

# MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

## SEPA AIR QUALITY TECHNICAL REPORT

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## Acronyms and Abbreviations

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°F	degrees Fahrenheit
Applicant	Millennium Bulk Terminals–Longview, LLC
BNSF	BNSF Railway Company
CFR	Code of Federal Regulations
CO	carbon monoxide
DPM	diesel particulate matter
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HAP	hazardous air pollutant
lb/day	pounds per day
NAAQS	National Ambient Air Quality Standards
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NEPA	National Environmental Policy Act
NO <sub>2</sub>	nitrogen dioxide
NO <sub>x</sub>	nitrogen oxide
NW AIRQUEST	Northwest International Air Quality Environmental Science and Technology Consortium
O <sub>3</sub>	ozone
OLM	Ozone Limiting Method
PM	particulate matter
PM <sub>2.5</sub>	particulate matter less than 2.5 micrometers in diameter
PM <sub>10</sub>	particulate matter less than 10 micrometers in diameter
ppb	parts per billion
ppm	parts per millions
Proposed Action	Millennium Bulk Terminals—Longview project
RCW	Revised Code of Washington
SEPA	Washington State Environmental Policy Act
SO <sub>2</sub>	sulfur dioxide
SWCAA	Southwest Clean Air Agency
TAP	toxic air pollutant
tpy	tons per year
TSP	total suspended particules
µg/m <sup>3</sup>	micrograms per cubic meter
USC	United States Code
VOC	volatile organic compound
WAC	Washington Administrative Code

This technical report assesses the potential air quality impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and No-Action Alternative. This report describes the regulatory setting, establishes the method for assessing potential air quality impacts, presents the historical and current air quality conditions in the study area, and assesses potential impacts.

## 1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) proposes to construct and operate a coal export terminal in Cowlitz County, Washington, along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming and the Uinta Basin in Utah and Colorado via rail, then load and transport the coal by ocean-going ships via the Columbia River and Pacific Ocean to overseas markets in Asia. The coal export terminal would be capable of receiving, stockpiling, blending, and loading coal by conveyor onto ships for export. Construction of the coal export terminal would begin in 2018. For the purpose of this analysis, it is assumed the coal export terminal would operate at full capacity in 2028.

The following subsections present a summary of the Proposed Action and No-Action Alternative. For detailed information on these alternatives, see the Washington State Environmental Policy Act (SEPA) Alternatives Technical Report (ICF International 2016).

### 1.1.1 Proposed Action

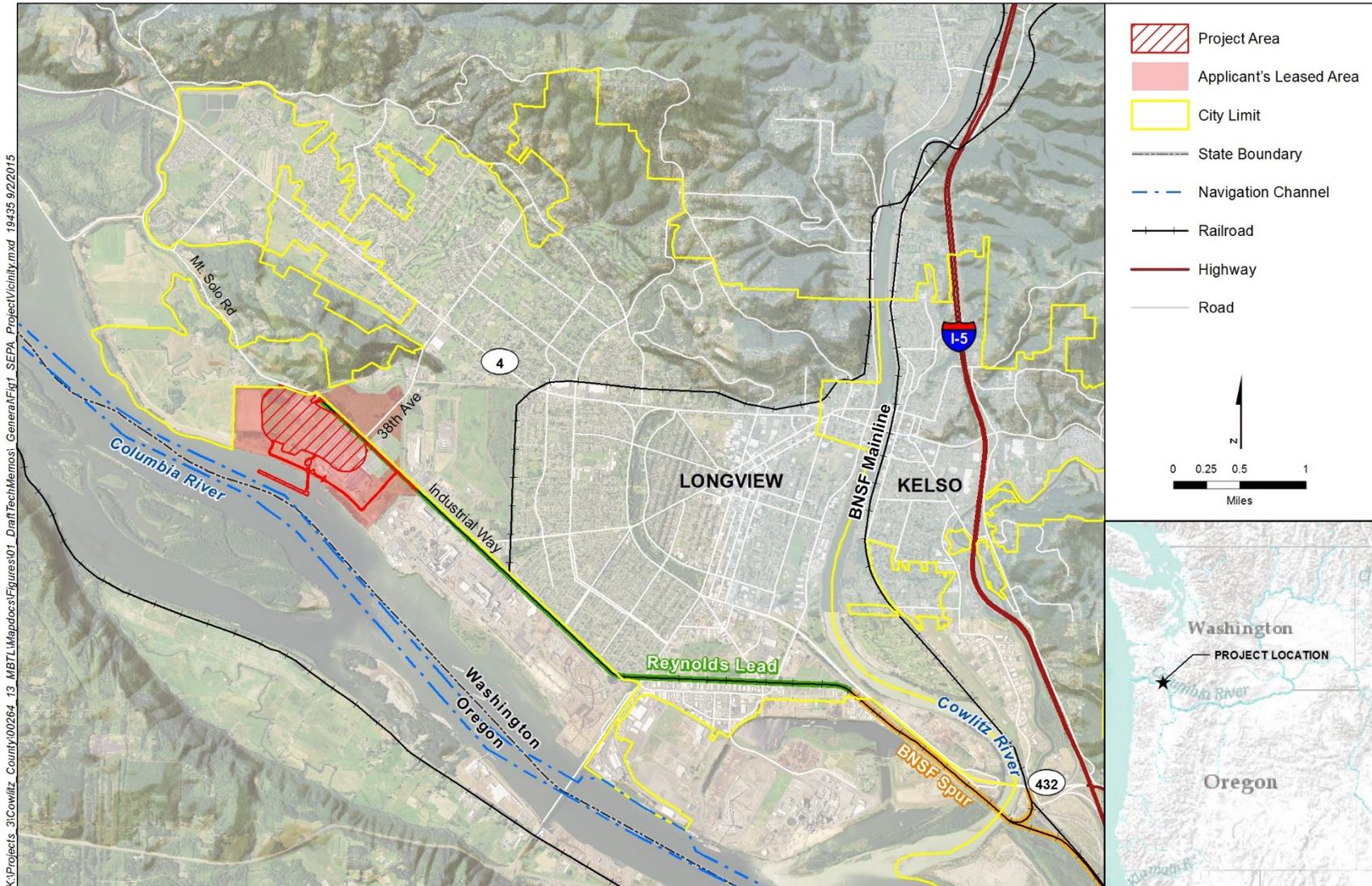
The Proposed Action would develop a coal export terminal on 190 acres (project area). The project area is located within an existing 540-acre area currently leased by the Applicant at the former Reynolds Metals Company facility, and land currently owned by Bonneville Power Administration. The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview city limits (Figure 2).

The Applicant currently and separately operates, and would continue to separately operate, a bulk product terminal on land leased by the Applicant. Industrial Way (State Route 432) provides vehicular access to the Applicant's leased land. The Reynolds Lead and the BNSF Spur, both operated by Longview Switching Company,<sup>1</sup> provide rail access to the Applicant's leased area from a point on the BNSF Railway Company (BNSF) main line (Longview Junction, Washington) located to the east in Kelso, Washington. Ships access the Applicant's leased area via the Columbia River and berth at an existing dock (Dock 1) operated by the Applicant in the Columbia River.

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<sup>1</sup> Longview Switching Company is jointly owned by BNSF Railway Company (BNSF) and Union Pacific Railroad.

Figure 1. Project Vicinity



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Under the Proposed Action, BNSF or Union Pacific Railroad trains would transport coal in rail cars from the BNSF main line at Longview Junction, Washington, to the project area via the BNSF Spur and Reynolds Lead. Coal would be unloaded from rail cars, stockpiled and blended, and loaded by conveyor onto ocean-going ships at two new docks (Docks 2 and 3) on the Columbia River for export.

Once construction is complete, the Proposed Action would have an annual throughput capacity of up to 44 million metric tons.<sup>2</sup> The coal export terminal would consist of one operating rail track, eight rail tracks for the storage of rail cars, rail car unloading facilities, stockpile areas for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and ship-loading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432). Ships would access the project area via the Columbia River and berth at one of the two new docks. Terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

### 1.1.2 No-Action Alternative

Under the No-Action Alternative, the proposed export terminal would not be constructed. Current operations of the bulk product terminal, which include the storage and transport of alumina and up to 150,000 metric tons per year of coal. Importing of alumina would continue and increase in the project area using Dock 1. The Applicant could expand the existing bulk product terminal onto the 190-acre project area, developing storage and shipment facilities to bulk product terminal operations. Coal and alumina would continue to be stored, transferred, and shipped. Additional bulk product transfers activities involving products such as calcine pet coke, coal tar pitch, cement, fly ash, and sand or gravel could also be pursued, and new or revised permits could be required. These operations would involve storage and upland transfer of bulk products, which would use existing or new buildings. Construction of new buildings could involve demolition and replacement of existing buildings and new or modified permits. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations and federal and state permits.

## 1.2 Regulatory Setting

Different jurisdictions are responsible for the regulation of air quality. These jurisdictions and their regulations, statutes, and guidance that apply to air quality are summarized in Table 1.

**Table 1. Regulations, Statutes, and Guidance for Air Quality**

Regulation, Statute, Guideline	Description
<b>Federal</b>	
National Environmental Policy Act (42 USC 4321 <i>et seq.</i> )	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).

<sup>2</sup> A metric ton is the U.S. equivalent to a tonne per the International System of Units, or 1,000 kilograms or approximately 2,204.6 pounds.

<b>Regulation, Statute, Guideline</b>	<b>Description</b>
Clean Air Act and Amendments	As amended in 1970, 1977, and 1990, requires the U.S. Environmental Protection Agency to develop and enforce regulations to protect the public from air pollutants and their health impacts.
National Ambient Air Quality Standards (U.S. Environmental Protection Agency)	Specifies the maximum acceptable ambient concentrations for seven criteria air pollutants: CO, lead, NO <sub>2</sub> , O <sub>3</sub> , PM10 and PM2.5, and SO <sub>2</sub> . Primary NAAQS set limits to protect public health, and secondary NAAQS set limits to protect public welfare. Geographic areas where concentrations of a given criteria pollutant exceed NAAQS are classified as nonattainment areas for that pollutant.
<b>State</b>	
Washington State Environmental Policy Act (WAC 197-11, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.
Washington State General Regulations For Air Pollution Sources (WAC 173-400) and Washington State Clean Air Act (RCW 70.94)	Establishes the rules and procedures to control or prevent the emissions of air pollutants. Provides the regulatory authority to control emissions from stationary sources, reporting requirements, emissions standards, permitting programs, and the control of air toxic emissions.
Washington State Operating Permit Regulation (WAC 173-401)	Establishes the elements for the state air operating permit program.
Washington State Controls for New Sources of Toxic Air Pollutants (WAC 173-460)	Establishes the systematic control of new or modified sources emitting toxic air pollution to prevent air pollution, reduce emissions, and maintain air quality that will protect human health and safety.
Washington State Ambient Air Quality Standards (WAC 173-476)	Establishes maximum acceptable levels in the ambient air for particulate matter, lead, SO <sub>2</sub> , NO <sub>2</sub> , O <sub>3</sub> , and CO.
<b>Local</b>	
Cowlitz County SEPA Regulations (CCC 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Southwest Clean Air Agency (SWCAA 400)	General regulations for regulating stationary sources of air pollution within Clark, Cowlitz, Lewis, Skamania, and Wahkiakum counties of Washington.
Notes: USC = United States Code; NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; CO = carbon monoxide; NO <sub>2</sub> = nitrogen oxides; O <sub>3</sub> = ozone; PM2.5 = particulate matter up to 2.5 micrometers in size; PM10 = particulate matter up to 10 micrometers in size; SO <sub>2</sub> = sulfur dioxide; NAAQS = National Ambient Air Quality Standards; HAPs = hazardous air pollutants; WAC = Washington Administrative Code; RCW = Revised Code of Washington; SEPA = Washington State Environmental Policy Act; SWCAA = Southwest Clean Air Agency	

The federal Clean Air Act and the Clean Air Act Amendments form the basis for a broad range of regulations that control allowable emissions and ambient concentrations of air pollutants in the environment. The National Ambient Air Quality Standards (NAAQS) were established by the U.S. Environmental Protection Agency (EPA) under authority of the Clean Air Act to protect the public from air pollution. Air pollutants for which there are NAAQS are called *criteria pollutants*. Geographic areas where concentrations of a given criteria pollutant exceed an ambient air quality standard are classified as *nonattainment areas* for that pollutant.

Under the federal Clean Air Act, the states are authorized to administer these programs and monitor air quality in different areas to determine if those areas are meeting the NAAQS.

Under RCW 70.94, local counties can choose to form a county authority or join a multi-county authority. Cowlitz County is part of the multi-county air pollution control authority. The Southwest Clean Air Agency (SWCAA) maintains compliance with the NAAQS for most stationary source types of air pollutants via an air permitting programs (Revised Code of Washington [RCW] 70.94.053 and 70.94.057 and SWCAA 400-020). This authority includes the regulation of fugitive dust sources (SWCAA-400-040) as well as vented emissions.

Other federal air quality regulatory programs for major stationary sources include Prevention of Significant Deterioration, National Emission Standards for Hazardous Air Pollutants (NESHAPS), Title V Air Permitting Program, and New Source Performance Standards (NSPS). None of these programs are expected to apply to the Proposed Action because stationary source emissions are well below major source thresholds, and because current NESHAPS and NSPS standards do not apply to the proposed facility type. The state also has rules for toxic air pollutants (TAPs) that are applicable to stationary sources. These rules were established to provide systematic control of TAP emissions (which include both carcinogens and noncarcinogens) in order to maintain the protection of human health and safety.

EPA first began regulating on-road mobile sources in 1970 as part of the Clean Air Act. EPA was given the added regulatory authority under Section 213 in the 1990 Clean Air Act Amendments to control emissions from nonroad engines (e.g., construction equipment, locomotives, and vessels). An extensive number of exhaust emissions standards and regulations have been issued by EPA since 1990 on all classes of nonroad engines including construction equipment, locomotives, vessels, off-road vehicles, and lawn and garden equipment. Regulations that are relevant to the Proposed Action include locomotive emission standards for new and re-built locomotive engines and the North America Emission Control Area for marine vessels limiting the sulfur content in fuel oil. No provisions have been made to allow states (other than California) or local authorities to impose additional regulations on these source categories.

### **1.2.1 Current NAAQS and Washington State Ambient Air Quality Standards**

Table 2 lists both the federal and state ambient air quality standards for six criteria air pollutants and total suspended particulates. Annual standards are never to be exceeded. Short-term standards are not to be exceeded more than once per year, unless noted. The NAAQS consist of primary standards and secondary standards. Primary standards are designed to protect public health, including protecting the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards are designed to protect public welfare from effects such as visibility reduction, soiling, and nuisance (e.g., preventing air pollution damage to vegetation). Compared to the NAAQS, the Washington State Department of Ecology (Ecology) has established additional state ambient standards for sulfur dioxide for other averaging periods, which applies to the Proposed Action.

