# INTERGATE QUINCY BUILDING E
# NOTICE OF CONSTRUCTION APPLICATION
## Addition of Gensets

**Sabey Data Center Properties / Quincy, WA**

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# 1. EXECUTIVE SUMMARY

Sabey Data Center Properties (Sabey) currently operates its Intergate Quincy data center (IGQ) in Quincy, Washington. Sabey is proposing to expand the permitted emission units to include 13 additional generators at Building E (the Project).

In September 2020, Sabey was issued NOC 20AQ-E022 for two new buildings, Buildings D and E, for a total of 32 gensets between the two buildings. In August 2022, Sabey was issued NOC 22AQ-E016 for the addition of 27 gensets to Building E. Permitted gensets at IGQ Buildings D and E campus include 57 "main gensets" rated up to 2,500 kW each and 2 "support gensets" (one 300 kW and one 1,500 kW), as well as 37 gensets at Buildings A, B, and C. Permitted genset models at the IGQ campus include Caterpillar, Cummins, MTU, and Rehlko engines ranging in size from 300 kW "support gensets" to 2,500 kW "main gensets." Of the previously permitted gensets, 5 Cummins DQKAF 2,250 kW main gensets, 4 Caterpillar 3516C 2,250 kW main gensets, and one Cummins 1 MW support genset have been installed at Building E. Sabey proposes to add 13 main gensets to Building E, bringing the facility-wide genset total to 109 gensets. Sabey is submitting this Notice of Construction (NOC) application for the proposed addition of these gensets to the permit.

The NOC application contains the following elements:

- Section 2. Description of Facility
- Section 3. Emission Calculations
- Section 4. Regulatory Applicability
- Section 5. Best Available Control Technology
- Section 6. Air Quality Dispersion Modeling
- Appendix A: Application Form and SEPA Documentation
- Appendix B: Site Plan
- Appendix C: Emission Calculations and Supporting Documentation
- Appendix D: BACT Cost Calculations
- Appendix E: AERMOD Modeling Parameters
- Appendix F: AERMOD Load Analysis Results
- Appendix G: Model Files

This application demonstrates that the proposed project meets the requirements for an NOC application under Washington Administrative Code (WAC) 173-400-110(2)(a). The required NOC application form can be found in Appendix A.

# 2. DESCRIPTION OF FACILITY

Sabey's IGQ facility Building E is used as an electronic data storage facility. In the event of interrupted power supply to the electronic storage devices, the facility has diesel-fired gensets to provide power.

The following equipment is currently permitted for the operation of Building E:

- 39 – up to 2,500 kWe main diesel-fired emergency gensets; and,
  - 10 gensets have been installed:
    - 5 Cummins DQKAF 2,250 kWe main gensets;
    - 4 Caterpillar 3516C 2,250 kW main gensets; and
    - 1 Cummins 1 MW support genset
- 1 – 1,500 kWe support diesel-fired emergency genset

Sabey is proposing to make the following additions at Building E:

- 13 – up to 2,500 kWe main diesel-fired emergency gensets

A site plan is included in Appendix B.

## 2.1 Standby Gensets

Building E will have a total of 52 diesel-fired main gensets of up to 2,500 kWe and 1 support genset of up to 1,500 kWe. The site plan (Appendix B) shows the locations of the proposed gensets. The main gensets will provide standby electrical power to the data center and the support genset will provide power for the building for emergency lighting during periods of interrupted power supply. With the addition of the proposed generators in this application, all engines at IGQ Building E will operate in accordance with the following conditions:

- Maximum of 1,350 hours per year for all engines at Building E including emergency operations, maintenance and testing operations; and
- In compliance with Tier 2 certification requirements.

Sabey has evaluated three vendors and six models for the proposed main gensets, including:

- Cummins Inc., QSK60-G26, 2,500 kWe Standby Generator Set;
- Cummins Inc., QSK60-G14, 2,250 kWe Standby Generator Set;
- Caterpillar 3516C, 2,500 kWe Standby Generator Set;
- Caterpillar 3516C, 2,250 kWe Standby Generator Set;
- Rehlko KD2250, 2,500 kWe Standby Generator Set; and,
- Rehlko KD2500, 2,700 kWe Standby Generator Set;

Sabey has not determined the vendor or model for the gensets to be installed at IGQ Building E. Therefore, all six models are included in this NOC application. The specifications from the vendors are included in Appendix C. If alternative genset models are identified, Sabey will evaluate for emissions and modeling implications and submit an appropriate revision request to Ecology, as applicable.

Table 2-1 below summarizes the operation scenarios for the 13 proposed additional gensets.

**Table 2-1. Operation Scenarios Summary**

| Operation Scenario | Operations for Each Genset [a] | | Total Operations for New Gensets | | |
|---|---|---|---|---|---|
| | (hr/day/genset) | (hr/yr/genset) | (engine-hr/hr) | (engine-hr/day) | (engine-hr/yr) |
| Engines Running at Any Load | 24 | 25 | 13 | 312 | 331 |

a. The operating scenario includes all categories of operations, including emergency run, maintenance and testing runs. Note that Sabey is proposing a building-wide hour limit for generator operations, so this "per-genset" hour value is the average hours per year for the individual engines at the building.

b. All 13 additional gensets will be operated up to 24 hr/day/genset which corresponds to maximum of 312 additional engine-hrs in any single day.

## 2.2 Building E Fuel Equipment

Each planned genset is equipped with an attached tank that is approximately 12,000 gallons. Since the attached tanks have a sufficient capacity to accommodate expected operations, no bulk fuel storage will be needed. In the application for Permit 20AQ-E022, Sabey was proposing 2,000 gallon attached tanks to each genset plus 20 stand-alone diesel fuel storage tanks with a capacity of 15,000 gallons. As discussed in Section 4.1, Sabey expects these fuel storage tanks will continue to be exempt from NOC permitting.

## 2.3 Support Generators and Cooling Units

Designs and uses for the support generators and cooling units have not changed from the NOC application in 2021.

# 3. EMISSION CALCULATIONS

This section describes each of the emission sources as well as the methodologies used to calculate criteria pollutant, HAP, and TAP emissions from each source at IGQ Building E. Detailed supporting calculations and supporting documentation for the emission calculations, such as manufacturer specifications, can be found in Appendix C.

## 3.1 Methodology

Criteria pollutants emitted from the gensets include particulate matter (PM), particulate matter with aerodynamic diameter less than 10 microns ($PM_{10}$), particulate matter with aerodynamic diameter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide ($SO_2$), carbon monoxide (CO), nitrogen oxides ($NO_X$), and volatile organic compounds (VOC).

In order to estimate the maximum emissions from the engines, vendor supplied emission data is reviewed. According to the specifications, all vendors confirm that the engines are Tier 2 certified[1] standby engines. The following information is provided by the vendors as shown in Appendix C:

- Caterpillar provides the genset power at various loads (10%, 25%, 50%, 75%, and 100%), corresponding engine power, fuel consumption rate, and emission data in pound per hour (lb/hr) for PM, $NO_X$, CO, and hydrocarbons. Altitude corrected power capability is also provided, but no correction is needed for the project.
- Cummins provides the genset power at various loads (25%, 50%, 75%, and 100%), corresponding engine power, fuel consumption rate, and guaranteed emission levels accounting for site variations in gram per horsepower-hr (g/hp-hr) for PM, $NO_X$, CO, and hydrocarbons. Derating factors associated with altitude and ambient temperatures are also provided, but no correction is needed for the project.
- Rehlko provides the genset power at various loads (10%, 25%, 50%, 75%, and 100%), corresponding engine power, fuel consumption rate, and emission data in g/kW-hr for PM, $NO_X$, CO, and hydrocarbons.

An hourly emission rate is calculated based on the provided g/hp-hr or g/kWh emission data for each vendor, except for Caterpillar, which provides lb/hr data. The summary of vendor performance emission data is provided in Appendix C. For each genset, the maximum hourly emissions are calculated based on the following conservative approaches:

- Maximum performance data across all loads and vendors is used to determine the hourly emission rate for $NO_X$, CO and PM.
- Maximum hydrocarbons (HC) performance data across all loads and vendors is used to determine the hourly emission rate for VOC. The HC emission rates are also conservatively assumed to estimate condensable particulate matter (CPM) emissions.
- $PM_{10}$ and $PM_{2.5}$ emissions are the sum of PM and CPM emissions determined above.
- Emission factor from Table 3.4-1, AP-42 and upper limit of 15 ppm sulfur content per 40 CFR 80.510(b) is used to determine $SO_2$ emissions. The maximum engine power at 100% load is used.
- Cold-start emissions occurring during the first minute of engine start-up are calculated for VOC, $NO_X$, CO, and PM based on data from California Energy Commission (CEC) "Air Quality Implications of Backup Generators in California." Maximum emission rate calculations conservatively assume 28 cold-start periods per year. Each cold start assumes the first minute of operation is impacted by the cold-start and the remaining 59 minutes in an hour is normal emission rates. Detailed cold-start emission calculations are provided in Appendix C.

[1] Tier 2 certified engines to meet the emission standards set forth under 40 CFR Part 60, Subpart IIII.

For HAP and TAP emissions emitted by the gensets, emission factors in the unit of pound per million British thermal unit (lb/MMBtu) are obtained from Tables 3.4-3 and 3.4-4, AP-42 and Ventura County Air Pollution Control District's AB 2588. For pollutants included in both sources, the maximum emission factor was used. The maximum hourly fuel consumption rate across all loads and vendors and the default diesel heat content of 0.137 MMBtu per gallon diesel fuel are used to determine the emission rates for each HAP/TAP, except for diesel particulate matter (DPM). DPM is characterized as the filterable portion of particulate matter and based on the filterable particulate matter emissions calculated for the criteria pollutant.

Minimal VOC emissions are expected from the working losses and standing losses of the diesel storage tanks. Due to the low vapor pressure of diesel (<0.01 psia) and the maximum operation of the gensets being at or below 29 hours per year per genset, the VOC emissions from the diesel storage tanks are expected to be minimal (< 1 tpy). Diesel generally contains trace amounts of HAPs, but the emissions are expected to be negligible. Therefore, the VOC and HAP emissions are not quantified for the diesel storage tanks.

## 3.2 Emission Summary

The project emissions are summarized in Table 3-1, and are compared to the exemption levels set forth under WAC 173-460-110(5). Maximum hourly emission rates across all vendors and loads, determined by the approach discussed in Section 3.1, are used to determine the hourly, daily, and annual emission rates for this project. Detailed emission calculations are provided in Appendix C.

**Table 3-1. Project Emission Summary**

| Pollutant | Maximum Emissions for New Engines [a] | | | NOC Exemption Levels (tpy) |
|---|---|---|---|---|
| | (lb/hr) | (lb/day) | (tpy) | |
| Filterable PM [b] | 61.91 | 1,485.74 | 0.85 | 1.25 |
| CPM [b] | 100.88 | 2,421.20 | 1.38 | -- |
| $PM_{10}$ [b] | 162.79 | 3,906.94 | 2.23 | 0.75 |
| $PM_{2.5}$ [b] | 162.79 | 3,906.94 | 2.23 | 0.5 |
| $SO_2$ [c] | 0.57 | 13.73 | 0.01 | 2 |
| CO [d] | 96.25 | 2,309.98 | 1.24 | 5 |
| $NO_X$ [d] | 809.48 | 19,427.47 | 9.59 | 2 |
| VOC | 100.88 | 2,421.20 | 1.38 | 2 |
| HAPs | 7.76 | 186.28 | 0.10 | -- |

a. Emissions calculated follow the operation scenarios in Table 2 1.
b. Diesel filterable PM hourly emissions are the maximum based on engine specifications across all loads and vendors. $PM_{10}$ and $PM_{2.5}$ emissions are the filterable PM emission rates plus the CPM emission rate. CPM emissions are conservatively assumed to be the same as hydrocarbon emissions from vendor data.
c. $SO_2$ emissions are calculated conservatively for 100% load (i.e., maximum engine power). $SO_2$ emissions are based on maximum sulfur content allowed in ULSD (15 ppm).
d. $NO_X$ and CO hourly emissions are the maximum based on engine specifications across all loads and vendors.

# 4. REGULATORY APPLICABILITY

The proposed additions to the facility will be located in Quincy, Washington, which is in attainment for all criteria pollutants. The following section analyzes the regulatory requirements potentially applicable to the emission sources identified for the IGQ facility.

## 4.1 NOC Applicability

A NOC permit application must be filed and an approval order issued by Ecology prior to the construction or modification of an affected facility per WAC 173-400-110(2)(a) unless the installation meets exemptions under WAC 173-400-110(4) or (5). The proposed project involves construction of 13 emergency gensets that do not meet any of the exemption criteria under WAC 173-460-110; therefore, the construction of 13 additional emergency gensets requires NOC approval.

## 4.2 New Source Review

A project in an attainment area is subject to the Prevention of Significant Deterioration (PSD) permitting program under WAC 173-400-700 if the project is either a "major modification" to an existing "major source," or is a new major source itself.

The IGQ facility is not a listed source category with a major source threshold of 100 tpy. Therefore, the major source threshold for the IGQ facility is 250 tpy of any regulated pollutant. The currently permitted IGQ facility is not considered a major source. As shown in Table 3-1, the PTE of the Project will be well below the 250 tpy threshold for all criteria pollutants. Therefore, the Project is neither considered a major modification to an existing major source nor is the Project a new major source itself, so it does not trigger major source review.

## 4.3 New Source Performance Standards (NSPS)

WAC 173-400-115 adopts federal NSPS by reference. NSPS apply to certain types of equipment that are newly constructed, modified, or reconstructed after a given applicability date. NSPS applicability is reviewed below for each emission unit for the expansion project.

### 4.3.1 NSPS Subpart A

All affected sources subject to an NSPS are also subject to the applicable general provisions of NSPS Subpart A unless specifically excluded by the source-specific NSPS. NSPS Subpart A addresses the following for facilities subject to a source-specific NSPS:

- Initial construction/reconstruction notification
- Initial startup notification
- Performance tests
- Performance test date initial notification
- General monitoring requirements
- General recordkeeping requirements
- Semi-annual monitoring system and/or excess emission reports

The NSPS requirements are different depending on whether the source is classified as a new construction, reconstruction, or modification. The following definitions in 40 CFR 60.2 are pertinent to this classification:

*Existing facility* means, with reference to a stationary source, any apparatus of the type for which a standard is promulgated in this part, and the construction or modification of which was commenced before the date of proposal of that standard; or any apparatus which could be altered in such a way as to be of that type.

*Modification* means any physical change in, or change in the method of operation of, an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted.

The proposed 13 additional gensets will be newly constructed sources. Therefore, the new construction classification is used to determine the applicable requirements in the subsequent NSPS regulations.

### 4.3.2 NSPS Subpart IIII

Subpart IIII applies to non-fire pump compression ignition (CI) internal combustion engines (ICE) manufactured after April 2006 and fire pump CI ICE manufactured after July 1, 2006. Therefore, the emergency gensets are subject to Subpart IIII. The requirements for each of the genset include:

- Purchase a certified engine.
- Use ultra-low sulfur diesel (ULSD) with sulfur content less than 15 ppm.
- Operate and maintain the engines according to manufacturer's emission-related written instructions.
- Operate for less than 100 hours per year for maintenance and testing, 50 of which can be non-emergency operations.
- Install a non-resettable hour meter to record time of operation of the engine and reason the engine was in operation.

As shown in the vendor specifications (Appendix C), the genset options Sabey is proposing are certified Tier 2 engines. Sabey will purchase certified engines and will operate in accordance with the requirements set forth under NSPS Subpart IIII.

## 4.4 National Emission Standards for Hazardous Air Pollutants

National Emission Standards for Hazardous Air Pollutants (NESHAPs) have been established in 40 CFR Part 61 and Part 63 to control emissions of Hazardous Air Pollutants (HAP) from stationary sources. The applicability of NESHAP rules often depends on a facility's major source status with respect to HAP emissions. Under 40 CFR Part 63, a major source is defined as "any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit considering controls, in the aggregate, 10 tons per year or more of any HAP or 25 tons per year or more of any combination of HAP." The currently permitted IGQ facility is considered an area source (not a major source) of HAP. Based on the Project's PTE, as represented in Appendix C, the Project will maintain the facility's area source status. The Project is not subject to any Part 61 NESHAPs.

### 4.4.1 NESHAP Subpart A

All affected sources subject to a Part 63 NESHAP are also subject to the general provisions of Part 63 Subpart A unless specifically excluded by the source-specific NESHAP. Per NESHAP Subpart A, the following definitions are important when characterizing whether the affected source is new, reconstructed, or existing:

*Affected source* means the collection of equipment, activities, or both within a single contiguous area and under common control that is included in a section 112(c) source category or subcategory for which a section 112(d) standard or other relevant standard is established pursuant to section 112 of the Act. Each relevant standard will define the "affected source," as defined in this paragraph.

*New Source* means any affected source the construction or reconstruction of which is commenced after the Administrator first proposes a relevant emission standard under this part establishing an emission standard applicable to such source.

*Reconstruction*, unless otherwise defined in a relevant standard, means the replacement of components of an affected or a previously non-affected source to such an extent that the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable new source.

*Existing Source* means any affected source that is not a new source.

NESHAP Subpart A applies to the Project because the proposed emergency gensets are considered new sources under Subpart ZZZZ.

### 4.4.2 NESHAP Subpart ZZZZ

The proposed emergency gensets will meet the requirements of NESHAP Subpart ZZZZ by meeting the applicable requirements of NSPS Subpart IIII. Pursuant to 40 CFR 63.6590(c), "no further requirements apply for such engines under this part." Therefore, compliance with NSPS Subpart IIII will ensure that the facility is also in compliance with NESHAP Subpart ZZZZ.

## 4.5 State and Local Regulatory Applicability

### 4.5.1 Washington Toxic Air Pollutant Regulations

In Washington, all new sources emitting TAPs are required to show compliance with the Washington TAP program pursuant to WAC 173-460. Ecology has established a de minimis emission rate, a small quantity emission rate (SQER), and an acceptable source impact level (ASIL) for each listed TAP. If the total project-related TAP emissions increase exceeds the de minimis level for a pollutant then permitting and a control technology review is triggered. If the emissions increases exceed the respective SQER, further determination of compliance with the ASIL using air dispersion modeling is required. Table 4-1 summarizes the Project's TAP emissions for those pollutants with emissions above the de minimis threshold in WAC 173-460-150, and the detailed calculations are included in Appendix C.

**Table 4-1. Project TAP Emission Summary**

| Pollutant | Averaging Period | De Minimis | SQER | Project Total | Modeling Required? |
|---|---|---|---|---|---|
| | | (lb/averaging period) | | | |
| Acetaldehyde | year | 3.00E+00 | 6.00E+01 | 45.91 | No |
| Acrolein | 24-hr | 1.30E-03 | 2.60E-02 | 1.87 | **Yes** |
| Arsenic | year | 2.50E-03 | 4.90E-02 | 0.09 | **Yes** |
| Benzene | year | 1.00E+00 | 2.10E+01 | 10.92 | No |
| 1,3-Butadiene | year | 2.70E-01 | 5.40E+00 | 12.74 | **Yes** |
| Cadmium | year | 1.90E-03 | 3.90E-02 | 0.09 | **Yes** |
| Chromium | 24-hr | 3.70E-04 | 7.40E-03 | 0.03 | **Yes** |
| Chromium (VI) | year | 3.30E-05 | 6.50E-04 | 5.86E-03 | **Yes** |
| Copper | 1-hr | 9.30E-03 | 1.90E-01 | 9.43E-03 | No |
| Formaldehyde | year | 1.40E+00 | 2.70E+01 | 101.17 | **Yes** |
| Hydrogen chloride | 24-hr | 3.30E-02 | 6.70E-01 | 10.29 | **Yes** |
| Manganese | 24-hr | 1.10E-03 | 2.20E-02 | 0.17 | **Yes** |
| Mercury | 24-hr | 1.10E-04 | 2.20E-03 | 0.11 | **Yes** |
| Naphthalene | year | 2.40E-01 | 4.80E+00 | 1.15 | No |
| Nickel | year | 3.10E-02 | 6.20E-01 | 0.23 | No |
| Propylene | 24-hr | 1.10E+01 | 2.20E+02 | 25.79 | No |
| Selenium | 24-hr | 7.40E-02 | 1.50E+00 | 0.12 | No |
| Xylenes | 24-hr | 8.20E-01 | 1.60E+01 | 2.34 | No |
| DPM | year | 2.70E-02 | 5.40E-01 | 1,696.68 | **Yes** |
| $SO_2$ | 1-hr | 4.60E-01 | 1.20E+00 | 0.57 | No |
| CO | 1-hr | 1.10E+00 | 4.30E+01 | 96.25 | **Yes** |
| $NO_2$ [b] | 1-hr | 4.60E-01 | 8.70E-01 | 80.95 | **Yes** |

a. The emissions are calculated based on 331 total engine-hr per year operation. Emission factors for CO, $NO_X$ and diesel engine exhaust particulate are obtained from vendor specifications (shown in Table 3 1). Emission factors for other TAPs are obtained from Tables 3.4-3 and 3.4-4, AP-42, and maximum hourly fuel consumption rate from vendor data is used.

b. For the comparison to SQER, it is assumed that 10% of NOX emitted in the form of $NO_2$.

Air dispersion modeling is performed for TAPs exceeding their respective SQERs, as shown in Table 6-X. The results are presented in Section 6, showing that model concentrations are below the ASIL for each respective modeled TAP except for DPM and $NO_2$. Sabey will perform a Second Tier Review in accordance with WAC 173-460-090 for DPM and $NO_2$. The Second Tier Review analysis will be submitted under separate cover from the NOC application.

### 4.5.2 State Regulatory Applicability

The following general Ecology regulations are relevant to the Project per WAC 173-400-040:

- No air contaminant shall exceed the opacity limit of 20% for more than 3 minutes in any one hour;
- $SO_2$ emissions shall be limited to less than 1,000 ppm on a dry basis, corrected to 7% oxygen.

