TECHNICAL SUPPORT DOCUMENT
PRELIMINARY DETERMINATION
CYRUSONE DATA CENTER

1. PROJECT DESCRIPTION

On January 3, 2019 Ecology received a hardcopy of a Notice of Construction (NOC) application submittal from CyrusOne LLC (CyrusOne). CyrusOne, the permittee, requesting approval for a permit application for a new facility named the CyrusOne Data Center to be located in Quincy, Washington. The NOC application was considered complete on January 28, 2019. Ecology requested additional information explaining the conservative assumptions used in the application with respect to NO2 and NAAQS, which CyrusOne provided to Ecology on February 19, 2019. Ecology considers this additional information as part of the application.

The CyrusOne data center complex will be located on Grant County Parcel No. 040411075, at 1025 NW D Street, Quincy, WA. The following information comprises the legal description of the facility provided by the applicant:

THAT PORTION OF FARM UNIT 186 IRRIGATION BLOCK 73, COLUMBIA BASIN PROJECTION IN THE NORTHWEST QUARTER OF SECTION 7, TOWNSHIP 20 NORTH, RANGE 24 E.W.M., GRANT COUNTY, WASHINGTON, DESCRIBED AS FOLLOWS;BEGINNING AT THE WEST QUARTER CORNER OF SAID SECTION; THENCE NORTH 89°57'58""EAST, FOLLOWING THE EAST-WEST MIDSECTION LINE OF SAID SECTION AND THE SOUTH BOUNDARY OF FARM UNIT 187, IRRIGATION BLOCK 73, 719.00 FEET, TO THE SOUTHWEST CORNER OF FARM UNIT 186 AND THE TRUE POINT OF BEGINNING; THENCE NORTH 89°57'58""EAST, FOLLOWING THE SOUTH BOUNDARY OF SAID FARM UNIT 186, 1166.19 FEET; THENCE NORTH 00°01'04""WEST, 1929.25 FEET, TO AN INTERSECTION WITH THE NORTH BOUNDARY OF SAID FARM UNIT 186 AND A POINT ON A CURVE THE CENTER OF WHICH BEARS NORTH 08°35'44""WEST; THENCE FOLLOWING THE BOUNDARIES OF SAID FARM UNIT 186 THROUGH THE FOLLOWING SEVEN (7) COURSES, GOING WESTERLY FOLLOWING SAID CURVE TO THE RIGHT HAVING A CENTRAL ANGLE OF 07°58'44"" A RADIUS OF 286.48 FEET AND AN ARC LENGTH OF 39.90 FEET; THENCE SOUTH 89°23'00""WEST, 185.45 FEET; THENCE WESTERLY FOLLOWING A TANGENTIAL CURVE TO THE LEFT HAVING A CENTRAL ANGLE OF 19°03'00"" A RADIUS OF 286.48 FEET AND AN ARC LENGTH OF 95.25 FEET; THENCE SOUTH 70°20'00""WEST, 428.53 FEET; THENCE SOUTHWESTERLY FOLLOWING A TANGENTIAL CURVE TO THE LEFT HAVING A CENTRAL ANGLE OF 07°09'00"" A RADIUS OF 572.96 FEET AND AN ARC LENGTH OF 71.50 FEET; THENCE SOUTH 63°11'00""WEST, 423.44 FEET, TO THE NORTHWEST CORNER OF SAID FARM UNIT 186; THENCE SOUTH 00°00'00""EAST, 1544.60 FEET, TO THE TRUE POINT OF BEGINNING.

The CyrusOne Data Center will contain forty-two (42) emergency engines to support two main buildings, but will be located in enclosures separate from the buildings. The emergency engines proposed in the application will be powered by diesel and may be referred to in this TSD as “diesel engine-generator sets”, “engine-generator sets,” “engine” or “generator,” depending on the context of each TSD section.

The Forty (40) engine-generator sets proposed in the application are MTU Model 16V4000G84S, each with a rated capacity of 2.25 megawatt electrical (MWe) units, and the other two (2) are MTU Model 12V2000G85-TB, each with a rated capacity of 0.750 MWe. If the facility is fully built-out as planned, it will have a combined capacity of up to approximately 91.5 MWe.

CyrusOne will use direct evaporative cooling units to cool the data server areas. According to the application, the cooling units are not a source of air emissions. In addition, the facility claims it "will not install any other diesel engines for use as fire pumps or for life-safety purposes."