**Table 2. Federal and Washington State Ambient Air Quality Standards**

Pollutant	Federal		State
	Primary	Secondary	
<b>Carbon monoxide</b>			
8-hour average <sup>a</sup>	9 ppm	No standard	9 ppm
1-hour average <sup>a</sup>	35 ppm	No standard	35 ppm
<b>Ozone</b>			
8-hour average <sup>b,c</sup>	0.070 ppm	0.070 ppm	0.075 ppm
<b>Nitrogen dioxide</b>			
1-hour average <sup>d</sup>	100 ppb	No standard	100 ppb
Annual average	53 ppb	53 ppb	53 ppb
<b>Sulfur dioxide</b>			
Annual average	No standard	No standard	0.02 ppm
24-hour average <sup>e</sup>	No standard	No standard	0.14 ppm
3-hour average <sup>e</sup>	No standard	0.50 ppm	0.50 ppm
1-hour average <sup>f</sup>	75 ppb	No standard	75 ppb
<b>Lead</b>			
Rolling 3-month average	0.15 µg/m <sup>3</sup>	0.15 µg/m <sup>3</sup>	0.15 µg/m <sup>3</sup>
<b>PM10</b>			
24-hour average <sup>g</sup>	150 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>
<b>PM2.5</b>			
Annual average <sup>h</sup>	12 µg/m <sup>3</sup>	15 µg/m <sup>3</sup>	12 µg/m <sup>3</sup>
24-hour average <sup>i</sup>	35 µg/m <sup>3</sup>	35 µg/m <sup>3</sup>	35 µg/m <sup>3</sup>

## Notes:

- <sup>a</sup> Not to be exceeded on more than 1 day per calendar year as determined under the conditions indicated in 173 WAC 476.
- <sup>b</sup> In December 2015, EPA lowered the federal standard for 8-hour ozone from 0.075 ppm to 0.070 ppm.
- <sup>c</sup> To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.070 ppm.
- <sup>d</sup> 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
- <sup>e</sup> Not to be exceeded more than once per calendar year.
- <sup>f</sup> 99th percentile of 1-hour daily maximum concentrations averaged over 3 years.
- <sup>g</sup> Not to be exceeded more than once per year average over 3 years.
- <sup>h</sup> Annual mean averaged over 3 years.
- <sup>i</sup> 98th percentile averaged over 3 years.

Source: 173 WAC 476; U.S. Environmental Protection Agency 2012.

ppm = parts per million; ppb= parts per billion; PM10 = particulate matter with a diameter of 10 micrometers or less; PM2.5 = particulate matter with a diameter of 2.5 micrometers or less; µg/m<sup>3</sup> = micrograms per cubic meter

## 1.2.2 Federal and State Air Toxics

Under the federal Clean Air Act, EPA is also required to control air toxics, which are pollutants known or suspected to cause cancer or other serious health effects, such as birth defects or reproductive effects. Examples of air toxics include benzene, formaldehyde, and toluene. EPA has identified 188 air toxics, which it refers to as *hazardous air pollutants* (HAPs). EPA's control of these pollutants differs from its control of criteria air pollutants discussed above. No ambient air quality standards have been established for air toxics. Instead, EPA has identified all major industrial stationary sources that emit these pollutants, and has developed national technology-based

performance standards to significantly reduce their emissions and ensure that major sources of these toxics are controlled, regardless of geographic location.

Ecology pursues reductions in TAPs, including diesel particulate matter (DPM), listed in Washington Administrative Code 173-460-150, from new or modified stationary sources.<sup>3</sup> In general, all sources that require a notice of construction application are required to assess its TAP emissions from stationary sources with a review of the best available control technology for toxic air pollutants, quantification of emissions, and human health protection demonstration. The objective is to reduce or eliminate TAPs from stationary sources prior to their generation whenever economically and technically practicable. However, the only new stationary source emission considered under the Proposed Action is fugitive coal dust. Fugitive coal dust itself is not a TAP, but components of it may be, so this rule may apply. SWCAA has a separate list of pollutants which may apply to emissions under the Proposed Action from this stationary source.

### 1.2.3 Attainment Status

Based on monitoring information collected over a period of years, EPA and Ecology designate regions as being attainment or nonattainment areas for regulated air pollutants. Attainment status indicates that air quality in an area meets the federal, health-based ambient air quality standards. Nonattainment status indicates that air quality in an area does not meet those standards. If the measured concentrations in a nonattainment area improve to levels consistently below the federal standards, Ecology and EPA can reclassify the nonattainment area to a maintenance area. In this situation, Ecology and the local clean air agency are required to implement maintenance plans to ensure ongoing emissions reductions, and continuous compliance with the federal standards.

Cowlitz County is currently designated unclassifiable-attainment for all NAAQS. This designation means that EPA and Ecology expect the area to meet air quality standards despite a lack of monitoring data. Currently, Ecology and SWCAA only operate a particulate matter less than 2.5 micrometers in diameter (PM<sub>2.5</sub>) air quality monitor.

## 1.3 Study Area

The study area for direct impacts on air quality is defined as the project area and emissions from Proposed Action-related trains along the Reynolds Lead and BNSF Spur. For indirect impacts, the study area comprises Cowlitz County, including vessel activity on the Columbia River. Emissions are aggregated and regulated at a larger scale than a localized study, and therefore direct and indirect emissions are combined. An assessment of air quality impacts from Proposed Action-related trains and vessels in Washington State is also addressed in this analysis.

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<sup>3</sup> A stationary source refers to an emissions source of air pollution that does not move.

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area as they pertain to air quality.

## 2.1 Methods

The air quality analysis evaluated emissions from construction and terminal operations.

Air emissions for the Proposed Action were estimated for carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen oxide (NO<sub>x</sub>), particulate matter less than 10 micrometers in diameter (PM<sub>10</sub>), PM<sub>2.5</sub>, and sulfur dioxide (SO<sub>2</sub>) to evaluate the impact on air quality. Because construction emissions are temporary and have a short period of activity, these emissions are only evaluated in comparison with emissions thresholds. Operational emissions, however, are evaluated in comparison to their impacts on air quality.

The methods used to assess construction-related air quality impacts was designed to estimate the strength of emissions during the peak construction period and to identify the maximum daily emissions. Sources of construction emissions included emissions from construction equipment, river barges, fugitive dust from earthwork activity, vehicle crossing delays, and construction worker commute vehicles.

The air quality assessment for terminal operations considered on-site activities that would generate potential fugitive emissions of particulate matter from the handling and transfer of coal, including unloading coal from rail cars, transferring coal on conveyors, piling coal onto storage piles, and loading coal onto ships. The coal transfers would occur in enclosed areas (i.e., rotary coal car dump and conveyors), as well as areas that are not enclosed (i.e., coal piles and the unloading of rail cars). In addition, the air quality assessment considered locomotive exhaust emissions that occur during the unloading and movement of coal cars, hoteling emissions during vessel loading, emissions from tugs used to maneuver vessels into the terminal, and emissions from operations (e.g., loader) and maintenance equipment.

The operational sources of emissions were assessed for their potential local air quality impacts using EPA's standard regulatory air dispersion model, AERMOD (Version 14134). AERMOD is the appropriate tool for this application as the air quality impacts are localized and AERMOD is designed to assess emissions for multiple point, area, and volume sources in simple and complex terrain, and uses hourly meteorological on-site data. AERMOD output results are compared to the federal and state ambient air quality standards presented in Table 2. Appendix A provides details of the analysis and list of the applicable VOCs and HAPs.

### 2.1.1 Data Sources

The following sources of information were used to determine the emissions impacts from the Proposed Action.

- California’s Air Resource Board, Appendix D, *Emission Estimation Methodology for Ocean Going Vessels* (California Air Resource Board 2011).
- Northwest International Air Quality Environmental Science and Technology Consortium (2015)
- Millennium Coal Export Terminal, Longview Washington, *Environmental Report Air Quality Analysis, Appendix L – Air Quality Modeling Analysis* prepared by URS Corporation (URS Corporation 2015).
- National Climatic Data Center Longview, Washington Monthly Climate Normals, Daily and Monthly Temperature Extremes and Precipitation Averages and Extremes by Month (National Climatic Data Center 2011).
- EPA’s *Compilation of Air Pollutant Emission Factors* (U.S. Environmental Protection Agency 1995a, 1995b, 1995c, 1996).
- EPA’s User’s Guide and Addendum for the AMS/EPA Regulatory Model—AERMOD (U.S. Environmental Protection Agency 2004, 2014).
- EPA’s Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data (U.S. Environmental Protection Agency 2000).
- EPA’s NONROAD Model (Nonroad engines, equipment, and vehicles), Version 2008a (U.S. Environmental Protection Agency 2009).
- EPA’s Federal Marine Compression-Ignition Engines – Exhaust Emission Standards (U.S. Environmental Protection Agency 2012).
- Ecology statewide emissions inventory levels (Washington State Department of Ecology 2014).

## 2.1.2 Impact Analysis Approach

The following sections describe the approach that was taken for the construction impact analysis and the operations impact analysis.

### 2.1.2.1 Construction Impact Analysis Approach

The Applicant has identified three construction scenarios:

- **Truck.** If material is delivered by truck, it is assumed that approximately 88,000 truck trips would be required over the construction period. Approximately 56,000 loaded trucks would be needed during the peak construction year.
- **Rail.** If material is delivered by rail, it is assumed that approximately 35,000 loaded rail cars would be required over the construction period. Approximately two-thirds of the rail trips would occur during the peak construction year.
- **Barge.** If material is delivered by barge, it is assumed that approximately 1,130 barge trips would be required over the construction period. Approximately two-thirds of the barge trips would occur during the peak construction year. Because the project area does not have an existing barge dock, the material would be off-loaded at an existing dock elsewhere on the Columbia River and transported to the project area by truck.

Emissions included in the construction analysis include those from barge and truck emissions associated with the delivery of construction supplies and materials, in addition to direct emissions

from construction equipment exhaust and fugitive dust emissions. Earthwork activity would take place during the first 18 months of construction. Based on the frequency and duration of use and fuel types, emissions were estimated based on either the EPA AP-42 compilation of emissions factors or EPA's NONROAD2008a model for non-road construction equipment activity. A brief description and key assumptions are presented in the following sections for each source type.

## Construction Equipment

Construction equipment exhaust emissions are the result of fuel combustion. This includes activity associated with rail infrastructure, construction of the conveyor and transfer stations, and surge bins, dock, and trestles. Combustion emissions estimates were obtained by applying the EPA NONROAD2008a emissions model (U.S. Environmental Protection Agency 2009) for nonroad equipment activity as reported in the *Environmental Report Air Quality Analysis, Appendix L – Air Quality Modeling Analysis* prepared by URS (URS Corporation 2015). Construction activity was assumed to occur 8 hours per day, 5 days per week, 52 weeks per year, with the exception of track laying machines, which were assumed to occur only 4 hours per day. Emissions factors were then combined with maximum numbers of equipment operated, duration of use, and horsepower to obtain annual emissions. Diesel particulate emissions were derived from PM10 emissions estimates for diesel-powered equipment, which included most on-site combustion sources as well as barges. Additional details on the approach are identified in Appendix A for annual emissions and maximum daily emissions.

## River Barges

Emissions estimates for barge engines were based on EPA's approach for large diesel engines<sup>4</sup> (U.S. Environmental Protection Agency 1996). The river barge was assumed to use ultra-low sulfur diesel, with less than 15 parts per million (ppm) sulfur content. The barge positioning time was assumed to take 1 hour (0.5 hour in and 0.5 hour out), with 753 round trips during the peak construction period (average of 2.9 daily). Additional details on this approach are identified in Appendix A for annual emissions and maximum daily emissions.

## Fugitive Dust from Earthwork Activity

Fugitive dust emissions were estimated using a conservative approach for construction equipment (U.S. Environmental Protection Agency 1995a). This method uses a generic, all-inclusive, emissions factor of 1.2 tons particulate matter (PM)/acre-month for land preparation activities. Land clearing, excavation, earth moving (cut and fill), and other miscellaneous dust-generating activities that typically occur during construction are included as part of this emissions factor. All earthwork for the project area was assumed to occur evenly over a 1-year period, and the standard best management practice of watering to minimize fugitive dust emissions was assumed to be used as well. Additional details on this approach are identified in Appendix A for annual emissions and maximum daily emissions.

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<sup>4</sup> The sum of HAPs factors was obtained from Tables 3.4-3 and 3.4-4 from EPA AP-42, *Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (U.S. Environmental Protection Agency 1996).

## Vehicle Delays at Rail Crossings

Off-site emissions associated with vehicle delays at train crossings from construction-related locomotives transporting construction materials along the Reynolds Lead and BNSF Spur are included in the analysis.

## Construction Worker Commute Vehicles

During peak construction, up to 200 construction workers may commute to the project area. Off-site emissions associated with commute vehicles for construction workers are included in the analysis. Additional details on this approach are identified in Appendix A.

### 2.1.2.2 Operations Impact Analysis Approach

The on-site transfer and storage of coal would create fugitive emissions of coal dust due to product movement and wind erosion. In addition, combustion emissions from rail and vessel movement, as well as some nonroad equipment emissions associated with the operation and maintenance of the terminal, are included in the analysis. The project area also includes emissions at Docks 2 and 3, as well as maneuvering to dock vessels at the terminal; these on-site emissions were considered in the analysis as well. The approach taken to address emissions associated with coal storage and handling, locomotive, vessel, vehicle delays at rail crossings, and employee commute vehicles is described below. A section that describes how emissions were characterized for air quality modeling is also presented below.

#### Coal Storage and Handling

Most on-site coal movement would occur in enclosed areas, including the rotary coal car dump and conveyors. Some transfer activities at the coal storage piles would not be enclosed; however, the conveyors, transfer towers, and the coal storage piles themselves would have systems in place for dust control (watering or dry fogging). Watering of the coal storage piles would help to reduce wind erosion. In general, the combination of these passive (enclosures) and active (watering, fogging) control systems would provide a high level of dust control (up to 99%); however, because these control systems would not operate with negative pressure, a more conservative 95% effectiveness assumption was used. This approach is consistent with a similar type facility that was issued a draft permit from Oregon Department of Environmental Quality. To account for the reduction in emissions from watering of the coal within the project area (URS Corporation 2014), only a 95% effectiveness in reducing coal dust emissions was assumed in this analysis.

#### Locomotives

The impact analysis approach for rail operations used EPA projected emissions factors (grams per gallon [g/gal]) for line-haul locomotives, which are based on projected changes in locomotive fleet over the next 30 years (U.S. Environmental Protection Agency 2009). These emissions were based on locomotive engine load and associated fuel consumption during transport to and from the coal export terminal, the unloading of coal from train cars, as well as the total annual coal throughput. Key assumptions for rail included an estimated duration of 111 minutes (1.85 hours) to unload a 125-car unit train (ICF International and Hellerworx 2016). It was assumed that all locomotives would use ultra-low-sulfur diesel (15 ppb sulfur). Appendices that present this approach in detail are identified in Table 3.

## Vessel

The impact analysis approach for vessel operations assumed that each vessel receiving coal would need three tugs to maneuver the ship, and would require 3 hours total time to assist with docking and departing operations. Further, it was estimated that an average of 13 hours would be needed to load each vessel with coal, and during this period of time, the vessel would be hoteling using auxiliary engines. The typical main and auxiliary engine size was based on Lloyd's Register of Ships Sea-web (Sea-Web 2015).<sup>5</sup> To comply with International Maritime Organization 2016 Emission Control Areas for North America, all vessels were assumed to use the maximum allowed sulfur content marine distillate fuel of 0.1% (1,000 ppm). It was also assumed that all tugboats would use ultra-low-sulfur diesel (15 ppb sulfur). To estimate the vessel emissions outside Cowlitz County but within Washington State, a one-way travel distance of 51.5 miles (Cowlitz County line to 3 nautical miles beyond the mouth of the Columbia River) was used in the analysis along with a round-trip travel time of 8.2 hours. Appendices that present this approach in detail are identified in Table 3.