# 5. BEST AVAILABLE CONTROL TECHNOLOGY.

Under WAC 173-400-113, Ecology requires all new sources or modifications to existing sources to use BACT for all pollutants not previously emitted or whose emissions would increase as a result of the new source or modification. A BACT analysis is included in this section for all emission units subject to NOC permitting.

## 5.1 BACT Methodology

In a memorandum dated December 1, 1987, the EPA stated its preference for a "top-down" analysis for PSD applications.[2] For this minor New Source Review (NSR) BACT analysis, Sabey is using the same top-down approach. The first step in this approach is to determine, for the emission unit in question, the most stringent control available for a similar or identical source or source category. If it can be shown that this level of control is technically, environmentally, or economically infeasible or inappropriate on the basis of energy concerns for the unit in question, 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, economic, or energy-related objections.

Presented below are the five basic steps of a top-down BACT review as identified by the EPA.[3]

**Step 1 – Identify All Control Technologies**
Available control technologies are identified for each emission unit in question.

**Step 2 – Eliminate Technically Infeasible Options**
After the identification of control options, an analysis is conducted to eliminate technically infeasible options. A control option is eliminated from consideration if there are process-specific conditions that prohibit the implementation of the control.

**Step 3 – Rank Remaining Control Technologies by Control Effectiveness**
Once technically infeasible options are removed from consideration, the remaining options are ranked based on their control effectiveness. If there is only one remaining option, or if all of the remaining technologies could achieve equivalent control efficiencies, ranking based on control efficiency is not required.

**Step 4 – Evaluate Most Effective Controls and Document Results**
Beginning with the most efficient control option in the ranking, detailed economic, energy, and environmental impact evaluations are performed. If a control option is determined to be economically feasible without adverse energy or environmental impacts, it is not necessary to evaluate the remaining options with lower control efficiencies.

The economic evaluation centers on the cost effectiveness of the control option. Costs of installing and operating control technologies are estimated and annualized following the methodologies outlined in the EPA's Control Cost Manual (CCM)[4] and other industry resources. Cost effectiveness is expressed in dollars per ton of pollutant controlled. Objective analyses of energy and environmental impacts associated with each option are also conducted.

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[2] U.S. EPA, Office of Air and Radiation. Memorandum from J.C. Potter to the Regional Administrators. Washington, D.C. December 1, 1987.
[3] U.S. EPA. *Draft New Source Review Workshop Manual*, Chapter B. Research Triangle Park, North Carolina. October 1990.

[4] U.S. EPA, Office of Air Quality Planning and Standards. *EPA Control Cost Manual*, 7th edition, updating in progress. https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution

**Step 5 – Select BACT**
In the final step, one pollutant-specific control option is proposed as BACT for each emission unit under review based on evaluations from the previous step.

Since there have been many BACT analysis performed for other data centers in Washington recently (Vantage Data Center and Microsoft Columbia Data Center with permits issued in 2023 and 2022, respectively) [5], Sabey completed the BACT analysis based on cost information available in the applications for these similar facilities. Detailed cost calculations are available in Appendix D.

## 5.2 BACT Analysis for $NO_X$ Emissions

Typical $NO_X$ emission control technologies include add-on controls, such as selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), non-selective catalytic reduction (NSCR), and other technologies without add-on controls, such as combustion technology meeting EPA standards. Other emerging technologies, including $NO_X$ adsorbers, water injection, ozone injection, and activated carbon absorption, which are not commercially available for stationary diesel generators, are not discussed in this case.

Of all of the add-on control options (SCR, SNCR, and NSCR), SCR appears to have the highest control effectiveness for the following reasons:

- SNCR does not use a catalyst for the reaction between ammonia or urea with $NO_X$ to reduce $NO_X$ emissions, unlike SCR. Lack of a catalyst requires a higher temperature to achieve the chemical reaction, which makes SCR applicable to more combustion sources.
- NSCR requires zero excess air and a catalyst without a reagent. However, diesel exhaust oxygen levels vary widely depending on engine load, which does not meet the requirement of zero excess air. Therefore, NSCR is not considered technologically applicable to diesel combustion engines.

Control technologies that are not add-on controls, including combustion technology meeting EPA tiered emission standards as well as the operating and maintenance requirements under 40 CFR Part 60 Subpart IIII, are considered feasible options for the Project.

A cost analysis was performed for the SCR option in accordance with the EPA's CCM methodologies as well as the information available from the applications for similar data centers recently permitted. The cost analysis is based on the following conservative assumptions:

- The direct emission control package cost is conservatively determined based on the average unit price of a 2,750 kWe genset from the Vantage application, and a 1.5 MWe genset from the Microsoft Columbia application.
- Indirect costs are calculated using the same ratios presented in the Vantage and Microsoft Columbia applications, which account for only approximately 16% of the purchased equipment cost, while CCM assumes the indirect cost accounts for 30% of purchased equipment cost.[6]
- It is conservatively assumed that the operating labor, supervisory labor, and electricity associated with operating the SCR, as well as the catalyst replacement cost are negligible.

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[5] Vantage Data Center, Approval Order No. 23AQ-E056; Microsoft Columbia Data Center, Approval Order No. 22AQ-E006.

[6] Chapter 2 (Selective Catalytic Reduction), Section 4 ($NO_X$ Controls) of EPA *Control Cost Manual*. Updated in November 2017.

The calculated cost to control per ton of $NO_X$ is $65,509 based on the conservative assumptions listed above for cost calculations and is cost prohibitive for the project.[7] Sabey proposes meeting EPA standards as BACT for $NO_X$.

## 5.3 BACT Analysis for CO, PM, and VOC Emissions

Available add-on control technologies for controlling CO, PM, and VOC emissions include diesel oxidation catalyst (DOC), diesel particulate filter (DPF), and three-way catalyst. Technologies without add-on controls, such as meeting EPA standards, are also considered feasible options for the Project.

DPF is an add-on control device, which is considered the highest ranked control for DPM with at least 85% based on recent NOC applications. DPF can also reduce the CO and VOC emissions (see the DPF emission information in Appendix D). DOC is another add-on control technology that is commercially available and reliable for controlling CO, PM, and VOC emissions. The DOC performance information in Appendix D shows high control efficiencies for CO and VOC (80% and 70%, respectively), as well as moderate control for PM (20%). A cost analysis is performed for DPF and DOC following similar approaches to the NOX cost analysis, including the following conservative assumptions:

- ► The direct emission control package costs for DPF and DOC are conservatively determined based on the average unit price of a 2,750 kWe genset from the Vantage application and a 1.5 MWe genset from the Microsoft Columbia application.
- ► Indirect costs are calculated using the same ratios presented in the Vantage, Yahoo!, and Microsoft MWH applications, which account for approximately 15-16% of the purchased equipment cost, while CCM assumes the instrumentation ranges from 5% to 30% of the purchased equipment cost.[6]
- ► It is conservatively assumed that the operating labor, supervisory labor, and electricity associated with operating the DPF and DOC are negligible.
- ► It is also conservatively assumed that the maintenance cost will be negligible, even though DPF will require regular cleaning when actually operated.
- ► The acceptable control cost thresholds are assumed to be $12,000 per ton PM, $5,000 per ton CO, and $12,000 per ton VOC.[9]

As shown in Appendix D, the calculated annualized control cost for DPF is $228,444 per year and for DOC is $177,453 per year. This results in cost effectiveness for the DPF of $230,263 per ton of CO removed, $236,060 per ton of VOC removed, and $316,804 per ton of PM removed. The DOC cost effectiveness is $178,865 per ton of CO removed, $183,369 per ton of VOC removed, and $836,706 per ton of PM removed. Each $/ton value is cost prohibitive for the particular pollutant.[7] Therefore, Sabey proposes meeting EPA tiered emission standards as well as the operating and maintenance requirements under 40 CFR Part 60 Subpart IIII as BACT for PM, CO, and VOC.

## 5.4 BACT Analysis for $SO_2$ Emissions

Commercially available add-on control technologies are not generally available for $SO_2$ emissions from engines. Rather, the main source of $SO_2$ from engines is the sulfur in the fuel. As discussed in Section 4.3.2, the engines are required to fire ULSD with sulfur content less than 15 ppm. Therefore, Sabey proposes using ULSD as BACT for $SO_2$ emissions.

[7] Consistent with Vantage and Microsoft Columbia applications.

## 5.5 BACT Analysis for TAP Emissions

WAC 173-460-060 requires all projects with emissions exceeding the de minimis value for a TAP to employ BACT for that TAP, called tBACT. As shown in Table 4-1, there are 22 TAPs with emissions greater than the respective de minimis levels. These TAPs are either also criteria pollutants (i.e., DPM, CO, and $NO_2$), or are emitted as PM or VOC,[8] which are addressed in Sections 5.2 to 5.4. Therefore, the proposed BACT for controlling criteria pollutants, including meeting EPA tiered emission standards as well as the operating and maintenance requirements under 40 CFR Part 60 Subpart IIII, are proposed as tBACT for these 22 TAPs.

[8] The only exception is hydrogen chloride, for which there are no listed controls in the EPA's RACT/BACT/LAER Clearinghouse database or any recent data center applications. Sabey proposes that meeting EPA tiered emissions standards and compliance with the operating and maintenance requirements under NSPS Subpart IIII is BACT for this TAP.

# 6. AIR DISPERSION MODELING

As discussed in Section 4.5.1, air dispersion modeling was performed for the TAPs showing emissions greater than their respective SQER. Additionally, an analysis for IGQ facility to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) for $PM_{10}$, $PM_{2.5}$, $NO_2$, CO, and $SO_2$ is also completed. This section discusses the methodologies applied for the air dispersion modeling analysis and presents the results for the TAP analysis and NAAQS analysis.

## 6.1 Dispersion Model Selection

The American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) modeling system, the most recent AERMOD dispersion model version 24142 with Plume Rise Model Enhancements (PRIME) advanced downwash algorithms, is used as the dispersion model in the air quality analysis.

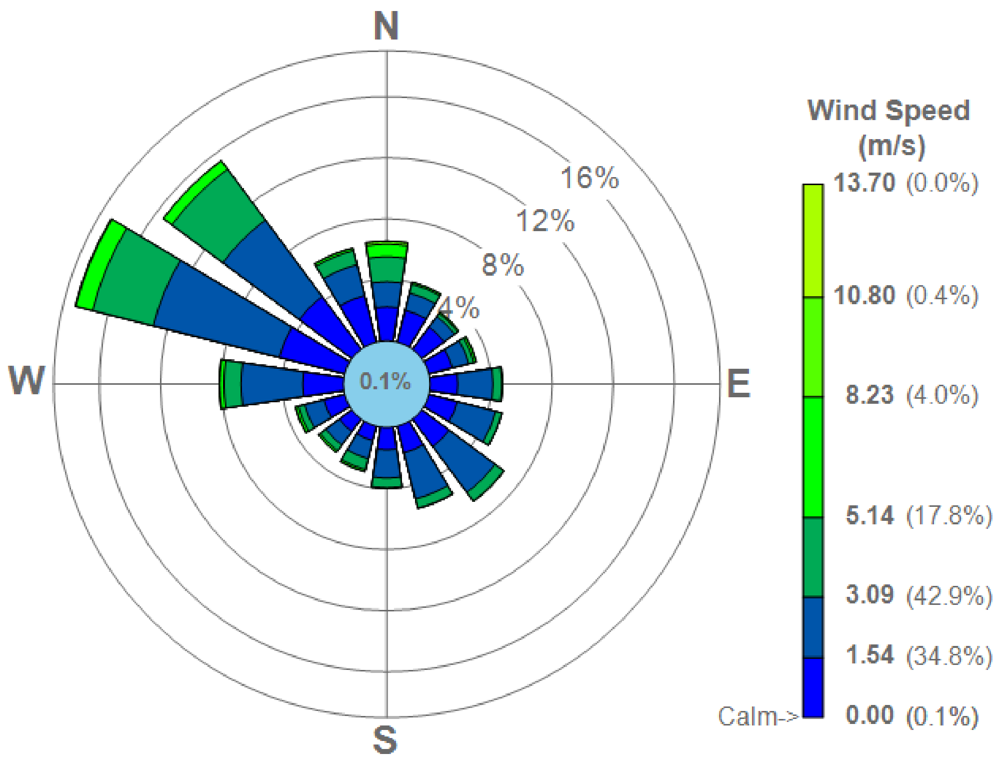
## 6.2 Meteorological Data

Five years of surface meteorological data are taken from a local meteorological tower located in Quincy, Washington at 330 3rd Ave NE (47.241, -119.847). The data from the five most recent years (2019 through 2023) are used. The meteorological data is processed using AERMET version 24142. Per discussions with Ecology, missing data is substituted with data from Grant County International Airport. Cloud cover data is also obtained from Grant County International Airport for the 2019-2023 period. The wind rose for the modeled period (2019-2023) is provided in Figure 6-1.

Trinity also reviewed the percentage of calm and missing data for the modeled period. The AERMOD-ready data shows 0.75% of calm wind data and 0.03% of missing data.

The upper air data is taken from the nearest upper air station in Spokane, Washington (OTX) for the corresponding period. All data is processed using regulatory default options, including the use of ADJ_U* for processing low wind speed stable conditions.

**Figure 6-1. 2019-2023 Wind Rose at Local Quincy, WA Met Station**




## 6.3 Coordinate System

The location of the emission sources, structures, and receptors for this modeling analysis are represented in the Universal Transverse Mercator (UTM) coordinate system using the North American 1983, CONUS (NAD83) projection. The UTM grid divides the world into coordinates that are measured in north meters (measured from the equator) and east meters (measured from the central meridian of a particular zone, which is set at 500 km). UTM coordinates for this analysis are based on UTM Zone 11.

## 6.4 Terrain Elevations

Terrain elevations for receptors, buildings, and sources are determined using National Elevation Dataset (NED) supplied by the United States Geological Survey (USGS).[9] The NED is a seamless dataset with the best available raster elevation data of the contiguous United States. NED data retrieved for this model have a grid spacing of 1/3 arc-second or 10 m. The AERMOD preprocessor, AERMAP version 24142, is used to compute model object elevations from the NED grid spacing. AERMAP also calculates hill height data for all receptors. All data obtained from the NED files are checked for completeness and spot-checked for accuracy.

[9] NED data retrieved in GeoTIFF format from the Multi-Resolution Land Characteristics (MRLC) Consortium website at http://www.mrlc.gov/viewerjs/.

## 6.5 Receptor Grids

Six (6) square Cartesian receptor grids are used in the analysis, in alignment with Ecology's guidance document for TAP reviews.

- A grid containing 12.5-meter spaced receptors and extending roughly 150 meters from the center of the project location.
- A grid containing 25-meter spaced receptors extending from 150 meters to 400 meters from the center of the project location.
- A grid containing 50-meter spaced receptors extending from 400 meters to 900 meters from the center of the project location.
- A grid containing 100-meter spaced receptors extending from 900 meters to 2,000 meters from the center of the project location.
- A grid containing 300-meter spaced receptors extending from 2,000 meters to 4,500 meters from the center of the project location.
- A grid containing 600-meter spaced receptors extending from 4,500 meters to 6,000+ meters from the center of the project location.

In addition, 10-meter spaced receptors are included along the property fenceline. All receptors are placed at a 1.5 m flagpole height, as requested by Ecology, for both the NAAQS and TAP analyses.

## 6.6 Building Downwash

Emissions from each source are evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if stack discharges might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the buildings were absent. The concepts and procedures expressed in the GEP Technical Support document, the Building Downwash Guidance document, and other related documents are applied to all structures at the IGQ facility.

Figure 6-1 shows the buildings included in this modeling analysis. Detailed building parameters are provided in Appendix E.

**Figure 6-2. Modeled Buildings and Fenceline**

The sources included for TAP modeling are the 13 gensets. Each of Buildings D and E will have two utility yards, one on the north side and one on the south side of the building. Each utility yard will consist of five gensets. The site plan (Appendix B) shows the locations of the utility yards and the position of the gensets. Table 6-2 shows the model ID and each genset's UTM location.

**Table 6-1. Modeled Sources**

| Model Unit ID | Description | UTM Easting (m) | UTM Northing (m) | Elevation (m) |
|---|---|---|---|---|
| E41 | E41 - Building E | 286,571.9 | 5,236,373.4 | 398.11 |
| E42 | E42 - Building E | 286,570.1 | 5,236,343.3 | 397.81 |
| E43 | E43 - Building E | 286,569 | 5,236,315.6 | 397.53 |
| E44 | E44 - Building E | 286,681.4 | 5,236,372.3 | 397.99 |
| E45 | E45 - Building E | 286,680.6 | 5,236,342.9 | 397.72 |
| E46 | E46 - Building E | 286,680.2 | 5,236,314.1 | 397.51 |
| E47 | E47 - Building E | 286,786.6 | 5,236,395.6 | 398.12 |
| E48 | E48 - Building E | 286,804.6 | 5,236,395.1 | 398.12 |
| E49 | E49 - Building E | 286,563.4 | 5,236,152.2 | 396.19 |
| E50 | E50 - Building E | 286,561.4 | 5,236,123.1 | 395.98 |
| E51 | E51 - Building E | 286,561.2 | 5,236,094.8 | 395.71 |
| E52 | E52 - Building E | 286,671.5 | 5,236,121.5 | 395.99 |
| E53 | E53 - Building E | 286,669.8 | 5,236,092.9 | 395.7 |

## 6.7 Load Analysis

A load analysis was performed for each pollutant to determine which load would result in the highest offsite concentration for each of the pollutants. The following load analysis was performed:

- For $NO_X$ and $PM_{2.5}$, highest hourly emissions across all vendors are included for each generator at each of 25%, 50%, 75% and 100% load.[10] For each load, the worst-case (i.e., lowest) flow rate and temperature from vendor provided information is applied for all generators modeled at the specified load.
- For filterable PM/DPM, the load analysis was performed for CAT, Cummins, and Rehlko at each load where the dispersion parameters are provided in the vendor specifications. The corresponding vendor emission rate, the flow rate and temperature are used.
- For CO and $SO_2$, the load analysis was performed for each load using the same flow rate and temperature for $NO_X$ and $PM_{2.5}$. Nominal emission rates corresponding to the load are modeled since the emission factors for CO and $SO_2$ on lb/hp-hr basis do not vary with the load.

The modeling parameters are available in Appendix E. The load analysis results are summarized in Table 6-4, and more details are provided in Appendix F. Based on the load analysis results, the following are used for compliance demonstration in Sections 6.10 and 6.11:

[10] 10% load was not included because only CAT and MTU provide flow rate and temperature at 10% load, while Cummins and Rehlko do not. Additionally, the generators are not expected to operate for more than an hour per operation event at 10% load, including testing.

- For $NO_X$, 100% load results in the maximum offsite concentration across all loads on 1-hour and annual basis. Out of all gensets, six engines located at Building E (model IDs E43, E44, E45, E46, E49, and E52) are the highest impacting units that result in maximum offsite 1-hour concentrations. These units are further discussed as part of the Monte Carlo analysis in Section 6.10.2.
- For $PM_{2.5}$, 10% load results in maximum offsite 24-hour average concentration across all loads and 10% load results in the maximum offsite annual averaged concentration across all loads.
- For $PM_{10}$, 10% load results in the maximum annual averaged offsite concentration across all loads.
- For CO, 10% load results in maximum offsite concentration across all loads on 1-hr and 8-hr basis.
- For $SO_2$, 100% load results in maximum offsite concentration across all loads on 1-hour, 3-hour, and 8-hour basis.
- For TAPs that are not criteria pollutants, 100% load results in maximum offsite 24-hour average concentration across all loads and 100% load results in the maximum offsite annual averaged concentration across all loads.

**Table 6-2. Load Analysis**

| Pollutant | Averaging Period | Worst Case Load [a] |
|---|---|---|
| $NO_X$ | 1-hr | 100% |
| $NO_X$ | Annual | 100% |
| $PM_{2.5}$/$PM_{10}$ | 24-hr | 10% |
| $PM_{2.5}$ | Annual | 10% |
| CO/$SO_2$ | 1-hr, 3-hr, and 8-hr | 10% |
| TAPs | Annual/24-hr/1-hr | 100% |

a. Determined based on load analysis results presented in Appendix F.

## 6.8 $NO_2$ to $NO_X$ Conversion

$NO_X$ is formed when nitrogen in ambient air is exposed to high temperatures during the combustion process. At these temperatures, some nitrogen is converted to NO and $NO_2$ (collectively referred to as $NO_X$). This project includes $NO_X$ emitted from the gensets from IGQ facility. Emission factors for these units are for emissions of $NO_X$, while the ambient air quality objective is for $NO_2$. In order to estimate the amount of $NO_2$ concentration from the amount of emitted $NO_X$, the following modeling approaches are applied to AERMOD inputs[11]:

- Plume Volume Molar Ratio Method (PVMRM) in AERMOD;
- In-stack ratio (ISR) of 0.1 for all generators. The ISR is aligned with other recent approved data center analyses, and is a conservative value based on EPA's ISR database for uncontrolled engines firing diesel or kerosene[12].
- Ozone background concentration of 52 ppb, based on NW-AIRQUEST at the site location.[13]

[11] Initial approval from Ecology during the pre-application meeting on November 14, 2024.

[12] Filtered available entries in Excel file "$NO_2$_ISR_database.xlsx", EPA $NO_2$/$NO_X$ in-stack ratio database, available at https://www3.epa.gov/scram001/no2_isr_database.htm, accessed May 15, 2018. The average ISR for RICE firing diesel or kerosene is 0.07.

[13] Northwest International Air Quality Environmental Science and Technology Consortium, Washington State University, available at http://lar.wsu.edu/nw-airquest/lookup.html. Accessed May 15, 2018.

