,000 per year.

Ecology concludes that use of DOC is not economically feasible for this project. Therefore, Ecology agrees with the applicant that these control option can be rejected as BACT.

4.2.1.3 Three-Way Catalysts.

Three way catalyst (TWC) technology can control CO, VOC and NOx in gasoline engines, but is only effective for CO and VOC control in diesel engines. According to DieselNet, an online information service covering technical and business information for diesel engines, published by Ecopoint Inc. of Ontario, Canada (https://www.dieselnet.com):

> *"The TWC catalyst, operating on the principle of non-selective catalytic reduction of NOx by CO and HC, requires that the engine is operated at a nearly stoichiometric air to- fuel (A/F) ratio... In the presence of oxygen, the three-way catalyst becomes ineffective in reducing NOx. For this reason, three-way catalysts cannot be employed*

for NOx control on diesel applications, which, being lean burn engines, contain high concentrations of oxygen in their exhaust gases at all operating conditions."

As noted by the applicant, diesel engine stack tests at another data center in Washington State (Titan Data Center in Moses Lake, WA), showed that TWC control increased the emission rate for nitrogen dioxide (NO2). This technology is therefore rejected as a control option.

4.2.2 *BACT Determination for PM, CO, and VOC*

Ecology determines BACT for particulate matter, carbon monoxide and volatile organic compounds is restricted operation of EPA Tier-2 certified engines operated as emergency engines as defined in 40 CFR§60.4219, and compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII. Oath will install engines consistent with this BACT determination.

4.3 BACT ANALYSIS FOR SULFUR DIOXIDE FROM DIESEL ENGINE EXHAUST

4.3.1. *BACT Options for SO2*

Oath did not find any add-on control options commercially available and feasible for controlling sulfur dioxide emissions from diesel engines. Oath proposed BACT for sulfur dioxide is the use of ultra-low sulfur diesel fuel (15 ppm by weight of sulfur). Ecology agrees with the applicant's proposed BACT for SO2.

4.4 BACT ANALYSIS FOR PM FROM COOLING TOWERS

According to the applicant, "no known contaminants will be introduced into the surrounding atmosphere" for cooling units to be used for Project Genesis. Also, because no changes are proposed for existing cooling tower operations or emission estimates, a BACT analysis was not performed. The following BACT determination from the previous Oath permit is continued into this permit: "maintaining the water droplet drift rate from cooling systems and drift eliminators to a maximum drift rate of 0.001% of the circulating water flow rate."

4.5 BEST AVAILABLE CONTROL TECHNOLOGY FOR TOXICS

Best Available Control Technology for Toxics (tBACT) means BACT, as applied to toxic air pollutants.[4] For TAPs that exceed small quantity emission rates (SQERs), the procedure for determining tBACT followed the same procedure used above for determining BACT. Of the technologies Oath considered for BACT, the minimum estimated costs as applied to tBACT are as follows:

- The minimum estimated cost to control diesel engine exhaust particulate is estimated to be $0.4 million per ton removed.
- The minimum estimated costs to control NO2 is estimated to be $150,000 per ton removed.
- The minimum estimated cost to control CO is estimated to be $22,800 per ton removed.

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[4] WAC 173-460-020

- For the other TAPS above SQERs, the minimum estimated cost per ton removed would be as follows: $10 million for benzene; $59 million for naphthalene; $198 million for 1,3-butadiene; and $980 million for acrolein.

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. Based on the information presented in this TSD, Ecology has determined that Table 4 below represents tBACT for the proposed project.

Table 4 tBACT Determination

Toxic Air Pollutant	tBACT
Primary NO_2	Compliance with the NOx BACT requirement
Diesel Engine Exhaust Particulate	Compliance with the PM BACT requirement
Carbon monoxide	Compliance with the CO BACT requirement
Sulfur dioxide	Compliance with the SO_2 BACT requirement
Benzene	Compliance with the VOC BACT requirement
Toluene	Compliance with the VOC BACT requirement
Xylenes	Compliance with the VOC BACT requirement
1,3 Butadiene	Compliance with the VOC BACT requirement
Formaldehyde	Compliance with the VOC BACT requirement
Acetaldehyde	Compliance with the VOC BACT requirement
Acrolein	Compliance with the VOC BACT requirement
Benzo(a)Pyrene	Compliance with the VOC BACT requirement
Benzo(a)anthracene	Compliance with the VOC BACT requirement
Chrysene	Compliance with the VOC BACT requirement
Benzo(b)fluoranthene	Compliance with the VOC BACT requirement
Benzo(k)fluoranthene	Compliance with the VOC BACT requirement
Dibenz(a,h)anthracene	Compliance with the VOC BACT requirement
Ideno(1,2,3-cd)pyrene	Compliance with the VOC BACT requirement
Naphthalene	Compliance with the VOC BACT requirement
Propylene	Compliance with the VOC BACT requirement
Cooling Tower Emissions (TAPs as PM)	Compliance with Cooling Tower BACT requirement