## Vehicle Delays at Train Crossings

Off-site emissions associated with vehicle delays at train crossings from locomotives transporting coal along the Reynolds Lead and BNSF Spur are included in this analysis. Appendices that present this approach in detail are identified in Table 3.

## Employee Commute Vehicles

The impact analysis approach for employee vehicle emissions assumed approximately 135 vehicles commuting to and from the project area each day, and an average travel time of 24.1 minutes. Appendices that present this approach in detail are identified in Table 3.

**Table 3. Summary of Operational Emissions, Source Type, and Appendix References for Details on the Emissions Calculation**

Source Type	Characterization for the Air Dispersion Modeling	Appendix Tab Presenting Details on Methods Used to Calculate Emissions
Handling and transfer of coal, including unloading coal from rail cars, transferring coal on conveyors, piling coal onto storage piles, and loading coal onto ships <sup>a</sup>	Volume	Tab F
Locomotive exhaust emissions that occur during unloading, idling, and switching of rail cars	Line	Tabs H, H2, and H3
Maneuvering and hotel emissions during vessel loading and tug assist maneuvering	Point	Tabs I, I2
Emissions from operations (e.g., loader) and maintenance equipment	Point	Tabs J, J2
Coal dust from coal storage piles	Area	Tabs D and E
Coal dust from moving rail cars	Line	Tab G
Notes:		
<sup>a</sup> The on-site coal transfers would occur in enclosed areas (i.e., rotary coal car dump and conveyors), as well as areas that are not enclosed (i.e., coal piles and the unloading of rail cars).		

<sup>5</sup> The Sea-Web data is produced by IHS Global Limited. The data is based on Lloyd's Register of Ships Sea-web provided ship characteristics data for ships over 100 gross tons.

## Characterizing Emissions for Air Quality Modeling

An air quality modeling impact assessment was conducted to assess the localized air quality impacts from operation of the terminal on air quality and assess the contribution from just terminal emissions, from all on-site activities, and from all activities, including off-site activities.

The air quality modeling methodology follows general EPA protocols used in air quality permitting. The methodology used is similar to the approach used in the *Environmental Report Air Quality Analysis, Appendix L – Air Quality Modeling Analysis* prepared by URS (URS Corporation 2015). One notable exception was the use of the Tier 3 level Ozone Limiting Method (OLM) to estimate NO<sub>2</sub> concentration. The OLM approach accounts for the NO<sub>x</sub> to NO<sub>2</sub> conversion,<sup>6</sup> using EPA's default NO<sub>2</sub>/NO<sub>x</sub> equilibrium ratio of 0.9, an in-stack NO<sub>2</sub> to NO<sub>x</sub> of 0.05 for locomotives,<sup>7</sup> an in-stack of NO<sub>2</sub> to NO<sub>x</sub> of 0.20 for vessels (Alföldy et al. 2013), and an NO<sub>2</sub> to NO<sub>x</sub> of 0.30 for on-site equipment (Wang et al. 2011). The OLM approach also requires the O<sub>3</sub> data. The nearest representative O<sub>3</sub> data available was from the Oregon Department of Environmental Quality's Sauvie Island monitor located in the Columbia River approximately 25 miles to the south-southeast of the project area. However, this site is not a year-round monitor, and other more distant and less representative sites would be needed to complete the analysis using monitored data. Instead, representative background concentrations for the study area were obtained from the Northwest International Air Quality Environmental Science and Technology Consortium (NW AIRQUEST), Washington State University, for the time period of 2009 through 2011.<sup>8</sup> The background ozone concentration for this location was 79 µg/m<sup>3</sup>.

The air quality model requires that emissions be characterized for use in AERMOD as four types of sources: point, volume, area, and line sources.<sup>9</sup> Each emissions source type characteristic is summarized below.

- **Point Sources.** Vessels and tug boat emissions from vented stacks were characterized as point sources. The operating and maintenance equipment were also modeled as point sources spread across the terminal. Exhaust emissions from on-site operations and maintenance equipment were also based on the NONROAD model. Vessel emissions factors came from several sources, including California's Air Resource Board (CARB) *Emission Estimation Methodology for Ocean Going Vessels* (California Air Resource Board 2011), and EPA's *Federal Marine Compression-Ignition Engines, Exhaust Emission Standards* for highest tier engines—auxiliary and Tugs C2; main engine C3 (U.S. Environmental Protection Agency 2012). This analysis assumes that EPA's engine emissions standards are fully implemented by 2016, and that all vessels would be using these types of engines by the time the terminal would become fully operational.
- **Volume sources.** Coal transfer operations were characterized as volume sources, which included eight transfer towers, a rotary rail dump, surge bins work points, and two conveyors to

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<sup>6</sup> Atmospheric chemistry changes NO to NO<sub>2</sub>; the rate at which this conversion takes place is limited by the available ozone and sunlight.

<sup>7</sup> About 5% of NO<sub>x</sub> freshly emitted from locomotives is in the form of NO<sub>2</sub> (Fritz pers. comm.).

<sup>8</sup> The consortium developed background design value estimates for 2009 through 2011, based on model-monitor interpolated products that provide realistic background design value estimates where nearby ambient monitoring data are unavailable. The work is sponsored by EPA Regional 10, Ecology, and others. More information about the NW AIRQUEST tool can be found at <http://www.lar.wsu.edu/nw-airquest/lookup.html>.

<sup>9</sup> AERMOD User Guide (2004) provides additional information on the definition of these source types.

load coal onto the vessels with emissions rates estimated based on the EPA AP-42, Chapter 13.2.4 approach (U.S. Environmental Protection Agency 1995b).

- **Area sources.** Area sources were used to model low-level ground releases. The four coal storage piles were modeled as area sources with emissions estimated following the EPA AP-42, Chapter 13.2.5 approach (U.S. Environmental Protection Agency 1995c).
- **Line sources.** Exhaust emissions from locomotives unloading operations and coal dust from moving rail cars were modeled as line sources. Coal dust particulate emissions were estimated following EPA's AP-42, Chapter 13.2.5 approach (U.S. Environmental Protection Agency 1995c), and locomotive exhaust emissions were estimated following EPA's NONROAD2008a model<sup>10</sup> (U.S. Environmental Protection Agency 2009).

Table 3 presents a list of emissions source types associated with operations, identifies how the source type is characterized in AERMOD, and lists the appendix where further details are provided on how emissions were calculated.

## 2.2 Existing Conditions

The existing environmental conditions related to air quality in the study area are described below.

### 2.2.1 Project Area Air Quality Conditions

The following sections describe the meteorological conditions and background air quality conditions.

#### 2.2.1.1 Prevailing Meteorology/Climate

The project area is located along the Columbia River in southwestern Washington, approximately 50 miles east of the Pacific Ocean. The region is characterized as a mid-latitude, west coast marine-type climate. The Cascade Range to the east has a large influence on the climate in Cowlitz County. The Cascade Range forms a barrier from continental air masses originating over the Columbia River Basin. The Cascades also induce heavy amounts of rainfall; as moist air from the west rises, it is forced to rise up the mountain slopes, which produces heavier rainfall on the western slopes of the Cascades and moderate rainfall amounts in the lower lying areas, such as Longview.

Summers in the region are mild and dry. Winters are cool, but typically wet and cloudy with a small range in daily temperature. The average annual precipitation in Longview is approximately 48 inches, with most precipitation falling during the months of November through March (National Climate Data Center 2011). Average annual rain events, taken as days with measured rain greater than 0.01-inch, are approximately 175 days per year, based on National Climatic Data Center summaries.

Due mostly to its geographical location, temperatures are usually mild. Days with maximum temperatures above 90 degrees Fahrenheit (°F) occur about 7 times per year on average. Days with a minimum temperature below 32°F occur about 57 times per year on average, and below 0°F temperatures occur only very rarely (none recorded between 1931 and 2006). Mean high

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<sup>10</sup> Rail emissions were based on the national fleet Class-1 line-haul locomotive fleet.

temperatures range from the high 70s in the summer to mid-40s (°F) in winter, while average lows are generally in the low 50s in summer and mid-30s in winter.

Meteorological data collected by the Weyerhaeuser meteorological tower at the nearby Mint Farm Industrial Park between 2001 and 2003 indicates that the prevailing winds in the vicinity of the project area are from the west-northwest and southeast, following along the alignment of the Columbia River at that location. In the fall and winter months (October through March), the winds are primarily from the southeast and east; the winds are typically from the west-northwest in the spring and summer months (April through September). Figure 3 shows the annual wind rose for the Mint Farm meteorological station for the three-year period from 2001 to 2003 with an average wind speed of 2.25 meters/second.

### 2.2.1.2 Background Air Quality

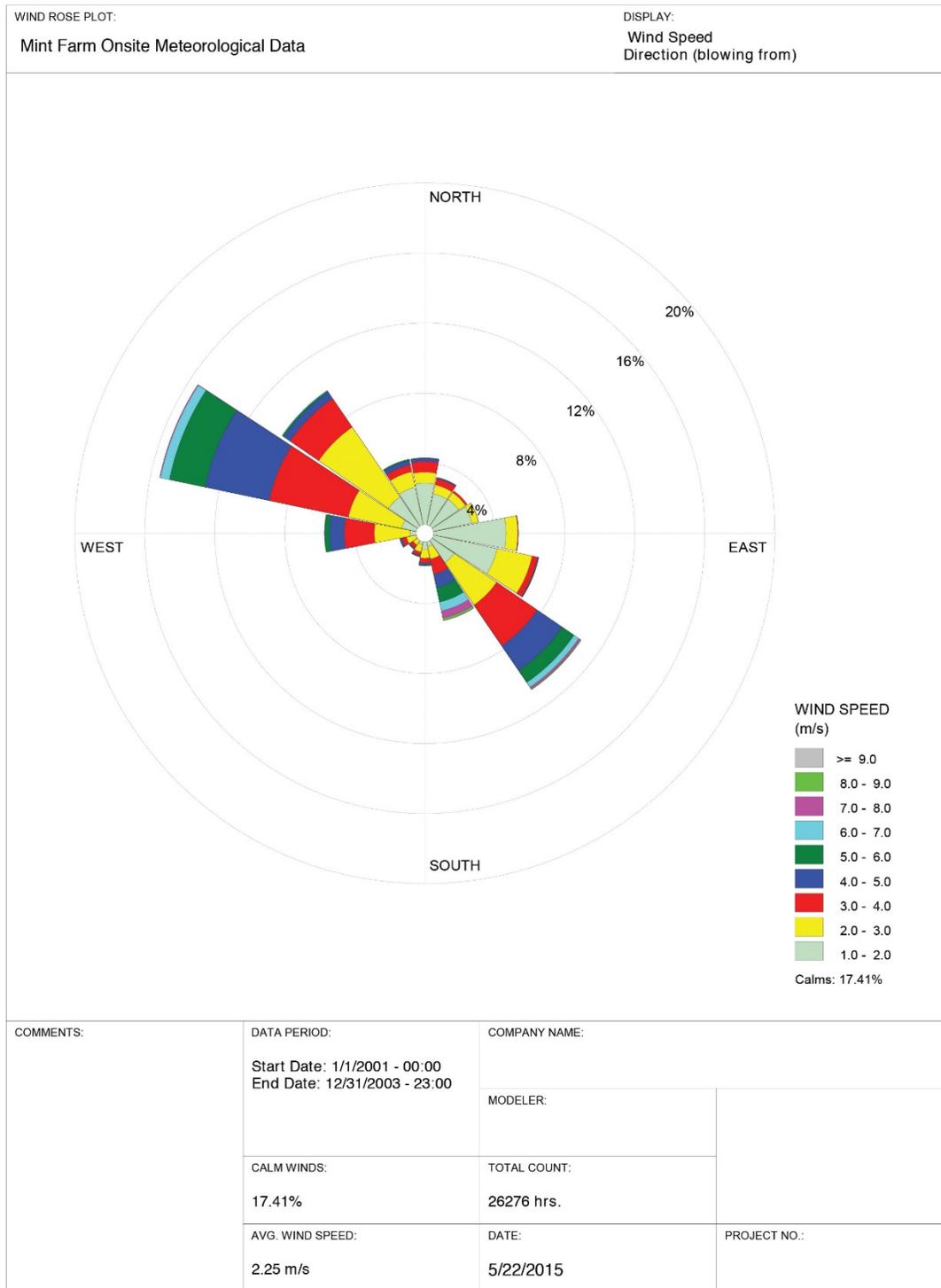
As discussed in Section 1.2.4, *Attainment Status*, Cowlitz County is attainment or unclassified for all criteria pollutants, indicating that air quality in the vicinity of the project area meets the federal and state ambient air quality standards shown in Table 2. The only available local air pollutant monitoring is for PM<sub>2.5</sub>. The monitor is operated by Ecology and is located at 1234 30th Avenue in Longview (Olympic School), approximately 1.5 miles east of the project area.

Beginning January 1, 2007, hourly data were made available for analysis and download at Ecology's monitoring data site (Washington State Department of Ecology 2015a). The maximum reported daily 24-hour PM<sub>2.5</sub> concentration between January 1, 2007 and February 2015 was 28.0 µg/m<sup>3</sup> reported on November 16, 2014. The second highest 24-hour average was 26.7 µg/m<sup>3</sup> reported on November 23, 2013. The 3-year average of 98th percentile is 17.8 µg/m<sup>3</sup>. This 3-year average is well below the 24-hour 98th percentile PM<sub>2.5</sub> standard of 35 µg/m<sup>3</sup>. The 3-year annual average PM<sub>2.5</sub> concentration has ranged from 4.9 to 6.1 µg/m<sup>3</sup> over the past 8 years, with the highest concentration occurring from 2012 through 2014. The monitoring shows that PM<sub>2.5</sub> levels in the Longview-Kelso area are well within the PM<sub>2.5</sub> air quality standards. However this PM<sub>2.5</sub> monitor is not a Federal Reference Method or Federal Equivalence Method monitor, and thus, cannot be used to make formal designations of attainment status.

Concentrations of other criteria pollutants for the study area also are expected to be well within air quality standards, although no monitoring data are available. Estimated values based on air quality modeling are discussed in Section 3.1.1.2, *Operations*.

In addition, criteria pollutants results from the Longview air toxics study (Southwest Clean Air Agency 2007) showed that measured levels of toxic pollutants were below levels of concern for short-term and long-term exposures. The study found that, of the air toxics that could be directly monitored, the air toxics of most concern for potential health risk in Longview are acetaldehyde, arsenic, benzene, manganese and formaldehyde, while DPM was identified as the most likely contributor to cancer risk in Washington State. No further studies on air toxic monitoring in the Longview-Kelso area has been conducted since that time. Regarding HAPs, the most recent national air toxic assessment (U.S. Environmental Protection Agency 2011) showed that Cowlitz County has an overall inhalation cancer risk of 30 cancers per million, which is slightly lower than the state average of 40 cancers per million and below the national average of 40 cancers per million. A similar pattern emerges when DPM is included in the analysis, but with levels nearly ten times higher (Washington State Department of Ecology 2011).