## 6.9 Significant Impact Levels (SIL) Analysis

Each criteria pollutant with an increase in emissions was modeled against the Significant Impact Level (SIL) to determine whether or not a cumulative impact analysis is required for each pollutant and averaging period. Modeled concentrations of CO, $SO_2$, and annual $PM_{2.5}$ were below the respective SIL, as shown in table 6-4. Therefore, a cumulative NAAQS compliance demonstration is not completed for these pollutants.

**Table 6-3. SIL Analysis Results**

| Pollutant | Averaging Period | Modeled Concentration (ug/m$^3$) | SIL (ug/m$^3$) | Exceeds SIL? |
|---|---|---|---|---|
| NO2 | 1-hr | 594.94 | 1 | **Yes** |
| | Annual | 0.64 | 7.5 | No |
| PM2.5 | 24-hr | 53.07 | 1.2 | **Yes** |
| | Annual | 0.04 | 0.13 | No |
| PM10 | 24-hr | 59.38 | 5 | **Yes** |
| CO | 1-hr | 766 | 2,000 | No |
| | 8-hr | 378 | 500 | No |
| SO2 | 1-hr | 2.26 | 7.8 | No |
| | 3-hr | 1.88 | 25 | No |

## 6.10 NAAQS Analysis

This section discusses the modeling analysis performed to demonstrate compliance with the 1-hr $NO_2$, 24-hr $PM_{10}$, and 24-hr $PM_{2.5}$ NAAQS.

### 6.10.1 Background Concentration

The background concentration of a pollutant is based on other industrial sites, residential pollutions, and/or naturally occurring impacts. In order to appropriately predict the overall air quality in the area after the new generators are installed, a background concentration is included for $PM_{10}$, $PM_{2.5}$, $SO_2$ and CO for NAAQS compliance demonstration. Time varying background concentration is included for the 1-hour $NO_2$ NAAQS compliance demonstration as discussed in Section 6.9.1.1. The background concentrations used for this modeling analysis are summarized in Table 6-4, which are obtained from NW-AIRQUEST data at the site location.[13]

**Table 6-4. Background Concentrations for NAAQS Analysis**

| Pollutant | Averaging Period | Background Concentration | | NAAQS (μg/m$^3$) |
|---|---|---|---|---|
| $PM_{10}$ | 24-hour | 77.9 | μg/m$^3$ | 150 |
| $PM_{2.5}$ | 24-hour | 18.5 | μg/m$^3$ | 35 |
| $NO_2$ | 1-hour | 55.6 | μg/m$^3$ | 188 |

#### *6.10.1.1 $NO_2$ Time Varying Background Concentration*

One additional refinement is made to the background concentration selection for $NO_2$. The Quincy – 3rd Ave NE monitor data was identified as a representative dataset to inform a time-varying background concentration for modeling. [14] The seasonal hour-of-day $NO_2$ data is representative for the IGQ facility based on proximity and the high concentration of data centers surrounding the monitor. The time varying $NO_2$ data is included in the model inputs for the 1-hour $NO_2$ NAAQS compliance demonstration.

The Quincy monitor data is available from August 2017 through September 2018. The seasonal hourly concentrations are calculated as the third highest monitored result for each hour in each season.[15] Table 6-5 below shows the seasonal hourly background data for Quincy.

[14] Seasons in AERMOD are divided based on full months and are defined as the following: Winter- December, January, February; Spring – March, April, May; Summer – June, July, August; Fall – September, October, November

[15] This method is consistent with EPA Memorandum Subject: Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard, dated March 1, 2011. https://www.epa.gov/sites/default/files/2015-07/documents/appwno2_2.pdf

### Table 6-5. Quincy Seasonal $NO_2$ Background Concentrations

| Hour | $NO_2$ Concentration (ppb) | | | |
|---|---|---|---|---|
| | Winter | Spring | Summer | Fall |
| 00:00 | 8.40 | 10.60 | 7.30 | 9.90 |
| 01:00 | 8.20 | 7.20 | 5.90 | 9.80 |
| 02:00 | 7.60 | 8.10 | 7.80 | 8.90 |
| 03:00 | 8.90 | 11.20 | 13.40 | 10.30 |
| 04:00 | 9.50 | 15.30 | 12.00 | 13.80 |
| 05:00 | 13.10 | 21.20 | 15.40 | 17.80 |
| 06:00 | 15.90 | 20.40 | 19.70 | 18.00 |
| 07:00 | 21.00 | 17.30 | 15.60 | 15.80 |
| 08:00 | 17.90 | 12.10 | 11.40 | 18.60 |
| 09:00 | 17.20 | 7.60 | 7.80 | 15.30 |
| 10:00 | 13.90 | 4.90 | 5.40 | 9.40 |
| 11:00 | 13.70 | 5.40 | 5.20 | 6.60 |
| 12:00 | 8.90 | 4.00 | 4.40 | 7.00 |
| 13:00 | 8.30 | 3.80 | 4.50 | 5.60 |
| 14:00 | 7.10 | 4.40 | 4.80 | 7.30 |
| 15:00 | 9.80 | 3.40 | 5.20 | 8.80 |
| 16:00 | 13.30 | 3.40 | 4.70 | 13.40 |
| 17:00 | 13.20 | 6.20 | 5.60 | 14.70 |
| 18:00 | 12.90 | 9.00 | 8.30 | 10.50 |
| 19:00 | 13.30 | 11.90 | 8.20 | 12.10 |
| 20:00 | 11.60 | 9.40 | 7.30 | 11.60 |
| 21:00 | 12.60 | 10.30 | 6.90 | 11.40 |
| 22:00 | 10.10 | 9.60 | 6.40 | 9.70 |
| 23:00 | 8.90 | 10.00 | 6.10 | 10.80 |

a. Background data uses hours 0-23, which corresponds to the beginning time of the recording hour. AERMOD meteorology shows hours 1-24, which represents the end of the recording hour. Therefore, hour 0 here = hour 1 in meteorological data.

### 6.10.2 Monte Carlo

The 1-hour $NO_2$ and 24-hour $PM_{2.5}$ NAAQS are in a probabilistic format. The generators will not be operated continuously throughout the year; rather, the generators' emissions will be intermittent and only during testing and emergency operations. Therefore, in order to account for the intermittent nature of the modeled sources and the likelihood of those periods of operation aligning with the worst-case meteorological conditions for pollutant dispersion, the ambient impact analysis was performed using the Monte Carlo statistical approach with a script developed by Ecology for the software "R".[16] This script takes into account the low probability of all intermittent emission sources occurring on days with meteorological conditions for poor pollutant dispersion within a year. It processes post files generated in AERMOD for the intermittent sources and uses random sampling to assign days of operation to days of meteorological conditions. The script then calculates the median 98$^{th}$ percentile 1-hour or 24-hour concentrations among 1,000 iterations for all receptors to determine the design value used for comparison to the 1-hour $NO_2$ NAAQS and 24-hour $PM_{2.5}$ NAAQS.

In addition to using the Monte Carlo analysis for the probabilistic 1-hour $NO_2$ and 24-hour $PM_{2.5}$ standards, Sabey has implemented the Monte Carlo analysis for the $PM_{10}$ 24-hour standard. Though not a probabilistic standard, the $PM_{10}$ emissions from the project are similarly intermittent in nature (in fact, emission rates of $PM_{2.5}$ and $PM_{10}$ are identical for this analysis). As such, Sabey developed a modified version of Ecology's Monte Carlo R script to more closely align with the $PM_{10}$ NAAQS standard. In this modified script, the selected percentile for the "PM2.5" formula in the script is modified from the 98$^{th}$ percentile to the 99.7$^{th}$ percentile. This corresponds with the second high in a 3 year dataset and therefore represents the value that would otherwise be selected for a $PM_{10}$ NAAQS modeling analysis. In using the Monte Carlo analysis, the intermittent nature of the source and the associated likelihood of those emissions overlapping with worst-case meteorological conditions for pollutant dispersion are more accurately accounted for.

The input to the Monte Carlo script requires the AERMOD post files that represent all possible monthly and annual operations, including:

- 13 generators operating simultaneously for emergency, maintenance, or testing operations, for up to 2 calendar days per year.
- Each engine may be tested monthly for 11 months per year. In order to test all 72 generators at buildings D and E in a given month, the testing may take up to 6 days per month (assuming up to 12 hours per day of testing). The six generators that result in the highest offsite concentrations among all 13 new generators on an hourly basis (model IDs E43, E44, E45, E46, E49, and E52) based on the $NO_X$ load analysis are conservatively included to represent the monthly testing scenario.
- Each engine may be operated for annual load testing and maintenance testing for up to 6 hours per year (i.e., 432 engine hours per year). In order to conservatively represent this operation scenario, the six generators that result in the highest offsite concentrations on an hourly basis (model IDs E43, E44, E45, E46, E49, and E52) based on the $NO_X$ load analysis is modeled for a combined 54 days per year based on a conservative 8-hour operating day for maintenance and testing.

Note that on an annual basis all engines at Building E have a proposed building-wide limit of 1,350 hours per year of operation.

[16] The Monte Carlo script was originally provided by Ranil Dhammapala (Ecology) on June 11, 2021. A correction was made to the R script in June 2023 to address an issue related to the latest updates to R. The corrected R script is used for all Monte Carlo analyses discussed in this application, and the same corrections are made to the modified PM10 script used in the previous NOC application.

### 6.10.3 $NO_2$ NAAQS Analysis

$NO_2$ NAAQS includes a 1-hour standard and an annual standard. The 1-hour $NO_2$ is in the form of a 3-year average of 98$^{th}$ percentile 1-hour daily maximum concentrations. As discussed in Section 6.7, modeling parameters corresponding to 100% load are used for $NO_2$ modeling.

#### *6.10.3.1 1-hour $NO_2$ NAAQS Compliance Demonstration*

The 1-hour $NO_2$ NAAQS is in a probabilistic format and relies on the Monte Carlo methodology. The source parameters for all new generators modeled for the $NO_2$ NAAQS demonstration are summarized in Table 6-5. Model parameters for previously permitted generators are consistent with the previous application.

**Table 6-6. 1-hour $NO_2$ NAAQS Model Source Parameters for New Generators**

| Pollutant | Averaging Period | Load Scenario [a] | Stack Height (m) | Temp (K) | Exit Velocity (m/s) | Diameter (m) | Modeled Emission Rate [b] (g/s/genset) |
|---|---|---|---|---|---|---|---|
| $NO_2$ | 1-hour | 100% | 18.29 | 717.09 | 46.66 | 0.46 | 7.85 |

a. Based on load analysis results as discussed in Section 6.7.
b. Maximum hourly emission rate at 100% load across all vendors (Cummins) is used here, which is 62.27 lb/hr.

According to Ecology's instructions, the median of all iterations from Monte Carlo output should be used to determine compliance with NAAQS. The results are summarized in Table 6-6, which demonstrates compliance with 1-hour $NO_2$ NAAQS.

**Table 6-7. 1-hr $NO_2$ NAAQS Model Results**

| Pollutant | Averaging Period | Monte Carlo Design Value [a,b] ($\mu g/m^3$) | UTM Easting (m) | UTM Northing (m) | 1-hr $NO_2$ NAAQS ($\mu g/m^3$) |
|---|---|---|---|---|---|
| $NO_2$ | 1-hour | 171.10 | 286879.4 | 5235959 | 188 |

a. The maximum median concentration from Monte Carlo output is listed here.
b. Time varying $NO_2$ background concentrations were included in the Monte Carlo analysis as described in Section 6.9.1.1.

### 6.10.4 $PM_{2.5}$ NAAQS Analysis

$PM_{2.5}$ NAAQS includes a 24-hour standard and an annual standard. The 24-hour $PM_{2.5}$ NAAQS is in the form of a 3-year average of 98th percentile 24-hour daily maximum concentrations, and the annual $PM_{2.5}$ NAAQS is in the form of annual mean concentration averaged over 3 years. As discussed in Section 6.7, modeling parameters corresponding to 10% load are used for $PM_{2.5}$ 24-hour modeling.

#### *6.10.4.1 24-hour $PM_{2.5}$ NAAQS Compliance Demonstration*

$PM_{2.5}$ 24-hour NAAQS used the Monte Carlo scenario described in Section 6.10.2. The individual engines selected for use in the Monte Carlo analysis to conservatively represent expected operating scenarios are described in Section 6.10.2 as well. The source parameters are summarized in Table 6-10. Model parameters for previously permitted generators are consistent with the previous application.

**Table 6-8. 24-hour $PM_{2.5}$ NAAQS Model Source Parameters for New Generators**

| Pollutant | Averaging Period | Load Scenario [a] | Stack Height (m) | Temp (K) | Exit Velocity (m/s) | Diameter (m) | Modeled Emission Rate [b] (g/s/genset) |
|---|---|---|---|---|---|---|---|
| $PM_{2.5}$ | 24-hour | 10% | 18.29 | 556.98 | 12.09 | 0.46 | 1.89E-01 |

a. Based on load analysis results as discussed in Section 6.7. Maximum hourly emission rate at 100% load across all vendors is used, which is 1.50 lb/hr.

As shown in Table 6-9, the maximum median concentration from the Monte Carlo analysis plus background will remain below the NAAQS.

**Table 6-9. 24-hour $PM_{2.5}$ NAAQS Model Result**

| Pollutant | Averaging Period | Monte Carlo Design Value [a] (µg/m³) | UTM Easting (m) | UTM Northing (m) | Background (µg/m³) | Secondary PM (µg/m³) | Total Modeled Concentration (µg/m³) | 24-hour $PM_{2.5}$ NAAQS (µg/m³) |
|---|---|---|---|---|---|---|---|---|
| $PM_{2.5}$ | 24-hour | 22.54 | 286519.4 | 5236097 | 18.49 | 3.42E-03 | 22.54 | 35 |

a. The design value from the Monte Carlo output is the maximum of the median 98th percentile 24-hour concentrations across all modeled receptors for the 1,000 iterations of the analysis. This design value is inclusive of the background concentrations provided in this table.

### 6.10.5 $PM_{10}$ NAAQS Compliance Demonstration

$PM_{10}$ 24-hr NAAQS standard allows one exceedance per year. As mentioned previously, in order to represent the intermittent nature of the genset operations accurately, $PM_{10}$ 24-hour NAAQS uses the Monte Carlo scenario described in Section 6.10.2. The input parameters for each generator are summarized in Table 6-10. Model parameters for previously permitted generators are consistent with the previous application.

**Table 6-10. $PM_{10}$ NAAQS Model Source Parameters**

| Pollutant | Averaging Period | Load Scenario [a] | Stack Height (m) | Temp (K) | Exit Velocity (m/s) | Diameter (m) | Modeled Emission Rate [b] (g/s/genset) |
|---|---|---|---|---|---|---|---|
| $PM_{10}$ | 24-hour | 10% | 18.29 | 556.98 | 12.09 | 0.46 | 1.89E-01 |

a. Based on load analysis results as discussed in Section 6.7.
b. Maximum hourly emission rate at 10% load across all vendors is used, which is 1.50 lb/hr.

As shown in Table 6-11, the maximum median concentration from the Monte Carlo analysis (using the modified Monte Carlo R script for $PM_{10}$) plus background will remain below the NAAQS.

**Table 6-11. $PM_{10}$ NAAQS Model Results**

| Pollutant | Averaging Period | Monte Carlo Design Value [a] (µg/m³) | UTM Easting (m) | UTM Northing (m) | Background (µg/m³) | 24-hour $PM_{10}$ NAAQS (µg/m³) |
|---|---|---|---|---|---|---|
| $PM_{10}$ | 24-hour | 127.97 | 286945.8 | 5235989 | 77.85 | 150 |

a. The $PM_{10}$ 24-hr NAAQS shall not be exceeded more than once per year. The design value from the Monte Carlo output is the maximum of the median 99.7th percentile 24-hour concentrations (corresponding with the highest second-high value over a 3-year dataset) across all modeled receptors for the 1,000 iterations of the analysis. This design value is inclusive of the background concentrations provided in this table.

## 6.11 TAP Analysis

As discussed in Section 4.5.1, dispersion modeling is required for several TAPs shown in Table 4-1. The following approaches were used for the analysis:

- Only the project emissions increase from the 13 proposed gensets were modeled for comparison to the TAP ASILs.
- The load analysis performed for TAPs with emissions determined based on fuel usage (see Appendix F for acrolein, benzene, and naphthalene) showed that 100% load has the maximum impact on both 24-hour averaging period and annual averaging period concentrations. A comprehensive load analysis was performed for DPM which used the load-specific data across all vendors (see Appendix F). It was determined that the maximum offsite impact is from all engines with 100% load emission profiles. Therefore, the DPM models are set up using the 100% load emission profile and source parameters for all vendors.
- $NO_2$ modeling parameters are consistent with the NAAQS analysis for 1-hour averaging period. All engines are modeled with the parameters presented in Table 6-5 for simultaneous operation. Additionally, $NO_2$ modeling applied the same $NO_2$ to $NO_X$ conversion approach as described in Section 6.9.
- CO modeling parameters are representative of the 10% load operating conditions and are modeled using the same parameters from the SIL analysis.

Table 6-12 shows the maximum modeled concentration and corresponding meteorological year for each TAP. Model files are provided in Appendix G.

**Table 6-12. Maximum Modeled TAP Concentrations**

| Year | Toxic Air Pollutant | Averaging Period | Maximum Modeled Concentration (μg/m³) | UTM Easting (m) | UTM Northing (m) | ASIL (μg/m³) | % of ASIL |
|---|---|---|---|---|---|---|---|
| N/A | Acrolein | 24-hr | 1.40E-01 | 286519.4 | 5236097 | 3.50E-01 | 40% |
| 2021 | Arsenic | year | 2.86E-06 | 286806.6 | 5235973 | 3.00E-04 | 1% |
| 2021 | 1,3-Butadiene | year | 3.90E-04 | 286806.6 | 5235973 | 3.30E-02 | 1% |
| 2021 | Cadmium | year | 2.67E-06 | 286806.6 | 5235973 | 2.40E-04 | 1% |
| N/A | Chromium | 24-hr | 2.48E-03 | 286519.4 | 5236097 | 1.00E-01 | 2% |
| 2021 | Chromium (VI) | year | 1.80E-07 | 286806.6 | 5235973 | 4.00E-06 | 5% |
| 2021 | Formaldehyde | year | 3.08E-03 | 286806.6 | 5235973 | 1.70E-01 | 2% |
| N/A | Hydrogen chloride | 24-hr | 7.68E-01 | 286519.4 | 5236097 | 9.00E+00 | 9% |
| N/A | Manganese | 24-hr | 1.28E-02 | 286519.4 | 5236097 | 3.00E-01 | 4% |
| N/A | Mercury | 24-hr | 8.26E-03 | 286519.4 | 5236097 | 3.00E-02 | 28% |
| 2023 | DPM | year | 1.38E-02 | 286786.7 | 5235971 | 3.30E-03 | 417% |
| 2022 | CO | 1-hr | 3.93E+02 | 286519.4 | 5236097 | 2.30E+04 | 2% |
| 2019 | $NO_2$ | 1-hr | 6.58E+02 | 286519.4 | 5236097 | 4.70E+02 | 140% |

As shown in Table 6-12, all modeled TAPs are in compliance with their corresponding ASIL, except for DPM and $NO_2$ are in exceedance of the ASIL. Therefore, a second-tier review will be conducted to demonstrate that DPM and $NO_2$ emissions from the project do not have significant health impacts on the community.

# APPENDIX A. APPLICATION FORMS AND SEPA DOCUMENTATION

# APPENDIX B. SITE PLAN

These records may be available upon request. To find out if there are more records for this project, contact Ecology's Public Records Office.

- Online: https://ecology.wa.gov/footer-pages/public-records-requests
- Public Records Officer email: PublicRecordsOfficer@ecy.wa.gov • Call: 360-407-6040

Para averiguar si existen más registros sobre ese proyecto, póngase en contacto con la oficina de archivos públicos del Departamento de Ecología, envíe un correo electrónico a recordsofficer@ecy.wa.gov, o llame al 360-407-6040

# APPENDIX C. EMISSION CALCULATIONS AND SUPPORTING DOCUMENTATION

1. Emission Calculation Summary
2. Engine Specifications – Project
   - Cummins DQKAN 2500 kW Specifications
   - Cummins DQKAF 2250 kW Specifications
   - Rehlko KD2250
   - Rehlko KD2500
   - Caterpillar 3516C 2250 kW Specifications
   - Caterpillar 3516C 2500 kW Specifications

**Table C-1. Potential Emission Summary**

| Emission Point | Annual Emission Rate (tpy) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | PM | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_X$ | VOC | CO | HAP |
| Existing Engines and Cooling Units [a] | 2.64 | 3.73 | 3.73 | 0.11 | 39.52 | 1.09 | 4.18 | 2.88E-02 |
| Existing Diesel Storage Tanks | -- | -- | -- | -- | -- | 2.00 | -- | 2.00E-02 |
| Building D Main Gensets | 0.11 | 0.41 | 0.41 | 0.01 | 16.24 | 0.33 | 3.29 | 9.64E-03 |
| Building D Support Gensets | 2.68E-03 | 0.01 | 0.01 | 0.01 | 0.10 | 0.00 | 0.05 | 1.78E-04 |
| Previously Permitted Building E Gensets | 2.29 | 5.96 | 5.96 | 0.02 | 29.57 | 3.67 | 3.76 | 2.67E-01 |
| **Previously Permitted Gensets** | **5.05** | **10.11** | **10.11** | **0.16** | **85.43** | **7.10** | **11.27** | **0.33** |
| **Project Emissions - Additional Building E Gensets** | **0.85** | **2.23** | **2.23** | **0.01** | **9.59** | **1.38** | **1.24** | **0.10** |
| **WAC Exemption Levels [b]** | 1.25 | 0.75 | 0.50 | 2.00 | 2.00 | 2.00 | 5.00 | N/A |
| **NSR Required?** | No | Yes | Yes | No | Yes | No | No | N/A |
| **Facility-Wide Potential Emissions** | **5.89** | **12.34** | **12.34** | **0.16** | **95.02** | **8.48** | **12.51** | **0.42** |
| **Title V Threshold** | **--** | 100 | 100 | 100 | 100 | 100 | 100 | 25 |
| **Title V Required?** | **N/A** | No | No | No | No | No | No | No |
| **PSD Major Source Threshold** | **--** | 250 | 250 | 250 | 250 | 250 | 250 | N/A |
| **PSD Major Source?** | **N/A** | No | No | No | No | No | No | No |

a. PTE from existing engines and cooling units are calculated based on the quantity and type of units actually installed and planned. These emissions include permitted emissions for the cooling units and diesel storage tanks included in Approval Order No. 20AQ-E022. HAP emissions are the sum of PTE for the TAPs that are HAPs too, assuming the unlisted HAPs are emitted in negligible amount.

b. WAC exemption levels are listed in WAC 173-400-110 Table 110(5).

