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memorandum

date	April 15, 2025
to	Tim Brooks, Winterbook Planning; David Peters, City of Portland Water Bureau
from	Phil Gleason, ESA | Environmental Science Associates
subject	Portland Water Bureau Filtration Facility Project: Operational Air Quality Analysis

Introduction

Under contract with Winterbrook Planning, Environmental Science Associates (ESA) has prepared this technical memorandum to estimate and evaluate operational air quality emissions associated with the Portland Water Bureau (PWB) Water Filtration Facility and Pipelines Project (Project).

As documented in this memorandum, the Project's operational emissions would not have the potential to adversely affect air quality natural resources. [1]

Project Description

The Project consists of constructing a new water filtration facility (Filtration Facility) and associated access roads and pipelines infrastructure (including the "Intertie") to meet Environmental Protection Agency (EPA) water quality standards and to improve seismic resiliency of the drinking water system. The Filtration Facility would remove sediments, microbes, and organic material from drinking water supplied to nearly one million people. Portland's water system serves the City of Portland and 19 wholesale water districts, including the Pleasant Home Water District directly in the area of the Filtration Facility.

The Filtration Facility is proposed to be located at 36155 SE Carpenter Ln, Gresham, in Sections 16, 21, 22 and 23, Township 1 South, Range 4 East in unincorporated Multnomah County, Oregon. The Filtration Facility site is approximately 96 acres and is bounded by SE Carpenter Lane to the north and east, and dirt access roads to the south and west for adjacent nursery operations. The Intertie is proposed to be located near 32801 SE Lusted Rd in Gresham, Oregon.

Major Project components include the following:

- A new Filtration Facility on former commercial nursery land, approximately 720 feet above sea level.

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1 The Hearings Officer held, and the Land Use Board of Appeals affirmed, that construction is not within the scope of the Proposed Use to be considered in this land use proceeding (Multnomah County, 2023a and LUBA, 2025). Accordingly, this memorandum addresses the post-development operational air quality emissions that would be generated by the Project.

- Approximately four (4) miles of new pipeline under road rights-of-way and about 0.5 miles of pipeline on private nursery land, including the Intertie.

Operational Air Quality Analysis

Environmental Setting

The land use permitting authority for the Project is Multnomah County, Oregon, where efforts to attain state and federal air quality standards are overseen by the Oregon Department of Environmental Quality (ODEQ).[2] The EPA and ODEQ have established health-based Ambient Air Quality Standards (AAQS) for six criteria pollutants: ozone (O_3),[3] carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$),[4] and lead (Pb). The EPA and ODEQ assess the air quality of an area by measuring and monitoring pollutant concentrations in the ambient air and comparing these concentrations to National AAQS and Oregon AAQS. Based on these comparisons, regions are classified into one of the following categories:

- **Attainment.** A region is "in attainment" if monitoring shows ambient concentrations of a specific pollutant are less than or equal to the AAQS. An area that has been re-designated from nonattainment to attainment is classified as a "**maintenance**" area for at least 20 years (and often indefinitely) to ensure that the air quality improvements are sustained.

- **Nonattainment.** If the AAQS are exceeded for a pollutant, the region is designated as nonattainment for that pollutant. Some AAQS require multiple exceedances of the standard in order for a region to be classified as nonattainment. Federal and state laws require nonattainment areas to develop strategies, plans, and control measures to reduce pollutant concentrations to levels that meet ("attain") standards.

- **Unclassified.** An area is unclassified if the ambient air monitoring data are incomplete and do not support an attainment or nonattainment designation.

The Project area has "maintenance" designations for O_3 and CO under the National AAQS and Oregon AAQS. The area has "attainment" or "unclassified" designations for all other criteria air pollutants (EPA, 2025; ODEQ, 2025).

Regional Criteria Air Pollutant Analysis

The Project would generate operational criteria air pollutants from the following sources:

- **Mobile Sources:** On-road vehicles would generate exhaust from fuel combustion and fugitive dust emissions from tire wear, brake wear, and road dust. On-road vehicle activity associated with the Project includes employee commutes, vendor deliveries, off-haul of residual solids, and on- and off-site trips made by PWB's fleet based out of the Filtration Facility.

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2 A small emergency across road that travels from the Filtration Facility to Bluff Road is located in Clackamas County; however, the land use permitting for that Project component has been completed and the road in and of itself would not generate operational air quality emissions.

3 Unlike pollutants that are directly emitted, O_3 is a secondary pollutant formed in the atmosphere through a photochemical reaction involving nitrogen oxides (NO_x), volatile organic compounds (VOCs), and sunlight. Emissions of NO_x and VOCs from vehicles, industrial processes, and other combustion sources are precursors to O_3 formation. Because of this, regulatory reviews focus on limiting precursor emissions to control O_3 levels, especially in regions designated as O_3 nonattainment or maintenance areas.

4 PM_{10} and $PM_{2.5}$ refer to inhalable particulate matter with a diameter of 10 microns or less and fine particulate matter with a diameter of 2.5 microns or less, respectively.

- **Emergency Backup Generators (eBUGs):** The Project would include a total of three (3) diesel-fueled eBUGs. Two (2) of these eBUGs would be located at the Filtration Facility and one (1) eBUG would be located at the Intertie. These engines would be periodically tested and maintained (through standard Operations and Maintenance [O&M]) to ensure reliability in the event of an emergency. The eBUGs would generate exhaust emissions during testing and emergency operation.

- **Dry Chemical Transfer:** Filtration Facility operation would require salt and soda ash for water treatment purposes. These dry chemicals would be transferred to the Filtration Facility via truck and pneumatically loaded into storage silos immediately east of the Filtration Facility's chemical storage building. Dry chemical transfer would generate fugitive dust emissions, although these emissions would be almost entirely abated by emission control devices (bag filters) installed on each of the silos.

Table 1 presents the Project's annual operational criteria air pollutant emissions, which were estimated by ESA using information contained in the land use record and data supplied by the PWB and Project Design Team. Emission factors for the Project's operational activities were derived from standardized sources (e.g., EPA's Motor Vehicle Emission Simulator, version 5.0.0, [MOVES5] and AP-42: Compilation of Air Emissions Factors from Stationary Sources [AP-42]). For details regarding activity information and the sources used to estimate emissions, see Attachment 1.

The ODEQ does not maintain formal numeric thresholds for evaluating whether a project's criteria air pollutant emissions may adversely affect natural resources or hinder progress toward meeting AAQS. Therefore, to assess whether the Project could adversely affect natural resources from an air quality standpoint, the Project's criteria air pollutant emissions are compared against the *De Minimis Thresholds* established under the Federal Clean Air Act's General Conformity Rule (40 Code of Federal Regulations [CFR] § 93.153). The *De Minimis Thresholds* established under the General Conformity Rule are used to assess whether project elements funded by the Federal Government could interfere with a state's plan to meet or maintain national air quality standards. If a project's emissions are below the *De Minimis Thresholds*, these emissions are considered to be too small to cause or contribute to a violation of the National AAQS.