**Figure 3. Wind Data for Mint Farm 2001-2003, Supplemented with Portland International Airport for Missing Hours**



WRPLOT View - Lakes Environmental Software

## 2.2.2 Cowlitz County Air Quality Conditions

Cowlitz County is classified as attainment or unclassified for all air pollutants. Of the criteria air pollutants, only PM<sub>2.5</sub> is currently being monitored in the county. The PM<sub>2.5</sub> monitoring station located at the Olympic Middle School is a neighborhood-scale site, affected primarily by smoke from home heating. It is considered representative of the Longview-Kelso area and is used for curtailment calls during the home heating season. The 24-hour design value in 2014 was 18 µg/m<sup>3</sup> (Washington State Department of Ecology 2015b). Although it is not a reference instrument, it is considered a strong indicator of the relative air quality for the Longview-Kelso area. Air quality in other locations of Cowlitz County is generally as good as or better than in the Longview-Kelso area. With respect to HAPs, the most recent national air toxic assessment (U.S. Environmental Protection Agency 2011) showed that Cowlitz County has an overall inhalation cancer risk of 30 cancers per million, which is lower than the state average of 40 cancers per million as well as below the national average of 40 cancers per million, not including DPM. A similar pattern emerges when DPM is included but with levels nearly ten times higher.

## 2.2.3 Washington State Air Quality Conditions

As described in the SEPA Rail Transportation Technical Report (ICF International and Hellerworx 2016), most loaded and empty trains would be expected to travel the same route between the Washington-Idaho State line and Pasco, Washington. West of Pasco, westbound loaded trains would travel to the project area along the Columbia River Gorge route, through Vancouver, to Longview Junction on the BNSF main line, and then along the BNSF Spur and Reynolds Lead to the project area. Empty trains would travel from the project area along the Reynolds Lead and BNSF Spur to Longview Junction, on the BNSF main line to Auburn, over Stampede Pass, then through Yakima and back to Pasco.

Air quality along the loaded portion of the rail route in eastern Washington from the Idaho border to Pasco is generally good. Spokane is a maintenance area for carbon monoxide, but has not had an exceedance of the carbon monoxide standard in over 10 years. Also in this region of the Columbia Plateau from spring through fall, high winds can combine with dry weather conditions to create dust storms, which can lead to extremely high levels of PM<sub>10</sub>. The state monitors for PM<sub>2.5</sub> along this route, but in general the monitoring is below the state's goal to keep concentrations below 20 µg/m<sup>3</sup>, which is well below the PM<sub>2.5</sub> NAAQS of 35 µg/m<sup>3</sup>. Air quality through the Columbia Gorge is generally good, with the primary concern focused on visibility impairment and regional haze issues; standards established to protect visibility are much lower than for health effects. The air quality from Vancouver up to Longview is generally good with PM<sub>2.5</sub> being the pollutant of most concern; readings are generally below the state's goal to keep PM<sub>2.5</sub> concentrations below 20 µg/m<sup>3</sup>. The few days with higher levels mostly occur during the home heating season. Vancouver design values cannot be calculated because of data completeness issues.

Unloaded rail cars would pass from Longview through Tacoma, up to Auburn, and over the Cascades via Stampede Pass. The area east of Auburn experiences some of the highest ozone levels in western Washington, but these levels are below the NAAQS. The ozone monitoring site near Enumclaw has shown exceedances of the 8-hour ozone standard during the past 3 years (Washington State Department of Ecology 2015b).

Air quality from Stampede Pass through Yakima and back to Pasco is generally good but in the Yakima region recent monitoring data in the area has shown higher than usual levels of PM2.5 that contains nitrate. In Yakima, much of the PM2.5 comes from wood burning, with the highest levels occurring during the wintertime as a result of increased wood burning along with stagnant air conditions (Washington State Department of Ecology 2015b); nitrate accounts for up to one-quarter of the wintertime PM2.5 in the Yakima area. High levels of daily PM2.5 are found in Ellensburg for 2 to 3 weeks each year. Unloaded rail cars would then pass along the same route from Pasco back to Spokane with the same air quality as described above.

Vessel traffic would traverse along the Columbia River between the project area and the mouth of the Columbia River. Wahkiakum and Pacific Counties are designated as attainment areas for criteria air pollutants.

With respect to HAPs, the 2005 EPA National-Scale Air Toxics Assessment was adjusted by Ecology to estimate cancer risk (Washington State Department of Ecology 2011). Inhalation cancer risks were highest in the major population centers along the rail route (i.e., Vancouver and Spokane), with a cancer risk of up to 500 cancers per million. For the smaller communities (i.e., Kelso-Longview, Spokane, Yakima, and Pasco), cancer risks were up to 300 cancers per million, although locations along the rail line have cancer risks of less than 75 cancers per million.<sup>11</sup>

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<sup>11</sup> EPA released the results from the 2011 National-Scale Air Toxics Assessment in December 2015. The 2011 Ecology study uses the 2005 National-Scale Air Toxics Assessment.

This chapter describes the impacts on air quality that would result from construction and operation of the Proposed Action or the ongoing activities of the No-Action Alternative.

## **3.1 Impacts**

This section describes the impacts on air quality that could result from the Proposed Action and No-Action Alternative.

### **3.1.1 Proposed Action**

Potential impacts on air quality from the Proposed Action are described below.

#### **3.1.1.1 Construction**

Maximum annual emission estimates associated with construction of the Proposed Action are presented in Table 4, and maximum daily emission estimates are presented in Table 5. Table 4 provides the maximum annual construction emissions during the peak of the construction period. Table 5 considers the same construction activities presented in Table 4, while looking at the maximum construction emissions occurring during an 8-hour weekday.

As mentioned in Section 1.2.4, *Attainment Status*, the study area is in attainment for all criteria pollutants. Although attainment areas are not subject to federal General Conformity rules (40 CFR 93, subpart B), the rule provides emission *de minimis* levels that could be used for evaluating the potential impact from construction emissions.

As shown in Table 4, the maximum annual construction-related emissions would be well below the *de minimis* levels established by the EPA. This means that although emissions of criteria pollutants would occur, they would not be expected to cause a significant change in air quality and are unlikely to adversely affect sensitive receptors surrounding the project area. Table 5 shows the maximum daily construction emissions. This maximum activity occurs early in the construction schedule with earthwork activity and with the delivery of construction of materials via barge and truck. Since no suitable docking locations are available for the type of barges needed to deliver materials in Cowlitz County, the barge emissions are included as informational since barge emissions would be outside the study area. Haul truck emissions are included for the truck trips needed to make deliveries of construction material to the project area.

The estimated emissions shown in Tables 4 and 5 assume that best management practices would be followed, including reduced idling measures, dust control measures to minimize soil disturbance, and the application of water along access roads to minimize the track-out of soil.

**Table 4. Maximum Annual Estimated Construction Emissions**

Source	Construction Emissions (tpy) [maximum per year]								
	NO <sub>x</sub>	CO	VOCs	SO <sub>2</sub>	TSP	PM10	PM2.5	HAPs	DPM
<b>Combustion Sources</b>									
Equipment (project area)	24.60	9.04	2.23	0.95	2.34	1.93	1.93	0.05	2.34
Haul Trucks (project area)	4.06	0.88	0.18	0.01	0.23	0.19	0.13	0.004	0.23
Haul Trucks (study area) <sup>a</sup>	9.37	2.04	0.41	0.03	0.54	0.44	0.31	0.010	0.54
Barges (study area) <sup>b</sup>	59.0	15.68	1.51	0.028	1.29	1.06	1.06	0.03	1.29
Passenger Commute Vehicles/Crossing-Delay (study area) <sup>a</sup>	0.05	7.5	0.13	0.010	0.22	0.22	0.04	0.001	<0.001
<b>Total Combustion Sources (project area)</b>	<b>28.66</b>	<b>9.92</b>	<b>2.41</b>	<b>0.96</b>	<b>2.57</b>	<b>2.12</b>	<b>2.06</b>	<b>0.05</b>	<b>2.57</b>
<b>Total Combustion Sources (all study area)<sup>c</sup></b>	<b>38.1</b>	<b>19.5</b>	<b>2.95</b>	<b>1.0</b>	<b>3.3</b>	<b>2.8</b>	<b>2.4</b>	<b>0.07</b>	<b>3.1</b>
<b>Fugitive Sources</b>									
Controlled Fugitive Earthwork (project area)	-	-	-	-	12.00	5.87	1.22	-	-
<b>Total Fugitive Sources</b>	-	-	-	-	<b>12.00</b>	<b>5.87</b>	<b>1.22</b>	-	-
<b>Total</b>									
<b>On-site construction emissions sources (project area)</b>	<b>28.7</b>	<b>9.9</b>	<b>2.41</b>	<b>0.96</b>	<b>14.6</b>	<b>7.99</b>	<b>3.28</b>	<b>0.05</b>	<b>2.6</b>
<b>All construction emissions sources<sup>c</sup></b>	<b>38.1</b>	<b>19.5</b>	<b>2.95</b>	<b>1.0</b>	<b>15.3</b>	<b>8.7</b>	<b>3.6</b>	<b>0.07</b>	<b>3.1</b>
General Conformity <i>de minimis</i> levels for ozone maintenance areas (CFR 93.153)	100	100	100	100		100	100		

Source: Combustion and fugitive emissions sources were obtained from various references, as described above under Section 2.1.2.1, *Construction Impact Analysis Approach*.

Notes:

<sup>a</sup> Not in the project area but within Cowlitz County.

<sup>b</sup> Not in project area. Based on barge maneuvering time for docking of 0.5 hour in and 0.5 hour out; does not include transit on the Columbia River.

<sup>c</sup> Rounded. Does not include barge emissions, but does include haul truck emissions to the project area.

"-" = not applicable

tpy = tons per year; NO<sub>x</sub> = nitrogen oxide; CO = carbon monoxide; VOCs = volatile organic compounds; SO<sub>2</sub> = sulfur dioxide; TSP = total suspended particles; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; HAPs = hazardous air pollutants; DPM = diesel particulate matter

**Table 5. Maximum Daily Estimated Construction Emissions**

Source	Construction Emissions (lb/day) [maximum daily]								
	NO <sub>x</sub>	CO	VOCs	SO <sub>2</sub>	TSP	PM10	PM2.5	HAPs	DPM
<b>Combustion Sources</b>									
Equipment (project area)	229.6	82.89	20.4	8.67	21.49	17.66	17.66	0.42	21.5
Haul Trucks (project area)	54.7	14.4	3.1	0.2	6.1	5.0	2.6	0.1	6.12
Haul Trucks (study area) <sup>a</sup>	110.48	24.0	4.81	0.33	6.34	5.21	3.66	0.12	6.34
Barges (study area) <sup>b</sup>	454.7	120.8	11.6	0.21	9.90	8.14	8.14	0.61	9.9
Passenger Commute and Crossing Delay (study area) <sup>a</sup>	1.43	20.0	0.35	0.03	0.58	0.58	0.11	0.01	<0.001
<b>Total Combustion Sources (project area)</b>	<b>284.3</b>	<b>97.29</b>	<b>23.5</b>	<b>8.87</b>	<b>27.59</b>	<b>22.66</b>	<b>20.26</b>	<b>0.52</b>	<b>27.62</b>
<b>Total Combustion Sources (all study area)<sup>c</sup></b>	<b>396.2</b>	<b>141.29</b>	<b>28.7</b>	<b>9.23</b>	<b>34.5</b>	<b>28.5</b>	<b>24.0</b>	<b>0.65</b>	<b>34.0</b>
<b>Fugitive Sources</b>									
Controlled Fugitive Earthwork	-	-	-	-	66.7	32.6	6.80	-	-
<b>Total Fugitive Sources</b>	-	-	-	-	<b>66.7</b>	<b>32.6</b>	<b>6.80</b>	-	-
<b>Total</b>									
<b>Onsite construction emissions sources (project area)</b>	<b>284.3</b>	<b>97.29</b>	<b>23.5</b>	<b>8.87</b>	<b>94.3</b>	<b>55.3</b>	<b>27.1</b>	<b>0.52</b>	<b>27.6</b>
<b>All construction emissions sources<sup>c</sup></b>	<b>396.2</b>	<b>141.29</b>	<b>28.7</b>	<b>9.23</b>	<b>101.21</b>	<b>61.1</b>	<b>30.8</b>	<b>0.65</b>	<b>34.0</b>
Notes:									
Source: Combustion and fugitive emissions sources were obtained from various references, as described above under Section 2.1.2.1, <i>Construction Impact Analysis Approach</i> .									
<sup>a</sup> Not in the project area, but within Cowlitz County.									
<sup>b</sup> Not in project area. Based on barge maneuvering time for docking of 0.5 hour in and 0.5 hour out; does not include transit on the Columbia River									
<sup>c</sup> Rounded. Does not include barge emissions, but does include haul truck emissions to the project area.									
“-“ = not applicable									
lb/day = pounds per day; NO <sub>x</sub> = nitrogen oxide; CO = carbon monoxide; VOCs = volatile organic compounds; SO <sub>2</sub> = sulfur dioxide; TSP = total suspended particles; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; HAPs = hazardous air pollutants; DPM = diesel particulate matter									

### 3.1.1.2 Operations

Sources of air pollution from the Proposed Action would include fugitive emissions from coal handling and mobile source emissions from maintenance and operation of the terminal, as well as emissions from trains and vessels used in transport. As presented in Table 6, rail and vessel emissions are the largest source of emissions, with the exception of particulate matter where all sources are important contributors. The terminal would produce only small quantities of air pollutants (maintenance/operations); the supporting operations of coal transport from vessels and trains are the dominant source of air emissions.

**Table 6. Full Operations Maximum Annual Average Emissions<sup>a</sup>**

Source	Maximum Annual Average Emissions (tpy)								
	NO <sub>x</sub>	CO	VOCs	SO <sub>2</sub>	TSP	PM10	PM2.5	HAPs	DPM
<b>Fugitive Sources</b>									
<i>Coal Transfer (except piles):</i>									
Material Handling	-	-	-	-	5.25	1.84	0.28	-	-
<i>Coal Piles:</i>									
Wind Erosion	-	-	-	-	1.08	0.92	0.14	-	-
Material Handling	-	-	-	-	2.62	0.92	0.14	-	-
<b>Mobile Sources</b>									
<i>Maintenance/Operations Equipment:</i>									
Combustion	4.36	1.42	0.36	0.19	0.38	0.31	0.31	0.01	0.38
Employee Commute\Crossing Delay	0.13	2.05	0.04	0.003	0.008	0.08	0.02	0.01	<0.01
<i>Locomotive:</i>									
Combustion (off-site) <sup>b</sup>	17.5	7.63	0.60	0.027	0.45	0.37	0.36	0.08	0.45
Fugitive Dust (off-site) <sup>b</sup>	-	-	-	-	0.94	0.80	0.12	-	-
Combustion (on-site)	11.6	4.00	0.48	0.01	0.30	0.25	0.24	0.04	0.21
Fugitive Dust (on-site)	-	-	-	-	2.10	1.79	0.27	-	-
<i>Vessels:</i>									
Combustion (off-site) <sup>b</sup>	24.8	37.9	14.1	3.04	2.17	1.78	1.64	0.03	0.00
Combustion (on-site)	23.3	65.9	15.3	4.52	1.27	1.05	1.02	0.08	0.56
<b>Total: All Mobile Sources, On-site and Off-site</b>	<b>81.7</b>	<b>118.9</b>	<b>30.9</b>	<b>7.8</b>	<b>7.6</b>	<b>6.4</b>	<b>4.0</b>	<b>0.3</b>	<b>1.6</b>
<b>Total - On-site Sources</b>	<b>39.3</b>	<b>71.3</b>	<b>16.14</b>	<b>4.72</b>	<b>13.00</b>	<b>7.08</b>	<b>2.40</b>	<b>0.13</b>	<b>1.15</b>
<b>Fugitive Dust Only</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>11.05</b>	<b>5.47</b>	<b>0.83</b>	<b>-</b>	<b>-</b>
<b>Mobile Combustion Sources</b>	<b>39.26</b>	<b>71.32</b>	<b>16.14</b>	<b>4.72</b>	<b>1.95</b>	<b>1.61</b>	<b>1.57</b>	<b>0.13</b>	<b>1.15</b>

Notes:

Source: Combustion and fugitive emissions sources were obtained from various references, as described in Section 2.1.2.2, *Operations Impact Analysis Approach*.