5. AMBIENT AIR MODELING

Ambient air quality impacts at and beyond the property boundary were modeled using EPA's AERMOD dispersion model, with EPA's PRIME algorithm for building downwash.

5.1 AERMOD Assumptions:

- Five years of sequential hourly meteorological data (2001–2005) from Moses Lake Airport were used. Twice-daily upper air data from Spokane were used to define mixing heights.
- The AMS/EPA Regulatory Model Terrain Pre-processor (AERMAP) was used to obtain height scale, receptor base elevation, and to develop receptor grids with terrain effects. For

area topography required for AERMAP, Digital topographical data (in the form of Digital Elevation Model files) were obtained from www.webgis.com.

- Each generator was modeled with applicable stack height of above local ground (20 ft for engines R through 12; 30 ft for engines 13 through R3; 42 ft for the 25 Project Genesis engines).
- The data center buildings, in addition to the individual generator enclosures were included to account for building downwash.
- The receptor grid for the AERMOD modeling was established using a 12.5-meter grid spacing along the facility boundary extending to a distance of 150 meters from each facility boundary. A grid spacing of 25 meters was used for distances of 150 meters to 400 meters from the boundary. A grid spacing of 50 meters was used for distances from 400 meters to 900 meters from the boundary. A grid spacing of 100 meters was used for distances from 900 meters to 2000 meters from the boundary. A grid spacing of 300 meters was used for distances from 2000 meters to 4500 meters from the boundary. A grid spacing of 600 meters was used for distances from 4500 meters to 6000 meters from the boundary.
- 1-hour NO_2 concentrations at and beyond the facility boundary were modeled using the Plume Volume Molar Ratio Method (PVMRM) module, with default concentrations of 49 parts per billion (ppb) of background ozone, and an equilibrium NO_2 to NOx ambient ratio of 90%.
- Dispersion modeling is sensitive to the assumed stack parameters (i.e., flowrate and exhaust temperature). The stack temperature and stack exhaust velocity at each generator stack were set to values corresponding to the engine loads for each type of testing and power outage.
- AERMOD Meteorological Pre-processor (AERMET) was used to estimate boundary layer parameters for use in AERMOD.
- AERSURFACE was used to determine the percentage of land use type around the facility based on albedo, Bowen ratio, and surface roughness parameters.
- As noted in the application, "the cumulative NAAQS air modeling demonstration does account for condensable PM from all existing and proposed emergency generators."

5.2 Ambient Impact Results

Except for diesel engine exhaust particulate (DEEP) and NO2 which are predicted to exceed its ASIL, AERMOD model results show that no NAAQS or ASIL will be exceeded at or beyond the property boundary. The applicant's modeling results are provided below:

	Standards in μg/m³		Maximum Ambient Impact Concentration (μg/m³)			Maximum Ambient Impact Concentration Added to Background (μg/m³) (If Available)
	NAAQS(b)			AERMOD		
Criteria Pollutant	Primary	Secondary		Filename	Background Concentrations (μg/m³) (a)	
Particulate Matter (PM_{10})						
1st-Highest 24-hour average during power outage with cooling towers	150	150	56	PM10_101115, PM10_101115b PM10_101215, PM10_101315	80	136
Particulate Matter ($PM_{2.5}$)						
Annual average	12	15	0.47	PM10_101115,	7.6	8