TABLE 1
ANNUAL PROJECT OPERATIONAL CRITERIA POLLUTANT EMISSIONS

Emission Source	Criteria Air Pollutant (tons per Year)					
	NOx	**VOC**	**CO**	**SOx**	**$PM_{2.5}$[a]**	**PM_{10}[a]**
Mobile Sources	0.65	0.08	3.23	0.00	0.22	1.18
eBUGs[b]	8.06	0.41	1.52	0.01	0.21	0.21
Standard O&M[b]	*1.04*	*0.05*	*0.20*	*0.00*	*0.03*	*0.03*
Emergency Use[b]	*7.02*	*0.36*	*1.32*	*0.01*	*0.19*	*0.19*
Dry Chemical Transfer[c]	--	--	--	--	0.01	0.01
Total[d]	**8.71**	**0.49**	**4.75**	**0.02**	**0.44**	**1.41**
De Minimis Threshold	100	100	100	100[e]	100[e]	100[e]
De Minimis Threshold Exceeded?	No	No	No	No	No	No

SOURCE: Developed by ESA, 2025; see Attachment 1.

ACRONYMS: NOx = oxides of nitrogen; VOC = volatile organic compounds; CO = carbon monoxide; SOx = oxides of sulfur; $PM_{2.5}$ = particulate matter with a diameter of less than 2.5 microns; PM_{10} = particulate matter with a diameter of less than 10 microns.

NOTES:

a. Includes PM emissions from vehicle exhaust, tire- and brake-wear, on- and off-road fugitive dust, and fugitive dust from material transfer.

b. The total emissions estimates for the eBUGs include emissions from two activities: 1) standard O&M and 2) emergency use. The values shown in italics are subtotals that collectively comprise the values shown in the “eBUG Operation: Total” row.

c. The fugitive dust emissions from dry chemical transfer would be almost entirely abated by emission control devices (bag filters) installed on each of the silos.

d. The Project area is designated as “attainment” for SOx, $PM_{2.5}$, and PM_{10}. Quantitative *De Minimis Thresholds* are only identified for areas with a designation of “maintenance” or “nonattainment.” The 100 tons per year thresholds identified for these pollutants was conservatively based on the values that would be applicable if the Project were in a “maintenance” designation for these pollutants.

e. The Project’s various emissions sources may not sum to the totals presented in this row due to rounding accounted for in the Excel workbook used to estimate emissions.

As shown in Table 1, the Project’s estimated operational criteria air pollutant emissions are substantially below the *De Minimis Thresholds*, would not have the potential to interfere with AAQS attainment, and therefore would not have the potential to adversely affect air quality natural resources.

Information that further supports this conclusion includes:

- ***De Minimis Threshold* Conservative Geographic Scope.** Generally, in a General Conformity Analysis, a project’s emissions are limited to attainment, nonattainment, and maintenance areas before being compared to the *De Minimis Thresholds*. These geographic areas are typically defined by county or metropolitan statistical areas. However, the emissions inventory for this Project includes all direct operational emissions, even those occurring out of state, based on trip origins and destinations. That is, all on-road vehicle activity was included as part of the Project for this analysis, even when the distance traveled is large and the entire trip may not be solely attributable to the Project (e.g., vendor deliveries from California that may serve other customers, as well). Therefore, comparing the Project’s total emissions to the *De Minimis Thresholds* offers a conservative assessment of potential effects. Limiting these emissions geographically would result in lower estimates.

- ***De Minimis Thresholds* for SOx and PM.** The *De Minimis Thresholds* only apply to areas that are designed nonattainment or maintenance. The Project is located within an area that has a “maintenance” designation for O_3 and CO.[5] Comparing the Project's SOx and PM (inclusive of $PM_{2.5}$ and PM_{10}) emissions against the 100 tons per year *De Minimis Thresholds* is a conservative approach, because the *De Minimis Thresholds* are not applicable for these pollutants under the General Conformity Rule.[6]

- **Mobile Source Emissions Estimates.** The mobile source emission estimates assume all vehicles would be powered by either gasoline or diesel. Some of the vehicles traveling to/from the Project would likely be powered by electricity given the current and projected fleet profile. Electric vehicles do not generate exhaust criteria air pollutant emissions. Thus, the mobile source emissions estimate provides a conservative assessment (i.e., an overestimate) of emissions from this source.

- **eBUG Emission Estimates.** In addition to periodic runtime associated with standard maintenance and testing activities, the eBUG emissions estimates include 168 hours of additional runtime (i.e., seven [7] full days of operation) for emergency use in the event of power loss. This estimate represents an anticipated "worst-case" scenario, based on a review of historical blackouts over the last decade and is specifically based on the 2021 February ice storm that caused multi-day outages (OOEM, ND).

- **Fugitive Dust Emissions from Unpaved Roads.** The emissions estimates generated for vehicles traveling on the Project's gravel surfaces were estimated using unpaved emission factors derived from AP-42. This is a conservative approach, because AP-42 explicitly acknowledges that adding gravel to a dirt road is a control mechanism to reduce fugitive dust emissions (EPA, 2006).

As described above, the Project's operational criteria air pollutant emissions would be below *De Minimis Thresholds* and would not have the potential to adversely affect air quality natural resources, even when incorporating numerous conservative assumptions.

Diesel Particulate Matter (DPM) Analysis

This section responds to concerns raised in Exhibits E.9 and J.7 of the land use record (Multnomah County, 2023b and 2023c). Most of the air quality-related comments in these exhibits pertain to construction, which is not within the scope of the Proposed Use to be considered in this land use proceeding (Multnomah County, 2023a and LUBA, 2025). However, Exhibits E.9 and J.7 also raise the topic of Diesel Particulate Matter (DPM) as a concern. As described below, the Project's operational DPM emissions would not have the potential to adversely affect air quality natural resources.

As described by ODEQ, "[d]iesel particulate matter is linked to a number of serious public health problems including aggravating asthma, heart and lung disease, cancer and premature mortality. In June 2012, the International Association for Research on Cancer classified diesel exhaust as a known carcinogen to humans." (ODEQ, ND). DPM would be emitted by several on- and off-site sources (i.e., mobile and stationary sources) that combust diesel fuels.[7] However, operational DPM emissions generated by the Project would not adversely affect air quality natural resources for several reasons.

First, the majority of DPM emissions generated by the Project's diesel-fueled vehicle trips (i.e., vendor deliveries and haul truck trips) would be widely dispersed off site and away from receptors close to the Project. Only a minor fraction of the Project's mobile source emissions shown in Table 1 would occur at and in the immediate

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5 As noted previously NOx and VOC are regulated for the purposes of O_3 attainment purposes, since O_3 is a secondary pollutant.

6 The 100 tons per year thresholds for SOx and PM would be applicable if the Project area also held a "maintenance" designation for those pollutants.

7 Cancer and chronic disease risks from DPM require prolonged, cumulative exposure. DPM, as a TAC specifically, does not have short-term or acute risks associated with it (OEHHA, 2015).

vicinity of the Filtration Facility. This is because truck trips associated with the Project typically travel long distances, and most of that travel is not in the Project area. Although the ODEQ has not established screening criteria for mobile sources (e.g., in terms of the number of heavy-duty truck trips generated by a project) that could trigger an adverse effect on air quality natural resources, various resources exist in California that provide insights and context as to what level of activity could generate an adverse condition and affect natural resources. The California Air Resources Board (CARB) *Air Quality and Land Use Handbook: A Community Health Perspective* includes a policy recommendation that siting new sensitive land uses (e.g., residences) should be avoided within 1,000 feet of distribution centers generating more than 100 (heavy-duty) truck trips per day (CARB, 2005).[8] Similarly, the *Air Quality and Greenhouse Guidelines* issued by the City and County of San Francisco (SF) in February 2025 establishes risk-based, trip-generation screening criteria for, "minor, low-impact sources that do not pose a significant health impact even in combination with other nearby sources," including a "175 trucks per day" screening value for projects that primarily generate trucking activity (SF, 2025).[9] Table 2 compares the Project's trip generation estimates to the policy recommendation and screening criterion issued by CARB and SF, respectively.