<sup>a</sup> Full operations = Maximum production (44 million metric tons per year).

<sup>b</sup> off-site = Not in the project area.

“-“ = Not applicable.

tpy = tons per year; NO<sub>x</sub> = nitrogen oxide; CO = carbon monoxide; VOCs = volatile organic compounds; SO<sub>2</sub> = sulfur dioxide; TSP = total suspended particles; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; HAPs = hazardous air pollutants; DPM = diesel particulate matter

## Air Quality Impact Assessment

A modeling analysis was performed with the AERMOD dispersion model. The results from the modeling are compared with the NAAQS.

Two sets of emissions were developed. The first set was used to model the long-term (annual average concentrations), reflecting emissions over an entire year with train and vessel arrivals spread over the year to simulate the average activity at the terminal. The second set of emissions was used to determine the short-term (24-hour or less concentrations), reflecting peak emissions that could occur during the course of an hour. Peak activity included a coal train unloading at the terminal, a vessel loading with coal, and a second vessel docking at the terminal.

To assess impacts associated with the Proposed Action, the AERMOD model was used to predict the increase in criteria pollutant concentrations. The maximum modeled incremental increases for each pollutant and averaging time were added to applicable background concentrations. With the exception of PM<sub>2.5</sub>, the background concentrations were obtained from NW AIRQUEST, Washington State University, for the time period 2009 through 2011.<sup>12</sup> These consortium values are typically recommended for use as background concentration by Ecology in air quality analyses when no representative monitoring data is available. The resulting total pollutant concentrations (background plus modeled concentration) were then compared with the appropriate NAAQS.

As described in Section 2.2, *Existing Conditions*, there is a monitoring program for PM<sub>2.5</sub> in the Longview-Kelso area and the resulting data were used to estimate the background concentration for PM<sub>2.5</sub>. The method for comparing modeled impacts with added background concentrations to each NAAQS is dependent on the form of the standard, and thus varies by pollutant and averaging time. The differences are footnoted in the comparison tables (Tables 7, 8, and 9). For example, the 1-hour NO<sub>2</sub> NAAQS is based on the 98<sup>th</sup> percentile of 1-hour daily maximum concentration (8th highest 1-hour daily maximum for a full year of hourly values) across the 3 meteorological modeling years (2009 through 2011) plus the background concentration.

Table 7 summarizes the maximum predicted criteria pollutant concentrations due to maintenance and operations of the terminal only. This includes the material handling and moving of the coal and coal piles, as well as exhaust emissions from mobile source equipment (e.g., loader). In no case are the terminal-only estimated emissions in combination with the background concentrations anticipated to cause a violation of any NAAQS. The highest incremental impact due to the terminal-only operation is the 24-hour PM<sub>10</sub> impact, which is 38% of the respective NAAQS.

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<sup>12</sup> The consortium developed background design value estimates for 2009 through 2011, based on model-monitor interpolated products that provide realistic background design value estimates where nearby ambient monitoring data are unavailable. The work is sponsored by EPA Regional 10, Ecology, and others. More information about the NW AIRQUEST tool can be found at <http://www.lar.wsu.edu/nw-airquest/lookup.html>.

**Table 7. AERMOD Modeling Results (Terminal Sources: Maintenance and Operations Equipment)<sup>a</sup>**

<b>Pollutant</b>	<b>Averaging Period</b>	<b>Modeled Impact (µg/m<sup>3</sup>)</b>	<b>Background<sup>b,c</sup> (µg/m<sup>3</sup>)</b>	<b>Total Predicted Concentration (µg/m<sup>3</sup>)</b>	<b>NAAQS (µg/m<sup>3</sup>)</b>
CO	1 hour <sup>d</sup>	10.7	827	838	40,000
	8 hour <sup>d</sup>	4	600	604	10,000
NO <sub>2</sub>	1 hour <sup>e,f</sup>	15	56.6	72	188
	Annual <sup>f,g</sup>	0.4	5.3	6	100
PM10	24 hour <sup>h</sup>	57	23	80	150
PM2.5	24 hour <sup>i</sup>	4.8	17.8	22.6	35
	Annual <sup>j</sup>	0.2	6.1	6.3	12
SO <sub>2</sub>	1 hour <sup>k</sup>	6.8	14.7	21.5	196
	3 hour <sup>l</sup>	4.5	11.5	16.0	1,300

## Notes:

- <sup>a</sup> Terminal sources include emissions from handling coal, coal storage piles, and mobile source exhaust emissions from the operation and maintenance of the facility.
- <sup>b</sup> Background design value estimates for 2009 through 2011, based on model-monitor interpolated products (except PM2.5) sponsored by EPA Regional 10, Ecology, and others. From NW AIRQUEST tool Washington State University (<http://www.lar.wsu.edu/nw-airquest/lookup.html>).
- <sup>c</sup> PM2.5 background based on Ecology's Kelso Monitor (2012 through 2014).
- <sup>d</sup> Modeled impact is the highest 2nd high for each calendar year over the 3 modeled years..
- <sup>e</sup> The NO<sub>2</sub> 1-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.
- <sup>f</sup> Modeled NO<sub>2</sub> impacts applied the Tier III Ozone Limiting Method (OLM), using an ozone background of 42ppb, as per the NW-AIRQUEST tool. For additional information regarding the modeling methodology, see Section 2.1.2.2, *Operations Impact Analysis Approach*.
- <sup>g</sup> The NO<sub>2</sub> annual modeled impact is the maximum annual mean over the 3 modeled years.
- <sup>h</sup> The PM10 24-hour modeled impact is 3-year average of the highest 2nd high concentration.
- <sup>i</sup> The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.
- <sup>j</sup> The PM2.5 annual modeled impact is the 3-year average of the annual mean.
- <sup>k</sup> The SO<sub>2</sub> 1-hour modeled impact is the 3-year average of the 99th percentile of the 1-hour daily maximum concentrations.
- <sup>l</sup> The SO<sub>2</sub> 3-hour modeled impact is not to be exceeded more than once per year.

µg/m<sup>3</sup> = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; CO = carbon monoxide; NO<sub>2</sub> = nitrogen dioxide; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; SO<sub>2</sub> = sulfur dioxide

Table 8 shows the modeling results for on-site sources (terminal emissions sources, plus cargo vessel and train operations while on-site). Cargo vessel operations are the main source of SO<sub>2</sub> emissions, which has an incremental increase in the 1-hour SO<sub>2</sub> concentration that is 61% of the respective standard. The incremental increase in the 24-hour PM10 is about half the respective standard. The maximum impacts for each pollutant plus the maximum background show total concentrations below the NAAQS for all criteria air pollutants.

**Table 8. AERMOD Modeling Results (On-site Sources)<sup>a</sup>**

Pollutant	Averaging Period	Modeled Impact ( $\mu\text{g}/\text{m}^3$ )	Background <sup>b,c</sup> ( $\mu\text{g}/\text{m}^3$ )	Total Predicted Concentration ( $\mu\text{g}/\text{m}^3$ )	NAAQS ( $\mu\text{g}/\text{m}^3$ )
CO	1 hour <sup>d</sup>	220	827	1,047	40,000
	8 hour <sup>d</sup>	71	600	671	10,000
NO <sub>2</sub>	1 hour <sup>d,e</sup>	100	56.6	157	188
	Annual <sup>f,g</sup>	10.8	5.3	12	100
PM10	24 hour <sup>h</sup>	85	23	108	150
PM2.5	24 hour <sup>i</sup>	12	17.8	29.8	35
	Annual <sup>j</sup>	1.1	6.1	7.2	12
SO <sub>2</sub>	1 hour <sup>k</sup>	119	14.7	134	196
	3 hour <sup>l</sup>	84	11.5	96	1,300

## Notes:

- <sup>a</sup> On-site sources include emissions from handling coal, coal storage piles, and mobile source exhaust emissions from the operation and maintenance of the facility.
- <sup>b</sup> Background design value estimates for 2009 through 2011, based on model-monitor interpolated products (except PM2.5) sponsored by EPA Regional 10, Ecology, and others. From NW AIRQUEST tool Washington State University (<http://www.lar.wsu.edu/nw-airquest/lookup.html>.)
- <sup>c</sup> PM2.5 background based on Ecology's Kelso Monitor (2012 through 2014).
- <sup>d</sup> Modeled impact is the highest 2nd high for each calendar year over the 3 modeled years.
- <sup>e</sup> The NO<sub>2</sub> 1-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.
- <sup>f</sup> Modeled NO<sub>2</sub> impacts applied the Tier III Ozone Limiting Method (OLM), using an ozone background of 42ppb, as per the NW-AIRQUEST tool. For additional information regarding the modeling methodology, see Section 2.1.2.2, *Operations Impact Analysis Approach*.
- <sup>g</sup> The NO<sub>2</sub> annual modeled impact is the maximum annual mean over the 3 modeled years.
- <sup>h</sup> The PM10 24-hour modeled impact is 3-year average of the highest 2nd high concentration.
- <sup>i</sup> The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.
- <sup>j</sup> The PM2.5 annual modeled impact is the 3-year average of the annual mean.
- <sup>k</sup> The SO<sub>2</sub> 1-hour modeled impact is the 3-year average of the 99th percentile of the 1-hour daily maximum concentrations.
- <sup>l</sup> The SO<sub>2</sub> 3-hour modeled impact is not to be exceeded more than once per year.

$\mu\text{g}/\text{m}^3$  = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; CO = carbon monoxide; NO<sub>2</sub> = nitrogen dioxide; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; SO<sub>2</sub> = sulfur dioxide

Table 9 shows the modeling results for all on-site sources and off-site sources (vessels arriving and departing from the terminal, assist tugs, plus trains arriving and departing from the terminal, to approximately 5 miles out). These results are similar to the on-site sources. The largest increase as a percentage of the NAAQS is the SO<sub>2</sub> concentration due to operation of the tugs and cargo vessels. Again, in all cases the maximum impacts for each pollutant plus the maximum background show total concentrations below the NAAQS for all criteria air pollutants.

**Table 9. AERMOD Modeling Results (On-site and Off-site Sources)**

Pollutant	Averaging Period	Modeled Impact ( $\mu\text{g}/\text{m}^3$ )	Background <sup>a,b</sup> ( $\mu\text{g}/\text{m}^3$ )	Total Predicted Concentration ( $\mu\text{g}/\text{m}^3$ )	NAAQS ( $\mu\text{g}/\text{m}^3$ )
CO	1 hour <sup>c</sup>	346	827	1,173	40,000
	8 hour <sup>c</sup>	97	600	697	10,000
NO <sub>2</sub>	1 hour <sup>c,d</sup>	100	56.6	157	188
	Annual <sup>e,f</sup>	16	5.3	21	100
PM10	24 hour <sup>g</sup>	85	23	108	150
PM2.5	24 hour <sup>h</sup>	12	17.8	29.8	35
	Annual <sup>i</sup>	1.2	6.1	7.3	12
SO <sub>2</sub>	1 hour <sup>j</sup>	130	14.7	145	196
	3 hour <sup>k</sup>	127	11.5	138	1,300

## Notes:

- a Background design value estimates for 2009 through 2011, based on model-monitor interpolated products (except PM2.5) sponsored by EPA Regional 10, Ecology, and others. Source: NW AIRQUEST tool Washington State University (<http://www.lar.wsu.edu/nw-airquest/lookup.html>).
- b PM2.5 background based on Ecology's Kelso Monitor (2012 through 2014).
- c Modeled impact is the highest 2nd high for each calendar year over the 3 modeled years.
- d The NO<sub>2</sub> 1-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.
- e Modeled NO<sub>2</sub> impacts applied the Tier III Ozone Limiting Method (OLM), using an ozone background of 42ppb, as per the NW-AIRQUEST tool. For additional information regarding the modeling methodology, see Section 2.1.2.2, *Operations Impact Analysis Approach*.
- f The NO<sub>2</sub> annual modeled impact is the maximum annual mean over the 3 modeled years.
- g The PM10 24-hour modeled impact is 3-year average of the highest 2nd high concentration.
- h The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.
- i The PM2.5 annual modeled impact is the 3-year average of the annual mean.
- k The SO<sub>2</sub> 1-hour modeled impact is the 3-year average of the 99th percentile of the 1-hour daily maximum concentrations.
- l The SO<sub>2</sub> 3-hour modeled impact is not to be exceeded more than once per year.
- $\mu\text{g}/\text{m}^3$  = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; CO = carbon monoxide; NO<sub>2</sub> = nitrogen dioxide; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; SO<sub>2</sub> = sulfur dioxide

## Proposed Action and Cowlitz County Emissions Comparison

The pollutant emissions totals within Cowlitz County for the Proposed Action during maximum terminal throughput (Table 6) are shown in Table 10 with the 2011 Cowlitz County emissions inventory totals.

When comparing potential train emissions (a combination of on-site and off-site fugitive dust and combustion emissions) resulting from full operations of the Proposed Action (Table 6) with the 2011 railroad emissions in Cowlitz County (Table 10), railroad-related emissions are estimated to increase by about 6%. The largest emissions increase for a single pollutant associated with rail is for PM10, which is equal to an increase of approximately 15% when compared to the 2011 rail emissions for Cowlitz County.

A similar comparison is made for vessel emissions as shown in Table 10; vessel-related emissions are estimated to increase by about 12%. The largest emissions increase for a single pollutant associated with vessels is for CO and VOC at approximately 69 and 63%, respectively when compared to the 2011 vessel emissions for Cowlitz County. The increase in CO emissions is

primarily due to ship hoteling, which would use the auxiliary engines while docked. While this emission increase represents a substantial increase relative to the commercial marine vessel category, overall it represents only a small increase (0.28% and 0.17%) to the total Cowlitz County CO and VOC emissions.