**Table C-2. Potential Facility-Wide TAP and HAP Emissions**

| Pollutant | Project Emission Rate | Existing Equipment PTE | Total |
|---|---|---|---|
| | (tpy) | | |
| Acenaphthene | 1.88E-05 | 1.74E-04 | 1.93E-04 |
| Acenaphthylene | 3.71E-05 | 3.44E-04 | 3.81E-04 |
| Acetaldehyde | 0.02 | 1.16E-03 | 0.02 |
| Acrolein | 9.93E-04 | 3.19E-04 | 1.31E-03 |
| Anthracene | 4.94E-06 | 4.62E-05 | 5.11E-05 |
| Arsenic | 4.69E-05 | 0.00E+00 | 4.69E-05 |
| Benzene | 5.46E-03 | 0.03 | 0.03 |
| Benzo(a)anthracene | 2.50E-06 | 2.36E-05 | 2.61E-05 |
| Benzo(a)pyrene | 1.03E-06 | 9.59E-06 | 1.06E-05 |
| Benzo(b)fluoranthene | 4.46E-06 | 4.12E-05 | 4.57E-05 |
| Benzo(g,h,l)perylene | 2.23E-06 | 2.08E-05 | 2.30E-05 |
| Benzo(k)fluoranthene | 8.75E-07 | 8.14E-06 | 9.01E-06 |
| 1,3-Butadiene | 6.37E-03 | 1.13E-05 | 6.38E-03 |
| Cadmium | 4.40E-05 | 0.00E+00 | 4.40E-05 |
| Chlorobenzene | 5.86E-06 | 0.00E+00 | 5.86E-06 |
| Chromium | 1.76E-05 | 0.00E+00 | 1.76E-05 |
| Chromium (VI) | 2.93E-06 | 0.00E+00 | 2.93E-06 |
| Chrysene | 6.14E-06 | 5.69E-05 | 6.30E-05 |
| Copper | 1.20E-04 | 0.00E+00 | 1.20E-04 |
| Dibenz(a,h)anthracene | 1.39E-06 | 1.30E-05 | 1.44E-05 |
| Ethyl benzene | 3.19E-04 | 0.00E+00 | 3.19E-04 |
| Fluoranthene | 1.62E-05 | 1.52E-04 | 1.68E-04 |
| Fluorene | 5.14E-05 | 4.84E-04 | 5.35E-04 |
| Formaldehyde | 0.05 | 3.27E-03 | 0.05 |
| Hexane | 7.88E-04 | 0.00E+00 | 7.88E-04 |
| Hydrogen chloride | 5.46E-03 | 0.00E+00 | 5.46E-03 |
| Indeno(1,2,3-cd)pyrene | 1.66E-06 | 1.55E-05 | 1.71E-05 |
| Lead | 2.43E-04 | 0.00E+00 | 2.43E-04 |
| Manganese | 9.08E-05 | 0.00E+00 | 9.08E-05 |
| Mercury | 5.86E-05 | 0.00E+00 | 5.86E-05 |
| Naphthalene | 5.77E-04 | 4.85E-03 | 5.43E-03 |
| Nickel | 1.14E-04 | 0.00E+00 | 1.14E-04 |
| Phenanthrene | 1.64E-04 | 1.52E-03 | 1.69E-03 |
| Propylene | 1.37E-02 | 1.11E-02 | 0.02 |
| Pyrene | 1.49E-05 | 1.39E-04 | 1.54E-04 |
| Selenium | 6.45E-05 | 0.00E+00 | 6.45E-05 |
| Toluene | 3.09E-03 | 1.05E-02 | 1.36E-02 |
| Xylenes | 1.24E-03 | 7.25E-03 | 8.49E-03 |
| Zinc | 6.56E-04 | 0.00E+00 | 6.56E-04 |
| PAH's | 1.64E-03 | 0.00E+00 | 1.64E-03 |
| Diesel engine exhaust, particulate | 0.85 | 0.94 | 1.78 |
| $SO_2$ | 7.29E-03 | 0.16 | 0.17 |
| CO | 1.24 | 14.29 | 15.53 |
| $NO_2$ | 0.96 | 9.17 | 10.13 |

**BUILDING E PROJECT SUMMARY**

| | | |
|---|---|---|
| **Proposed Building E Operating Hours Limit:** | **1350** | **hrs/yr** |

a. Annual operating hours for all engines is based on 25 hrs/yr/engine at Building E.

**Table C-3. Operation Scenario Summary**

| Operation Scenario | Project | Maximum Operations for Each Engine (hr/day/engine) | (hr/yr/engine) | Maximum Operations for All Engines (engine-hr/hr) | (engine-hr/day) | (engine-hr/yr) |
|---|---|---|---|---|---|---|
| Main Genset Running at Any Load [a] | New Project | 24 | 25 | 13 | 312 | 331 |
| | | | **Total Operating Hours** | 53 | 1272 | 1350 |

a. This operating scenario includes all categories of operations, including emergency run, maintenance and testing runs. When all engines are required to be operated at the same time (e.g., emergency operation, certain testing), the maximum number of days of such operation will be 2 days in any given year while keeping the total number of hours per engine per calendar year equal to or below 30. Maintenance and testing runs outside of these 2 days will be operated for a single engine at any hour, up to 24 engine-hours in any day.

**Table C-4. Criteria Pollutants Emission Estimate - Main Gensets - Worst Case - Building E (New Project)**

| Pollutant | Emission Factor | | Maximum Engine Emission Rate Across Any Load/Vendor[a] Warm Engine (lb/hr/engine) | Cold-Start (lb/hr/engine) | (tpy/engine)[e] | Annual Total for All Engines (tpy) |
|---|---|---|---|---|---|---|
| Particulate Matter (PM) [b] | Maximum Vendor Hourly Emission Rate | | 1.12 | 4.76 | 0.07 | 0.85 |
| Condensable PM [b] | Maximum Vendor Hourly Emission Rate for Total | | 1.82 | 7.76 | 0.11 | 1.38 |
| Particulate Matter <10 microns ($PM_{10}$) [b] | Maximum Vendor Hourly Emission Rate | | 2.93 | 12.52 | 0.17 | 2.23 |
| Particulate Matter < 2.5 microns ($PM_{2.5}$) [b] | Maximum Vendor Hourly Emission Rate | | 2.93 | 12.52 | 0.17 | 2.23 |
| Sulfur Dioxide ($SO_2$) [c] | 1.21E-05 | lb/hp-hr per AP-42 | 0.04 | 0.04 | 0.00 | 0.01 |
| Carbon Monoxide (CO) [d] | Maximum Vendor Hourly Emission Rate | | 6.53 | 7.40 | 0.10 | 1.24 |
| Nitrogen Oxides ($NO_X$) [d] | Maximum Vendor Hourly Emission Rate | | 62.27 | 58.33 | 0.74 | 9.59 |
| Volatile Organic Compounds (VOC) | Maximum Vendor Hourly Emission Rate | | 1.82 | 7.76 | 0.11 | 1.38 |

a. This operating scenario includes all categories of operations, including emergency run, maintenance and testing runs. When all engines are required to be operated at the same time (e.g., emergency operation, certain testing), the maximum number of days of such operation will be 2 days in any given year while keeping the total number of hours per engine per calendar year equal to or below 30. Maintenance and testing runs outside of these 2 days will be operated for a single engine at any hour, up to 24 engine-hours in any day.

b. Diesel PM hourly emissions are the maximum based on engine specifications across all loads and vendors (see Load Emissions tables) for conservatism. $PM_{10}$ and $PM_{2.5}$ emissions are the diesel PM emission rates plus the condensable PM emission rate. Condensable PM emissions are conservatively assumed to be the same as hydrocarbon emissions from vendor data, which is also conservatively assumed to be the maximum hourly emission rate across all loads and vendors.

c. $SO_2$ emissions are calculated conservatively assuming constant operation at 100% load (i.e., maximum engine power). $SO_2$ emissions are based on maximum sulfur content allowed in ULSD (15 ppm) and are calculated according to methodology presented in AP-42, Chapter 3.4, Table 3.4-1.

d. $NO_X$ and CO hourly emissions are the maximum based on engine specifications across all loads and vendors (see Load Emissions tables) for conservatism.

e. Emission calculations conservatively assumes 28 1-hour cold-start periods per year.

**Table C-5. Maximum Emissions for All Engines - Building E Additional Gensets**

| Pollutant | Maximum Emission for All Engines: Hourly Total for All Engines (lb/hr) | Daily Totals for All Engines (lb/day) | Annual Total for All Engines (tpy) |
|---|---|---|---|
| Particulate Matter (PM) | 61.91 | 1485.74 | 0.85 |
| Condensable PM | 100.88 | 2421.20 | 1.38 |
| Particulate Matter <10 microns ($PM_{10}$) | 162.79 | 3906.94 | 2.23 |
| Particulate Matter < 2.5 microns ($PM_{2.5}$) | 162.79 | 3906.94 | 2.23 |
| Sulfur Dioxide ($SO_2$) | 0.57 | 13.73 | 0.01 |
| Carbon Monoxide (CO) | 96.25 | 2309.98 | 1.24 |
| Nitrogen Oxides ($NO_X$) | 809.48 | 19427.47 | 9.59 |
| Volatile Organic Compounds (VOC) | 100.88 | 2421.20 | 1.38 |
| Hazardous Air Pollutants (HAPs) | 7.76 | 186.28 | 0.10 |

**Table C-6. Building E Additional Gensets HAP and TAP Emissions**

| Pollutant | CAS Number | HAP? | TAP? | AP-42 Emission Factors[1] (lb/MMBtu) | Ventura County AB 2588 Diesel Internal Combustion Emission Factors[1] (lb/1000 gal) | (lb/MMBtu) | Building E Main Genset Emissions - Worst Case[2] (lb/hr) | (lb/day) | (tpy) | Averaging Period | De Minimis (lb/avg period) | SQER (lb/avg period) | Project Emissions | Modeling Required?[3] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene[4] | 83-32-9 | Yes | No | 4.68E-06 | | | 1.48E-03 | 0.04 | 1.88E-05 | - | - | - | - | -- |
| Acenaphthylene[4] | 208-96-8 | Yes | No | 9.23E-06 | | | 2.91E-03 | 0.07 | 3.71E-05 | - | - | - | - | -- |
| Acetaldehyde[4] | 75-07-0 | Yes | Yes | 2.52E-05 | 0.78 | 5.72E-03 | 1.80 | 43.26 | 0.02 | year | 3.00E+00 | 6.00E+01 | 45.91 | No |
| Acrolein | 107-02-8 | Yes | Yes | 7.88E-06 | 0.03 | 2.47E-04 | 0.08 | 1.87 | 9.93E-04 | 24-hr | 1.30E-03 | 2.60E-02 | 1.87 | Yes |
| Anthracene[4] | 120-12-7 | Yes | No | 1.23E-06 | | | 3.88E-04 | 9.31E-03 | 4.94E-06 | - | - | - | - | -- |
| Arsenic | 7440-38-2 | Yes | Yes | | 1.60E-03 | 1.17E-05 | 3.68E-03 | 0.09 | 4.69E-05 | year | 2.50E-03 | 4.90E-02 | 0.09 | Yes |
| Benzene | 71-43-2 | Yes | Yes | 7.76E-04 | 0.19 | 1.36E-03 | 0.43 | 10.29 | 5.46E-03 | year | 1.00E+00 | 2.10E+01 | 10.92 | No |
| Benzo(a)anthracene[4] | 56-55-3 | Yes | Yes | 6.22E-07 | | | 1.96E-04 | 4.71E-03 | 2.50E-06 | year | 4.50E-02 | 8.90E-01 | 4.99E-03 | De Minimis |
| Benzo(a)pyrene[4] | 50-32-8 | Yes | Yes | 2.57E-07 | | | 8.10E-05 | 1.94E-03 | 1.03E-06 | year | 8.20E-03 | 1.60E-01 | 2.06E-03 | De Minimis |
| Benzo(b)fluoranthene[4] | 205-99-2 | Yes | Yes | 1.11E-06 | | | 3.50E-04 | 8.40E-03 | 4.46E-06 | year | 4.50E-02 | 8.90E-01 | 8.91E-03 | De Minimis |
| Benzo(g,h,l)perylene[4] | -- | Yes | No | 5.56E-07 | | | 1.75E-04 | 4.21E-03 | 2.23E-06 | - | - | - | - | -- |
| Benzo(k)fluoranthene[4] | 207-08-9 | Yes | Yes | 2.18E-07 | | | 6.87E-05 | 1.65E-03 | 8.75E-07 | year | 4.50E-02 | 8.90E-01 | 1.75E-03 | De Minimis |
| 1,3-Butadiene | 106-99-0 | Yes | Yes | | 0.22 | 1.59E-03 | 0.50 | 12.01 | 6.37E-03 | year | 2.70E-01 | 5.40E+00 | 12.74 | Yes |
| Cadmium | 7440-43-9 | Yes | Yes | | 1.50E-03 | 1.09E-05 | 3.45E-03 | 0.08 | 4.40E-05 | year | 1.90E-03 | 3.90E-02 | 0.09 | Yes |
| Chlorobenzene | 108-90-7 | Yes | Yes | | 2.00E-04 | 1.46E-06 | 4.60E-04 | 1.10E-02 | 5.86E-06 | 24-hr | 3.70E+00 | 7.40E+01 | 1.10E-02 | De Minimis |
| Chromium | 7440-47-3 | Yes | Yes | | 6.00E-04 | 4.38E-06 | 1.38E-03 | 0.03 | 1.76E-05 | 24-hr | 3.70E-04 | 7.40E-03 | 0.03 | Yes |
| Chromium (VI) | 18540-29-9 | No | Yes | | 1.00E-04 | 7.30E-07 | 2.30E-04 | 5.52E-03 | 2.93E-06 | year | 3.30E-05 | 6.50E-04 | 5.86E-03 | Yes |
| Chrysene | 218-01-9 | Yes | Yes | 1.53E-06 | | | 4.82E-04 | 1.16E-02 | 6.14E-06 | year | 4.50E-01 | 8.90E+00 | 1.23E-02 | De Minimis |
| Copper | 7440-50-8 | No | Yes | | 4.10E-03 | 2.99E-05 | 9.43E-03 | 0.23 | 1.20E-04 | 1-hr | 9.30E-03 | 1.90E-01 | 9.43E-03 | No |
| Dibenz(a,h)anthracene[4] | 53-70-3 | Yes | Yes | 3.46E-07 | | | 1.09E-04 | 2.62E-03 | 1.39E-06 | year | 4.10E-03 | 8.20E-02 | 2.78E-03 | De Minimis |
| Ethyl benzene | 100-41-4 | Yes | Yes | | 1.09E-02 | 7.96E-05 | 0.03 | 0.60 | 3.19E-04 | year | 3.20E+00 | 6.50E+01 | 0.64 | De Minimis |
| Fluoranthene[4] | 206-44-0 | Yes | No | 4.03E-06 | | | 1.27E-03 | 0.03 | 1.62E-05 | - | - | - | - | -- |
| Fluorene[4] | 86-73-7 | Yes | No | 1.28E-05 | | | 4.04E-03 | 0.10 | 5.14E-05 | - | - | - | - | -- |
| Formaldehyde[4] | 50-00-0 | Yes | Yes | 7.89E-05 | 1.73 | 1.26E-02 | 3.97 | 95.32 | 0.05 | year | 1.40E+00 | 2.70E+01 | 101.17 | Yes |
| Hexane | 110-54-3 | Yes | Yes | | 0.03 | 1.96E-04 | 0.06 | 1.49 | 7.88E-04 | 24-hr | 2.60E+00 | 5.20E+01 | 1.49 | De Minimis |
| Hydrogen chloride | 7647-01-0 | Yes | Yes | | 0.19 | 1.36E-03 | 0.43 | 10.29 | 5.46E-03 | 24-hr | 3.30E-02 | 6.70E-01 | 10.29 | Yes |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | Yes | Yes | 4.14E-07 | | | 1.31E-04 | 3.13E-03 | 1.66E-06 | year | 4.50E-02 | 8.90E-01 | 3.32E-03 | De Minimis |
| Lead | 7439-92-1 | Yes | Yes | | 8.30E-03 | 6.06E-05 | 0.02 | 0.46 | 2.43E-04 | year | 1.00E+01 | 1.40E+01 | 0.49 | De Minimis |
| Manganese | 7439-96-5 | Yes | Yes | | 3.10E-03 | 2.26E-05 | 7.13E-03 | 0.17 | 9.08E-05 | 24-hr | 1.10E-03 | 2.20E-02 | 0.17 | Yes |
| Mercury | 7439-97-6 | Yes | Yes | | 2.00E-03 | 1.46E-05 | 4.60E-03 | 0.11 | 5.86E-05 | 24-hr | 1.10E-04 | 2.20E-03 | 0.11 | Yes |
| Naphthalene[4] | 91-20-3 | Yes | Yes | 1.30E-04 | 0.02 | 1.44E-04 | 0.05 | 1.09 | 5.77E-04 | year | 2.40E-01 | 4.80E+00 | 1.15 | No |
| Nickel | 7440-02-0 | Yes | Yes | | 3.90E-03 | 2.85E-05 | 8.97E-03 | 0.22 | 1.14E-04 | year | 3.10E-02 | 6.20E-01 | 0.23 | No |
| Phenanthrene | 85-01-8 | Yes | No | 4.08E-05 | | | 1.29E-02 | 0.31 | 1.64E-04 | - | - | - | - | -- |
| Propylene[4] | 115-07-1 | No | Yes | 2.79E-04 | 0.47 | 3.41E-03 | 1.07 | 25.79 | 1.37E-02 | 24-hr | 1.10E+01 | 2.20E+02 | 25.79 | No |
| Pyrene[4] | 129-00-0 | Yes | No | 3.71E-06 | | | 1.17E-03 | 0.03 | 1.49E-05 | - | - | - | - | -- |
| Selenium | 7782-49-2 | Yes | Yes | | 2.20E-03 | 1.61E-05 | 5.06E-03 | 0.12 | 6.45E-05 | 24-hr | 7.40E-02 | 1.50E+00 | 0.12 | No |
| Toluene | 108-88-3 | Yes | Yes | 2.81E-04 | 0.11 | 7.69E-04 | 0.24 | 5.82 | 3.09E-03 | 24-hr | 1.90E+01 | 3.70E+02 | 5.82 | De Minimis |
| Xylenes | 1330-20-7 | Yes | Yes | 1.93E-04 | 0.04 | 3.09E-04 | 0.10 | 2.34 | 1.24E-03 | 24-hr | 8.20E-01 | 1.60E+01 | 2.34 | No |
| Zinc | 7440-66-6 | No | No | | 0.02 | 1.64E-04 | 0.05 | 1.24 | 6.56E-04 | - | - | - | - | -- |
| PAH's | -- | No | No | | 0.06 | 4.08E-04 | 0.13 | 3.09 | 1.64E-03 | - | - | - | - | -- |
| Diesel engine exhaust, particulate[5] | -- | No | Yes | See Vendor Data | | | 61.91 | 87.58 | 0.85 | year | 2.70E-02 | 5.40E-01 | 1,696.68 | Yes |
| $SO_2$[6] | 7446-09-05 | No | Yes | See Vendor Data | | | 0.57 | 1.58 | 7.29E-03 | 1-hr | 4.60E-01 | 1.20E+00 | 0.57 | No |
| CO[6] | 630-08-0 | No | Yes | See Vendor Data | | | 96.25 | 246.50 | 1.24 | 1-hr | 1.10E+00 | 4.30E+01 | 96.25 | Yes |
| $NO_2$[6] | 10102-44-0 | No | Yes | See Vendor Data | | | 80.95 | 1,942.75 | 0.96 | 1-hr | 4.60E-01 | 8.70E-01 | 80.95 | Yes |
| | | | | | | Total HAP Emissions: | 7.76 | 186.28 | 0.10 | | | | | |
| | | | | | | Total TAP Emissions: | 248.50 | 2,490.13 | 3.17 | | | | | |

1. AP-42 emission factors are from AP-42 Tables 3.4-3 and 3.4-4. Emission factors are from Ventura County Air Pollution Control District, AB 2588 Combustion Emission Factors for Diesel Internal Combustion.
2. Diesel heat content 0.137 MMBtu/gal per AP-42, Appendix A. Fuel consumption rate is provided in Table 1c. Emissions in this table represent the maximum hourly, daily, and annual emission for each pollutant.
3. Modeling is required if the project emissions are greater than the respective Small Quantity Emission Rate.
4. These are categorized as polycyclic organic matter (POM), which is a HAP.
5. Diesel particulate matter is assumed to be equivalent to filterable particulate matter.
6. $SO_2$, CO and $NO_X$ emissions with maximum operation scenario (when all emergency generators are in operation) are listed here. It is conservatively assumed that 10% of $NO_X$ are emitted in the form of $NO_2$.