TABLE 2
PROJECT TRUCK TRIP GENERATION AND MOBILE SOURCE HEALTH RISK SCREENING CRITERIA

Trip Type	Average Daily Trips (One-Way)			CARB Criterion Exceeded?	SF Criterion Exceeded?
	Project[a]	CARB Criterion	SF Criterion[b,c]		
Heavy-duty Truck Trips	9.3	100	350	No	No

SOURCE: CARB, 2005 and SF, 2025 for Screening Criteria. See Attachment 1 for Project trip generation references.

NOTES:

a. Project trips are detailed in Attachment 1 and were aggregated into average weekday values for the purposes of this comparison.

b. Heavy-duty trucks trips include chemical-truck deliveries, refuse trucks used to off-haul residual solids from the water-treatment process, and non-chemical-related vendor truck trips (e.g., FedEx deliveries).

c. The "trucks per day" metric established by SF reflects round trips, not one-way trips, and therefore requires doubling for the purposes of comparing a project's one-way trips to the criterion.

As shown in Table 2, the Project's trip types and quantities would not exceed either CARB's policy recommendation nor SF's criterion, indicating that the Project's DPM mobile source exhaust emissions would not have the potential to adversely affect air quality natural resources.

Second, the eBUGs would not generate DPM emissions in quantities that could adversely affect air quality natural resources, particularly when considering the locations of these sources and local meteorological conditions. The Filtration Facility eBUGs would be located on the interior of the Filtration Facility site, adjacent to the main electrical complex and northern electrical complex. The main electrical complex and northern electrical complex are located approximately 1,700 and 875 feet from the nearest sensitive receptor locations (i.e., residences), respectively. These distances are large enough that DPM emissions from the Filtration Facility's eBUGs are anticipated to have ample time and space to disperse (i.e., become less concentrated). DPM emissions from the Intertie's eBUG (which is much smaller and generates substantially fewer emissions than those at the Filtration Facility) would similarly disperse in a rapid manner, away from the nearest sensitive receptor location

8 Although the Project is not a distribution center, the heavy-duty truck trips associated with a distribution warehouse would be similar in terms of the types of truck trips that would be generated by the Project.

9 The "trucks per day" metric reflects round trips, not one-way trips, and therefore require doubling for the purposes of comparing a project's one-way trips to the criterion.

(approximately 415 feet from the Intertie's electrical building). At both the Filtration Facility and Intertie, prevailing winds from the northwest would disperse DPM emissions away from sensitive receptor locations.[10, 11]

Finally, through the Cleaner Air Oregon Program (CAO Program), the Project proposes three eBUGs that would be permitted through a General Air Contaminant Discharge Permit (ACDP) from ODEQ.[12] All new sources applying for an ACDP (including the eBUGs) are evaluated under the CAO Program to assess whether DPM emissions exceed the applicable screening threshold listed in Oregon Administrative Rule (OAR) 340-245-8010 Table 1. The Project's eBUGs would typically only be run for routine testing as part of standard O&M, would be situated toward the interior of the Filtration Facility and Intertie sites (i.e., away from the nearest residences), and typical wind conditions would transport pollutants away from the nearest sensitive receptor locations. Given these considerations, the Project's risks from eBUG DPM emissions are anticipated to be well below the screening threshold level and not trigger further review under the CAO Program.

In summary, DPM emissions from Project's operations would be limited and would not adversely affect air quality natural resources for several reasons. DPM emissions from trucks would largely occur away from the site and away from receptors near the Project. DPM concentrations from eBUG operation would substantially reduce before reaching receptors, based on 1) the large distances between the sources and receptor locations, and 2) prevailing winds in the area that would blow emissions away from the nearest sensitive receptors. Finally, risks from eBUG DPM emissions are anticipated to be well below the screening threshold level established in the CAO Program.

Conclusion

The Project would not have the potential to adversely affect air quality natural resources. The Project's operational criteria air pollutant emissions would be below *De Minimis Thresholds*, even after accounting for numerous conservative assumptions, and DPM emissions emitted by the Project would not be generated in sufficient quantities to adversely affect air quality natural resources after considering source locations, local meteorological conditions, and the regulatory framework that would guide the Project's eBUG air quality permitting process.

References

The following references were used in the preparation of this technical memorandum.

California Air Resources Board (CARB), 2005. "Air Quality and Land Use Handbook: A Community Health Perspective" Sacramento, CA. April 2005. https://ww2.arb.ca.gov/sites/default/files/2023-05/Land%20Use%20Handbook_0.pdf

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10 As shown in Attachment 2, prevailing winds at Portland International Airport, representative of wind conditions at the Project, would be from the northwest, dispersing pollutants to the southeast. The nearest sensitive receptors are upwind (i.e., northwest) of the Filtration Facility and Intertie. Sensitive receptors downwind (i.e., southeast) of the Filtration Facility and Intertie are much farther away.

11 Although this discussion has primarily focused on DPM dispersion from eBUGs, the overall dispersion characteristics at the site would hold true for all sources of emissions (e.g., mobile sources, fugitive dust, etc.) generated by activities at and near the Project site (i.e., pollutants would typically disperse in a direction opposite of sensitive receptor locations).

12 A General ACDP differs from a site-specific Standard ACDP in the fact that a General ACDP is more streamlined and limited in scope. Whereas a General ACDP is a pre-approved, category-specific permit designed for common, low-risk sources (such as the eBUGS) that meet strict eligibility criteria, a Standard ACDP is a fully customized permit required for more complex or higher-risk facilities.

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Attachment 1

Operational Air Quality Emission Calculations

City of Portland Water Bureau

Filtraation Facility Project

Operational Air Quality Calculations

Prepared by: **Environmental Science Associates**
April 2025

Table SUM-1: Summary of Project Operational Air Quality Emissions

Source	Emission Totals (US Short tons / yr)					
	NOx	VOC	CO	SOx	PM2.5	PM10
Mobile Sources	0.65	0.08	3.23	0.00	0.22	1.18
Emergency Back Up Generators	8.06	0.41	1.52	0.01	0.21	0.21
Fugitive Emissions from Dry Chemical Transfer	0	0	0	0	0.01	0.01
Total	**8.71**	**0.49**	**4.75**	**0.02**	**0.44**	**1.41**
De Minimis Threshold	100	100	100	100	100	100
De Minimis Threshold Exceeded?	No	No	No	No	No	No

Table DCT-1: Conversion Factors

lbs/ton
2000

Table DCT-2: Filtration Facility Operations

Weekdays	261
Annual Work Days for Delivery	261

Note: Assumes dry chemical deliveries 5 days per week; does not include holidays.