**Table 10. Maximum Annual Emissions Estimates in Cowlitz County for Locomotive and Commercial Marine Vessels for the Proposed Action in Comparison with the 2011 Cowlitz County Emissions Inventory**

	Maximum Annual Average Emissions (tpy)						
	NO <sub>x</sub>	CO	VOCs	SO <sub>2</sub>	PM10	PM2.5	DPM
<b>Locomotive</b>							
Proposed Action Emissions	41	16	1.6	0.06	3.5	1.2	0.88
Cowlitz County Emissions	789	137	43	6	23	23	23
<b>Commercial Marine Vessels</b>							
Proposed Action Emissions	48	104	29	7.6	2.8	2.7	0.6
Cowlitz County Emissions	1,109	150	46	199	37	34	34

Notes:  
Source: Washington State Department of Ecology 2014.  
tpy = tons per year; NO<sub>x</sub> = nitrogen oxide; CO = carbon monoxide; VOCs = volatile organic compounds; SO<sub>2</sub> = sulfur dioxide; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; DPM = diesel particulate matter

### Proposed Action and Washington State Emissions Comparison

The pollutant emissions totals for the Proposed Action during maximum production throughout Cowlitz County combined with statewide emissions associated with the vessel and rail transport are shown in Table 11 in comparison with the 2011 Washington statewide emissions inventory totals for locomotives and commercial marine vessels. The largest increase in locomotive emissions for any one pollutant would be CO at 38%, followed by NO<sub>x</sub> with a 15% increase. For commercial marine vessels, the relative increase is smaller with a maximum increase of 12% for VOC and just under 11% for CO.

**Table 11. Maximum Annual Emissions Estimates in Washington State for Locomotive and Commercial Marine Vessels for the Proposed Action in Comparison with the 2011 Statewide Emissions Inventory**

	Maximum Annual Average Emissions (tpy)						
	NO <sub>x</sub>	CO	VOCs	SO <sub>2</sub>	PM10	PM2.5	DPM
<b>Locomotive</b>							
Proposed Action Emissions	2,209	963	76	3	47	46	47
Statewide Emissions	15,026	2,536	810	95	N/A	430	428
<b>Commercial Marine Vessels</b>							
Proposed Action Emissions	161	276	93	21	13	11	10
Statewide Emissions	20,486	2,521	782	11,529	N/A	1,213	1,021

Notes:  
Source: Washington State Department of Ecology 2014.  
tpy = tons per year; NO<sub>x</sub> = nitrogen oxide; CO = carbon monoxide; VOCs = volatile organic compounds; SO<sub>2</sub> = sulfur dioxide; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; DPM = diesel particulate matter

Locomotive emissions would occur along the rail routes described in Section 2.2.3, *Washington State Air Quality Conditions*.<sup>13</sup> Vessel emissions would occur along the Columbia River between the project area and 3 nautical miles beyond the mouth of the Columbia River.

### 3.1.2 No-Action Alternative

Under the No Action Alternative, the Applicant would not construct the export terminal and impacts on air quality related to construction and operation of the proposed export terminal would not occur. The Applicant would continue with current and future increased operations in the project area. The project area could be developed for other industrial uses including an expanded bulk product terminal or other industrial uses. The Applicant has indicated that, over the long term, it would expand the existing bulk product terminal and develop new facilities to handle more products such as calcine petroleum coke, coal tar pitch, and cement, as described in the SEPA Alternatives Technical Report (ICF International 2016).

Expanded bulk terminal operations and maintenance would result in emissions of air pollutants. The Applicant has identified planned future rail and vessel operations for the No-Action Alternative. Emissions were estimated assuming that current and future operations would result in two daily trains arriving and departing the facility with an average rail car length of 30 cars carrying bulk product. Each train would be composed of two locomotives with an average of 26 vessels arriving and departing each year. In addition, truck haul emissions associated with the transport to the nearby Weyerhaeuser facility are included. The estimated emissions are shown in Table 12. The largest emissions for any single air pollutant is NO<sub>x</sub> at 4.4 tons per year. These emissions are lower than the proposed export terminal which were shown to be less than *de minimis*. Therefore, no adverse air quality impacts would be anticipated under the No-Action Alternative.

**Table 12. No-Action Alternative Annual Average Emissions from Rail, Vessel and Haul Trucks**

Source	Maximum Annual Average Emissions (tpy)								
	NO <sub>x</sub>	CO	VOCs	SO <sub>2</sub>	TSP	PM10	PM2.5	HAPs	DPM
Locomotive Combustion	3.1	1.4	0.11	0.01	0.08	0.07	0.06	0.01	0.06
Vessel Combustion	1.1	2.6	0.63	0.19	0.08	0.06	0.06	0.003	0.02
Haul Trucks	0.2	0.1	0.02	0.002	0.04	0.04	0.01	0.001	0.04
Total	4.4	4.1	0.76	0.20	0.20	0.17	0.13	0.014	0.12

Notes:

tpy = tons per year; NO<sub>x</sub> = nitrogen oxide; CO = carbon monoxide; VOCs = volatile organic compounds; SO<sub>2</sub> = sulfur dioxide; PM10 = particulate matter less than 10 micrometers in diameter; PM2.5 = particulate matter less than 2.5 micrometers in diameter; TSP = total suspended particles; HAPs = hazardous air pollutants; DPM = diesel particulate matter

## 3.2 Mitigation

Based on the findings in this technical report, the co-lead agencies (Cowlitz County and Washington State Department of Ecology) determined mitigation measures are not required.

<sup>13</sup> For more information on the coal train routes, see the SEPA Rail Transportation Technical Report (ICF International and Hellerworx 2016).

## Chapter 4 Required Permits

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The following permit would be required in relation to air quality for the Proposed Action.

- **Notice of Construction—Southwest Clean Air Agency.** Businesses and industries that cause, or have the potential to cause, air pollution are required to receive approval from the local air agency prior to beginning construction. These are requirements of Washington’s Clean Air Act and apply statewide (Chapter 70.94 RCW). Businesses located in Cowlitz County are regulated by the SWCAA. SWCAA rules generally require an air permit for a stationary sources emitting more than 0.75 ton per year of PM10 or 0.5 ton per year for PM2.5<sup>14</sup>. It is anticipated that these levels will be exceeded and the Applicant would need to file a permit application and receive an approved Notice of Construction air permit prior to constructing, installing, establishing or modifying any equipment or operations that may emit air pollution.

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<sup>14</sup> Other criteria pollutants have higher emission threshold levels.

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## 5.2 Personal Communications

Fritz, Steven. Manager, Design and Development Department. Engine, Emissions and Vehicle Research Division, Southwest Research Institute, San Antonio, TX. March 24, 2014—telephone conversation.

Appendix A  
**Air Quality Data**

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**APPENDIX A1  
CONSTRUCTION EMISSIONS**

**SUMMARY**

Source	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	Construction Emissions (tpy) [Maximum per Year]							
						PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2e</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	DPM
<b>COMBUSTION SOURCES</b>													
Equipment (On-site)	24.6	9.04	2.23	0.95	2.34	1.93	1.93	4.55E-02	5,035	5,025.67	2.47E-01	1.22E-02	2.34
Haul Trucks (Off-site) <sup>1</sup>	9.37	2.04	0.41	0.03	0.54	0.44	0.31	0.010	3,161	3,159	5.91E-02	2.87E-03	0.54
Haul Trucks (On-site) <sup>1</sup>	4.06	0.88	0.18	0.01	0.23	0.19	0.13	0.004	1,369	1,368	2.56E-02	1.24E-03	0.23
Haul Trucks idle (On-site) <sup>2</sup>	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0.00E+00	0.00E+00
Passenger Commute Vehicles (off-site)	0.51	7.38	0.13	0.01	-	0.22	0.04	-	1485.28	1482.77	0.02	0.01	-
Crossing Delay (Off-Site)	0.0126	0.0798	0.0025	0.0001	-	0.0015	0.0006	0.0010	-	-	-	-	-
Barges (Off-site)	59.04	15.68	1.51E+00	2.77E-02	1.29E+00	1.06E+00	1.06E+00	7.90E-02	3,050	3,044	1.49E-01	7.38E-03	1.29
Trains:													
Combustion (Off-site)	18.48	8.06	0.64	2.85E-02	4.79E-01	3.94E-01	3.82E-01	8.57E-02	3,125	3,095	2.42E-01	7.88E-02	4.79E-01
Combustion (On-site)	0.71	3.11E-01	2.45E-02	1.10E-03	1.85E-02	1.52E-02	1.47E-02	3.31E-03	121	119	9.35E-03	3.04E-03	1.85E-02
<b>Highest Combination for Transport (Trucks) - Combustion On!</b>													
Total - Onsite only	28.6	9.9	2.41	0.97	2.58	2.12	2.06	4.99E-02	6,404	6,393	0.27	1.34E-02	2.58
Total - All Construction Sources in Count	38.5	19.4	2.95	1.00	3.11	2.78	2.41	6.12E-02	11,051	11,035	0.35	2.34E-02	3.11
Total combustin													
<b>FUGITIVE SOURCES</b>													
Controlled Fugitive Earthwork	-	-	-	-	12.00	5.87	1.22	-	-	-	-	-	-
Total Fugitive Sources	-	-	-	-	12.00	5.87	1.22	-	-	-	-	-	-
<b>Highest Combination for Transport (Trucks) - All Source:</b>													
Total - Onsite only	28.6	9.9	2.41	0.97	14.58	7.99	3.28	4.99E-02	6,404	6,393	0.27	1.34E-02	2.58
Total - All Construction Sources in Count	38.5	19.4	2.95	1.00	15.11	8.65	3.64	6.12E-02	11,051	11,035	0.35	2.34E-02	3.11
General Conformity <i>de minimis</i> levels for ozone mainte	100	100	100	100	100	100	100	100	100	100	100	100	100

Note:

<sup>1</sup> For Haul truck TSP & HAPs, use same emission ratio as emission factor ratios for Large Diesel Engines (below); PM<sub>10</sub> and PM<sub>2.5</sub> ratio to TSP; HAPs ratio to CO.

<sup>2</sup> See assumptions for surrogate idle/onsite in Tab A4 Material Transfer by Truck

**INPUT DATA:**

**Major Construction Activities and Typical Equipment Fleets**

Construction Equipment Type	Rail Infrastructure and Rotary Car Dump Station		Conveyors, Transfer Stations and Surge Bins		Shiploader, Dock, and Trestles	
	Max Qty. per Month	Duration (months)	Max Qty. per Month	Duration (months)	Max Qty. per Month	Duration (months)
Mobile Cranes (25-50t)						
Mobile Cranes (50-150t)						
Mobile Cranes (150-300t)						
Water Trucks <sup>2</sup>	1	12	1	12	0	0
Dump Trucks	3	12	1	12	0	0
Dozers	1	5	0	0	0	0
Excavators <sup>3</sup>	1	9	2	12	1	3
Rollers	2	9	2	12	1	3
Graders	2	9	0	0	1	3
Compactors	2	9	2	12	1	3
Track Laying Machine	1	6	0	0	0	0
Drill Rigs	1	2	2	6	0	0
Impact Piling Rigs	2	6	2	6	2	6
Loaders <sup>4</sup>	1	12	1	12	1	9
River Barge	0	0	0	0	2	18
Generator	2	18	2	18	2	18
Air Compressor	2	18	2	18	2	18

Source: MBTL, *Noise Resource Report*, Appendix D-1 (URS, June 2014)

NOTES:

<sup>1</sup> Mobile cranes to be shared between the 3 areas. - removed here because not all material is onsite so crane work may not start the first year.

<sup>2</sup> Water truck to be shared between the 2 land areas.

<sup>3</sup> Excavators to be shared between the 3 areas.

<sup>4</sup> Loaders to be shared between the 3 areas.

Typical construction fleet may be modified with equivalent items as construction activities demand

Assume entire construction period for all 3 areas is

18 months total  
5 days/week

**ONSITE EQUIPMENT (NON-BARGE) EMISSIONS**

Note: using NONRoad T/Y as calculated which may assume 24/7, so conservative

Equipment Type	Engine Size (hp)	Fuel	Maximum Units Onsite (per year)	EPA NONROAD SCC Number	EPA NONROAD model combustion emission factor (tons/yr per unit)					
					THC-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Crane, 50 ton	165	Diesel	0	2270002045	5.15E-02	1.65E-01	6.50E-01	120.43	2.38E-02	5.04E-02
Crane, 150 ton	280	Diesel	0	2270002045	7.69E-02	2.12E-01	9.99E-01	201.70	3.88E-02	6.33E-02
Crane, 300 ton	450	Diesel	0	2270002045	8.22E-02	3.69E-01	1.44E+00	215.37	4.28E-02	7.47E-02
Water Trucks	350	Diesel	1	2270002051	3.06E-02	9.01E-02	3.12E-01	108.922	1.86E-02	3.49E-02
Dump Trucks	350	Diesel	4	See Notes	3.06E-02	9.01E-02	3.12E-01	108.922	1.86E-02	3.49E-02
Dozers	185	Diesel	0.4	2270002069	1.66E-01	8.15E-01	1.96E+00	437.06	8.46E-02	2.35E-01
Excavators	230	Diesel	2	2270002036	3.15E-01	1.24E+00	3.65E+00	977.30	1.79E-01	3.62E-01
Rollers	350	Diesel	3.8	2270002015	4.20E-02	1.70E-01	5.19E-01	110.57	2.12E-02	4.42E-02
Graders	185	Diesel	1.8	2270002048	5.49E-02	2.71E-01	6.48E-01	146.26	2.83E-02	7.85E-02
Compactors	25	Diesel	3.8	2270002009	2.47E-04	1.15E-03	2.15E-03	0.26	5.65E-05	1.78E-04
Track Laying Machine	See Notes	Diesel	0.5	See Notes	1.96E-01	9.29E-01	2.35E+00	459.49	9.05E-02	2.51E-01
Drill Rigs	NONROAD Default	Diesel	1.2	2270002033	4.12E-02	1.48E-01	5.47E-01	62.90	1.27E-02	3.29E-02
Impact Piling Rigs	NONROAD Default	Diesel	3	2270002033	4.12E-02	1.48E-01	5.47E-01	62.90	1.27E-02	3.29E-02
Loaders	140	Diesel	1	2270002060	1.96E-01	9.29E-01	2.35E+00	459.49	9.05E-02	2.51E-01
Generator	30	Diesel	6	2270006005	1.10E-01	4.39E-01	1.00E+00	119.95	2.48E-02	8.80E-02
Air Compressor	25	Diesel	6	2270006015	2.27E-04	1.17E-03	2.23E-03	0.29	6.30E-05	1.77E-04

NOTES:

Assume Dump Truck size/emissions same as Water Truck

Assume Track Laying Machine uses 1 diesel locomotive and 1 front end loader engine (Harsco Rail, New Track Construction). Assume full-time locomotive used 4 hrs/day, 5 days

Horsepower and weight estimates based on capacity ratings and industry specifications, or average ratings per equipment type. Where hp could not be assumed, an average hp rate in NONROAD for the equipment type was used.