**Table C-7. Building E Additional Gensets Load Emissions**

| Make/Model | Generator Operation (Main or Support) | Size *Size* (hp) | Size *Size* (kW) | *Tier* | Engine Power[2] *P_1* 100% | *P_0.75* 75% | *P_0.5* 50% | *P_0.25* 25% | *P_0.1* 10% | Units | Fuel Use (gal/hr)[2] *FUL_1* 100% | *FUL_0.75* 75% | *FUL_0.5* 50% | *FUL_0.25* 25% | *FUL_0.1* 10% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cummins QSK60-G26 | Main | 3626 | 2500 | 2 | 3626 | 2721 | 1852 | 982 | 461 | hp | 177 | 130 | 92 | 55 | 31 |
| Cummins QSK60-G14 | Main | 3239 | 2250 | 2 | 3239 | 2422 | 1637 | 851 | 379 | hp | 153 | 120 | 87 | 50 | 29 |
| Rehlko KD2250[1,4] | Main | 3353 | 2500 | 2 | 2500 | 1875 | 1250 | 625 | 250 | kW | 167.1 | 136.9 | 95.2 | 55.4 | 29.9 |
| Rehlko KD2500[1,5] | Main | 3621 | 2700 | 2 | 2700 | 2025 | 1350 | 675 | 270 | kW | 172.9 | 152.3 | 99 | 55.6 | 55.6 |
| Cat 3516C - 2250 | Main | 3017 | 2250 | 2 | 2250 | 1688 | 1125 | 563 | 225 | kW | 159.2 | 125 | 91 | 53 | 29 |
| Cat 3516C - 2500 | Main | 3353 | 2500 | 2 | 2500 | 1875 | 1250 | 625 | 250 | kW | 171.3 | 133.2 | 97.1 | 57.2 | 30.9 |

[1]Exhaust volume flowrate calculated using mass flowrate following the below equation.

$$\text{Volume rate}=\frac{\frac{\text{mass in kg/hr}\times 1000\text{ g/kg}}{\text{MW of exhaust air (g/mol)}}\times\text{Gas Constant}\left(\text{m}^3\cdot\text{Pa}/(\text{K}\cdot\text{mol})\right)\times\text{Temperature(K)}}{\text{Ambient Pressure (Pa)}}\times\left(\frac{\text{ft}}{0.3048\text{ m}}\right)^3\times\frac{1\text{ hr}}{60\text{ min}}$$

| | | |
|---|---|---|
| Gas constant | 8.314 | $m^3$-Pa/(K-mol) |
| MW of exhaust | 28.9647 | g/mol (assuming equal to ambient air) |
| Ambient pressure | 101325 | Pa |

[2]Data obtained from manufacturer's data sheet

[3]Calculated using the maximum emission rate between manufacturer's listed PM and VOC

[4]Fuel use (gal/hr) at 10% load is assumed to be equal to the rate submitted for these engine models in the NOC application for Approval Order No. 22AQ-E016. Per the manufacturer, fuel use data was not recorded at 10% load and is therefore unavailable.

[5]Fuel use (gal/hr) at 10% load is assumed to be equal to the rate recorded at 25% load for these engines. Per the manufacturer, fuel use data was not recorded at 10% load and is therefore unavailable.

**Table C-7. Building E Addi**

| Make/Model | NOx Emission Rate[2] *NOx_1* 100% | *NOx_0.75* 75% | *NOx_0.5* 50% | *NOx_0.25* 25% | *NOx_0.1* 10% | Units | $NO_x$ Emission Rate (lb/hr)[2] *NOx_1* 100% | *NOx_0.75* 75% | *NOx_0.5* 50% | *NOx_0.25* 25% | *NOx_0.1* 10% | Max NOx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cummins QSK60-G26 | 5.86 | 5.38 | 5.23 | 5.01 | 6.1 | g/hp-hr | 46.84 | 32.27 | 21.35 | 10.85 | 6.20 | 46.84 |
| Cummins QSK60-G14 | 8.72 | 5.95 | 4.55 | 5.23 | 8.33 | g/hp-hr | 62.27 | 31.77 | 16.42 | 9.81 | 6.96 | 62.27 |
| Rehlko KD2250[1,4] | 8 | 5.7 | 5.9 | 5.5 | 8.9 | g/kW-hr | 44.09 | 23.56 | 16.26 | 7.58 | 4.91 | 44.09 |
| Rehlko KD2500[1,5] | 10.4 | 5.7 | 5.8 | 6.4 | 8.4 | g/kW-hr | 61.91 | 25.45 | 17.26 | 9.52 | 5.00 | 61.91 |
| Cat 3516C - 2250 | | | | | | | 44.73 | 26.89 | 13.98 | 7.26 | 6.99 | 44.73 |
| Cat 3516C - 2500 | | | | | | | 50.59 | 31.09 | 15.44 | 7.87 | 7.02 | 50.59 |

| Make/Model | CO Emission Rate[2] *CO_1* 100% | *CO_0.75* 75% | *CO_0.5* 50% | *CO_0.25* 25% | *CO_0.1* 10% | Units | CO Emission Rate (lb/hr)[2] *CO_1* 100% | *CO_0.75* 75% | *CO_0.5* 50% | *CO_0.25* 25% | *CO_0.1* 10% | Max CO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cummins QSK60-G26 | 0.80 | 0.60 | 1.60 | 1.60 | 3.20 | g/hp-hr | 6.40 | 3.60 | 6.53 | 3.46 | 3.25 | 6.53 |
| Cummins QSK60-G14 | 0.80 | 0.40 | 0.60 | 1.40 | 4.40 | g/hp-hr | 5.71 | 2.14 | 2.17 | 2.63 | 3.68 | 5.71 |
| Rehlko KD2250[1,4] | 0.30 | 0.60 | 0.60 | 1.80 | 6.99 | g/kW-hr | 1.65 | 2.48 | 1.65 | 2.48 | 3.85 | 3.85 |
| Rehlko KD2500[1,5] | 0.30 | 0.80 | 0.60 | 1.70 | 4.10 | g/kW-hr | 1.79 | 3.57 | 1.79 | 2.53 | 2.44 | 3.57 |
| Cat 3516C - 2250 | | | | | | | 4.42 | 2.68 | 2.49 | 3.42 | 4.77 | 4.77 |
| Cat 3516C - 2500 | | | | | | | 6.01 | 2.88 | 2.41 | 3.30 | 4.62 | 6.01 |

[1] Exhaust volume flowrate calc
[1] Exhaust volume flowrate calculated using mass flowrate following the below equation.

Volume rate= mass ir / MW of

$$\text{Volume rate}=\frac{\frac{\text{mass in kg/hr}\ \times 1000\ \text{g/kg}}{\text{MW of exhaust air (g/mol)}}\times \text{Gas Constant}\ \left(\text{m}^3\cdot\text{Pa/(K}\cdot\text{mol)}\right)\times\text{Temperature(K)}}{\text{Ambient Pressure (Pa)}}\times\left(\frac{\text{ft}}{0.3048\ \text{m}}\right)^3\times\frac{1\ \text{hr}}{60\ \text{min}}$$

| | | |
|---|---|---|
| Gas constant | 8.314 | $m^3$-Pa/(K-mol) |
| MW of exhaust | 28.9647 | g/mol (assuming equal to ambient air) |
| Ambient pressure | 101325 | Pa |

[2] Data obtained from manufac
[2] Data obtained from manufacturer's data sheet

[3] Calculated using the maximu
[3] Calculated using the maximum emission rate between manufacturer's listed PM and VOC

[4] Fuel use (gal/hr) at 10% loa
therefore unavailable.
[4] Fuel use (gal/hr) at 10% load is assumed to be equal to the rate submitted for these engine models in the NOC application for Approval Order No. 22AQ-E016. Per the manufacturer, fuel use data was not recorded at 10% load and is therefore unavailable.

[5] Fuel use (gal/hr) at 10% loa
[5] Fuel use (gal/hr) at 10% load is assumed to be equal to the rate recorded at 25% load for these engines. Per the manufacturer, fuel use data was not recorded at 10% load and is therefore unavailable.

**Table C-7. Building E Addi**

| Make/Model | VOC Emission Rate[2] *VOC_1* 100% | *VOC_0.75* 75% | *VOC_0.5* 50% | *VOC_0.25* 25% | *VOC_0.1* 10% | Units | VOC Emission Rate (lb/hr)[2] *VOC_1* 100% | *VOC_0.75* 75% | *VOC_0.5* 50% | *VOC_0.25* 25% | *VOC_0.1* 10% | Max VOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cummins QSK60-G26 | 0.07 | 0.07 | 0.10 | 0.20 | 0.71 | g/hp-hr | 0.56 | 0.42 | 0.41 | 0.43 | 0.72 | 0.72 |
| Cummins QSK60-G14 | 0.07 | 0.05 | 0.12 | 0.26 | 0.63 | g/hp-hr | 0.50 | 0.27 | 0.43 | 0.49 | 0.53 | 0.53 |
| Rehlko KD2250[1,4] | 0.29 | 0.39 | 0.64 | 1.19 | 3.30 | g/kW-hr | 1.60 | 1.61 | 1.76 | 1.64 | 1.82 | 1.82 |
| Rehlko KD2500[1,5] | 0.27 | 0.32 | 0.60 | 1.08 | 2.82 | g/kW-hr | 1.61 | 1.43 | 1.79 | 1.61 | 1.68 | 1.79 |
| Cat 3516C - 2250 | | | | | | | 1.06 | 1.44 | 1.16 | 0.89 | 0.99 | 1.44 |
| Cat 3516C - 2500 | | | | | | | 1.10 | 1.10 | 1.20 | 0.90 | 0.96 | 1.20 |

| Make/Model | Manufacturer's PM Emission Rate[2] *MPM_1* 100% | *MPM_0.75* 75% | *MPM_0.5* 50% | *MPM_0.25* 25% | *MPM_0.1* 10% | Units | Manufacturer's PM Emission Rate (lb/hr)[2] *MPM_1* 100% | *MPM_0.75* 75% | *MPM_0.5* 50% | *MPM_0.25* 25% | *MPM_0.1* 10% | Max PM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cummins QSK60-G26 | 0.08 | 0.04 | 0.10 | 0.18 | 0.18 | g/hp-hr | 0.64 | 0.24 | 0.41 | 0.39 | 0.18 | 0.64 |
| Cummins QSK60-G14 | 0.08 | 0.06 | 0.14 | 0.30 | 0.58 | g/hp-hr | 0.57 | 0.32 | 0.51 | 0.56 | 0.48 | 0.57 |
| Rehlko KD2250[1,4] | 0.06 | 0.17 | 0.13 | 0.34 | 0.42 | g/kW-hr | 0.33 | 0.70 | 0.36 | 0.47 | 0.23 | 0.70 |
| Rehlko KD2500[1,5] | 0.05 | 0.25 | 0.17 | 0.40 | 0.47 | g/kW-hr | 0.30 | 1.12 | 0.51 | 0.60 | 0.28 | 1.12 |
| Cat 3516C - 2250 | | | | | | | 0.31 | 0.28 | 0.30 | 0.30 | 0.30 | 0.31 |
| Cat 3516C - 2500 | | | | | | | 0.41 | 0.27 | 0.29 | 0.31 | 0.31 | 0.41 |

[1]Exhaust volume flowrate calc [1]Exhaust volume flowrate calculated using mass flowrate following the below equation.

Volume rate= $\frac{\text{mass ir}}{\text{MW of}}$

$$\text{Volume rate}=\frac{\frac{\text{mass in kg/hr} \times 1000\text{ g/kg}}{\text{MW of exhaust air (g/mol)}}\times \text{Gas Constant }\left(m^3\cdot \text{Pa}/(\text{K}\cdot\text{mol})\right)\times \text{Temperature(K)}}{\text{Ambient Pressure (Pa)}}\times\left(\frac{\text{ft}}{0.3048\text{ m}}\right)^3\times\frac{1\text{ hr}}{60\text{ min}}$$

Gas constant 8.314 $m^3$-Pa/(K-mol)
MW of exhaust 28.9647 g/mol (assuming equal to ambient air)
Ambient pressure 101325 Pa

[2]Data obtained from manufac [2]Data obtained from manufacturer's data sheet

[3]Calculated using the maximu [3]Calculated using the maximum emission rate between manufacturer's listed PM and VOC

[4]Fuel use (gal/hr) at 10% loa therefore unavailable. [4]Fuel use (gal/hr) at 10% load is assumed to be equal to the rate submitted for these engine models in the NOC application for Approval Order No. 22AQ-E016. Per the manufacturer, fuel use data was not recorded at 10% load and is therefore unavailable.

[5]Fuel use (gal/hr) at 10% loa [5]Fuel use (gal/hr) at 10% load is assumed to be equal to the rate recorded at 25% load for these engines. Per the manufacturer, fuel use data was not recorded at 10% load and is therefore unavailable.

**Table C-7. Building E Addi**

| | Temperature (K)[2] | | | | | Exhaust Flow Rate (kg/hr)[2] | | | | | Exhaust Flow Rate (acfm)[2] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *TMP_1* | *TMP_0.75* | *TMP_0.5* | *TMP_0.25* | *TMP_0.1* | | | | | | *EXH_1* | *EXH_0.75* | *EXH_0.5* | *EXH_0.25* | *EXH_0.1* |
| **Make/Model** | **100%** | **75%** | **50%** | **25%** | **10%** | **100%** | **75%** | **50%** | **25%** | **10%** | **100%** | **75%** | **50%** | **25%** | **10%** |
| Cummins QSK60-G26 | 799.26 | 772.59 | 783.71 | 747.59 | 640.93 | | | | | | 19205 | 14796 | 10860 | 6823 | 4384 |
| Cummins QSK60-G14 | 751.48 | 729.26 | 711.48 | 661.48 | 594.82 | | | | | | 16429 | 14037 | 11174 | 6770 | 4403 |
| Rehlko KD2250[1,4] | 723.15 | 718.15 | 673.15 | 683.15 | 608.15 | 14692 | 14382 | 10647 | 6321 | 4366 | 17714.85 | 17221.17 | 11949.98 | 7199.96 | 4427.1 |
| Rehlko KD2500[1,5] | 743.15 | 738.15 | 673.15 | 688.15 | 618.15 | 15025 | 14952 | 11346 | 6577 | 4466 | 18617.41 | 18402.3 | 12734.53 | 7546.389 | 4602.998 |
| Cat 3516C - 2250 | 717.09 | 698.82 | 684.82 | 654.09 | 556.98 | | | | | | 17407.1 | 14427.7 | 11023.3 | 6779 | 4258.9 |
| Cat 3516C - 2500 | 729.32 | 702.48 | 685.98 | 661.93 | 567.93 | | | | | | 18497.4 | 15125.9 | 11701.1 | 7273.8 | 4428.4 |

[1]Exhaust volume flowrate calc
[1]Exhaust volume flowrate calculated using mass flowrate following the below equation.

Volume rate= mass ir / MW of

$$\text{Volume rate}=\frac{\frac{\text{mass in kg/hr} \times 1000\text{ g/kg}}{\text{MW of exhaust air (g/mol)}}\times\text{Gas Constant }\left(\text{m}^3\cdot\text{Pa}/(\text{K}\cdot\text{mol})\right)\times\text{Temperature(K)}}{\text{Ambient Pressure (Pa)}}\times\left(\frac{\text{ft}}{0.3048\text{ m}}\right)^3\times\frac{1\text{ hr}}{60\text{ min}}$$

8.314
28.9647
101325

[2]Data obtained from manufac
[2]Data obtained from manufacturer's data sheet
[3]Calculated using the maximu
[3]Calculated using the maximum emission rate between manufacturer's listed PM and VOC
[4]Fuel use (gal/hr) at 10% loa
therefore unavailable.
[4]Fuel use (gal/hr) at 10% load is assumed to be equal to the rate submitted for these engine models in the NOC application for Approval Order No. 22AQ-E016. Per the manufacturer, fuel use data was not recorded at 10% load and is therefore unavailable.
[5]Fuel use (gal/hr) at 10% loa
[5]Fuel use (gal/hr) at 10% load is assumed to be equal to the rate recorded at 25% load for these engines. Per the manufacturer, fuel use data was not recorded at 10% load and is therefore unavailable.

**Table C-8a. Cold Start Scaling Factors**

| Pollutant | Spike Duration (seconds) [a] | Cold-Start Emission Spike [a] (ppm) | Steady-State (Warm) Emissions [a] (ppm) | Cold-Start Scaling Factor |
|---|---|---|---|---|
| PM+HC | 14 | 900 | 30 | 4.27 |
| $NO_X$ | 8 | 40 | 38 | 0.94 |
| CO | 20 | 750 | 30 | 9.00 |

a. Spike duration, cold-start emission spike, and steady-state (warm) emissions based on data from California Energy Commission (CEC) "Air Quality Implications of Backup Generators in California. The cold-start scaling factor is derived as the ratio of the spike concentration and duration to the steady-state emissions for the initial 60 seconds. An example calculation is provided below for HC. Since a cold-start curve was not developed by CEC, it is assumed that the PM will experience the same trend as HC.

**Table C-8b. Building E Cold Start Emission Rates**

| Pollutant | Worst-case Emission Rate (lb/hr/engine) | | |
|---|---|---|---|
| | Main Genset - Worst Case | | |
| | Warm | Cold-Start | Startup Emission Rate [1] |
| HC | 1.82 | 7.76 | 1.92 |
| $NO_X$ | 62.27 | 58.33 | 62.20 |
| CO | 6.53 | 58.79 | 7.40 |
| DEEP/PM | 1.12 | 4.76 | 1.18 |
| $PM_{10}/PM_{2.5}$ | 2.93 | 12.52 | 3.09 |

a. Startup hourly emission rate assumes one minute of cold-start emissions and 59 minutes of warm engine emissions.

**Table C-8c. Building E Cold Start Emissions**

| Pollutant | Annual Emissions from Cold Start Hours - Main Gensets (tpy) |
|---|---|
| HC | 0.35 |
| $NO_X$ | 11.32 |
| CO | 1.35 |
| DEEP | 0.21 |
| $PM_{10}/PM_{2.5}$ | 0.56 |

a. Calculations conservatively assume 28 cold starts per engine, per year.

# APPENDIX D. BACT COST ANALYSIS

**Table D-1. General Cost Calculation Inputs**

| | |
|---|---|
| Number of Main Engines | 13 |
| Number of Support Engines | 0 |
| Bank Prime Rate (Mar 2025) [a] | 7.50% |
| Lifespan of SCR (yrs.) [b] | 25 |
| Lifespan of DPF (yrs.) [b] | 25 |
| Lifespan of DOC (yrs.) [b] | 25 |
| Lifespan of Tier 4 Integrated Control System (yrs.) | 25 |
| CEPCI 2016 ($) | 541.7 |
| CEPCI 2024 ($) | 791 |

a. Capital recovery is calculated using a 7.5% annual interest rate, which is the bank prime rate as of March 2025.

b. A 25-yr life span is conservatively assumed for the SCR system, consistent with the recent Vantage and CyrusOne applications and in accordance with Section 4, Chapter 2 of EPA APCCM, 7th Edition. A 25-year life span is conservatively assumed for the DPF, DOC, and Tier 4 Integrated Control System, consistent with the recent Vantage and CyrusOne applications.

**Table D-2. Criteria Pollutant Emission Rates and Control Efficiencies [a]**

| Pollutant | Main tpy | SCR Removal % | DPF Removal % | DOC Removal % | Tier 4 Removal % |
|---|---|---|---|---|---|
| Particulate Matter (PM) | 0.85 | 0% | 85% | 25% | 85% |
| Carbon Monoxide (CO) | 1.24 | 0% | 80% | 80% | 80% |
| Volatile Organic Compounds (VOC) | 1.38 | 0% | 70% | 70% | 70% |
| Nitrogen Oxides ($NO_X$) | 9.59 | 90% | 0% | 0% | 90% |

a. Control technology removal efficiencies are consistent with historic submissions and updated for consistency with calculations from recent Vantage and Microsoft Columbia applications.

**Table D-3. Toxic Air Pollutant Emission Rates and Control Efficiencies [a]**

| Pollutant | Main [b] tpy | SCR Removal % | DPF Removal % | DOC Removal % | Tier 4 Removal % |
|---|---|---|---|---|---|
| Acetaldehyde | 2.30E-02 | 0% | 70% | 70% | 70% |
| Acrolein | 9.93E-04 | 0% | 70% | 70% | 70% |
| Arsenic | 4.69E-05 | 0% | 70% | 70% | 70% |
| Benzene | 5.46E-03 | 0% | 70% | 70% | 70% |
| 1,3-Butadiene | 6.37E-03 | 0% | 70% | 70% | 70% |
| Cadmium | 4.40E-05 | 0% | 85% | 25% | 85% |
| Chromium | 1.76E-05 | 0% | 85% | 25% | 85% |
| Chromium (VI) | 2.93E-06 | 0% | 85% | 25% | 85% |
| Copper | 1.20E-04 | 0% | 85% | 25% | 85% |
| Formaldehyde | 5.06E-02 | 0% | 70% | 70% | 70% |
| Hydrogen chloride | 5.46E-03 | 0% | 0% | 0% | 0% |
| Manganese | 9.08E-05 | 0% | 85% | 25% | 85% |
| Mercury | 5.86E-05 | 0% | 85% | 25% | 85% |
| Naphthalene | 5.77E-04 | 0% | 70% | 70% | 70% |
| Nickel | 1.14E-04 | 0% | 85% | 25% | 85% |
| Propylene | 1.37E-02 | 0% | 70% | 70% | 70% |
| Selenium | 6.45E-05 | 0% | 85% | 25% | 85% |
| Xylenes | 1.24E-03 | 0% | 70% | 70% | 70% |
| Diesel engine exhaust, particulate | 8.48E-01 | 0% | 85% | 25% | 85% |
| Sulfur Dioxide ($SO_2$) | 7.29E-03 | 0% | 0% | 0% | 0% |
| Carbon Monoxide (CO) | 1.24E+00 | 0% | 80% | 80% | 80% |
| Nitrogen Dioxide ($NO_2$) | 9.59E-01 | 90% | 0% | 0% | 90% |

a. Control technology removal efficiencies are consistent with historic submissions and updated for consistency with calculations from recent Vantage and Microsof

b. Diesel partciulate emissions and metal TAPs are assumed to be emitted as PM.