Table DCT-3: PM Emissions Factors (Material Transfer)

Process	PM10 Emission Factors (lbs/ton)		PM2.5 Emission Factors (lbs/ton)[a]	
	Unabated	Abated	Unabated	Abated
Soda Ash: Pneumatic unloading to elevated storage silo[b]	1.1	0.0049	1.1	0.0049
Salt: Pneumatic unloading to elevated storage silo[c]	0.47	0.00034	0.47	0.00034

Sources: EPA, 2026a; AP-42, Table 11.12-2

a AP-42 does not provide separate emission factors for PM2.5; thus, calculations assume the same emission rates for PM2.5 as PM10.

b Emissions from soda ash are considered to be representative of cement supplement unloading to elevated storage silo.

c Emissions from salt are considered to be representative of cement unloading to elevated storage silo

Table DCT-4: Annual Material Throughput for Soda Ash and Salt		
Material	Annual Throughput (Pounds)	Annual Throughput (US tons)
Soda Ash	6,800,000	3,400
Salt	780,000	390

Source: Stantec, 2025a

Table DCT-5: Soda Ash and Salt Fugitive Emissions (Annual)

Material	Abated PM10 Emissions		Abated PM2.5 Emissions	
	Pounds	US tons	Pounds	US tons
Soda Ash	16.66	0.01	16.66	0.01
Salt	0.13	0.00	0.13	0.00
Total	16.79	0.01	16.79	0.01

Table GEN-1: General Assumptions

Engine size provided = engine power input (i.e. hp = bhp)

Table GEN-2: Standard Conversion Factors

Units / Conversion	Value
hp / kW	1.34102
g / lbs	453.592
lbs / US Short ton	2000

Table GEN-3: Generator Information

Generator[a]	Size (kW)	Size (bhp)[b]	Engine Tier	Annual O&M Use (hrs)	Annual Non-O&M Use (hrs)	Annual Use (Total)	Fuel Tank Size (gal)	50% Load Consumption Rate (gal / hr)	Full Load Consumption Rate (gal / hr)	Emergency Runtime Capacity (hrs)
FF: Gen1	2500	3353	Tier II	50	168	218	4500	91.1	173.1	26.00
FF: Gen2	2750	3688	Tier II	50	168	218	4500	91.1	173.1	26.00
IT: Gen3	50	96	Tier III	50	168	218	250	2.9	5.3	47.17

Sources: CM/GC Services, 2024; Cummins, 2019; OOEM, ND

a FF = Filtration Facility; IT = Intertie

b The bhp for IT: Gen3 was specifically identified in Cummins, 2019

Table GEN-4: Tier 2 Emission Factors

Emission Factors						
(g / hp-hr)[a]						g / gal[b]
NOx	VOC	CO	PM2.5	PM10	SOx	SOx
5.31	0.27	1	0.14	0.14	8.09E-03	4.52E-06

Sources: EPA, 2025a, 2025b, and 2025c

a Emfacs for NOx, VOC, CO and PM based on EPA, 2025a for the size of generator proposed; SOx emission factors based on EPA, 2025b

b EPA, 2025c for engines <600hp.

Table GEN-5: Tier 3 Emission Factors

Emission Factors						
(g / hp-hr)[a]						g / gal[b]
NOx	VOC	CO	PM2.5	PM10	SOx	SOx
3.59	0.23	1	0.18	0.18	8.09E-03	4.52E-06

Sources: EPA, 2025a, 2025b, and 2025c

a Emfacs for NOx, VOC, CO and PM based on EPA, 2025a for the size of generator proposed; SOx emission factor for generators >600hp based on EPA, 2025b

b EPA, 2025c for engines <600hp.

Table GEN-5: Emissions Calculations (O&M)

Generator	Engine Size (bhp)	Load Factor	Annual Runtime (hrs)	Gallons Consumed	Emission Totals (g / yr)						Emission Totals (US short tons / yr)					
					NOx	VOC	CO	PM2.5	PM10	SOx	NOx	VOC	CO	PM2.5	PM10	SOx
FF: Gen1	3353	0.50	50	4555	445051.0	22629.7	83813.8	11733.9	11733.9	678.1	0.49	0.02	0.09	0.01	0.01	0.00
FF: Gen2	3688	0.50	50	4555	489556.1	24892.7	92195.1	12907.3	12907.3	745.9	0.54	0.03	0.10	0.01	0.01	0.00
IT: Gen3	96	0.50	50	145	8616.0	552.0	2400.0	432.0	432.0	6.55E-04	0.01	0.00	0.00	0.00	0.00	0.00
										Total	**1.04**	**0.05**	**0.20**	**0.03**	**0.03**	**0.00**

Table GEN-6: Emissions Calculations (Emergency Use)

Generator	Engine Size (bhp)	Load Factor	Annual Runtime (hrs)	Gallons Consumed	Emission Totals (g / yr)						Emission Totals (US short tons / yr)					
					NOx	VOC	CO	PM2.5	PM10	SOx	NOx	VOC	CO	PM2.5	PM10	SOx
FF: Gen1	3353	1.00	168	29080.8	2990742.8	152071.7	563228.4	78852.0	78852.0	4556.5	3.30	0.17	0.62	0.09	0.09	0.01
FF: Gen2	3688	1.00	168	29080.8	3289817.1	167278.8	619551.2	86737.2	86737.2	5012.2	3.63	0.18	0.68	0.10	0.10	0.01
IT: Gen3	96	1.00	168	890.4	85639.7	4354.6	16128.0	2257.9	2257.9	4.02E-03	0.09	0.00	0.02	0.00	0.00	0.00
										Total	**7.02**	**0.36**	**1.32**	**0.19**	**0.19**	**0.01**

Table GEN-7: Emissions Calculations (Total)

Generator	Engine Size (bhp)	Load Factor	Annual Runtime (hrs)	Gallons Consumed	Emission Totals (g / yr)						Emission Totals (US short tons / yr)					
					NOx	VOC	CO	PM2.5	PM10	SOx	NOx	VOC	CO	PM2.5	PM10	SOx
FF: Gen1	3353	--	218	33635.80	3435793.82	174701.38	647042.15	90585.90	90585.90	5234.57	3.79	0.19	0.71	0.10	0.10	0.01
FF: Gen2	3688	--	218	33635.80	3779373.20	192171.52	711746.37	99644.49	99644.49	5758.03	4.17	0.21	0.78	0.11	0.11	0.01
IT: Gen3	96	--	218	1035.40	94255.68	4906.56	18528.00	2689.92	2689.92	0.00	0.10	0.01	0.02	0.00	0.00	0.00
										Total	**8.06**	**0.41**	**1.52**	**0.21**	**0.21**	**0.01**

Table GEN-8: Emissions Calculations for Report Comination (Total)

Generator	Emission Totals (US short tons / yr)					
	NOx	VOC	CO	SOx	PM2.5	PM10
FF: Gen1	3.79	0.19	0.71	0.01	0.10	0.10
FF: Gen2	4.17	0.21	0.78	0.01	0.11	0.11
IT: Gen3	0.10	0.01	0.02	0.00	0.00	0.00
Total	**8.06**	**0.41**	**1.52**	**0.01**	**0.21**	**0.21**

Table MS-1: Mobile Source Emissions Summary

Vehicle Trip Type	Exhaust and Fugitive Dust Emissions (US Short tons)									
	NOx	VOC	CO	SOx	PM2.5			PM10		
					Exhaust	Dust	Total	Exhaust	Dust	Total
Employee Commute	0.12	0.05	2.89	0.00	0.01	0.06	0.07	0.02	0.26	0.27
Chemical Deliveries	0.31	0.01	0.18	0.00	0.01	0.04	0.05	0.02	0.17	0.19
Refuse Trucks	0.18	0.01	0.12	0.00	0.00	0.03	0.03	0.01	0.11	0.12
PWB Fleet	0.03	0.00	0.03	0.00	0.00	0.06	0.06	0.00	0.59	0.59
Non-Chemical Vendor Deliveries	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.02
Total	**0.65**	**0.08**	**3.23**	**0.00**	**0.02**	**0.20**	**0.22**	**0.04**	**1.14**	**1.18**