Emission Rates for Onsite Equipment (tpy)

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO2	CH4	N2O	CO2e
Crane, 50 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0	0.0000	0.0000
Crane, 150 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0	0.0000	0.0000
Crane, 300 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0	0.0000	0.0000
Water Trucks	0.31	0.09	0.03	0.02	0.03	0.03	0.03	0.003	109	0.0053	0.0003	109
Dump Trucks	1.25	0.36	0.12	0.07	0.14	0.11	0.11	0.002	436	0.0214	0.0011	437
Dozers	0.82	0.34	0.07	0.04	0.10	0.08	0.08	0.002	182	0.0089	0.0004	182
Excavators	7.30	2.48	0.63	0.36	0.72	0.60	0.60	0.012	1955	0.0960	0.0047	1958
Rollers	1.95	0.64	0.16	0.08	0.17	0.14	0.14	0.003	415	0.0204	0.0010	415
Graders	1.13	0.47	0.10	0.05	0.14	0.11	0.11	0.002	256	0.0126	0.0006	256
Compactors	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1	0.0000	0.0000	1
Track Laying Machine	1.17	0.46	0.10	0.05	0.13	0.10	0.10	0.002	230	0.0113	0.0006	230
Drill Rigs	0.64	0.17	0.05	0.01	0.04	0.03	0.03	0.001	73	0.0036	0.0002	74
Impact Piling Rigs	1.64	0.44	0.12	0.04	0.10	0.08	0.08	0.002	189	0.0093	0.0005	189
Loaders	2.35	0.93	0.20	0.09	0.25	0.21	0.21	0.005	459	0.0226	0.0011	460
Generator	6.02	2.63	0.66	0.15	0.53	0.43	0.43	0.013	720	0.0353	0.0017	721
Air Compressor	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.000	2	0.0001	0.0000	2
<b>Total Onsite Construction Equipment (tpy)</b>	<b>24.6</b>	<b>9.0</b>	<b>2.23</b>	<b>0.95</b>	<b>2.34</b>	<b>1.93</b>	<b>1.93</b>	<b>0.05</b>	<b>5026</b>	<b>0.25</b>	<b>0.01</b>	<b>5035</b>

Note:

For PM<sub>10</sub>, PM<sub>2.5</sub>, HAPs, and GHGs (CH<sub>4</sub> and N<sub>2</sub>O), use same emission ratio as emission factor ratios for Large Diesel Engines (below); PM<sub>10</sub> and PM<sub>2.5</sub> ratio to TSP; HAPs ratio to CO, and; GHGs ratio to CO<sub>2</sub>.

**BARGE EMISSIONS**

Barges for Construction	2	
Engine Size (propulsion)	3500 hp	
Total Barge Engines	7000 hp	(Maximum # Units per year)
Barge Positioning Time	1 hrs/ship (in-out)	(Conservative estimate)
Total Power per "Trip"	7,000 hp-hrs	
Construction Trips	2.90 per day	(assume 2/3 of material imported during first year)
	753 per year	
Annual Power	5,271,666 hp-hrs/yr	
Annual Diesel Fuel Use	36,902 MMBtu/yr	
	270,095 gallons/yr	

Emission Factors for Barges

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	lb/MMBtu, fuel input PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Large Diesel Engines:	3.20	0.8500	0.0819	0.002	0.07	0.06	0.06	0.00428	165	0.0081	0.0004	165
Source:												
Emission factors from: EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines (10/96). Assume Sulfur content of 0.0015% by weight (15 ppm). Assume TSP to PM10 ratio from Table 3.4-2, and PM2.5=PM10. Sum of HAPs factors from Table 3.4-3 and 3.4-4.												
Global Warming Potentials (GWPs):												
	CO <sub>2</sub> - 1											
	CH <sub>4</sub> - 25											
	N <sub>2</sub> O - 298											
<b>Emission Rates for Barges (tpy)</b>												
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Construction - Barges	59.0	15.68	1.51	0.03	1.29	1.06	1.06	0.08	3044	0.15	0.007	3050

<b>FUGITIVE DUST EMISSIONS</b>												
Methodology based on EPA AP-42 Chapter 13.2.3 Heavy Construction Operation												
Assumed acreage for groundwork	100	acres										
Assumed schedule for groundwork	1	year										
	12	months										
Annual Groundwork Operation:	8.33	acres/month										
AP-42 Emission Factor	1.2	tons PM/acre/month										
Uncontrolled PM Emissions	120.0	tons										
Controlled Emissions (assume watering only; no factor included for natural control from precipitation)												
Control %:	90	WRAP Fugitive Dust Handbook, Table 9-4, Watering.										
PM <sub>10</sub> and PM <sub>2.5</sub> Fractions of Total PM												
(CARB Appendix A CEIDARS PM <sub>2.5</sub> and PM <sub>10</sub> fractions of TSP; Fugitive Dust - Construction and Demolition)												
(http://www.aqmd.gov/docs/default-source/ceqa/handbook/localized-significance-thresholds/particulate-matter-(pm)-2.5-significance-thresholds-and-calculation-methodology/appendix-a-updated-ceidars-table-with-pm2-5-fractions.doc?sfvrsn=)												
PM <sub>10</sub> Fraction of Total PM	0.489											
PM <sub>2.5</sub> Fraction of Total PM	0.102											
<b>Emission Rates for Fugitive Dust (tpy)</b>												
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Construction - Fugitive Dus	-	-	-	-	12.00	5.87	1.22	-	-	-	-	-

**APPENDIX A2  
CONSTRUCTION EMISSIONS**

**SUMMARY**

Source	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	Construction Emissions (lb/day) [Maximum daily]							
						PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2e</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	DPM
<b>COMBUSTION SOURCES</b>													
Equipment (On-site)	229.6	82.89	20.39	8.67	21.49	17.66	17.66	0.42	45,519	45,431	2.23	0.11	21.49
Haul Trucks (Off-site) <sup>1</sup>	110.48	24.00	4.81	0.33	6.34	5.21	3.66	0.12	37,259	37,232	6.96E-01	3.39E-02	6.34
Haul Trucks (On-site and project study area) <sup>1</sup>	54.7	14.4	3.1	0.2	6.1	5.0	2.6	0.1	18236.0	18,214	0.5	0.0	6.12
Passenger Commute Vehicles (off-site)	1.36	19.60	0.34	0.03	0.57	0.57	0.11	-	3944.46	3,938	0.04	0.02	-
Crossing Delay (Off-Site) <sup>3</sup>	0.07	0.44	0.01	0.00	0.01	0.01	0.003	0.01	-	-	-	-	-
Barges (Off-site)	454.7	120.79	11.64	0.21	9.90	8.14	8.14	0.61	23,492	23,446.50	1.15E+00	5.68E-02	9.90

<sup>1</sup> For Haul truck TSP & HAPs, use same emission ratio as emission factor ratios for Large Diesel Engines (below); PM<sub>10</sub> and PM<sub>2.5</sub> ratio to TSP; HAPs ratio to CO.

<sup>2</sup> See assumptions for surrogate idle/onsite in Tab A4 Material Transfer by Truck

<sup>3</sup> Original assumption was 1 min/day for each of the 365 days, so T/Y value was divided by 365 to get value per day.

**INPUT DATA:**

**Major Construction Activities and Typical Equipment Fleets**

Construction Equipment Type	Rail Infrastructure and Rotary Car Dump Station		Conveyors, Transfer Stations and Surge Bins		Shiploader, Dock, and Trestles	
	Max Qty. per Month	Duration (months)	Max Qty. per Month	Duration (months)	Max Qty. per Month	Duration (months)
Mobile Cranes (25-50t) <sup>1</sup>						
Mobile Cranes (50-150t) <sup>1</sup>						
Mobile Cranes (150-300t) <sup>1</sup>						
Water Trucks <sup>4</sup>	1	12	1	12	0	0
Dump Trucks	3	12	1	12	0	0
Dozers	1	5	0	0	0	0
Excavators <sup>3</sup>	1	9	2	12	1	3
Rollers	2	9	2	12	1	3
Graders	2	9	0	0	1	3
Compactors	2	9	2	12	1	3
Track Laying Machine	1	6	0	0	0	0
Drill Rigs	1	2	2	6	0	0
Impact Piling Rigs	2	6	2	6	2	6
Loaders <sup>4</sup>	1	12	1	12	1	9
River Barge	0	0	0	0	2	18
Generator	2	18	2	18	2	18
Air Compressor	2	18	2	18	2	18

Source: MBTL, *Noise Resource Report*, Appendix D-1 (URS, June 2014).

**NOTES:**

<sup>1</sup> Mobile cranes to be shared between the 3 areas. - removed here because not all material is onsite so crane work may not start the first year.

<sup>2</sup> Water truck to be shared between the 2 land areas.

<sup>3</sup> Excavators to be shared between the 3 areas.

<sup>4</sup> Loaders to be shared between the 3 areas.

Typical construction fleet may be modified with equivalent items as construction activities demand

Assume entire construction period for all 3 areas is: 18 months total  
5 days/week

**ONSITE EQUIPMENT (NON-BARGE) EMISSIONS**

Equipment Type	Engine Size (hp)	Fuel	Maximum Units Onsite (per max)	EPA NONROAD SCC Number	EPA NONROAD model combustion emission factor (tons/yr per unit)					
					THC-Exhaust	CO-Exhaust	NOx-Exhaust	CO <sub>2</sub> -Exhaust	SO <sub>2</sub> -Exhaust	PM-Exhaust
Crane, 50 ton	165	Diesel	0	2270002045	5.15E-02	1.65E-01	6.50E-01	120.43	2.38E-02	5.04E-02
Crane, 150 ton	280	Diesel	0	2270002045	7.69E-02	2.12E-01	9.99E-01	201.70	3.88E-02	6.33E-02
Crane, 300 ton	450	Diesel	0	2270002045	8.22E-02	3.69E-01	1.44E+00	215.37	4.28E-02	7.47E-02
Water Trucks	350	Diesel	1	2270002051	3.06E-02	9.01E-02	3.12E-01	108.922	1.86E-02	3.49E-02
Dump Trucks	350	Diesel	4	See Notes	3.06E-02	9.01E-02	3.12E-01	108.922	1.86E-02	3.49E-02
Dozers	185	Diesel	1.0	2270002069	1.66E-01	8.15E-01	1.96E+00	437.06	8.46E-02	2.35E-01
Excavators	230	Diesel	2	2270002036	3.15E-01	1.24E+00	3.65E+00	977.30	1.79E-01	3.62E-01
Rollers	350	Diesel	5.0	2270002015	4.20E-02	1.70E-01	5.19E-01	110.57	2.12E-02	4.42E-02
Graders	185	Diesel	3.0	2270002048	5.49E-02	2.71E-01	6.48E-01	146.26	2.83E-02	7.85E-02
Compactors	25	Diesel	5.0	2270002009	2.47E-04	1.15E-03	2.15E-03	0.26	5.65E-05	1.78E-04
Track Laying Machine <sup>5</sup>	See Notes	Diesel	0.5	See Notes	1.96E-01	9.29E-01	2.35E+00	459.49	9.05E-02	2.51E-01
Drill Rigs	NONROAD Default	Diesel	3.0	2270002033	4.12E-02	1.48E-01	5.47E-01	62.90	1.27E-02	3.29E-02

Impact Piling Rigs	NONROAD Default	Diesel	6	2270002033	4.12E-02	1.48E-01	5.47E-01	62.90	1.27E-02	3.29E-02
Loaders	140	Diesel	1	2270002060	1.96E-01	9.29E-01	2.35E+00	459.49	9.05E-02	2.51E-01
Generator	30	Diesel	6	2270006005	1.10E-01	4.39E-01	1.00E+00	119.95	2.48E-02	8.80E-02
Air Compressor	25	Diesel	6	2270006015	2.27E-04	1.17E-03	2.23E-03	0.29	6.30E-05	1.77E-04

NOTES: 15.07692308  
 Assume Dump Truck size/emissions same as Water Truck.  
 Assume Track Laying Machine uses 1 diesel locomotive and 1 front end loader engine (Harsco Rail, New Track Construction). Assume full-time locomotive used 4 hrs/day, 5 days/wk.  
 If max hour is needed, this should be 1.

Factor to convert to lb/day (2000lb/T)(5 day/week \* 52 week/year) 7.692307692

Emission Rates for Onsite Equipment (lb/day)

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2e</sub>
Crane, 50 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.0000	0.0000	0
Crane, 150 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.0000	0.0000	0
Crane, 300 ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.0000	0.0000	0
Water Trucks	2.40	0.69	0.24	0.14	0.27	0.22	0.22	0.003	838	0.0411	0.0020	839
Dump Trucks	9.59	2.77	0.94	0.57	1.07	0.88	0.88	0.014	3351	0.1645	0.0081	3358
Dozers	15.10	6.27	1.28	0.65	1.81	1.48	1.48	0.032	3362	0.1650	0.0082	3369
Excavators	56.12	19.09	4.85	2.76	5.58	4.58	4.58	0.096	15035	0.7381	0.0364	15065
Rollers	19.97	6.54	1.61	0.81	1.70	1.40	1.40	0.033	4253	0.2088	0.0103	4261
Graders	14.95	6.25	1.27	0.65	1.81	1.49	1.49	0.031	3375	0.1657	0.0082	3382
Compactors	0.08	0.04	0.01	0.00	0.01	0.01	0.01	0.000	10	0.0005	0.0000	10
Track Laying Machine	9.03	3.57	0.75	0.35	0.96	0.79	0.79	0.018	1767	0.0868	0.0043	1771
Drill Rigs	12.63	3.41	0.95	0.29	0.76	0.63	0.63	0.017	1452	0.0713	0.0035	1454
Impact Piling Rigs	25.27	6.81	1.90	0.59	1.52	1.25	1.25	0.034	2903	0.1425	0.0070	2909
Loaders	18.06	7.14	1.50	0.70	1.93	1.59	1.59	0.036	3535	0.1735	0.0086	3541
Generator	46.27	20.26	5.07	1.14	4.06	3.34	3.34	0.102	5536	0.2718	0.0134	5547
Air Compressor	0.10	0.05	0.01	0.00	0.01	0.01	0.01	0.000	14	0.0007	0.0000	14
Max Onsite Construction Equipment (lb/day)	229.6	82.9	20.39	8.67	21.49	17.66	17.66	0.42	45431	2.23	0.11	45519

Note:  
 For PM<sub>10</sub>, PM<sub>2.5</sub>, HAPs, and GHGs (CH<sub>4</sub> and N<sub>2</sub>O), use same emission ratio as emission factor ratios for Large Diesel Engines (below); PM<sub>10</sub> and PM<sub>2.5</sub> ratio to TSP; HAPs ratio to CO, and; GHGs ratio to CO<sub>2</sub>.

BARGE EMISSIONS

Barges for Construction 2  
 Engine Size (propulsion) 3500 hp  
 Total Barge Engines 7000 hp (Maximum # Units per year)  
 Barge Positioning Time 1 hrs/ship (in-out) (Conservative estimate for emissions at docking site)  
 Total Power per "Trip" 7,000 hp-hrs  
 Construction Trips: 2.9 max per day (only make deliveries 5 days per week)  
 Annual Power 20,300 hp-hrs/day  
 Annual Diesel Fuel Use 142 MMBtu/day  
 1,040 gallons/day

Emission Factors for Barges

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2e</sub>
Large Diesel Engines	3.20	0.85	0.08	0.002	0.07	0.06	0.06	0.004	165	0.0081	0.0004	165

Source:  
 Emission factors from: EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines (10/96). Assume Sulfur content of 0.0015% by weight (15 ppm). Assume TSP to PM<sub>10</sub> ratio from Table 3.4-2, and PM<sub>2.5</sub>=PM<sub>10</sub>. Sum of HAPs factors from Table 3.4-3 and 3.4-4.  
 Global Warming Potentials (GWPs):  
 CO<sub>2</sub> - 1  
 CH<sub>4</sub> - 25  
 N<sub>2</sub>O - 298

Emission Rates for Barges (lb/day)

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2e</sub>
Construction - Barges	454.7	120.79	11.64	0.21	9.90	8.14	8.14	0.61	23447	1.15	0.057	23492

FUGITIVE DUST EMISSIONS

Methodology based on EPA AP-42 Chapter 13.2.3 Heavy Construction Operations  
 Assumed acreage for groundwork 100 acres  
 Assumed schedule for groundwork 1 year  
 12 months  
 Annual Groundwork Operations 8.33 acres/month

AP-42 Emission Factor 1.2 tons PM/acre/month  
 Uncontrolled PM Emissions: 666.7 lbs /1 day 10 tons for one month  
 Controlled Emissions (assume watering only; no factor included for natural control from precipitation):  
 Control %: 90 WRAP Fugitive Dust Handbook, Table 9-4, Watering.