1.1. Potential to Emit for Criteria Pollutants and Toxic Air Pollutants (TAPs)

Because emissions of any single criteria pollutant are less than 100 tons per year, and because emissions of any single hazardous air pollutant (HAP) are less than 10 tpy (and less than 25 tpy for combined HAPs), a Title V major permit is not required. Because emissions are less than Title I New Source Review (NSR) major levels (100 tpy for listed sources on page A-11 of the 1990 NSR Workshop Manual, but 250 tpy for all other sources such as data centers), a prevention of significant deterioration (PSD) air permit is also not required. Also, because Quincy is in attainment for all pollutants, an NSR nonattainment permit is not required. For this project, a Title I NSR minor permit is required. In order to stay below the potential to emit (PTE) emissions levels listed in the permit, the permit requires that each engine meet the emission requirements of EPA Tier 2 engines. Table 1 contains the PTE estimates for project criteria pollutants and toxic air pollutants (TAPs).

Table 1. Potential-To-Emit Estimates for Criteria Pollutants* and Toxic Air Pollutants (TAPs)**

Pollutant	Emission Factor Units = g/kW-hr (except where noted)	PTE (TPY) Avg	References (a),(f)
*NO_x	8.5 (2.25 MWe engines); 8.10 (0.75 MWe engines)	36	(b),(e)
NO_2**	0.85 (2.25 MWe engines); 0.81 (0.75 MWe engines); 10% of NOx	3.6	(b)
*CO**	1.7 (2.25 MWe engines); 1.0 (0.75 MWe engines)	7.9	(b)
*$PM_{2.5}$/PM_{10}	2.9 lb/hr (2.25 MWe engines); 0.57 lb/hr (0.75 MWe engines)	2.3	(b)
*VOC	1.6 (2.25 MWe engines); 0.91 (0.75 MWe engines)	1.8	(a),(b),(e)
*SO_2**	15 ppm	0.027	(c)
*Lead**	NA	Negligible	(d)
*Ozone**	NA	NA	(e)
Diesel Engine Exhaust, Particulate (DEEP)**	0.19 (2.25 MWe engines); 0.25 (0.75 MWe engines);	0.62	(b),(g)
Propylene**	2.8E-03 lb/MMBTU	5.0E-02	(h)
Benzene**	7.8E-04 lb/MMBTU	1.4E-02	(h)
Xylenes**	1.9E-04 lb/MMBTU	3.5E-03	(h)
Napthalene**	1.3E-04 lb/MMBTU	2.3E-03	(h)
Formaldehyde**	7.9E-05 lb/MMBTU	1.4E-03	(h)
1,3 Butadiene**	3.9E-05 lb/MMBTU	7.0E-04	(h)
Acrolein**	7.9E-06 lb/MMBTU	1.4E-04	(h)
Acetaldehyde**	2.5E-05 lb/MMBTU	4.5E-04	(h)
Benzo(a)anthracene**	6.2E-07 lb/MMBTU	1.1E-05	(h)
Benzo(b)fluoranthene**	1.1E-06 lb/MMBTU	2.0E-05	(h)
Dibenz(a,h)anthracene**	3.5E-07 lb/MMBTU	6.2E-06	(h)
Benzo(a)Pyrene**	2.6E-07 lb/MMBTU	4.6E-06	(h)
Toluene**	2.8E-04 lb/MMBTU	5.5E-03	(h)

Chrysene**	1.5E-06 lb/MMBTU	2.7E-05	(h)
Benzo(k)fluoranthene**	2.2E-07 lb/MMBTU	3.9E-06	(h)
Indeno(1,2,3-cd)pyrene**	4.1E-07 lb/MMBTU	7.4E-06	(h)

(a) The list of EPA criteria pollutants that have related National Ambient Air Quality Standards (NAAQS). 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 TAP and is exempt from minor New Source Review requirements per WAC 173-400-110(5)(b).

(b) Potential to Emit (PTE) estimates are based on manufacturer specifications provided with the application. The load with the highest emissions, after considering the maximum power rated for that load, was used. PM10 and PM2.5 emissions are listed as the same value. However, diesel engine particulate emissions are considered to be of size PM2.5. For modeling purposes to show compliance with NAAQS, condensable particulate was conservatively assumed to be equal to VOC. The highest summed emission factor of filterable particulate (DEEP) and VOC (after considering power rating) were used for filterable plus condensable emission totals (PM2.5 & PM10 totals). PTE includes applicable cold start "black puff" factors of 4.3 (PM & HC), and 9.0 (CO) as presented in the application (Appendix B).

(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.