Table MS-2: Standard Conversions

Grams / Lbs	Lbs / US Short ton
453.592	2000

Table MS-3: Exhaust Mobile Source Emission Calculations for Passenger Vehicles (Gasoline) and Passenger Trucks (Gasoline and Diesel)

Vehicle Category	Number of Trips (One-way)			Annual Mileage Breakdown: Rural				Total Annual Mileage		Exhaust Emission Rates (Unrestricted; grams / mile)[a]						Exhaust Emission Rates (Restricted; grams / mile)[b]						Exhaust Emissions (grams)						Exhaust Emissions (US Short tons)					
				On-site (Unrestricted)[a]		Off-site: Paved																											
	Weekday	Total Week	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Unrestricted[a]	Restricted[b]	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10
Passenger Vehicles	50.00	350.00	18,200.00	2,275.00	0.00	274,820.00	268,905.00	277,095.00	268,905.00	0.07	0.04	2.22	0.00	0.00	0.02	0.08	0.04	2.53	0.00	0.00	0.01	39,352.51	21,990.16	1,293,827.29	908.99	2,113.60	6,847.40	0.04	0.02	1.43	0.00	0.00	0.01
Passenger Trucks	50.00	350.00	18,200.00	2,275.00	0.00	274,820.00	268,905.00	277,095.00	268,905.00	0.13	0.05	2.20	0.00	0.01	0.02	0.13	0.04	2.68	0.00	0.00	0.01	71,862.53	26,042.05	1,330,728.68	1,212.61	2,607.66	7,392.68	0.08	0.03	1.47	0.00	0.00	0.01
																											Commute Exhaust Emissions Sub-Total	0.1	0.1	2.9	0.0	0.0	0.0

Sources: Global Transportation Engineering, 2022; Portland Water Bureau, 2025

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

Table MS-4: Fugitive Dust Mobile Source Emission Calculations for Passenger Vehicles and Trucks

Vehicle Category	Number of Trips (One-Way)			Annual Mileage Breakdown: Rural				Total Annual Mileage		Fugitive Dust Emission Factors Paved (g / mi)		Fugitive Dust Emission Factors Unpaved (lbs / mi)		Annual Fugitive Dust Emissions (grams)		Annual Fugitive Dust Emissions (US Short tons)	
				On-site (Unrestricted)[a]		Off-site: Paved											
	Weekday	Total Week	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Paved	Unpaved	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10
Passenger Vehicles	50	350	18200	2275	0	274820	268905	546000.00	0	0.05	0.21	27.18	271.78	28990.95	115963.79	0.03	0.13
Passenger Trucks	50	350	18200	2275	0	274820	268905	546000.00	0	0.05	0.21	27.18	271.78	28990.95	115963.79	0.03	0.13
															Commute Fugitive Dust Emissions Subtotal	0.06	0.26

Sources: Global Transportation Engineering, 2022; Portland Water Bureau, 2025

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

Table MS-5: Exhuast Mobile Source Emission Calculations for Chemical Deliveries (Diesel Fuel)

Vehicle Category	Number of Trips		Annual Mileage Breakdown: Rural				Total Annual Mileage		Exhaust Emission Rates (Unrestricted; grams / mile)[a]						Exhaust Emission Rates (Restricted; grams / mile)[b]						Exhaust Emissions (grams)						Exhaust Emissions (US Short tons)					
			On-site (Unrestricted)[a]		Off-site: Paved																											
	Avg Monthly Deliveries	Annual (One-Way)	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Unrestricted[a]	Restricted[b]	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10
Single Unit Short-Haul Truck[c]	15.6	374.4	92.18	0.00	11206.56	3219.84	11298.74	3219.84	0.818	0.0582	0.818	0.0025	0.0318	0.0687	0.6466	0.0473	0.6627	0.0025	0.0227	0.0446	11324.39203	809.2085122	11376.31377	36.16103919	432.8824536	919.6613727	0.0	0.0	0.0	0.0	0.0	0.0
Combination Unit Short-Haul Truck[d]	16	384	94.55	0.00	4569.60	5721.60	4664.15	5721.60	2.1138	0.0928	2.1138	0.0049	0.0599	0.1506	1.8371	0.0877	1.2516	0.0048	0.042	0.1007	20370.18438	934.7463941	17020.06149	50.50874645	519.2002757	1278.352045	0.0	0.0	0.0	0.0	0.0	0.0
Combination Unit Long-Haul Truck[e]	5.6	134.4	33.09	0.00	2489.28	91281.60	2522.37	91281.60	2.9604	0.1358	2.9604	0.0051	0.0906	0.1884	2.658	0.1253	1.439	0.0051	0.0683	0.1301	250097.8771	11777.79037	138824.5025	474.7526186	6463.710535	12354.89462	0.3	0.0	0.2	0.0	0.0	0.0
																										Chemical Delivery Exhaust Emissions Sub-Total	0.3	0.0	0.2	0.0	0.0	0.0

Sources: Stantec, 2021, 2025b, and 2025c

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

c "Single Unit Short-Haul Trucks" refers to trucks where the cab and cargo are on the same chassis, and the trip distance is less than 200 miles.

d "Combination Unit Short-Haul Trucks" refers to trucks where the cab and cargo are separate (e.g., cab with a trailor), and the trip distance is less than 200 miles.

e "Combination Unit Long-Haul Trucks" refers to trucks where the cab and cargo are separate (e.g., cab with a trailor), and the trip distance is more than 200 miles.

Table MS-6: Fugitive Dust Mobile Source Emission Calculations for Chemical Deliveries

Vehicle Category	Number of Trips		Annual Mileage Breakdown: Rural				Total Annual Mileage		Fugitive Dust Emission Factors Paved (g / mi)		Fugitive Dust Emission Factors Unpaved (lbs / mi)		Annual Fugitive Dust Emissions (grams)		Annual Fugitive Dust Emissions (US Short tons)	
			On-site (Unrestricted)[a]		Off-site: Paved											
	Avg Monthly Deliveries	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Paved	Unpaved	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10
Single Unit Short-Haul Truck[c]	15.6	374.4	92.18	0.00	11206.56	3219.84	14518.58	0	0.33	1.32	0.08	0.75	4794.11	19176.45	0.01	0.02
Combination Unit Short-Haul Truck[d]	16	384	94.55	0.00	4569.60	5721.60	10385.75	0	0.33	1.32	0.08	0.75	3429.43	13717.71	0.00	0.02
Combination Unit Long-Haul Truck[e]	5.6	134.4	33.09	0.00	2489.28	91281.60	93803.97	0	0.33	1.32	0.08	0.75	30974.57	123898.27	0.03	0.14
														Chemical Delivery Dust Emissions Subtotal	0.04	0.17

Sources: Stantec, 2021, 2025b, and 2025c

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

c "Single Unit Short-Haul Trucks" refers to trucks where the cab and cargo are on the same chassis, and the trip distance is less than 200 miles.

d "Combination Unit Short-Haul Trucks" refers to trucks where the cab and cargo are separate (e.g., cab with a trailor), and the trip distance is less than 200 miles.

e "Combination Unit Long-Haul Trucks" refers to trucks where the cab and cargo are separate (e.g., cab with a trailor), and the trip distance is more than 200 miles.