1st-highest 24-hour average for cooling towers and electrical bypass	35	35	12.6 (includes local background)	PM10_101115b PM25_100515-COPY	21 (includes regional background only)	34
Carbon Monoxide (CO)						
8-hour average	10,000 (9 ppm)		326	CO_100715b CO_100715a	3,308	3,634
1-hour average	40,000 (35 ppm)		637		5,776	6,413
Nitrogen Oxides (NO_2)						
Annual average	100 (53 ppb)	100	7.71	NOx_101215, NOx_101215b NOx_100715	5.4	13
1-hour average	188 (100 ppb)	--	105 (includes local background)		16 (includes regional background only)	121
Sulfur Dioxide (SO_2)						
3-hour average	--	1,300 (0.5 ppm)	1.6	SO2_100615a	2.1	3.7
1-hour average	195 (75 ppb)	--	2.3	SO2_100615b	2.6	4.9
Toxic Air Pollutant	**ASIL (μg/m^3)**	**Averaging Period**	**1st-Highest Ambient Concentration (μg/m^3)**	**AERMOD Filename**		
DEEP	0.00333	Annual average	0.15	DEEP_100615a		
NO_2	470	1-hour average	859	NO2_100715		
CO	23,000	1-hour average	637	CO_100715a		
S02	660	1-hour average	4.9	(d)		
Acrolein	0.06	24-hour average	0.0067	Acrolein_101415		
Benzene	0.0345	Annual Average	0.0029	(c)		
1,3-Butadiene	0.00588	Annual Average	0.00015	(c)		
Naphthalene	0.0294	Annual Average	0.00048	(c)		

Notes:
μg/m^3 = Micrograms per cubic meter.
ppm = Parts per million.
ASIL = Acceptable source impact level.
DEEP = Diesel engine exhaust, particulate

(a) Sum of "regional background" plus "local background" values except where noted. Regional background concentrations obtained from WSU NW Airquest website http://lar.wsu.edu/nw-airquest/lookup.html. Local background values for PM2.5, PM10, and NO2 consisted of the ambient impacts, at Project Genesis' maximum impact location, caused by emissions from the nearby emergency generators and industrial emission sources at the existing Oath Data Center, Sabey Data Center, Vantage Data Center, Intuit Data Center, and the Celite facility.

(b) Ecology interprets compliance with the National Ambient Air Quality Standards (NAAQS) as demonstrating compliance with the Washington Ambient Air Quality Standards (WAAQS).

(c) A dispersion factor was used to approximate the control emissions impact.

(d) Oath was not required to model SO2 for comparison to the ASIL for Project Genesis, because estimated emissions of 0.9 lb/hr are below the WAC 173-460-150 small quantity emission rate of 1.45 lb/hr.

Oath Project Genesis has demonstrated compliance with the national ambient air quality standards (NAAQS) and acceptable source impact levels (ASILs) except for DEEP and NO2. As required by WAC 173-460-090, emissions of DEEP and NO2 were further evaluated as explained in the following section of this document.

6. SECOND TIER REVIEW FOR DIESEL ENGINE EXHAUST PARTICULATE

Proposed emissions of diesel engine exhaust, particulate (DEEP) and NO2 exceed the regulatory trigger level for toxic air pollutants (also called an Acceptable Source Impact Level, (ASIL)). A second tier review was required for DEEP and NO2 in accordance with WAC 173-460-090, and Oath Project Genesis was required to prepare a health impact assessment (HIA). The HIA presents an evaluation of both non-cancer hazards and increased cancer risk attributable to Oath's increased emissions of identified carcinogenic compounds. In light of the rapid development of other data centers in the Quincy area, and recognizing the potency of DEEP emissions, Ecology decided to evaluate Oath's Project Genesis proposal in a community-wide basis, even though it is not required to do so by state law. Oath reported the cumulative risks associated with Oath Project Genesis and prevailing sources in their HIA document based on a cumulative modeling approach.

As part of the community-wide approach, the Oath Project Genesis second-tier health impact assessment (HIA) considered the cumulative impacts of DEEP and NO2 from the proposed generators, nearby existing permitted sources, and other background sources including State Route (SR) 28 and the adjacent railroad line. The Oath Project Genesis DEEP and NO2 HIA document along with a brief summary of Ecology's review will be available on Ecology's website.

7. CONCLUSION

Based on the above analysis, Ecology concludes that operation of the 48 generators and 12 cooling cells will not have an adverse impact on air quality. Ecology finds that Oath's Data Center has satisfied all requirements for NOC approval.

******END OF OATH TSD ******