(f) PTE in tons per year (TPY) is based on an estimated yearly average of emissions over a rolling monthly three-year period of the listed pollutant. Other single event and unlikely scenarios were also considered. The applicant demonstrated that these scenarios were in compliance with NAAQS. An explanation in the CyrusOne application for PTE (TPY) Max and one-time ultra-worst year scenarios is repeated here. A "'*theoretical maximum year'" addresses the worst-case consideration that, for fuel usage and hour limitations to be averaged over a 3-year period, there is potential for emitting the 3-year maximum entirely within a single year. Because maintenance would need to be conducted each year, the theoretical maximum year includes one year of hours allotted to maintenance (14 hours) plus three years of hours allotted to power outage use (72 hours) for each generator. The theoretical maximum year also includes up to 756 total cumulative generator run hours that can be used for the purposes of startup and commissioning. The theoretical maximum cumulative hours for all 2.25-MW generators in a single year would be 4,160 (3,440 hours for maintenance and power outage and 720 hours for commissioning). The theoretical maximum cumulative hours for the 750-kW generators in a single year would be 208 (172 hours for maintenance and power outage and 36 hours for commissioning). If more than 756 total cumulative generator operating hours are required for startup and commissioning in a single year, those would be counted against the annual operating runtime limit. This unlikely but possible event is considered the ultra-worst case scenario for project related emissions from the emergency generators and was used for demonstration of compliance with the annually averaged NAAQS and Washington State TAP standards with an annual averaging period."*

(g) The DEEP ASIL is considered to be only the filterable portion of particulate as defined in this note. It is based on the cancer unit risk factor established by the California Office of Environmental Health Hazard Assessment (OEHHA) which states: "The complex and potentially variable mix of chemical species in the condensed phase and the vapor phase of diesel exhaust, required the measure of exposure related to carcinogenic risk to be specified. The most commonly used measure of exposure is atmospheric concentration of particles in µg/m3. That measure is obtained from the mass of particles collected on a filter per volume of the air that flowed through the filter. On the basis of its relation to health studies and its general practicality, that measure was used in the diesel exhaust TAC document cancer risk assessment (OEHHA, 1998)". This is also consistent with California Code of Regulations § 93115.14 as referenced in Section 3 of this TSD. Therefore, DEEP does not include condensable particulate emissions.

(h) EPA AP-42 § 3.3 or 3.4 from: Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors.

1.2. Maximum Operation Scenarios Based on Tier 2 Compliant Engines

Cold start adjustment factors are used to approximate the additional emissions from cold engines burning off the accumulated fuel and crankcase oil on cold cylinders. Cold start factors are based on California Energy Commission tests as presented in the application. CyrusOne used 1-minute cold start factors of 4.3 (PM/VOC), 9.0 (CO), and 1.0 (NOx). These are approximately equivalent to other data centers in Quincy which applied 10-minute cold start factors of 1.26, 1.56, and 1.0 to a 15 minute period.

CyrusOne also considered NAAQS compliance during a theoretical worst-year scenarios as explained in footnote f in Table 1.

2. APPLICABLE REQUIREMENTS

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

2.1. Chapter 70.94 Revised Code of Washington (RCW), Washington Clean Air Act,

2.2. Chapter 173-400 Washington Administrative Code (WAC), General Regulations for Air Pollution Sources,

2.3. Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants, and

2.4. 40 CFR Part 60 Subpart IIII and 40 CFR 63 Subpart ZZZZ* (* See section 2.4.4)

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

2.4.1. Support for permit Approval Condition 2.1 regarding applicability of 40 CFR 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 CyrusOne 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 CyrusOne (0.750 MWe and 2.25 MWe). Instead, 40CFR60 requires the engines at CyrusOne to meet the Tier 2 emission levels of 40CFR89.112 (see section 4 with respect to add-on controls). 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 CyrusOne:

§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.*

(Note: Based on information provided by the applicant, CyrusOne will use the following engines specifications: 2012 MTU Model 12V2000G85-TB rated 0.750 MWe and 2018 MTU Model 16V4000G84S rated 2.25 MWe. Based on these specifications, the 0.750 MWe engine has 23.9 liters displacement over 12 cylinders, or 1.99 liters per cylinder; the 2.25 MWe engines have 76.3 liters displacement over 16 cylinders, or 4.8 liters per cylinder. Thus, because the specified engines at CyrusOne will all have a displacement of less than 30 liters per cylinder, and are for emergency purposes only, they are 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.***

(Note: Thus, as outlined in previous note, and based on the power ratings listed in *40 CFR 60.4202(a)*, the 0.750 MWe and 2.25 MWe engines at CyrusOne are required to meet the applicable 40 CFR 89 Tier 2 emission standards.)