Table MS-7: Exhuast Mobile Source Emission Calculations for Refuse Trucks (Diesel Fuel)

Vehicle Category	Number of Trips		Annual Mileage Breakdown: Rural				Total Annual Mileage		Exhaust Emission Rates (Unrestricted; grams / mile)[a]						Exhaust Emission Rates (Restricted; grams / mile)[b]						Exhaust Emissions (grams)						Exhaust Emissions (US Short tons)					
			On-site (Unrestricted)[a]		Off-site: Paved																											
	Weekly	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Unrestricted[a]	Restricted[b]	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10
Refuse Truck	9	936	164.86	0.00	13478.40	62992.80	13643.26	62992.80	2.4383	0.1198	2.4383	0.0049	0.0775	0.1718	2.0684	0.1048	1.2031	0.005	0.0486	0.0926	163558.4944	8236.402855	109055.8942	378.8088597	4120.100349	8173.632048	0.2	0.0	0.1	0.0	0.0	0.0

Sources: Global Transportation Engineering, 2022

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

Table MS-8: Fugitive Dust Mobile Source Emission Calculations for Refuse Trucks

Vehicle Category	Number of Trips		Annual Mileage Breakdown: Rural				Total Annual Mileage		Fugitive Dust Emission Factors Paved (g / mi)		Fugitive Dust Emission Factors Unpaved (lbs / mi)		Annual Fugitive Dust Emissions (grams)		Annual Fugitive Dust Emissions (US Short tons)	
			On-site (Unrestricted)[a]		Off-site: Paved											
	Weekly	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Paved	Unpaved	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10
Refuse Truck	9	936	164.8636364	0	13478.4	62992.8	76636.06	0	0.33	1.32	0.08	0.75	25305.63	101222.54	0.03	0.11

Sources: Global Transportation Engineering, 2022

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

Table MS-9: Exhuast Mobile Source Emission Calculations for PWB Fleet (Diesel Fuel)

Vehicle Category	Number of Trips		Annual Mileage Breakdown: Rural				Total Annual Mileage		Exhaust Emission Rates (Unrestricted; grams / mile)[a]						Exhaust Emission Rates (Restricted; grams / mile)[b]						Exhaust Emissions (grams)						Exhaust Emissions (US Short tons)					
			On-site (Unrestricted)[a]		Off-site: Paved																											
	Weekly	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Unrestricted[a]	Restricted[b]	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10
Light Commerical Trucks	70	3640	641.14	1923.41	43388.80	0.00	45953.35	0.00	0.5428	0.0777	0.5428	0.0015	0.0278	0.0463	0.1297	0.0387	1.8097	0.0023	0.0054	0.0131	24942.45459	3569.709863	24942.45459	68.130459	1278.797534	2128.519976	0.0	0.0	0.0	0.0	0.0	0.0

Sources: Portland Water Bureau, 2025

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

Table MS-10: Fugitive Dust Mobile Source Emission Calculations for PWB Fleet

Vehicle Category	Number of Trips		Annual Mileage Breakdown: Rural				Total Annual Mileage		Fugitive Dust Emission Factors Paved (g / mi)		Fugitive Dust Emission Factors Unpaved (lbs / mi)		Annual Fugitive Dust Emissions (grams)		Annual Fugitive Dust Emissions (US Short tons)	
			On-site (Unrestricted)[a]		Off-site: Paved											
	Weekly	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Paved	Unpaved	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10
Light Commerical Trucks	70	3640	641.14	1923.41	43388.8	0	44029.94	1923.41	0.05	0.21	27.18	271.78	54613.14	532104.27	0.06	0.59

Sources: Portland Water Bureau, 2025

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

Table MS-11: Exhuast Mobile Source Emission Calculations for Non-Chemical Vendor Deliveries (Diesel Fuel)

Vehicle Category	Number of Trips		Annual Mileage Breakdown: Rural				Total Annual Mileage		Exhaust Emission Rates (Unrestricted; grams / mile)[a]						Exhaust Emission Rates (Restricted; grams / mile)[b]						Exhaust Emissions (grams)						Exhaust Emissions (US Short tons)					
			On-site (Unrestricted)[a]		Off-site: Paved																											
	Weekly	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Unrestricted[a]	Restricted[b]	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10	NOx	VOC	CO	SOx	PM2.5	PM10
Single Unit Short-Haul Truckc	7	364	64.11	0.00	3894.80	5969.60	3958.91	5969.60	0.818	0.0582	0.818	0.0025	0.0318	0.0687	0.6466	0.0473	0.6627	0.0025	0.0227	0.0446	7098.239192	512.3547347	7194.502375	24.77231355	261.694984	538.0854715	0.0	0.0	0.0	0.0	0.0	0.0

Sources: Portland Water Bureau, 2025

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

Table MS-12: Fugitive Dust Mobile Source Emission Calculations for Non-Chemical Deliveries

Vehicle Category	Number of Trips		Annual Mileage Breakdown: Rural				Total Annual Mileage		Fugitive Dust Emission Factors Paved (g / mi)		Fugitive Dust Emission Factors Unpaved (lbs / mi)		Annual Fugitive Dust Emissions (grams)		Annual Fugitive Dust Emissions (US Short tons)	
			On-site (Unrestricted)[a]		Off-site: Paved											
	Weekly	Annual	Paved	Unpaved	Unrestricted[a]	Restricted[b]	Paved	Unpaved	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10
Single Unit Short-Haul Truckc	7	364	64.11363636	0	3894.8	5969.6	9928.51	0.00	0.33	1.32	0.08	0.75	3278.45	13113.79	0.00	0.01

Sources: Portland Water Bureau, 2025

a "Unrestricted" refers to all other rural roads (e.g., county roads, local streets) with direct property access. Typically lower-speed and more stop-and-go.

b "Restricted" refers to highways/freeways in rural areas with limited access (e.g., no direct property access) that are designed for higher-speed travel.

Table MSEF-1: Rural Unrestricted Vehicle Emission Factors (Exhaust and Tire- and Brake-wear)[a]

	NOx	VOC[b]	CO	SOx	PM2.5	PM10[c]
	g/mile					
Passenger Car, Gas	0.069	0.044	2.218	0.002	0.004	0.015
Passenger Truck, Gas + Diesel	0.134	0.053	2.198	0.002	0.006	0.017
Light Commercial Truck, Diesel	0.543	0.078	0.543	0.001	0.028	0.046
Refuse Trucks, Diesel	2.438	0.120	2.438	0.005	0.077	0.172
Single Unit Short-Haul Truck, Diesel	0.818	0.058	0.818	0.002	0.032	0.069
Combination Short-Haul Truck, Diesel	2.114	0.093	2.114	0.005	0.060	0.151
Combination Long-Haul Truck, Diesel	2.960	0.136	2.960	0.005	0.091	0.188

a From MOVES5 for Multnomah, OR; speed and model years aggregated. Road type rural unrestricted.

b Non-methane Organic Compounds

c PM10 and PM2.5 includes brakewear and tirewear

Table MSEF-2: Rural Restricted Vehicle Emission Factors (Exhaust and Tire- and Brake-wear)[a]