**Table D-4. SCR Cost Calculation Inputs**

| | |
|---|---|
| MW of $NH_3$ (g/mol) | 17.03 |
| MW of $NO_X$ (g/mol) | 46.01 |
| Ammonia Cost ($/gal) | 0.293 |
| Operational Hours (hr/yr/engine) | 25 |
| Aqueous Ammonia Concentration (%w/w) | 29% |
| Specific Gravity 29% ammonia [a] | 0.9 |
| Water density (lb/gal) | 8.35 |
| Size of main engines (MW) | 2.5 |
| NRF [b] | 1.125 |
| $CC_{replace}$ ($/ft$^3$) [c] | 227 |

a. The specific gravity of 29% ammonia is estimated as 0.9, per the aqua ammonia specific gravity chart from Inyo Process (https://inyoprocess.com/images/chem_appl/aqua_ammonia_specific_gravity_chart.pdf)

b. NRF is the $NO_X$ removal, as defined in the EPA Control Cost Manual, 7th Edition, Equation 2.41.

c. $CC_{replace}$ is the cost of catalyst replacement. The value used is the catalyst replacement cost used in EPA Control Cost Manual, 7th Edition, Section 4, Chapter 2.5, Example Problem #1.

**BACT Cost Analysis for $NO_X$ - SCR Option - Main Gensets**

**Table D-5a. Capital Costs**

| **Capital Cost** | **Description** | **Calculated Cost** | | **Reference** |
|---|---|---|---|---|
| *Direct Cost* | | | | |
| | Emission Control Package for 13 Main Engines | $ | 2,128,510 [a] | A |
| | Sales Tax | $ | 138,353 [b] | B = WA State Tax of 6.5% x A |
| | Shipping | $ | 106,425 [b] | C = 5% of package price x A |
| | Installation for 13 Main Engines | $ | 520,995 [c] | D |
| *Total Direct Cost* | | *$* | *2,894,283* | TDC = A + B + C + D |
| *Indirect Cost* | | | | |
| | Engineering | $ | 39,000 [d] | E |
| | Construction and Field Expenses | $ | 39,000 [d] | F |
| | Contractor Fees | $ | 196,811 [d] | G = 6.8% x (A + B + C + D) |
| | Startup | $ | 39,000 [d] | H |
| | Performance Test | $ | 28,942.83 [d] | I = 1% x (A + B + C + D) |
| | Contingencies | $ | 237,328.81 [d] | J = 10% x (A + B + C + D) |
| *Total Indirect Cost* | | *$* | *580,083* | TIC = E + F + G + H + I + J |
| **Total Capital Investment** | | **$** | **3,474,365** | TCI = TDC + TIC |

**Table D-5b. Operating Costs**

| Operating Cost | | | | Reference |
|---|---|---|---|---|
| *Direct Annual Cost* | | | | |
| | Maintenance | $ | 17,372 [e] | K = 0.5% x TCI |
| | Catalyst Cost | $ | 165,379 [e] | L = {Cost of replacement catalyst} |
| | Reagent Consumption | $ | 905 [f] | M = {$NO_X$ removal, cost of ammonia} |
| *Total Direct Annual Costs* | | $ | *183,656* | DAC = K + L + M |
| *Indirect Annual Costs* | | | | |
| | Administrative Charges | $ | 793 [b] | N = 3% x ((Op. Labor Cost) + 40% x K) |
| | Property Tax | $ | 34,743.65 [b] | O = 1% x TCI |
| | Insurance | $ | 34,743.65 [b] | P = 1% x TCI |
| | Capital Recovery | $ | 311,687.66 [g] | $CRC_S$ = TCI x CRF |
| *Total Indirect Annual Costs* | | $ | *381,968* | IDAC = N + O + P + CRC |
| **Total Annual Cost** [h] | | **$** | **565,624** | TAC = DAC + IDAC |

a. Cost for SCR control package is the average unit price from recent Vantage (2022) and Microsoft Columbia (2022) applications.

b. Shipping costs are calculated in accordance to Table 2.4, Section 2.6.4, Chapter 2, Section 1 of EPA Air Pollution Control Cost Manual (APCCM), 7th Edition. Sales tax is calculated using the Washington state sales tax rate. Administrative charges calculated in accordance with Equation 2.69, Chapter 2, Section 4 of EPA Air Pollution Control Cost Manual. Operator labor cost used in the calculation of administrative charges is calculated assuming a maximum labor usage of 25 hr/yr/engine, which is the maximum number of operational hours for each engine. Operator labor cost is calculated using the labor rate in Section 4, Chapter 2, 2.5 of the EPA Air Pollution Control Cost Manual Example Problem #1. Administrative charges, property tax, and insurance are calculated according to Section 1, Chapter 2, 2.6.5.8 of the APCCM.

c. Cost for SCR installation is the average unit price from recent Vantage (2022) and Microsoft Columbia (2022) applications.

d. Each of the indirect capital costs are calculated following the most conservative approach between the Vantage and Microsoft Columbia applications.

e. Maintenance cost is calculated in accordance with Equation 2.57 of Chapter 2, Section 4 of EPA APCCM, 7th Edition. Catalyst cost is calculated per Equation 2.67, Chapter 2, Section 4 of EPA APCCM, 7th Edition.

f. Reagent consumption is calculated in accordance to Equation 2.35, Chapter 2, Section 4 of EPA APCCM. It is assumed that anhydrous ammonia is used for this BACT cost analysis, because "anhydrous ammonia typically has the lowest capital and operating costs" (page 2-12 of Chapter 2, Section 4 of EPA APCCM). It is assumed that the $NO_X$ removal efficiency is 90%, and the cost of ammonia is at the EPA default value of $0.293/gal ammonia, as listed in Chapter 2, Section 4, 2.6 of the EPA APCCM. The control efficiency used in the Vantage and Microsoft Columbia applications is 90%. Additionally, using anhydrous ammonia will bring additional cost for equipment to store the anhydrous ammonia and other cost associated with demonstrating compliance with Risk Management Program, which are not included in this conservative cost calculation.

g. Capital recovery is calculated using a 7.5% annual interest rate, which is the bank prime rate as of March 2025, and a 25-yr life span for the SCR system, in accordance with Section 4, Chapter 2 of EPA APCCM, 7th Edition.

h. For annual operating cost, it is conservatively assumed that operating labor, supervisory labor, and electricity are negligible since the emission units will not be operated continuously.

**Table D-5c. Criteria Pollutant Control Cost Effectiveness**

| **Annual Control Cost for SCR** | | $ 565,624 | |
|---|---|---|---|
| | **Ecology Acceptable Unit Cost ($/ton)** | **Total Removal (tpy)** | **Reasonable Annual Cost ($/yr)** |
| Removal efficiency of 90% for NOx | $12,000 | 8.63 [a,c] | $ 103,611.32 |
| | | Total Reasonable Annual Cost for Combined Pollutants [a,b] | $ 103,611.32 |
| | | Is the control device cost reasonable? | No |

a. Removal efficiencies are consistent with recent Microsoft Columbia and Vantage cost calculations.

b. The total reasonable annual cost compared to the actual annual control cost demonstrates that the control is cost prohibitive. This is consistent with Microsoft Columbia and Vantage applications.

c. "Ecology Acceptable Unit Costs" are consistent with the cost thresholds used in Microsoft Columbia and Vantage applications.

**Table D-5d. Toxic Air Pollutant Control Cost Effectiveness**

| Pollutant [a] | ASIL (μg/m$^3$) | ASIL Based Cost Factor [b] | Ecology Acceptable Unit Cost ($/ton) [c] | Total Removal (tpy) | Reasonable Annual Cost ($/yr) [d] |
|---|---|---|---|---|---|
| Removal efficiency of 0% for Acetaldehyde | 3.70E-01 | 4.9 | $ 51,063 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Acrolein | 3.50E-01 | 4.9 | $ 51,317 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Arsenic | 3.00E-04 | 8.0 | $ 83,520 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Benzene | 1.30E-01 | 5.3 | $ 55,833 | 0.00E+00 | $ - |
| Removal efficiency of 0% for 1,3-Butadiene | 3.30E-02 | 5.9 | $ 62,085 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Cadmium | 2.40E-04 | 8.1 | $ 84,537 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Chromium | 1.00E-01 | 5.4 | $ 57,029 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Chromium (VI) | 4.00E-06 | 9.8 | $ 103,208 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Copper | 1.00E+02 | 2.4 | $ 25,529 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Formaldehyde | 1.70E-01 | 5.2 | $ 54,610 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Hydrogen chloride | 9.00E+00 | 3.5 | $ 36,510 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Manganese | 3.00E-01 | 5.0 | $ 52,020 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Mercury | 3.00E-02 | 6.0 | $ 62,520 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Naphthalene | 2.90E-02 | 6.0 | $ 62,674 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Nickel | 3.80E-03 | 6.9 | $ 71,942 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Propylene | 3.00E+03 | 1.0 | $ 10,020 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Selenium | 2.00E+01 | 3.1 | $ 32,869 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Xylenes | 2.20E+02 | 2.1 | $ 21,934 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Diesel engine exhaust, particulate | 3.30E-03 | 6.9 | $ 72,585 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Sulfur Dioxide (SO2) | 6.60E+02 | 1.6 | $ 16,924 | 0.00E+00 | $ - |
| Removal efficiency of 0% for Carbon Monoxide (CO) | 2.30E+04 | 0.1 | $ 731 | 0.00E+00 | $ - |
| Removal efficiency of 90% for Nitrogen Dioxide (NO2) | 4.70E+02 | 1.8 | $ 18,472 | 8.63E-01 | $ 15,949.49 |
| Total Reasonable Annual Cost for Combined Pollutants | | | | | $ 15,949.49 |
| Is the control device cost reasonable? | | | | | No |

a. Removal efficiencies are consistent with recent Microsoft Columbia and Vantage cost calculations.

b. ASIL Based Cost Factor derived from the Hanford Methodology. https://www.osti.gov/servlets/purl/991923 . Cost Factor = $Log_{10}$(27,000 / ASIL)

c. Assumes a maximum ceiling value of $10,500/ton, as described in the Hanford Evaluation of Best Available Control Technology for Toxics (tBACT) Double Sheel Tank Farms Primary Ventilation Systems Supporting Waste Transfer Operations and consistent with other recent data center NOC applications.

d. The total reasonable annual cost compared to the actual annual control cost demonstrates that the control is cost prohibitive. This is consistent with Microsoft Columbia and Vantage applications.

**BACT Cost Analysis for CO, PM and VOC - Diesel Particulate Filter - Main and Support Gensets**

**Table D-6a. Capital Costs**

| **Capital Cost** | **Description** | **Calculated Cost** | | **Reference** |
|---|---|---|---|---|
| *Direct Cost* | | | | |
| | Emission Control Package for 13 Main Engines | $ 1,295,587 | a | A |
| | Sales Tax | $ 84,213 | b | B = WA State Tax of 6.5% x A |
| | Shipping | $ 64,779.33 | b | C = 5% x A |
| | Instrumentation | $ 12,955.87 | b | D = 1% x A |
| *Total Direct Cost* | | *$ 1,457,535* | | TDC = A + B + C + D |
| *Indirect Cost* | | | | |
| | Engineering | $ 26,000 | c | E |
| | Construction and Field Expenses | $ - | c | F |
| | Contractor Fees | $ 99,112 | c | G = 6.8% x (A + C + D + E) |
| | Startup | $ 19,500.00 | c | H |
| | Performance Test | $ 14,575.35 | c | I = 1% x (A + C + D + E) |
| | Contingencies | $ 144,457.89 | c | J = 10% x (A + C + D + E) |
| *Total Indirect Cost* | | *$ 303,646* | | TIC = E + F + G + H + I + J |
| **Total Capital Investment** | | **$ 1,761,180** | | TCI = TDC + TIC |

**Table D-6b. Operating Costs**

| Operating Cost | | | | Reference |
|---|---|---|---|---|
| *Indirect Annual Costs* [e] | | | | |
| | Administrative Charges | $ | 35,224 [b] | K = 2% × TCI |
| | Property Tax | $ | 17,612 [b] | L = 1% × TCI |
| | Insurance | $ | 17,612 [b] | M = 1% × TCI |
| | Capital Recovery | $ | 157,996.68 [d] | $CRC_S$ = TCI x CRF |
| *Total Indirect Annual Costs* | | $ | *228,444* | IDAC = K + L + M + CRC |
| **Total Annual Cost** [f] | | **$** | **228,444** [f] | TAC = IDAC |

a. Cost for diesel particulate filter is the average unit price from recent Vantage (2022) and Microsoft Columbia (2022) applications.

b. Shipping costs and instrumentation costs are calculated in accordance to Table 2.4, Section 2.6.4, Chapter 2, Section 1 of EPA Air Pollution Control Cost Manual (APCCM), 7th Edition. Sales tax is calculated using the Washington state sales tax rate. Indirect annual costs are calculated per EPA APCCM Section 1, Chapter 2, 2.6.5.8.

c. Each of the indirect capital costs are calculated following the most conservative approach between the EPA Air Pollution Control Cost Manual - Sixth Edition, Section 6, Chapter 1, Vantage application and Microsoft Columbia application.

d. Capital recovery is calculated using a 7.5% annual interest rate, which is the bank prime rate as of March 2025, and a 25-yr life span for the DPF, following the precedent of the Vantage and CyrusOne permit applications.

e. Indirect annual costs calculated in accordance with EPA Air Pollution Control Cost Manual - Sixth Edition, Section 6, Chapter 1.

f. For direct annual operating cost, it is conservatively assumed that operating labor, supervisory labor, and electricity are negligible since the emission units will not be operated continuously. The cost for maintenance is also conservatively assumed negligible, though the diesel particulate filter will require regular cleaning and maintenance.

**Table D-6c. Criteria Pollutant Control Cost Effectiveness**

| **Annual Control Cost for Diesel Particulate Filter** | | **$ 228,444** | |
|---|---|---|---|
| | **Ecology Acceptable Unit Cost ($/ton)** | **Total Removal (tpy)** | **Cost Effectiveness ($/ton)** |
| Removal efficiency of 85% for PM | $12,000 | 0.72 [a,c] | $ 8,653.06 |
| Removal efficiency of 80% for CO | $5,000 | 0.99 [a,c] | $ 4,960.51 |
| Removal efficiency of 70% for VOC | $12,000 | 0.97 [a,c] | $ 11,612.82 |
| | | Total Reasonable Annual Cost for Combined Pollutants [a,b] | $ 25,226.40 |
| | | Is the control device cost reasonable? | No |

a. Removal efficiencies are consistent with recent Microsoft Columbia and Vantage cost calculations.

b. The total reasonable annual cost compared to the actual annual control cost demonstrates that the control is cost prohibitive. This is consistent with Microsoft Columbia and Vantage applications.

c. "Ecology Acceptable Unit Costs" are consistent with the cost thresholds used in Microsoft Columbia and Vantage applications.

**Table D-6d. Toxic Air Pollutant Control Cost Effectiveness**

| Pollutant[a] | ASIL (µg/m$^3$) | ASIL Based Cost Factor [b] | Ecology Acceptable Unit Cost ($/ton)[c] | Total Removal (tpy) | Reasonable Annual Cost ($/yr)[d] |
|---|---|---|---|---|---|
| Removal efficiency of 70% for Acetaldehyde | 3.70E-01 | 4.9 | $ 51,063 | 1.61E-02 | $ 820.50 |
| Removal efficiency of 70% for Acrolein | 3.50E-01 | 4.9 | $ 51,317 | 6.95E-04 | $ 35.69 |
| Removal efficiency of 70% for Arsenic | 3.00E-04 | 8.0 | $ 83,520 | 3.28E-05 | $ 2.74 |
| Removal efficiency of 70% for Benzene | 1.30E-01 | 5.3 | $ 55,833 | 3.82E-03 | $ 213.38 |
| Removal efficiency of 70% for 1,3-Butadiene | 3.30E-02 | 5.9 | $ 62,085 | 4.46E-03 | $ 276.88 |
| Removal efficiency of 85% for Cadmium | 2.40E-04 | 8.1 | $ 84,537 | 3.74E-05 | $ 3.16 |
| Removal efficiency of 85% for Chromium | 1.00E-01 | 5.4 | $ 57,029 | 1.49E-05 | $ 0.85 |
| Removal efficiency of 85% for Chromium (VI) | 4.00E-06 | 9.8 | $ 103,208 | 2.49E-06 | $ 0.26 |
| Removal efficiency of 85% for Copper | 1.00E+02 | 2.4 | $ 25,529 | 1.02E-04 | $ 2.61 |
| Removal efficiency of 70% for Formaldehyde | 1.70E-01 | 5.2 | $ 54,610 | 3.54E-02 | $ 1,933.65 |
| Removal efficiency of 0% for Hydrogen chloride | 9.00E+00 | 3.5 | $ 36,510 | 0.00E+00 | $ - |
| Removal efficiency of 85% for Manganese | 3.00E-01 | 5.0 | $ 52,020 | 7.72E-05 | $ 4.02 |
| Removal efficiency of 85% for Mercury | 3.00E-02 | 6.0 | $ 62,520 | 4.98E-05 | $ 3.11 |
| Removal efficiency of 70% for Naphthalene | 2.90E-02 | 6.0 | $ 62,674 | 4.04E-04 | $ 25.33 |
| Removal efficiency of 85% for Nickel | 3.80E-03 | 6.9 | $ 71,942 | 9.71E-05 | $ 6.99 |
| Removal efficiency of 70% for Propylene | 3.00E+03 | 1.0 | $ 10,020 | 9.58E-03 | $ 95.99 |
| Removal efficiency of 85% for Selenium | 2.00E+01 | 3.1 | $ 32,869 | 5.48E-05 | $ 1.80 |
| Removal efficiency of 70% for Xylenes | 2.20E+02 | 2.1 | $ 21,934 | 8.70E-04 | $ 19.08 |
| Removal efficiency of 85% for Diesel engine exhaust, particulate | 3.30E-03 | 6.9 | $ 72,585 | 7.21E-01 | $ 52,340.16 |
| Removal efficiency of 0% for Sulfur Dioxide (SO2) | 6.60E+02 | 1.6 | $ 16,924 | 0.00E+00 | $ - |
| Removal efficiency of 80% for Carbon Monoxide (CO) | 2.30E+04 | 0.1 | $ 731 | 9.92E-01 | $ 725.40 |
| Removal efficiency of 0% for Nitrogen Dioxide (NO2) | 4.70E+02 | 1.8 | $ 18,472 | 0.00E+00 | $ - |
| Total Reasonable Annual Cost for Combined Pollutants | | | | | $ 56,511.58 |
| Is the control device cost reasonable? | | | | | No |

a. Removal efficiencies are consistent with recent Microsoft Columbia and Vantage cost calculations.

b. ASIL Based Cost Factor derived from the Hanford Methodology. https://www.osti.gov/servlets/purl/991923 . Cost Factor = $Log_{10}$(27,000 / ASIL)

c. Assumes a maximum ceiling value of $10,500/ton, as described in the Hanford Evaluation of Best Available Control Technology for Toxics (tBACT) Double Sheel Tank Farms Primary Ventilation Systems Supporting Waste Transfer Operations and consistent with other recent data center NOC applications.

d. The total reasonable annual cost compared to the actual annual control cost demonstrates that the control is cost prohibitive. This is consistent with Microsoft Columbia and Vantage applications.

**BACT Cost Analysis for CO, PM and VOC - Diesel Oxidation Catalyst - Main and Support Gensets**

**Table D-7a. Capital Costs**

| **Capital Cost** | **Description** | **Calculated Cost** | | **Reference** |
|---|---|---|---|---|
| *Direct Cost* | | | | |
| | Emission Control Package for 13 Main Engines | $ 1,069,367 | [a] | A |
| | Sales Tax | $ 69,509 | [b] | B = WA State Tax of 6.5% x A |
| | Shipping | $ 53,468.35 | [b] | C = 5% x A |
| | Instrumentation | $ 10,693.67 | [b] | D = 1% x A |
| *Total Direct Cost* | | *$ 1,203,038* | | TDC = A + B + C + D |
| *Indirect Cost* | | | | |
| | Engineering | $ 15,600 | [c] | E |
| | Construction and Field Expenses | $ - | [c] | F |
| | Contractor Fees | $ 81,807 | [c] | G = 6.8% x (A + B + C + D) |
| | Startup | $ 19,500.00 | [c] | H |
| | Performance Test | $ 12,030.38 | [c] | I = 1% x (A + B + C + D) |
| | Other instrumentation | $ 36,091.14 | [c] | J = 3% x (A + B + C + D) |
| *Total Indirect Cost* | | *$ 165,028* | | TIC = E + F + G + H + I + J |
| **Total Capital Investment** | | **$ 1,368,066** | | TCI = TDC + TIC |

**Table D-7b. Operating Costs**

| Operating Cost | | | | Reference |
|---|---|---|---|---|
| *Indirect Annual Costs* [e] | | | | |
| | Administrative Charges | $ | 27,361 [b] | K = 2% × TCI |
| | Property Tax | $ | 13,681 [b] | L = 1% × TCI |
| | Insurance | $ | 13,681 [b] | M = 1% × TCI |
| | Capital Recovery | $ | 122,730.12 [d] | $CRC_S$ = TCI x CRF |
| *Total Indirect Annual Costs* | | $ | *177,453* | IDAC = K + L + M + CRC |
| **Total Annual Cost** [f] | | **$** | **177,453** [f] | TAC = DAC |

a. Cost for diesel oxidation catalyst control package is the average unit price from recent Vantage (2022) and Microsoft Columbia (2022) applications.

b. Shipping costs and instrumentation costs are calculated in accordance to Table 2.4, Section 2.6.4, Chapter 2, Section 1 of EPA Air Pollution Control Cost Manual (APCCM), 7th Edition. Sales tax is calculated using the Washington state sales tax rate. Indirect annual costs are calculated per EPA APCCM Section 1, Chapter 2, 2.6.5.8.

c. Each of the indirect capital costs are calculated following the most conservative approach between the Vantage and Microsoft Columbia applications.

d. Capital recovery is calculated using a 7.5% annual interest rate, which is the bank prime rate as of March 2025, and a 25-yr life span for the DOC, following the precedent of the Vantage and Microsoft Columbia permit applications.

e. Indirect annual costs calculated in accordance with EPA Air Pollution Control Cost Manual - Sixth Edition, Section 6, Chapter 1.

f. For direct annual operating cost, it is conservatively assumed that operating labor, supervisory labor, and electricity are negligible since the emission units will not be operated continuously. The cost for maintenance is also assumed negligible, since diesel oxidation catalyst requires minimal maintenance once properly installed. The cost for catalyst replacement is conservatively assumed to be zero.