> *(b) Stationary CI internal combustion engine manufacturers must certify their 2007 model year and later emergency stationary CI ICE with a maximum engine*

*power **greater than 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 (b)(1) through (2) of this section.*

(1) For 2007 through 2010 model years, the emission standards in table 1 to this subpart, for all pollutants, for the same maximum engine power.

(2) For 2011 model year and later, the certification emission standards for new nonroad CI engines for engines of the same model year and maximum engine power in 40 CFR 89.112 and 40 CFR 89.113 for all pollutants.

2.4.2. Support for permit Approval Condition 1.1 regarding applicability of 40 CFR 60.4211(f):

The emergency engine generators approved for operation by the Order are to be used solely for those purposes authorized for emergency generators under 40 CFR 60, Subpart IIII. The permit allows emergency use consistent with the hourly operation requirements described in 40 CFR 60.4211(f), except that there shall be no operation of this equipment to produce power for demand-response arrangements, peak shaving arrangements, nor to provide power as part of a financial arrangement with another entity, nor to supply power to the grid. Operating generators for uses beyond what is allowed in Approval Condition 1.1 goes beyond the intended use of emergency generators for data center back-up power only. Approval Condition 1.1 is consistent with the provisions of other data center permits in Quincy.

2.4.3. Support for Approval Condition 8.5 regarding recordkeeping requirements describing the purpose of engine operation:

Recording the reason for operating engines (along with load rate and duration) is consistent with the provisions of other data center permits in Quincy. In order to demonstrate compliance with 40 CFR 60.4211(f), this Approval Condition requires that CyrusOne record this information. In addition to demonstrating compliance 40 CFR 60.4211(f), this condition is also required to show compliance with Approval Conditions 8.1.3. and because of its importance to Ecology and the Quincy community. Consistent with the application, which did not request extended operation at low loads, provisions for extended operation of low loads are not specified in the permit. Extended operation at low-loads is defined as operation of engines which would cause wet stacking and the potential need for burn-off of wet-stacked engines. If the facility pursues extended operation at low loads, Ecology may require additional information from the facility.

2.4.4. 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 AND VISUAL EMISSIONS TESTING

Source testing requirements and test method options outlined in Section 4 of the Approval Order requires a five-load test for PM, NO_X, CO, and VOC. PM is considered to be DEEP at size $PM_{2.5}$ or smaller, which tests only for the filterable particulate matter, consistent with California Code of Regulations § 93115.14 *ATCM for Stationary CI Engines – Test Methods* (measuring front half particulate only) per subsection (a)(1)(A)(1).

Ecology also includes the partial dilution probe method from 40 CFR 1065 as an option. Use of this test more closely simulates the test that manufacturers are required to use to meet NSPS requirements, and will potentially reduce testing time compared to other test options. By reducing testing time, engine emissions from stack testing will be reduced.

For this permit, engine testing is determined as described in sections 3.1, 3.2, 3.3, and 3.4 of this TSD.

3.1. New Engine Stack Testing

The permit requires that CyrusOne test at least one engine from each manufacturer and each size engine from each manufacturer according to one of two options: Option 1: the new engine shall be tested onsite as soon as possible after commissioning and before it becomes operational. Option 2: before becoming operational onsite, the engine shall be tested at the manufacturer's testing cell if the onsite conditions are reproduced and verified as so, by the manufacturer in a letter to Ecology. 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.

3.2. Periodic Stack Testing

Every 60 months after the first testing performed, starting with engines tested after the date of this permit, CyrusOne is required to test at least one engine, including the engine with the most operating hours.

3.3. Visual Emissions Testing

Unless otherwise approved in writing by Ecology, Approval Condition 5.3.7 for opacity is assume to apply at all times including during potential burn-off of wet stacked engines. An alternate approval would require some type of demonstration as explained in section 2.4.3 of this TSD.

3.4. 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, any or all of the following test methods: Methods 5, 201A, 202, or 40CFR1065.

4. SUPPORT FOR BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

As noted in Condition 2.1 of the Approval Order, each engine must meet the emission requirements of EPA Tier 2 engines. Ecology does not consider additional control equipment to be Best Available Control Technology (BACT) at CyrusOne because of the reasons outlined in this section.

BACT is defined[1] as "*an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under chapter 70.94 RCW emitted from or which results from any new or modified stationary source, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of the "best available control technology" result in emissions of any pollutants which will exceed the emissions allowed by any applicable standard under 40 CFR Part 60 and Part 61. 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.*

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

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.[2] 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 (SO_2). BACT for toxics (tBACT) is included in Section 4.5.