	NOx	VOC[b]	CO	SOx	PM2.5	PM10[c]
	g/mile					
Passenger Car, Gas	0.075	0.036	2.526	0.002	0.003	0.010
Passenger Truck, Gas + Diesel	0.129	0.043	2.684	0.002	0.004	0.010
Light Commercial Truck, Diesel	0.130	0.039	1.810	0.002	0.005	0.013
Refuse Trucks, Diesel	2.068	0.105	1.203	0.005	0.049	0.093
Single Unit Short-Haul Truck, Diesel	0.647	0.047	0.663	0.002	0.023	0.045
Combination Short-Haul Truck, Diesel	1.837	0.088	1.252	0.005	0.042	0.101
Combination Long-Haul Truck, Diesel	2.658	0.125	1.439	0.005	0.068	0.130

a From MOVES5 for Multnomah, OR; speed and model years aggregated. Road type rural restricted.

b Non-methane Organic Compounds

c PM10 and PM2.5 includes brakewear and tirewear

Table MSEF-3: Paved Road Emission Factors (Vendor and Refuse Trucks)

Variable	PM10	PM2.5	
k =	1	0.25	particle size multiplier, g/VMT [Table 13.2-1.1]
sL =	0.03	0.03	road surface silt loading (g/m2) [Table 13.2.1-2]
W =	30	30	Assumes, on average, chemical and waste off-haul trucks would weigh approximately 30 tons.
EF =	1.321	0.330	g/VMT

Equation: $EF = k(sL)^{0.90} \times W^{1.02}$

Source: EPA, 2011; AP-42, Section 13.2.1: Paved Roads

Table MSEF-4: Paved Road Emission Factors (Passenger Cars & Trucks + Light Commercial Trucks)

Variable	PM10	PM2.5	
k =	1	0.25	particle size multiplier, g/VMT [Table 13.2-1.1]
sL =	0.03	0.03	road surface silt loading (g/m2) [Table 13.2.1-2]
W =	5	5	GVWR capped at 10,000 lbs for Light Commercial Trucks
EF =	0.212	0.053	g/VMT

Equation: $EF = k(sL)^{0.90} \times W^{1.02}$

Source: EPA, 2011; AP-42, Section 13.2.1: Paved Roads

Table MSEF-5: Unpaved Road PM10 Emission Factors (Vendor and Refuse Trucks)

Variable	Value	
Average Vehicle Weight (tons)	30	Assumes, on average, chemical and waste off-haul trucks would weigh approximately 30 tons.
Silt Content (%)	6.4	Value for municipal solid waste landfills.
P, Number of days with Precip >0.01 inches	161	From NOAA's Climate Data Online for Station US1ORCC0093 near Sandy, OR
Default Emission Factor (lb/mile)	1.34	
Low-Speed Emission Factor (lb/mile)	0.75	Reduced for low speeds; accounts for a 44% reduction assuming truck speeds are limited to 15 mph or less (Countless Environmental, 2006)

Equation: Emission Factor [lb/mi] = 1.5 x (silt content [%] / 12)^0.9 x (average vehicle weight [tons] / 3)^0.45 x (365-P)/365

Sources: EPA, 2006b; AP-42, Section 13.2.2, Table 13.2.2-1, Reference for Silt Content: Average for a Service Road associated with the project.
Countless Environmental, 2006
NOAA, 2025

Table MSEF-6: Unpaved Road PM2.5 Emission Factor (Vendor and Refuse Trucks)

Variable	Value	
Average Vehicle Weight (tons)	30	Assumes, on average, chemical and waste off-haul trucks would weigh approximately 30 tons.
Silt Content (%)	6.4	Value for municipal solid waste landfills.
P, Number of days with Precip >0.01 inches	161	From NOAA's Climate Data Online for Station US1ORCC0093 near Sandy, OR
Default Emission Factor (lb/mile)	0.13	
Low-Speed Emission Factor (lb/mile)	0.08	Reduced for low speeds; accounts for a 44% reduction assuming truck speeds are limited to 15 mph or less (Countless Environmental, 2006)

Equation: Emission Factor [lb/mi] = 0.15 x (silt content [%] / 12)^0.9 x (average vehicle weight [tons] / 3)^0.45 x (365-P)/365

Sources: EPA, 2006b; AP-42, Section 13.2.2, Table 13.2.2-1, Reference for Silt Content: Average for a Service Road associated with the project.
Countless Environmental, 2006
NOAA, 2025

Table MSEF-7: Calculation of Unpaved Road PM10 Emission Factor (Passenger Vehicles & Trucks + Light Commerical Trucks)

Variable	Value	
Average Vehicle Weight (tons)	5	GVWR capped at 10,000 lbs for Light Commercial Trucks
Silt Content (%)	6.4	Value for municipal solid waste landfills.
P, Number of days with Precip >0.01 inches	161	From NOAA's Climate Data Online for Station US1ORCC0093 near Sandy, OR
Default Emission Factor (lb/mile)	0.60	
Low-Speed Emission Factor (lb/mile)	0.34	Reduced for low speeds; accounts for a 44% reduction assuming truck speeds are limited to 15 mph or less (Countless Environmental, 2006)

Equation: Emission Factor [lb/mi] = 1.5 x (silt content [%] / 12)^0.9 x (average vehicle weight [tons] / 3)^0.45 x (365-P)/365

Sources: EPA, 2006b; AP-42, Section 13.2.2, Table 13.2.2-1, Reference for Silt Content: Average for a Service Road associated with the project.
Countless Environmental, 2006
NOAA, 2025

Table MSEF-8: Calculation of Unpaved Road PM2.5 Emission Factor (Passenger Vehicles & Trucks + Light Commerical Trucks)

Variable	Value	
Average Vehicle Weight (tons)	5	GVWR capped at 10,000 lbs for Light Commercial Trucks
Silt Content (%)	6.4	Value for municipal solid waste landfills.
P, Number of days with Precip >0.01 inches	161	From NOAA's Climate Data Online for Station US1ORCC0093 near Sandy, OR
Emission Factor (lb/mile)	0.06	
Emission Factor (lb/mile)	0.03	Reduced for low speeds; accounts for a 44% reduction assuming truck speeds are limited to 15 mph or less (Countless Environmental, 2006)

Equation: Emission Factor [lb/mi] = 0.15 x (silt content [%] / 12)^0.9 x (average vehicle weight [tons] / 3)^0.45 x (365-P)/365

Sources: EPA, 2006b; AP-42, Section 13.2.2, Table 13.2.2-1, Reference for Silt Content: Average for a Service Road associated with the project.
Countless Environmental, 2006
NOAA, 2025

Table TGS-1: Updated Trip Generation Information

Vehicle Type	Number of Round Trips[a]			Number of One-Way Trips[a]		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly
Passenger Vehicles[b]				100		
Chemical Deliveries[c]			37.2	1.9		
Refuse Trucks[b]		9		6.4		
PWB Vehicle Fleet[d]		35				
Non-Chemical Vendor Deliveries[d]		7		1		
Heavy-duty Truck Trip Subtotal[e]				**9.3**		