**Table D-7c. Criteria Pollutant Control Cost Effectiveness**

| **Annual Control Cost for Diesel Oxidation Catalyst** | | **$ 177,453** | |
|---|---|---|---|
| | **Ecology Acceptable Unit Cost ($/ton)** | **Total Removal (tpy)** | **Reasonable Annual Cost ($/yr)** |
| Removal efficiency of 25% for PM | $12,000 | 0.21 [a,c] | $ 2,545.02 |
| Removal efficiency of 80% for CO | $5,000 | 0.99 [a,c] | $ 4,960.51 |
| Removal efficiency of 70% for VOC | $12,000 | 0.97 [a,c] | $ 11,612.82 |
| Total Reasonable Annual Cost for Combined Pollutants [a,b] | | | $ 19,118.35 |
| Is the control device cost reasonable? | | | No |

a. Removal efficiencies are consistent with recent Microsoft Columbia and Vantage cost calculations.

b. The total reasonable annual cost compared to the actual annual control cost demonstrates that the control is cost prohibitive. This is consistent with Microsoft Columbia and Vantage applications.

c. "Ecology Acceptable Unit Costs" are consistent with the cost thresholds used in Microsoft Columbia and Vantage applications.

**Table D-7d. Toxic Air Pollutant Control Cost Effectiveness**

| Pollutant[a] | ASIL (µg/m³) | ASIL Based Cost Factor [b] | Ecology Acceptable Unit Cost ($/ton)[c] | Total Removal (tpy) | Reasonable Annual Cost ($/yr)[d] |
|---|---|---|---|---|---|
| Removal efficiency of 70% for Acetaldehyde | 3.70E-01 | 4.86 | $ 51,063 | 1.61E-02 | $ 820.50 |
| Removal efficiency of 70% for Acrolein | 3.50E-01 | 4.89 | $ 51,317 | 6.95E-04 | $ 35.69 |
| Removal efficiency of 70% for Arsenic | 3.00E-04 | 7.95 | $ 83,520 | 3.28E-05 | $ 2.74 |
| Removal efficiency of 70% for Benzene | 1.30E-01 | 5.32 | $ 55,833 | 3.82E-03 | $ 213.38 |
| Removal efficiency of 70% for 1,3-Butadiene | 3.30E-02 | 5.91 | $ 62,085 | 4.46E-03 | $ 276.88 |
| Removal efficiency of 25% for Cadmium | 2.40E-04 | 8.05 | $ 84,537 | 1.10E-05 | $ 0.93 |
| Removal efficiency of 25% for Chromium | 1.00E-01 | 5.43 | $ 57,029 | 4.40E-06 | $ 0.25 |
| Removal efficiency of 25% for Chromium (VI) | 4.00E-06 | 9.83 | $ 103,208 | 7.33E-07 | $ 0.08 |
| Removal efficiency of 25% for Copper | 1.00E+02 | 2.43 | $ 25,529 | 3.00E-05 | $ 0.77 |
| Removal efficiency of 70% for Formaldehyde | 1.70E-01 | 5.20 | $ 54,610 | 3.54E-02 | $ 1,933.65 |
| Removal efficiency of 0% for Hydrogen chloride | 9.00E+00 | 3.48 | $ 36,510 | 0.00E+00 | $ - |
| Removal efficiency of 25% for Manganese | 3.00E-01 | 4.95 | $ 52,020 | 2.27E-05 | $ 1.18 |
| Removal efficiency of 25% for Mercury | 3.00E-02 | 5.95 | $ 62,520 | 1.47E-05 | $ 0.92 |
| Removal efficiency of 70% for Naphthalene | 2.90E-02 | 5.97 | $ 62,674 | 4.04E-04 | $ 25.33 |
| Removal efficiency of 25% for Nickel | 3.80E-03 | 6.85 | $ 71,942 | 2.86E-05 | $ 2.06 |
| Removal efficiency of 70% for Propylene | 3.00E+03 | 0.95 | $ 10,020 | 9.58E-03 | $ 95.99 |
| Removal efficiency of 25% for Selenium | 2.00E+01 | 3.13 | $ 32,869 | 1.61E-05 | $ 0.53 |
| Removal efficiency of 70% for Xylenes | 2.20E+02 | 2.09 | $ 21,934 | 8.70E-04 | $ 19.08 |
| Removal efficiency of 25% for Diesel engine exhaust, particulate | 3.30E-03 | 6.91 | $ 72,585 | 2.12E-01 | $ 15,394.16 |
| Removal efficiency of 0% for Sulfur Dioxide (SO2) | 6.60E+02 | 1.61 | $ 16,924 | 0.00E+00 | $ - |
| Removal efficiency of 80% for Carbon Monoxide (CO) | 2.30E+04 | 0.07 | $ 731 | 9.92E-01 | $ 725.40 |
| Removal efficiency of 0% for Nitrogen Dioxide (NO2) | 4.70E+02 | 1.8 | $ 18,472 | 0.00E+00 | $ - |
| Total Reasonable Annual Cost for Combined Pollutants | | | | | $ 19,549.49 |
| Is the control device cost reasonable? | | | | | No |

a. Removal efficiencies are consistent with recent Microsoft Columbia and Vantage cost calculations.

b. ASIL Based Cost Factor derived from the Hanford Methodology. https://www.osti.gov/servlets/purl/991923 . Cost Factor = $Log_{10}$(27,000 / ASIL)

c. Assumes a maximum ceiling value of $10,500/ton, as described in the Hanford Evaluation of Best Available Control Technology for Toxics (tBACT) Double Sheel Tank Farms Primary Ventilation Systems Supporting Waste Transfer Operations and consistent with other recent data center NOC applications.

d. The total reasonable annual cost compared to the actual annual control cost demonstrates that the control is cost prohibitive. This is consistent with Microsoft Columbia and Vantage applications.

**BACT Cost Analysis for CO, PM, $NO_X$ and VOC - Tier 4 Integrated Control Package - Main and Support Gensets**

**Table D-8a. Capital Costs**

| Capital Cost | Description | Calculated Cost | Reference |
|---|---|---|---|
| *Direct Cost* | | | |
| | Emission Control Package for 13 Main Engines | $ 2,838,524 [a] | A |
| | Sales Tax | $ 184,504 [b] | B = WA State Tax of 6.5% x A |
| | Shipping | $ 141,926.20 [b] | C = 5% x A |
| | Instrumentation | $ 28,385.24 [b] | D = 1% x A |
| *Total Direct Cost* | | $ *3,193,340* | TDC = A + B + C + D |
| *Indirect Cost* | | | |
| | Engineering | $ 65,000 [c] | E |
| | Construction and Field Expenses | $ 39,000 [c] | F |
| | Contractor Fees | $ 217,147 [c] | G = 6.8% x (A + B + C + D) |
| | Startup | $ 39,000.00 [c] | H |
| | Performance Test | $ 31,933.40 [c] | I = 1% x (A + B + C + D) |
| | Contingencies | $ 319,333.95 [c] | J = 10% x (A + B + C + D) |
| *Total Indirect Cost* | | $ *711,414* | TIC = E + F + G + H + I + J |
| **Total Capital Investment** | | **$ 3,904,754** | TCI = TDC + TIC |

**Table D-8b. Operating Costs**

| Operating Cost | | | | Reference |
|---|---|---|---|---|
| *Indirect Annual Costs* | | | | |
| | Administrative Charges | $ 78,095 | b | K = 2% × TCI |
| | Property Tax | $ 39,048 | b | L = 1% × TCI |
| | Insurance | $ 39,048 | b | M = 1% × TCI |
| | Capital Recovery | $ 350,298.10 | d | $CRC_S$ = TCI x CRF |
| *Total Indirect Annual Costs* | | $ *506,488* | | IDAC = K + L + M + CRC |
| **Total Annual Cost** [e] | | **$ 506,488** | e | TAC = IDAC |

a. Cost for tier 4 integrated control package is the average unit price from recent Vantage (2022) and Microsoft Columbia (2022) applications.

b. Shipping costs and instrumentation costs are calculated in accordance to Table 2.4, Section 2.6.4, Chapter 2, Section 1 of EPA Air Pollution Control Cost Manual (APCCM), 7th Edition. Sales tax is calculated using the Washington state sales tax rate. Indirect annual costs are calculated per EPA APCCM Section 1, Chapter 2, 2.6.5.8.

c. Each of the indirect capital costs are calculated following the most conservative approach between the Vantage and Microsoft Columbia applications.

d. Capital recovery is calculated using a 7.5% annual interest rate, which is the bank prime rate as of March 2025, and a 25-yr life span for the DPF, following the precedent of the Vantage and Microsoft Columbia permit applications.

e. For annual operating cost, it is conservatively assumed that operating labor, supervisory labor, and electricity are negligible since the emission units will not be operated continuously. The cost for maintenance is also conservatively assumed negligible.

**Table D-8c. Criteria Pollutant Control Cost Effectiveness**

| **Annual Control Cost for Diesel Oxidation Catalyst** | | **$ 506,488** | | |
|---|---|---|---|---|
| | **Ecology Acceptable Unit Cost ($/ton)** | **Total Removal (tpy)** | | **Reasonable Annual Cost ($/yr)** |
| Removal efficiency of 85% for PM | $12,000 | 0.72 | a,c | $ 8,653.06 |
| Removal efficiency of 80% for CO | $5,000 | 0.99 | a,c | $ 4,960.51 |
| Removal efficiency of 70% for VOC | $12,000 | 0.97 | a,c | $ 11,612.82 |
| Removal efficiency of 90% for NOx | $12,000 | 8.63 | a,c | $ 103,611.32 |
| | | Total Reasonable Annual Cost for Combined Pollutants | a,b | $ 128,837.71 |
| | | Is the control device cost reasonable? | | No |

a. Removal efficiencies are consistent with recent Microsoft Columbia and Vantage cost calculations.

b. The total reasonable annual cost compared to the actual annual control cost demonstrates that the control is cost prohibitive. This is consistent with Microsoft Columbia and Vantage applications.

c. "Ecology Acceptable Unit Costs" are consistent with the cost thresholds used in Microsoft Columbia and Vantage applications.

**Table D-8d. Toxic Air Pollutant Control Cost Effectiveness**

| Pollutant [a] | ASIL (μg/m$^3$) | ASIL Based Cost Factor [b] | Ecology Acceptable Unit Cost ($/ton) [c] | Total Removal (tpy) | Reasonable Annual Cost ($/yr) [d] |
|---|---|---|---|---|---|
| Removal efficiency of 70% for Acetaldehyde | 3.70E-01 | 4.86 | $ 51,063 | 1.61E-02 | $ 820.50 |
| Removal efficiency of 70% for Acrolein | 3.50E-01 | 4.89 | $ 51,317 | 6.95E-04 | $ 35.69 |
| Removal efficiency of 70% for Arsenic | 3.00E-04 | 7.95 | $ 83,520 | 3.28E-05 | $ 2.74 |
| Removal efficiency of 70% for Benzene | 1.30E-01 | 5.32 | $ 55,833 | 3.82E-03 | $ 213.38 |
| Removal efficiency of 70% for 1,3-Butadiene | 3.30E-02 | 5.91 | $ 62,085 | 4.46E-03 | $ 276.88 |
| Removal efficiency of 85% for Cadmium | 2.40E-04 | 8.05 | $ 84,537 | 3.74E-05 | $ 3.16 |
| Removal efficiency of 85% for Chromium | 1.00E-01 | 5.43 | $ 57,029 | 1.49E-05 | $ 0.85 |
| Removal efficiency of 85% for Chromium (VI) | 4.00E-06 | 9.83 | $ 103,208 | 2.49E-06 | $ 0.26 |
| Removal efficiency of 85% for Copper | 1.00E+02 | 2.43 | $ 25,529 | 1.02E-04 | $ 2.61 |
| Removal efficiency of 70% for Formaldehyde | 1.70E-01 | 5.20 | $ 54,610 | 3.54E-02 | $ 1,933.65 |
| Removal efficiency of 0% for Hydrogen chloride | 9.00E+00 | 3.48 | $ 36,510 | 0.00E+00 | $ - |
| Removal efficiency of 85% for Manganese | 3.00E-01 | 4.95 | $ 52,020 | 7.72E-05 | $ 4.02 |
| Removal efficiency of 85% for Mercury | 3.00E-02 | 5.95 | $ 62,520 | 4.98E-05 | $ 3.11 |
| Removal efficiency of 70% for Naphthalene | 2.90E-02 | 5.97 | $ 62,674 | 4.04E-04 | $ 25.33 |
| Removal efficiency of 85% for Nickel | 3.80E-03 | 6.85 | $ 71,942 | 9.71E-05 | $ 6.99 |
| Removal efficiency of 70% for Propylene | 3.00E+03 | 0.95 | $ 10,020 | 9.58E-03 | $ 95.99 |
| Removal efficiency of 85% for Selenium | 2.00E+01 | 3.13 | $ 32,869 | 5.48E-05 | $ 1.80 |
| Removal efficiency of 70% for Xylenes | 2.20E+02 | 2.09 | $ 21,934 | 8.70E-04 | $ 19.08 |
| Removal efficiency of 85% for Diesel engine exhaust, particulate | 3.30E-03 | 6.91 | $ 72,585 | 7.21E-01 | $ 52,340.16 |
| Removal efficiency of 0% for Sulfur Dioxide (SO2) | 6.60E+02 | 1.61 | $ 16,924 | 0.00E+00 | $ - |
| Removal efficiency of 80% for Carbon Monoxide (CO) | 2.30E+04 | 0.07 | $ 731 | 9.92E-01 | $ 725.40 |
| Removal efficiency of 90% for Nitrogen Dioxide (NO2) | 4.70E+02 | 1.76 | $ 18,472 | 8.63E-01 | $ 15,949.49 |
| Total Reasonable Annual Cost for Combined Pollutants | | | | | $ 72,461.06 |
| Is the control device cost reasonable? | | | | | No |

a. Removal efficiencies are consistent with recent Microsoft Columbia and Vantage cost calculations.

b. ASIL Based Cost Factor derived from the Hanford Methodology. https://www.osti.gov/servlets/purl/991923 . Cost Factor = $Log_{10}$(27,000 / ASIL)

c. Assumes a maximum ceiling value of $10,500/ton, as described in the Hanford Evaluation of Best Available Control Technology for Toxics (tBACT) Double Shell Tank Farms Primary Ventilation Systems Supporting Waste Transfer Operations and consistent with other recent data center NOC applications.

d. The total reasonable annual cost compared to the actual annual control cost demonstrates that the control is cost prohibitive. This is consistent with Microsoft Columbia and Vantage applications.

# APPENDIX E. AERMOD MODELING PARAMETERS

**Table E-1. For Each Main Genset - Criteria Pollutant Model Parameters**

| Load | Flow Rate (acfm) | Diameter (ft) | Height (ft) | Temp (K) | Exit Velocity (m/s) |
|---|---|---|---|---|---|
| 100% | 16,429 | 1.51 | 60 | 717.09 | 46.66 |
| 75% | 14,037 | 1.51 | 60 | 698.82 | 39.86 |
| 50% | 10,860 | 1.51 | 60 | 673.15 | 30.84 |
| 25% | 6,770 | 1.51 | 60 | 654.09 | 19.23 |
| 10% | 4,259 | 1.51 | 60 | 556.98 | 12.09 |

| Load | Maximum Hourly Emission Rate, Warm Engine (lb/hr/engine) | | | Maximum Hourly Emission Rate, Cold Start (lb/hr/engine) | | | Annual Emission Rate (tpy/engine) | | |
|---|---|---|---|---|---|---|---|---|---|
| | $NO_X$ | $PM_{10}/PM_{2.5}$ | CO | $NO_X$ | $PM_{10}/PM_{2.5}$ | CO | $NO_X$ | $PM_{10}/PM_{2.5}$ | CO |
| 100% | 62.27 | 0.64 | 6.40 | 62.20 | 1.67 | 7.25 | 0.79 | 0.02 | 0.09 |
| 75% | 32.27 | 1.12 | 3.60 | 32.24 | 2.18 | 4.08 | 0.41 | 0.03 | 0.05 |
| 50% | 21.35 | 0.51 | 6.53 | 21.33 | 1.53 | 7.40 | 0.27 | 0.02 | 0.10 |
| 25% | 10.85 | 0.60 | 3.46 | 10.83 | 1.62 | 3.93 | 0.14 | 0.02 | 0.05 |
| 10% | 7.02 | 0.48 | 4.77 | 7.01 | 1.50 | 5.41 | 0.09 | 0.02 | 0.07 |

| Load | Maximum Hourly Modeled Emission Rate (g/s/engine) | | | | Annual Modeled Emission Rate (g/s/engine) | | |
|---|---|---|---|---|---|---|---|
| | $NO_X$ | $PM_{10}/PM_{2.5}$ | CO | $SO_2$ | $NO_X$ | $PM_{2.5}$ | CO |
| 100% | 7.85E+00 | 2.10E-01 | 9.13E-01 | 5.54E-03 | 2.28E-02 | 6.49E-04 | 2.69E-03 |
| 75% | 4.07E+00 | 2.75E-01 | 5.14E-01 | 4.16E-03 | 1.18E-02 | 8.37E-04 | 1.51E-03 |
| 50% | 2.69E+00 | 1.92E-01 | 9.33E-01 | 2.77E-03 | 7.81E-03 | 5.96E-04 | 2.74E-03 |
| 25% | 1.37E+00 | 2.04E-01 | 4.95E-01 | 1.39E-03 | 3.97E-03 | 6.31E-04 | 1.46E-03 |
| 10% | 8.85E-01 | 1.89E-01 | 6.81E-01 | 5.54E-04 | 2.57E-03 | 5.87E-04 | 2.00E-03 |

**Table E-2. DPM Load Analysis Parameters - Building E Additional Gensets**

| Operation Load | Flow Rate [1] | Diameter | Exit Velocity | Temperature [a] | Stack Height | DPM Maximum Hourly Emission Rate [1] | | DPM Maximum Hourly Emission Rate, Cold Start [1] | | DPM Annual Emissions | Maximum Annualized Modeled Emission Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (acfm) | (m) | (m/s) | (K) | (ft) | (lb/hr/engine ) | (g/s/engine) | (lb/hr/engine) | (g/s/engine) | (lb/yr/engine) | (g/s/engine) |
| **Cummins QSK60-G26** | | | | | | | | | | | |
| 10% | 4,384 | 0.46 | 12.44969289 | 641 | 60 | 0.18 | 2.31E-02 | 0.19 | 2.43E-02 | 4.94 | 7.10E-05 |
| 25% | 6,823 | 0.46 | 19.38 | 748 | 60 | 0.39 | 4.91E-02 | 0.41 | 5.18E-02 | 10.52 | 1.51E-04 |
| 50% | 10,860 | 0.46 | 30.84 | 784 | 60 | 0.41 | 5.14E-02 | 0.43 | 5.42E-02 | 11.02 | 1.59E-04 |
| 75% | 14,796 | 0.46 | 42.02 | 773 | 60 | 0.24 | 3.02E-02 | 0.25 | 3.19E-02 | 6.48 | 9.32E-05 |
| 100% | 19,205 | 0.46 | 54.54 | 799 | 60 | 0.64 | 8.06E-02 | 0.67 | 8.50E-02 | 17.26 | 2.48E-04 |
| **Cummins QSK60-G14** | | | | | | | | | | | |
| 10% | 4,403 | 0.46 | 12.50364913 | 595 | 60 | 0 | 6.11E-02 | 0.51 | 6.44E-02 | 13.08 | 1.88E-04 |
| 25% | 6,770 | 0.46 | 19.23 | 661 | 60 | 0.56 | 7.09E-02 | 0.59 | 7.48E-02 | 15.19 | 2.19E-04 |
| 50% | 11,174 | 0.46 | 31.73 | 711 | 60 | 0.51 | 6.37E-02 | 0.53 | 6.71E-02 | 13.64 | 1.96E-04 |
| 75% | 14,037 | 0.46 | 39.86 | 729 | 60 | 0.32 | 4.04E-02 | 0.34 | 4.26E-02 | 8.65 | 1.24E-04 |
| 100% | 16,429 | 0.46 | 46.66 | 751 | 60 | 0.57 | 7.20E-02 | 0.60 | 7.59E-02 | 15.42 | 2.22E-04 |
| **Rehlko KD2250[1,4]** | | | | | | | | | | | |
| 10% | 4,427 | 0.46 | 12.57 | 608 | 60 | 0.23 | 2.92E-02 | 0.24 | 3.08E-02 | 6.25 | 8.99E-05 |
| 25% | 7,200 | 0.46 | 20.45 | 683 | 60 | 0.47 | 5.90E-02 | 0.49 | 6.22E-02 | 12.65 | 1.82E-04 |
| 50% | 11,950 | 0.46 | 33.94 | 673 | 60 | 0.36 | 4.51E-02 | 0.38 | 4.76E-02 | 9.67 | 1.39E-04 |
| 75% | 17,221 | 0.46 | 48.90 | 718 | 60 | 0.70 | 8.85E-02 | 0.74 | 9.34E-02 | 18.97 | 2.73E-04 |
| 100% | 17,715 | 0.46 | 50.31 | 723 | 60 | 0.33 | 4.17E-02 | 0.35 | 4.39E-02 | 8.93 | 1.28E-04 |
| **Rehlko KD2500[1,5]** | | | | | | | | | | | |
| 10% | 4,603 | 0.46 | 13.07 | 618 | 60 | 0.28 | 3.53E-02 | 0.29 | 3.72E-02 | 7.55 | 1.09E-04 |
| 25% | 7,546 | 0.46 | 21.43 | 688 | 60 | 0.60 | 7.50E-02 | 0.63 | 7.91E-02 | 16.07 | 2.31E-04 |
| 50% | 12,735 | 0.46 | 36.16 | 673 | 60 | 0.51 | 6.38E-02 | 0.53 | 6.72E-02 | 13.66 | 1.96E-04 |
| 75% | 18,402 | 0.46 | 52.26 | 738 | 60 | 1.12 | 1.41E-01 | 1.18 | 1.48E-01 | 30.13 | 4.33E-04 |
| 100% | 18,617 | 0.46 | 52.87 | 743 | 60 | 0.30 | 3.75E-02 | 0.31 | 3.95E-02 | 8.03 | 1.16E-04 |
| **Cat 3516C - 2250** | | | | | | | | | | | |
| 10% | 4,259 | 0.46 | 12.09 | 557 | 60 | 0.30 | 3.78E-02 | 0.32 | 3.99E-02 | 8.10 | 1.16E-04 |
| 25% | 6,779 | 0.46 | 19.25 | 654 | 60 | 0.30 | 3.78E-02 | 0.32 | 3.99E-02 | 8.10 | 1.16E-04 |
| 50% | 11,023 | 0.46 | 31.30 | 685 | 60 | 0.30 | 3.78E-02 | 0.32 | 3.99E-02 | 8.10 | 1.16E-04 |
| 75% | 14,428 | 0.46 | 40.97 | 699 | 60 | 0.28 | 3.53E-02 | 0.30 | 3.72E-02 | 7.56 | 1.09E-04 |
| 100% | 17,407 | 0.46 | 49.43 | 717 | 60 | 0.31 | 3.91E-02 | 0.33 | 4.12E-02 | 8.37 | 1.20E-04 |
| **Cat 3516C - 2500** | | | | | | | | | | | |
| 10% | 4,428 | 0.46 | 12.58 | 568 | 60 | 0.31 | 3.91E-02 | 0.33 | 4.12E-02 | 8.37 | 1.20E-04 |
| 25% | 7,274 | 0.46 | 20.66 | 662 | 60 | 0.31 | 3.91E-02 | 0.33 | 4.12E-02 | 8.37 | 1.20E-04 |
| 50% | 11,701 | 0.46 | 33.23 | 686 | 60 | 0.29 | 3.65E-02 | 0.31 | 3.85E-02 | 7.83 | 1.13E-04 |
| 75% | 15,126 | 0.46 | 42.95 | 702 | 60 | 0.27 | 3.40E-02 | 0.28 | 3.59E-02 | 7.29 | 1.05E-04 |
| 100% | 18,497 | 0.46 | 52.53 | 729 | 60 | 0.41 | 5.17E-02 | 0.43 | 5.45E-02 | 11.07 | 1.59E-04 |