4.1. BACT Analysis for NO_X from Diesel Engine Exhaust

CyrusOne reviewed the following BACT information for internal combustion engines.

4.1.1. BACT options for NO_X

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

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

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 NO_X 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.

CyrusOne has evaluated the cost effectiveness of installing and operating SCR systems on each of the proposed diesel engines. Assuming no direct annual maintenance, labor, and operation costs, the analysis indicates that the use of SCR systems would cost approximately $27,000 per ton of NO_X removed from the exhaust stream each year; or higher, if taking into account California Area Resource Board (CARB) estimated operation, labor, and maintenance costs. 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 $39,000 for NO_X alone or $32,000 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 NO_X control alternatives described in subsection 4.1.1.3., it is not economically feasible for this project. Furthermore, although NOx includes more than just NO2, the only NO_X that currently have NAAQS is NO_2. Cost per ton removal of NO_2 is approximately an order of magnitude more expensive than for NO_X, and is addressed under tBACT in Section 4.5.

Therefore, Ecology agrees with the applicant that this NO_X 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 CyrusOne Data Center 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 NO_X 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 NO_X 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 NO_XOUT uses urea, and has achieved 50–70 percent NO_X reduction. Because the SNCR system does not use a catalyst, the reaction between ammonia and NO_X occurs at a higher temperature than with an SCR, making SCR applicable to more combustion sources. Currently, the preferred technology for back-end NO_X 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 NO_X 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 NO_X. 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 NO_X 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 NO_X formation control approach and not a back-end NO_X control technology. It works by reducing the peak flame temperature and therefore reducing NO_X 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 effect 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 NO_X adsorbers, RAPER-NO_X, ozone injection, and activated carbon absorption.

- **NO_X Adsorbers:** NO_X adsorbing technologies (some of which are known as SCONO$_X$ or EMx^{GT}) use a catalytic reactor method similar to SCR. SNONO$_X$ 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 NO_2, which can be adsorbed onto the potassium carbonate. While this technology can achieve NO_X reductions up to 90 percent (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-NO_X:** This technology consists of passing exhaust gas through cyanic acid crystals, causing the crystals to form isocyanic acid, which reacts with the NO_X to form CO_2, 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, would 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 NO_2 and further to NO_3. NO_3 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 NO_X is in attainment in many areas of the United States (including Quincy, WA), the primary reason to control NO_X is that 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 NO_X from diesel engine exhaust. However, it is not progressing to commercialization and is therefore rejected.

4.1.2. BACT determination for NO_X

Ecology determines that BACT for NO_X 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, 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. CyrusOne 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

The following demonstrated technologies for the control of PM, CO, and VOC emissions from the proposed diesel engines are discussed in this section:

4.2.1. BACT options for PM, CO, and VOC from diesel engine exhaust

4.2.1.1. Diesel particulate filters

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 percent 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.

CyrusOne has evaluated the cost effectiveness of installing and operating catalyzed DPFs on each of the proposed diesel engines. The analysis indicates that the use of catalyzed DPFs would cost approximately $731,000 per ton of engine exhaust particulate removed from the exhaust stream at CyrusOne each year. Catalyzed DPFs also remove CO and VOCs at costs of approximately $65,000 and $334,000 per ton per year respectively. If the cost effectiveness of catalyzed DPF use is evaluated using the total amount of PM, CO, and VOCs reduced, the cost estimate would be approximately $51,000 per ton of pollutants removed per year.

These annual estimated costs (for catalyzed DPF use alone) provided by CyrusOne are conservatively low estimates that take into account installation, tax, and shipping capital costs but assume a lower bound estimate for operational, labor and maintenance costs of $0, whereas an upper bound CARB estimate would increase the cost per ton price.

Ecology concludes that use of catalyzed 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 hydrocarbon emissions.

CyrusOne 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 CyrusOne followed for engines within this application (including for SCR-only, DPF-only, and Tier 4 capable integrated control system technologies).

- CyrusOne obtained the following recent DOC equipment costs from a vendor: ($11,500 for a stand-alone catalyzed DOC per single 2.25 MWe generator; and $6,500 for a single 0.750 MWe generator). For forty (42) 2.25 MWe generators and two (2) 0.750 MWe generators, this amounts to $472,400. According to the vendor, DOC control efficiencies for this unit are 80%, 70%, and 25%, for CO, HC, and filterable PM respectively.

- The subtotal becomes $649,700 after accounting for shipping ($26,000), WA sales tax ($30,700), and direct on-site installation ($126,000).