Sources: Global Transportation Engineering, 2022; Portland Water Bureau, 2025; Stantec, 2021 and 2025b

a Values that are underlined reflect raw data supplied by sources

b From Global Transportation Engineering, 2022

c From Stantec, 2021 and 2025a

d From Portland Water Bureau, 2025

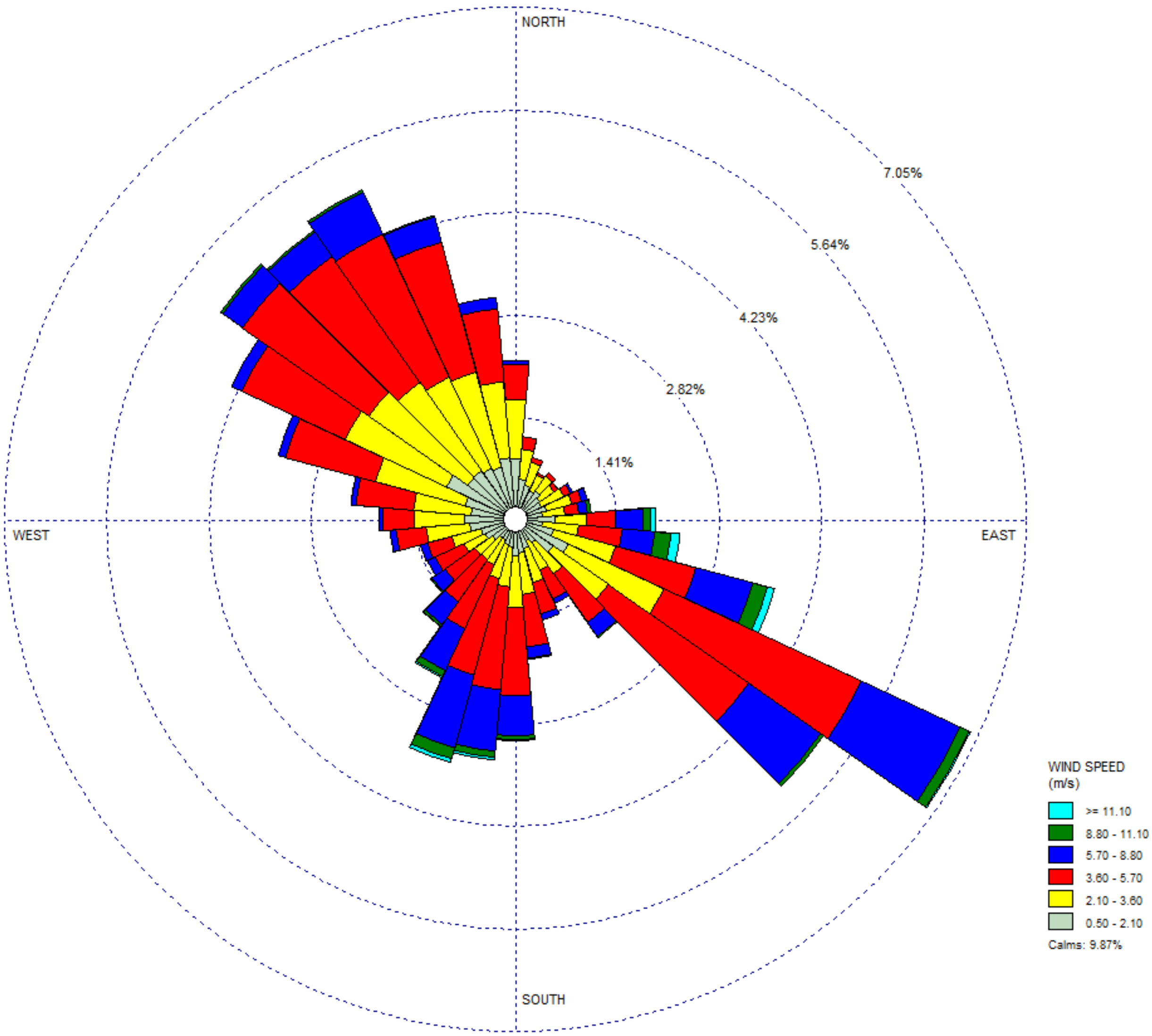
e Reflects only heavy-duty truck trips associated with Project operation

Short Reference	Long Reference
CM/GC, 2024	CM/GC Services (CM/GC), 2024. "Section 26 32 13 - Standby Power Generation". May 2024.
Countless Environmental, 2006	Countless Environmental, 2006. WRAP Fugitive Dust Handbook. September 7, 2006.
Cummins, 2019	Cummins Inc. (Cummins), 2019. Specification Sheet for Diesel Generator Set QSB5 Series Engine 50-125 kW Standby EPA Tier 3 Emissions.
EPA, 2006b	United States Environmental Protection Agency (EPA), 2006b. AP-42: Compilation of Air Emissions Factors from Stationary Sources. Section 13.2.2: Unpaved Roads. November 2006.
EPA, 2011	United States Environmental Protection Agency (EPA), 2011. AP-42: Compilation of Air Emissions Factors from Stationary Sources. Section 13.2.1: Paved Roads. January 2011.
EPA, 2025a	United States Environmental Protection Agency (EPA), 2025a. "nonroad-compression-ignition-2011-present.xlsx." March 2025.
EPA, 2025b	United States Environmental Protection Agency (EPA), 2025b. AP-42: Compilation of Air Emissions Factors from Stationary Sources. Section 3.4: Large Stationary Diesel and All Stationary Dual-fuel Engines. April 2025
EPA, 2025c	United States Environmental Protection Agency (EPA), 2025c. AP-42: Compilation of Air Emissions Factors from Stationary Sources. Section 3.3: Gasoline and Diesel Industrial Engines. April 2025
Globe Transportation Engineering, 2022	Globe Transportation Engineering, 2022. Memorandum: Portalnd Water Bureau Bull Run Filtration Project Traffic Impact Analysis. September 2, 2022.
NOAA, 2025	National Oceanic and Atmospheric Administration (NOAA), 2025. National Centers for Environmental Information. Climate Data Online Request 3978032 for Station US1ORCC0093. April 1, 2025.
OOEM, ND	Oregon Office of Emergency Management (OOEM), ND. "2021 February Winter Storm Spotlight". Website. Accessed April 11, 2025. https://storymaps.arcgis.com/stories/150aa3d2141645da84c476d8ee9ee0e8?
Portland Water Bureau, 2025	Portland Water Bureau, 2025. Personal Communication. Call between Portland Water Bureau's Michelle Cheek and Lyda Hakes, and ESA's Phil Gleason. April 2, 2025.
Stantec, 2021	Stantec, 2021. Final Basis of Design Report for the Bull Run Treatment Projects. Prepared for the Portland Water Bureau. May 2021.
Stantec, 2025a	Stantec, 2025a. Personal Communication. Email. Subject: RE: Filtration Facility - ESA AQ Request for Information (URGENT). Stantec's Mark Graham to ESA's Phil Gleason. April 3, 2025.
Stantec, 2025b	Stantec, 2025b. Personal Communication. Call between Stantec's Mark Graham; Portland Water Bureau's Michelle Cheek, Lyda Hakes, David Peters, Christopher Bowker and Thomas Gilman; and ESA's Phil Gleason. April 3, 2025.
Stantec, 2025c	Stantec, 2025c. Personal Communication. Email. Subject: Filtration Facility - ESA Request for Information (URGENT) - ATTORNEY CLIENT PRIVILEGE. From Stantec's Mark Graham to ESA's Phil Gleason. April 3, 2025.

Attachment 2

Windrose for Portland International Airport

Attachment 2



Windrose for Portland International Airport (PDX) From 1984 to 1990

Source: EPA, 2024

Notes: Figure shows the direction from which wind is blowing. As shown in the figure, the longest bars (i.e., most frequent winds) originate from the northwest (NW), indicating that the prevailing wind is from the NW.