**Table E-3. TAP Model Emission Rates - Building E Additional Genset**

| Pollutant | Averaging Period | Emission Rate (g/s) |
|---|---|---|
| Acrolein | 24-hr | 7.56E-04 |
| Arsenic | year | 1.04E-07 |
| 1,3-Butadiene | year | 1.41E-05 |
| Cadmium | year | 9.73E-08 |
| Chromium | 24-hr | 1.34E-05 |
| Chromium (VI) | year | 6.48E-09 |
| Formaldehyde | year | 1.12E-04 |
| Hydrogen chloride | 24-hr | 4.15E-03 |
| Manganese | 24-hr | 6.91E-05 |
| Mercury | 24-hr | 4.46E-05 |
| Diesel engine exhaust, particulate | year | 1.88E-03 |
| CO | 1-hr | 9.33E-01 |
| NO2 | 1-hr | 7.85E+00 |

**Table E-4. Modeled Rectangular Buildings**

| Model ID | Description | UTM X (m) | UTM Y (m) | Elevation (m) | Height (m) | X Length (m) | Y Length (m) | Angle (Degrees) |
|---|---|---|---|---|---|---|---|---|
| BUILD_D | Building D | 286910.1 | 5236112.2 | 395.5 | 8.08 | 158.2 | 80.6 | 2.9 |

**Table E-5. Modeled Polygon Buildings**

| Model ID | Description | UTM X (m) | UTM Y (m) | Elevation (m) | Height (m) |
|---|---|---|---|---|---|
| BUILD_C | Existing Building | 286884 | 5236274 | 397.01 | 8.53 |
| BUILD_B | Existing Building | 287223 | 5236464.95 | 397.33 | 8.53 |
| BUILD_A | Existing Building | 287218.45 | 5236317.87 | 396.06 | 8.53 |
| DWALLE | Genset Enclosure - Building D, East Side | 287072.7 | 5236189.7 | 395.62 | 3.66 |
| DWALLW | Genset Enclosure - Building D, West Side | 286877.6 | 5236202.8 | 396.4 | 3.66 |
| DWALLSW | Genset Enclosure - Building D, Southwest Side | 286911 | 5236112.6 | 395.5 | 3.66 |
| DWALLSE | Genset Enclosure - Building D, Southeast Side | 287001.7 | 5236106.9 | 395.03 | 3.66 |
| BUILD_E | Existing Building | 286578.1 | 5236377.8 | 398.14 | 6.1 |
| EWALL_NW | Genset Enclosure - Building E, Northwest Side | 286576.9 | 5236380 | 398.17 | 3.05 |
| EWALL_NE | Genset Enclosure - Building E, | 286808 | 5236273.7 | 397.11 | 3.05 |
| EWALL_SW | Genset Enclosure - Building E, Southwest Side | 286569.1 | 5236188.1 | 396.55 | 3.05 |
| EWALL_SE | Genset Enclosure - Building E, Southeast Side | 286804.3 | 5236178.5 | 396.35 | 3.05 |

**Table E-6. Model Background Concentrations**

| Pollutant | Averaging Period | Background Concentration/ Use [a,b,c] | Units | Background Concentration ($\mu g/m^3$) |
|---|---|---|---|---|
| $NO_2$ | 1-hr | N/A | N/A | N/A |
| | Annual | 3.00 | ppb | 5.6 |
| $PM_{10}$ | 24-hr | 77.85 | $\mu g/m^3$ | 77.9 |
| $PM_{2.5}$ | 24-hr | 18.49 | $\mu g/m^3$ | 18.5 |
| | Annual | 5.69 | $\mu g/m^3$ | 5.7 |
| CO | 1-hr | 1.13 | ppm | 1293.6 |
| | 8-hr | 0.79 | ppm | 904.4 |
| O3 | PVMRM | 51.97 | ppb | 101.9 |
| | 8-hr | 57.55 | ppb | 112.9 |
| $SO_2$ | 1-hr | 3.05 | ppb | 8.0 |
| | 3-hr | 5.60 | ppb | 14.7 |
| | 24-hr | 0.93 | ppb | 2.4 |
| | Annual | 0.17 | ppb | 0.4 |
| DPM | Annual | 0.14 | $\mu g/m^3$ | 0.14 |

a. Background concentrations for models are determined using the NW-AIRQUEST database tool. https://idahodeq.maps.arcgis.com/apps/MapSeries/index.html?appid=0c8a006e11fe4ec5939804b873098dfe

b. Time varying $NO_2$ background concentrations were used to quantify $NO_2$ 1-hr total impacts, as described in Section 6.10.1.1 of the associated NOC application report.

c. Background concentration for DPM are consistent with the NOC application submitted for Approval Order No. 20AQ-E022.

**Table E-7. Secondary $PM_{2.5}$ Calculations**

| Precursor Pollutant | Precursor Project Emissions [a] (tpy) | MERP Modeled Emissions (tpy) | Maximum Concentration [b] | |
|---|---|---|---|---|
| | | | $PM_{2.5}$ - Daily ($\mu g/m^3$) | $PM_{2.5}$ - Annual ($\mu g/m^3$) |
| $NO_X$ | 39.16 | 500 | 3.39E-03 | 1.95E-04 |
| $SO_2$ | 0.03 | 500 | 2.91E-05 | 5.18E-07 |
| | | **Total** | 3.42E-03 | 1.96E-04 |

a. The listed precursor emissions are the worst-case project emissions among all operating scenarios.

b. The modeled emission rate precursor concentrations are determined by scaling the project emission rate by the modeled air quality impact from the Klickitat County, WA modeled source as shown in Equation 1, *Clarification on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program (2024):*

**Equation 1:** Project Air Quality Impact = Project emission rate x Modeled air quality impact from hypothetical source / Modeled emission rate from hypothetical source

Note that total Building E emissions are conservatively used for the "project" emissions for the purpose of determining secondary PM2.5 impacts.

"MaxConc" values are shown below per the MERPs View Qlik tool:

| | Daily $PM_{2.5}$ | Annual $PM_{2.5}$ |
|---|---|---|
| $NO_x$ | 0.04333 | 0.00249 |
| $SO_2$ | 0.49867 | 0.00887 |

# APPENDIX F. AERMOD LOAD ANALYSIS RESULTS

**Table F-1. Maximum Modeled Concentrations**

| Pollutant | Averaging Period | Maximum Modeled Concentration (µg/m$^3$) | | | | |
|---|---|---|---|---|---|---|
| | | MAIN10 | MAIN25 | MAIN50 | MAIN75 | MAIN100 |
| CO | 8-HR | 335.29 | 197.38 | 262.63 | 126.29 | 201.51 |
| CO | 1-HR | 755.53 | 397.18 | 521.96 | 242.60 | 380.93 |
| $NO_2$ | ANNUAL | 0.21 | 0.23 | 0.32 | 0.40 | 0.67 |
| $NO_2$ | 1-HR | 959.62 | 1,079.90 | 1,478.18 | 1,850.60 | 3,167.60 |
| $PM_{10}$ | 24-HR | 49.61 | 42.98 | 30.24 | 35.54 | 25.38 |
| $PM_{2.5}$ | ANNUAL | 0.04 | 0.03 | 0.02 | 0.03 | 0.02 |
| $PM_{2.5}$ | 24-HR | 32.13 | 23.85 | 17.22 | 21.79 | 15.25 |
| $SO_2$ | 3-HR | 0.55 | 0.93 | 1.15 | 1.39 | 1.65 |
| $SO_2$ | 1-HR | 0.61 | 1.11 | 1.53 | 1.93 | 2.26 |
| TAPS | 1-HR | 62,502.60 | 45,931.11 | 55,507.29 | 72,059.65 | 74,648.05 |
| TAPS | 24-HR | 17,467.48 | 14,318.87 | 21,170.79 | 29,976.75 | 32,763.54 |
| TAPS | ANNUAL | 3,992.22 | 2,945.41 | 3,582.40 | 4,506.74 | 4,595.90 |

**Table F-2. Individual Engine Load Analysis Results at Worst Case Load for $PM_{2.5}$, $PM_{10}$, and $NO_x$**

| Engine ID | Maximum Modeled Concentration (µg/m3) | | |
|---|---|---|---|
| | $PM_{2.5}$ 24-hr 10% Load | $PM_{10}$ 24-hr 10% Load | $NO_x$ 1-hr 100% Load |
| E41 | 5.00 | 7.22 | 3.66E+02 |
| E42 | 5.17 | 6.31 | 3.79E+02 |
| E43 | 8.25 | 9.94 | 5.91E+02 |
| E44 | 8.62 | 11.71 | 7.42E+02 |
| E45 | 11.33 | 17.00 | 1.04E+03 |
| E46 | 12.30 | 16.96 | 1.29E+03 |
| E47 | 5.59 | 7.66 | 3.55E+02 |
| E48 | 4.69 | 6.70 | 3.11E+02 |
| E49 | 13.54 | 18.75 | 7.55E+02 |
| E50 | 5.89 | 7.52 | 3.71E+02 |
| E51 | 7.02 | 8.97 | 3.60E+02 |
| E52 | 8.47 | 13.05 | 6.91E+02 |
| E53 | 7.08 | 10.42 | 5.35E+02 |

**Table F-3. Summary of DPM Load Analysis Results**

| Engine Model | Maximum Concentration (µg/m3) | Worst-Case Operating Load |
|---|---|---|
| Caterpillar 3516C-2250 | 8.33E-03 | 10% |
| Caterpillar 3516C-2500 | 8.42E-03 | 10% |
| Rehlko KD2250 | 8.77E-03 | 25% |
| Rehlko KD2500 | 1.07E-02 | 25% |
| Cummins QSK60-G14 | 1.30E-02 | 10% |
| Cummins QSK60-G26 | 7.28E-03 | 25% |

# APPENDIX G. ELECTRONIC MODEL FILES

Files are attached electronically. A directory of files is provided below.

**Table G-1. Modeling Files Directory**

| Folder | File Name | Description |
|---|---|---|
| \BPIP | Bpip input file<br>Bpip output file<br>Bpip summary file | Files for BPIP inputs and outputs. |
| \Load Analysis\CO | CL1923.ami<br>CL1923.aml | AERMOD input and output files for the CO load analysis. |
| \Load Analysis\DPM | *Model*.ami<br>*Model*.aml | AERMOD input and output files for the DPM load analysis for each of the 2 main gensets being considered. File names are specified using the make and model of the given modeled engine. |
| \Load Analysis\NOx | NL1923_Ann.ami<br>NL1923_Ann.aml<br>NL1923.ami<br>NL1923.aml | AERMOD input and output files for the $NO_2$ load analysis. |
| \Load Analysis\PM | PM2.5_PL1923.ami<br>PM2.5_PL1923.aml<br>PM2.5_PL1923_Ann.ami<br>PM2.5_PL1923_Ann.aml<br>PM10_PL1923.ami<br>PM10_PL1923.aml | AERMOD input and output files for the $PM_{2.5}$/$PM_{10}$ load analysis. |
| \Load Analysis\SO2 | SL1923.ami<br>SL1923.aml | AERMOD input and output files for the $SO_2$ load analysis. |
| \Load Analysis\TAP | TL1923.ami<br>TL1923.aml | AERMOD input and output files for the TAP load analysis. |
| \MET Data | Quincy_MWH_Spokane_1923.PFL<br>Quincy_MWH_Spokane_1923.SFC | Meteorological files as inputs to AERMOD, including the surface file and upper air file. |
| \Monte Carlo Script | MonteCarlo_script_parallel_processing_June2023.R<br>Modified $PM_{10}$ Monte Carlo Script.R | A copy of the Monte Carlo script provided by Ecology, which is used to execute the Monte Carlo analysis for both $NO_2$ and $PM_{2.5}$. A modified copy of the Monte Carlo script for $PM_{10}$ is also included. |
| \NAAQS Models\NO2 | NN1923_allgens_half1.ami<br>NN1923_allgens_half1.aml<br>NN1923_allgens_half2.ami<br>NN1923_allgens_half2.aml<br>NN1923_EYY_half1.ami<br>NN1923_EYY_half1.aml<br>NN1923_EYY_half2.ami<br>NN1923_EYY_half2.aml | AERMOD input and output files for the $NO_2$ NAAQS models for each of the 6 highest-contributing gensets, determined using the $NO_2$ load analysis. "YY" indicates the model ID of the particular genset. Due to the size of the models, the receptor grid was split in half (h1 and h2) and two iterations of the models were run. The maximum of the two analyses was presented in the results. |
| \NAAQS Models\NO2\R | MC_NO2_half1_output.csv<br>MC_NO2_half2_output.csv | Output file from the Monte Carlo Analysis for the two iterations of the analyses. |

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| | NO2_eYY_100_month_h1.mxd<br>NO2_eYY_100_month_h2.mxd | Max daily output file from AERMOD for each of the 6 highest-contributing gensets, determined using the $NO_2$ load analysis. These engines are used to represent the monthly testing of all gensets, per the model procedures outlined in Section 6 of this report. "YY" indicates the model ID of the particular genset. |
| | NO2_allgens_h1.mxd<br>NO2_allgens_h2.mxd | Max daily output file from AERMOD for the operating scenario where all gensets operate simultaneously for emergency operations, per the model procedures outlined in Section 6 of this report. |
| | NO2_eYY_100_h1.mxd<br>NO2_eYY_100_h2.mxd | Max daily output file from AERMOD for each of the 6 highest-contributing gensets, determined using the $NO_2$ load analysis. These files remaining maintenance and testing hours (54 days total) divided equally between the 6 highest-contributing generators, per the model procedures outlined in Section 6 of this report. |
| | postfile_days_array.csv | File containing the index of Monte Carlo input files for use in the R script. |
| | r_sabey_NO2_half1.R<br>r_sabey_NO2_half2.R | R script containing the command lines for executing the Monte Carlo script provided by Ecology. |
| \NAAQS Models\PM2.5 | PM2.5_24HR_N1923.ami<br>PM2.5_24HR_N1923.aml | AERMOD input and output files for the $PM_{2.5}$ NAAQS model. |
| \NAAQS Models\PM2.5\R | MC_PM25_output.csv | Output file from the Monte Carlo Analysis |
| | Pm25_eYY_month.bin | Binary post output file from AERMOD for each of the 6 highest-contributing gensets, determined using the $PM_{2.5}$ load analysis. These engines are used to represent the monthly testing of all gensets, per the model procedures outlined in Section 6 of this report. "YY" indicates the model ID. |
| | Pm25_all.bin | Binary post output file from AERMOD for the operating scenario where all gensets operate simultaneously for emergency operations, per the model procedures outlined in Section 6 of this report. |
| | Pm25_e49.bin | Binary post output file from AERMOD for the highest-contributing genset (model ID E49, 10% load). This file represents the operating scenario for maintenance and load testing for each genset, per the model procedures outlined in Section 6 of this report. |
| | Sabey_Receptors.txt | Text file containing receptors for use with binary output files in the Monte Carlo R script. |
| | postfile_days_array.csv | File containing the index of Monte Carlo input files for use in the R script. |
| | R_sabey_PM25.R | R script containing the command lines for executing the Monte Carlo script provided by Ecology. |
| \NAAQS Models\PM10 | PM10_24HR_N1923.ami<br>PM10_24HR_N1923.out | AERMOD input and output files for the $PM_{10}$ NAAQS model. |
| | MC_PM10_output.csv | Output file from the Monte Carlo Analysis |

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| \NAAQS Models\PM10\R | Pm10_eYY_month.bin | Binary post output file from AERMOD for each of the 6 highest-contributing gensets, determined using the $PM_{10}$ load analysis. These engines are used to represent the monthly testing of all gensets, per the model procedures outlined in Section 6 of this report. "YY" indicates the model ID. |
| | Pm10_all.bin | Binary post output file from AERMOD for the operating scenario where all gensets operate simultaneously for emergency operations, per the model procedures outlined in Section 6 of this report. |
| | Pm10_e49.bin | Binary post output file from AERMOD for the highest-contributing genset (model ID E49, 10% load). This file represents the operating scenario for maintenance and load testing for each genset, per the model procedures outlined in Section 6 of this report. |
| | Sabey_Receptors.txt | Text file containing receptors for use with binary output files in the Monte Carlo R script. |
| | postfile_days_array.csv | File containing the index of Monte Carlo input files for use in the R script. |
| | R_sabey_PM10.R | R script containing the command lines for executing the Monte Carlo script provided by Ecology. |
| \TAP Models\Acrolein | Acrolein1923.ami<br>Acrolein1923.aml | AERMOD input and output files for the Acrolein TAP model. |
| \TAP Models\Arsenic | Arsenic*xx*.ami<br>Arsenic*xx*.aml | AERMOD input and output files for the Acrolein TAP model. Model years are indicated by "*xx*" among 2019-2023. |
| \TAP Models\1,3-Butadiene | BT*xx*.ami<br>BT*xx*.aml | AERMOD input and output files for the 1,3-Butadiene TAP models. Model years are indicated by "*xx*" among 2019-2023. |
| \TAP Models\Cadium | Cadmium*xx*.ami<br>Cadmium*xx*.aml | AERMOD input and output files for the Cadmium TAP models. Model years are indicated by "*xx*" among 2019-2023. |
| \TAP Models\Chromium | Chromium*xx*.ami<br>Chromium*xx*.aml | AERMOD input and output files for the Chromium TAP models. Model years are indicated by "*xx*" among 2019-2023. |
| \TAP Models\Chromium VI | Chromium1923.ami<br>Chromium1923.aml | AERMOD input and output files for the Chromium VI TAP model. |
| \TAP Models\CO | CT*xx*.ami<br>CT*xx*.aml | AERMOD input and output files for the CO TAP models. Model years are indicated by "*xx*" among 2019-2023. |
| \TAP Models\DPM | DT*xx*.ami<br>DT*xx*.aml | AERMOD input and output files for the DPM TAP models. Model years are indicated by "*xx*" among 2019-2023. |
| \TAP Models\Formaldehyde | FT*xx*.ami<br>FT*xx*.aml | AERMOD input and output files for the Formaldehyde TAP models. Model years are indicated by "*xx*" among 2019-2023. |
| \TAP Models\Hydrogen Chloride | HCl1923.ami<br>HCl1923.aml | AERMOD input and output files for the Hydrogen Chloride TAP model. |

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| \TAP Models\Manganese | Manganese1923.ami<br>Manganese1923.aml | AERMOD input and output files for the Manganese TAP model. |
| \TAP Models\Mercury | Mercury1923.ami<br>Mercury1923.aml | AERMOD input and output files for the Mercury TAP model. |
| \TAP Models\NO2 | NT*xx*.ami<br>NT*xx*.aml | AERMOD input and output files for the $NO_2$ TAP models. Model years are indicated by "*xx*" among 2019-2023. |