- After adding indirect installation costs, the total capital investment amounts to $819,600. 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 $85,244.

- At the control efficiencies provided from the vendor, the annual tons per year (tpy) of emissions for CO (7.9 tpy), HC (1.76 tpy), and PM (0.62 tpy) become 6.3 tpy, 1.23 tpy, and 0.16 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 ($85,244 divided by 6.3 tpy for CO, etc.).

The corresponding annual DOC cost-effectiveness value for CO destruction alone is approximately $13,500 per ton. If PM and hydrocarbons were individually considered, the cost-effectiveness values would be $546,000 and $69,000 per ton of pollutant removed annually, respectively.

These annual estimated costs (for DOC use alone) provided by CyrusOne are conservatively low estimates that take into account installation, tax, shipping, and other capital costs as mentioned above, but assume a lower bound estimate for operational, labor and maintenance costs of $0, whereas an upper bound CARB estimate could potentially amount to an additional $23,000 per year of direct annual costs. This would provide a more realistic cost range of $13,500 - $17,100 per ton of CO removed, and a cost range of $11,100 - $14,100 per ton for removal of CO, PM, and HC combined.

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 NO_X in gasoline engines. However, Ecology concludes that a three-way catalyst is not feasible for this project and can be rejected as BACT based on a review of the following literature:[3]

> "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."

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. CyrusOne 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 SO_2

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

4.3.2. BACT determination for SO_2

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

[3] DieselNet, an online information service covering technical and business information for diesel engines, published by Ecopoint Inc. of Ontario, Canada (https://www.dieselnet.com).

4.4. BACT Analysis for PM from Cooling Towers not Required

According to the application, “there will not be any wet mechanical-draft cooling towers used for the project.” Instead, CyrusOne will use direct evaporative cooling units to cool the data center server areas. According to the applicant, “the units use direct evaporative cooling to cool data halls, which make up most of the data center complex. The cooling units evaporate City or well water into the airstream serving the data halls, and eventually discharge that air back into the atmosphere. The main impact of the system to the surrounding environment is increased moisture/humidity. No known contaminants will be introduced into the surrounding atmosphere.” Because the cooling units are not a source of air emissions, a BACT analysis was not performed.

4.5. Best Available Control Technology for Toxics

Best Available Control Technology for Toxics (tBACT) means BACT, as applied to TAPs[4]. The procedure for determining tBACT followed the same procedure used above for determining BACT. Of the technologies CyrusOne considered for BACT, the minimum estimated costs as applied to tBACT for key TAPs (those above small quantity emission rates in WAC 173-460-150) are as follows:

- The minimum estimated costs to control diesel engine exhaust particulate (DEEP) is estimated to be $550,000 per ton removed.
- The minimum estimated cost to control NO_2 is estimated to be $272,000 per ton removed.
- The minimum estimated cost to control CO is estimated to be $13,500 per ton removed.
- The minimum estimated costs to control acrolein, which could be treated with the VOC treatment listed under BACT, are estimated to be greater than approximately $860 million per ton.
- The minimum estimated costs to control benzene, which could be treated with the VOC treatment listed under BACT, are estimated to be greater than approximately $8 million per ton.
- The minimum estimated costs to control naphthalene, which could be treated with the VOC treatment listed under BACT, are estimated to be greater than approximately $52 million per ton.

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 4.5 below represents tBACT for the proposed project.

Table 4.5. tBACT Determination

Toxic Air Pollutant	tBACT
CO	Compliance with the CO BACT requirement

[4] WAC 173-460-020.

Table 4.5. tBACT Determination	
Toxic Air Pollutant	**tBACT**
NO_2	Compliance with the NOx BACT requirement
Diesel Engine Exhaust, Particulate	Compliance with the PM BACT requirement
Propylene	Compliance with the VOC BACT requirement
Sulfur dioxide	Compliance with the SO_2 BACT requirement
Benzene	Compliance with the VOC BACT requirement
Xylenes	Compliance with the VOC BACT requirement
Napthalene	Compliance with the VOC BACT requirement
Formaldehyde	Compliance with the VOC BACT requirement
1,3 Butadiene	Compliance with the VOC BACT requirement
Acrolein	Compliance with the VOC BACT requirement
Benzo(b)fluoranthene	Compliance with the VOC BACT requirement
Dibenz(a,h)anthracene	Compliance with the VOC BACT requirement
Benzo(a)Pyrene	Compliance with the VOC 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. AERMOD modeling results are presented in Table 5.

The AERMOD model used the following data and assumptions:

5.1. Five years of sequential hourly meteorological data from Moses Lake Airport were used. Twice-daily upper air data from Spokane were used to define mixing heights. The five years of data range from January 1, 2012 through December 31, 2016.

5.2. 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.

5.3. Each of the 2.25 MWe generators was modeled with stack heights of 35 feet above local ground, and with and vertical stack diameters 18-inch. The 0.750 MWe generators were modeled at 25 feet above local ground, and 12 inches diameter.

5.4. The data center buildings, in addition to the individual generator enclosures were included to account for building downwash.

5.5. 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 the nearest emission source. A grid spacing of 25 meters was used for distances of 150 meters to 400 meters. A grid spacing of 50 meters was used for distances from 400 meters to 900 meters. A grid spacing of 100 meters was used for distances from 900 meters to 2,000 meters. A grid spacing of 300 meters was used for distances from 2,000 meters to 4,500 meters. A grid spacing of 600 meters was used for distances beyond 4,500 meters from the boundary.

5.6. 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. CyrusOne deviated from actual loads in a way that most likely overestimates actual emissions. As described in the application: "The modeling setup for short-term impacts at full-variable load included load-specific stack parameters (i.e., flow rate and exhaust exit temperature), which correspond to the characteristic worst-case emission load of each pollutant… The stack parameters setup for long-term impacts conservatively used the vendor-reported load-specific exhaust flow rate and temperature that would result in the worst-case dispersion conditions (i.e., the load condition with the lowest reported exhaust temperature and velocity)."

5.7. Annual 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 NO_X ambient ratio of 90 percent.

5.8. AERMOD modeling results in the application show the highest 1-hour NO_2 impact occur within the westside of the facility boundary. CyrusOne used a stochastic Monte Carlo statistical package to evaluate the 8th highest daily 1-hour NO_2 impacts caused by randomly occurring emissions distributed throughout the data center. As described in the application: "the script iteratively tests a thousand combinations of results from all the generator runtime scenarios, wind directions, and wind speeds to estimate the probability, at any given receptor location, that the NAAQS standard will be violated. For the 1-hour NO2 NAAQS analysis, the script estimates the 98th-percentile concentration at each individual receptor location within the modeling domain." The stochastic Monte Carlo analysis considered conservatively high occurrences of runtime events as described below:

5.8.1 Runtime scenarios were ranked, based on worst-case potential facility emissions, The worst case scenario was assumed to occur when all 42 generators activate concurrently, such as during a power-outage. Because the next worst case scenarios were assumed to be during monthly maintenance or load bank testing which may occur on any generator throughout the facility, CyrusOne looked at four representative AERMOD runs at different facility locations.

5.8.2 CyrusOne analyzed these scenarios by post-processing the 1st-highest impact of these AERMOD runs using Ecology's Monte Carlo script. The script estimated the 98th-percentile impact value at every receptor location within the modeling domain, and found the highest impact of 139 ug/m^3 (including local background emission impacts). Ecology modelers found a similar result (139.6 ug/m^3). Ecology modelers also used recent 1-year Quincy background monitoring data of approximately 43.1 ug/m3. After adding this regional specific background impact, the total NO2 impact is estimated by Ecology to be 182.7 ug/m^3 as shown in Table 5.

5.9. AERMOD Meteorological Pre-processor (AERMET) was used to estimate boundary layer parameters for use in AERMOD.

5.10. AERSURFACE was used to determine the percentage of land use type around the facility based on albedo, Bowen ratio, and surface roughness parameters.

Except for DEEP and NO2, which are predicted to exceed their acceptable source impact levels (ASILs), AERMOD model results show that no NAAQS or ASIL will be exceeded at or beyond the property boundary. The modeling results as listed in the application are provided below:

Table 5. AERMOD Modeling Results

Criteria Pollutant	Standards in µg/m³ NAAQS(a) Primary	Standards in µg/m³ NAAQS(a) Secondary	Maximum Applicable Ambient Impact Concentration (µg/m³)	Local Background Concentrations (µg/m³) (b)	Regional Background Concentrations (µg/m³) (b)	Maximum Ambient Impact Concentration Added to Background (µg/m³) (If Available)
Particulate Matter (PM_{10})	Modeling Files: PM10_24HR_PO3.ADI					
1st-Highest 24-hour average	150	150	66	19	62	147
Particulate Matter ($PM_{2.5}$)	Modeling Files: PM25_ANN.ADI; PM25_24HR_MT.ADI					
Annual average	12	15	2.3	0.6	6.5	9.4
24-hr: 5th highest modeled impacts. (Simulation impacts from 4th highest day)	35	35	11	Negligible	21	32
Carbon Monoxide (CO)	Modeling File: CO_1HR8HR.ADI					
8-hour average	10,000	N/A	4,388 (c)	Negligible	3,308	8,196 (c)
1-hour average	40,000	N/A	7,490 (c)	Negligible	5,776	13,266 (c)
Nitrogen Oxides (NO_2)	Modeling Files: NO2_ANN.ADI; NO2_PO.ADI; NO2_MT1.ADI; NO2_MT2.ADI.ADI; NO2_MT3.ADI; NO2_MT4.ADI. Script input files/source group: MAXDAILY_APO_NO2.DAT/(APO); MAXDAILY_AMT1_NO2.DAT/(AMT1); MAXDAILY_AMT2_NO2.DAT/(AMT2); MAXDAILY_AMT3_NO2.DAT/(AMT3); MAXDAILY_AMT4_NO2.DAT/(AMT4)					
Annual average	100	100	34	3	2.8	39
1-hour average	188	N/A	139.6 (modeled + local background)		43.1	182.7
Sulfur Dioxide (SO_2)	Modeling File: SO2_1HR3HR.ADI					
3-hour average	N/A	1,300	8.0	Negligible	2.1	10
1-hour average	200	N/A	7.8	Negligible	2.6	10

Toxic Air Pollutant	Modeling Files	ASIL (µg/m³)	Averaging Period	1st-Highest Ambient Concentration (µg/m³)
DEEP	ncDPM_ANN.ADI	0.00333	Annual average	0.660
NO_2	NO2_1HR_ASIL.ADI	470	1-hour average	1,446
CO	CO_1HR8HR.ADI	23,000	1-hour average	7,490
Acrolein	ACR_1HR24HR.ADI	0.06	24-hour average	0.024
Benzene	Derived from: ncDPM_ANN.ADI	0.0345	Annual Average	0.020
1,3-Butadiene		0.00588	Annual Average	0.00099
Naphthalene		0.0294	Annual Average	0.0033

Notes:
N/A = not applicable and/or not provided
µg/m³ = Micrograms per cubic meter.
ppm = Parts per million.
ASIL = Acceptable source impact level.
DEEP = Diesel engine exhaust, particulate
(a) Ecology interprets compliance with the National Ambient Air Quality Standards (NAAQS) as demonstrating compliance with the Washington Ambient Air Quality Standards (WAAQS).
(b) Regional background is based on 1-year of Quincy monitoring. Local background concentrations took into account other nearby data centers and the Con Agra facility.
(c) For CO (NAAQS) modeling, CyrusOne used a lower stack exit velocity (13.58 m/s) than what was used for the other pollutants (53.06 m/s). Because a lower exit velocity generally would cause higher modeled impacts, actual CO impacts are assumed to be less than those stated in this table.

CyrusOne has demonstrated compliance with the NAAQS and ASILs except for DEEP and NO2. As required by WAC 173-460-090, emissions of DEEP and NO2 were further evaluated, and a summary of that evaluation is presented in the following section of this document.

6. SECOND TIER REVIEW FOR DIESEL ENGINE EXHAUST PARTICULATE

Proposed emissions of DEEP and NO_2 from the forty-two (42) CyrusOne engines exceed the TAPs regulatory Tier 2 trigger levels (or ASILs, as defined in section 5 Table 5). A second tier review was required for DEEP and NO_2 in accordance with WAC 173-460-090, and CyrusOne was required to prepare a health impact assessment (HIA). The HIA presents an evaluation of both noncancer hazards and increased cancer risk attributable to CyrusOne's increased emissions of all identified carcinogenic compounds. Pollutants evaluated in the HIA included: DEEP, NO_2, 1,3-butadiene, naphthalene, carbon monoxide, benzene, acrolein, and numerous others. CyrusOne also reported the DEEP and NO_2 cumulative risks associated with CyrusOne and prevailing sources in their HIA document based on a cumulative modeling approach. The CyrusOne cumulative risk study is based on proposed generators, nearby existing permitted sources, and other background sources including highways and railroads. Ecology concluded that the applicant has satisfied all requirements of a second tier analysis (*pending*).

7. CONCLUSION

Based on the above analysis, Ecology concludes that operation of the 42 generators will not have an adverse impact on air quality. Ecology finds that this project has satisfied all NOC requirements including those regarding second tier analysis for DEEP and NO_2.

[End of TSD for CyrusOne Data Center]