PM<sub>10</sub> and PM<sub>2.5</sub> Fractions of Total PM  
 (CARB Appendix A CEIDARS PM<sub>2.5</sub> and PM<sub>10</sub> fractions of TSP; Fugitive Dust - Construction and Demolition)  
 ([http://www.aqmd.gov/docs/default-source/ceqa/handbook/localized-significance-thresholds/particulate-matter-\(pm\)-2.5-significance-thresholds-and-calculation-methodology/appendix-a-updated-ceidars-table-with-pm2-5-fractions.doc?sfvrsn=2](http://www.aqmd.gov/docs/default-source/ceqa/handbook/localized-significance-thresholds/particulate-matter-(pm)-2.5-significance-thresholds-and-calculation-methodology/appendix-a-updated-ceidars-table-with-pm2-5-fractions.doc?sfvrsn=2))

PM<sub>10</sub> Fraction of Total PM 0.489  
 PM<sub>2.5</sub> Fraction of Total PM 0.102

Emission Rates for Fugitive Dust (lb/day)												
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2e</sub>
Construction - Fugitive Dust	-	-	-	-	66.67	32.60	6.80	-	-	-	-	-

	Operations Commuter Emissions (tpy)												
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2e</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	DPM
<b>2018</b>													
Passenger Commute Vehicles, Operations (off-site)	7.34E-02	1.06E+00	1.81E-02	1.52E-03	-	3.10E-02	5.90E-03	-	213	212.38	2.24E-03	1.02E-03	-
<b>2028</b>													
Passenger Commute Vehicles - Operations (off-site)	3.66E-02	1.07E+00	1.23E-02	1.97E-03	-	5.40E-02	9.07E-03	-	275	274.24	2.19E-03	1.60E-03	-
Crossing Delay (Off-Site)	9.78E-02	9.73E-01	2.36E-02	1.36E-03	-	2.75E-02	6.58E-03	9.19E-03	-	-	-	-	-
sum	0.13	2.05	0.04	0.0033	-	0.08	0.02	0.01	274.77	274.24	0.0022	0.00160	-
<b>2038</b>													
Passenger Commute Vehicles Operations (off-site)	1.71E-02	4.67E-01	4.84E-03	1.05E-03	-	4.06E-02	7.77E-03	-	158	157.88	6.36E-04	9.90E-04	-
Crossing Delay (Off-Site)	2.87E-02	2.91E-01	7.83E-03	5.36E-04	-	1.15E-02	2.38E-03	3.06E-03	-	-	-	-	-

**Material Haul Traffic**

Assume Peak Year Truck Haul Traffic is 56,000 Round Trips (MTBL Supplementary Traffic Report Construction Traffic Analysis, March 2015)

Peak trips per day is capped at 330 trips (MTBL Supplementary Traffic Report Construction Traffic Analysis, March 2015)

		Number	Miles (RT) <sup>1</sup>	miles/year
Haul Trucks	Freeway @ 55mph	56000	32.8	1836800
	SR432 @ 35mph	56000	14.2	795200
				miles/day
Haul Truck	Freeway @ 55mph	330	32.8	10824
	SR432 @ 35mph	330	14.2	4686

<sup>1</sup>16.4 miles on the I-5 and 7.1 miles on WA-432 to MBTL

Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH4	N2O	CO2eq	
<b>2018</b>											
<b>Construction Annual</b>				<b>T/year</b>							
Combo Short Haul Truck @ 55mph	9.37	0.44	0.31	0.03	2.04	0.41	3159.07	0.06	0.00	3161.40	
Combo Short Haul Truck @ 35mph	4.06	0.19	0.13	0.01	0.88	0.18	1367.65	0.03	0.00	1368.66	
<b>Total:</b>	<b>13.43</b>	<b>0.63</b>	<b>0.44</b>	<b>0.04</b>	<b>2.92</b>	<b>0.58</b>	<b>4526.72</b>	<b>0.08</b>	<b>0.00</b>	<b>4530.06</b>	
<b>Construction Max Day</b>				<b>lbs/day</b>							
Combo Short Haul Truck @55 mph	110	5.2	3.7	0.3	24.0	4.8	37232	0.7	0.0	37259	
Combo Short Haul Truck @ 35mph	55	5.0	2.6	0.2	14.4	3.1	18214	0.5	0.0	18236	
<b>Total:</b>	<b>165</b>	<b>10.2</b>	<b>6.3</b>	<b>0.5</b>	<b>38.4</b>	<b>7.9</b>	<b>55446</b>	<b>1.2</b>	<b>0.1</b>	<b>55495</b>	

Factors:

453.59	g/lb
2000	lbs/ton
5280	ft/mile
3.78541	l/gal

Global Warming Potentials (GWPs):

CO <sub>2</sub>	- 1
CH <sub>4</sub>	- 25
N <sub>2</sub> O	- 298

MOVES factors (g/mile) for surrogate idle were based on 2.5 mi/hr travel. So to get g/hr, multiply by 2.5 mi/hr. For onsite/idle, assume 0.25 hr. So factor is 2.5/.25 to get grams/trip

mi/hr	2.5
hr	0.25
factor for 1/2 hr idle/trip	10

**Mobile Source - Moves run for Cowlitz County, WY, 2018**

**Emission factors for Truck Exhaust**

Emission factors for Truck Exhaust												
Emission Factors (gm/mile)												
Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH <sub>4</sub>	N <sub>2</sub> O	Benzene	Form	CO2eq
<b>2018</b>												
Short Haul Combo - diesel @ 55mph (Rural restricted)	4.63	0.22	0.15	0.01	1.01	0.20	1560.24	0.03	0.00	0.00	0.02	1561.39
Short Haul Combo - diesel @ 35mph (Urban un-restricted)	5.30	0.49	0.26	0.02	1.39	0.30	1763.06	0.05	0.00	0.00	0.03	1765.19
Short Haul Combo - diesel @ idle (Rural unrestricted)	6.00	0.42	0.24	0.02	1.48	0.35	1927.59	0.06	0.00	0.00	0.03	1930.06

**APPENDIX A5 Material Transfer by Rail (annual T/year)**

**LOCOMOTIVE EMISSIONS**

**5-year construction schedule (35,000 loaded rail cars)**

Unit Trains (cars/train) **100** cars =Millennium Coal Export Terminal Longview, Washington Traffic and Transportation, Resource Report, September 2014,URS Corporation'

Unit Trains Required **467** Trains/yr 6 trains per month' Millennium Coal Export Terminal Longview, Washington Traffic and Transportation, Resource Report, September 2014,URS Corporation'  
**3** Locomotives/Train (full)  
**3** Locomotives/Train (empty)

Engine Size: **4400** hp/locomotive *Electro-Motive Diesel, GE Transportation (http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives); GE AC4400CW (4400hp) or ElectroMotive Diesel SD70Ace (4300hp). Also consistent with DKS traffic analysis*  
 Locomotive Fuel Use: **20.8** bhp-hr/gal (conversion for large line-haul locomotive, *Emission Factors for Locomotives, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009.*)

Fuel Use per Train **Full Build-Out**

**ON SITE**

Loaded Train: **4.6%** Percent Load **607.2** hp Notch 1 setting and associated load @ 6 mph (202 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)  
**29** gallons/hr

Idle Train: **0.25%** Percent Load **33** hp Idle setting and associated load (11 hp) @idle based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)  
**2** gallons/hr

**OFF SITE**

Loaded Train: **65.4%** Percent Load **8628** hp Notch 6 setting and associated load @ 40 mph (2876 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)  
**415** gallons/hr

Empty Train: **65.4%** Percent Load **8628** hp Assume same notch 6 setting as loaded (conservative)  
**415** gallons/hr

**Longview Short Line (Longview Switching Company (LSC) Track)**

Offsite

Distance from Main Rail Line to Site: **7.10** miles distance from GIS drawings per Danny Stratten (ICF) Feb 2014  
 Travel Time to Site: **0.71** hrs DKS travel speed average of 10 mph  
 Total Power: **5721572** hp-hr/yr  
 Total Fuel Use: **275076** gallons/yr

Onsite

Onsite loop distance: **8727** ft Per train average loop distance (Drawings 80552-500-GE-DLP-0020\_RevA.pdf and 80552-500-ST-DAL-2019-00-RevA.pdf, WorleyParsons)  
 Travel Distance: **1.65** miles (one loop onsite; does not include dump track time which is operated by electric indexing system)

Time per Train: **1.48** hours time needed to unload the coal from 125 cars **scaled from 125** coal cars  
 Total Power: **220776** hp-hr/yr  
 Total Fuel Use: **10614** gallons/yr

Total Fuel Use (On and Offsite) **285690** gallons/yr

**Emission Factors (2028 full operation)**

	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
2028 National Locomotive Fleet Avera (g/gal)	61	26.6	2.1	0.094	1.58	1.3	1.26	0.28	10217	0.80	0.26	10314

Sources:

<sup>1</sup> NOx, CO, VOC, SO2, PM10, PM2.5 2025 emission factors from: *Emission Factors for Locomotives*, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009. Table 5.6,7, Line-Haul Emission Factors. From text: PM<sub>2.5</sub> = 0.97\* PM<sub>10</sub>.

<sup>2</sup>SO2 emission factor using S content of 15 ppm

<sup>3</sup>TSP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Diesel-fuel Engines* (10/96). Based on ratio of total particulate to PM10 in diesel engines, as given in Table 3.4-2.

<sup>4</sup>HAP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Diesel-fuel Engines* (10/96). Total HAPs from Tables 3.4-3 and 3.4-4, sum of HAPs as indicated by footnote b. For diesel fuel: 7000 Btu/hp-hr.

<sup>5</sup>Direct Emissions from Mobile Combustion Sources, EPA, Office of Air and Radiation, EPA-430-K-08-004, May 2008. N<sub>2</sub>O and CH<sub>4</sub> from Table A-6.

<sup>6</sup>Global Warming Potentials (GWPs):

CO<sub>2</sub> - 1  
 CH<sub>4</sub> - 25  
 N<sub>2</sub>O - 298

**Emission Rates (tpy)**

	Full Build-Out	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO2	CH4	N2O	CO2e
Offsite		1.85E+01	8.06E+00	6.36E-01	2.85E-02	4.79E-01	3.94E-01	3.82E-01	8.57E-02	3.10E+03	2.42E-01	7.88E-02	3.12E+03
Onsite		7.13E-01	3.11E-01	2.45E-02	1.10E-03	1.85E-02	1.52E-02	1.47E-02	3.31E-03	1.19E+02	9.35E-03	3.04E-03	1.21E+02
Total		1.92E+01	8.37E+00	6.61E-01	2.96E-02	4.98E-01	4.09E-01	3.97E-01	8.90E-02	3.21E+03	2.52E-01	8.18E-02	3.25E+03

**APPENDIX A6 Material Transfer by Rail (Max Day)**  
**LOCOMOTIVE EMISSIONS**

	<b>5-year construction schedule (35,000 loaded rail cars)</b>	
Unit Trains (cars/train)	100 cars	-Millennium Coal Export Terminal Longview, Washington Traffic and Transportation, Resource Report, September 2014, URS Corporation'
Unit Trains Required	1.3 Trains/day	6 trains per month' Millennium Coal Export Terminal Longview, Washington Traffic and Transportation, Resource Report, September 2014, URS Corporation'
	3 Locomotives/Train (full)	Constinet with DKS traffic analysis
	3 Locomotives/Train (empty)	Constinet with DKS traffic analysis
Engine Size:	4400 hp/locomotive	<i>Electro-Motive Diesel, GE Transportation</i> ( <a href="http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives">http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives</a> ); GE AC4400CW (4400hp) or ElectroMotive Diesel SD70Ace (4300hp). Also consistent with DKS tr
Locomotive Fuel Use:	20.8 bhp-hr/gal	(conversion for large line-haul locomotive, <i>Emission Factors for Locomotives, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009.</i> )
Fuel Use per Train	<b>Full Build-Out</b>	
<b>ON SITE</b>		
Loaded Train:	4.6% Percent Load 607.2 hp 29 gallons/hr	Notch 1 setting and associated load @ 6 mph (202 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
Idle Train:	0.25% Percent Load 33 hp 2 gallons/hr	Idle setting and associated load (11 hp) @idle based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
<b>OFF SITE</b>		
Loaded Train:	65.4% Percent Load 8628 hp 415 gallons/hr	Notch 6 setting and associated load @ 40 mph (2876 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
Empty Train:	65.4% Percent Load 8628 hp 415 gallons/hr	Assume same notch 6 setting as loaded (conservative)
<hr/>		
Longview Short Line (Longview Switching Company (LSC) Track)		
Offsite		
Distance from Main Rail Line to Site:	7.10 miles	distance from GIS drawings per Danny Stratten (ICF) Feb 2014
Travel Time to Site:	0.71 hrs	DKS travel speed average of 10 mph
Total Power:	15927 hp-hr/yr	
Total Fuel Use:	786 gallons/yr	
Onsite		
Onsite loop distance:	8727 ft	Per train average loop distance (Drawings 80552-500-GE-DLP-0020_RevA.pdf and 80552-500-ST-DAL-2019-00-RevA.pdf, WorleyParsons'
Travel Distance:	1.65 miles	(one loop onsite; does not include dump track time which is operated by electric indexing system)
Time per Train:	1.48 hours	time needed to unload the coal from 125 cars <b>scaled from 125</b> coal cars
Total Power:	615 hp-hr/yr	
Total Fuel Use:	30 gallons/yr	
Total Fuel Use (On and Offsite)	795 gallons/yr	

Emission Factors (2028 full operation)													
	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e	
2028 National Locomotive Fleet Average (g/gal)	61	26.6	2.1	0.094	1.58	1.3	1.26	0.28	10217	0.80	0.26	10314	

Sources:  
<sup>1</sup> NOx, CO, VOC, SO2, PM10, PM2.5 2025 emission factors from: *Emission Factors for Locomotives*, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009, Table 5,6,7, Line-Haul Emission Factors. From text: PM<sub>2.5</sub> = 0.97\* PM<sub>10</sub>.  
<sup>2</sup> SO2 emission factor using S content of 15 ppm  
<sup>3</sup> TSP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Based on ratio of total particulate to PM10 in diesel engines, as given in Table 3.4-2.  
<sup>4</sup> HAP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Total HAPs from Tables 3.4-3 and 3.4-4, sum of HAPs as indicated by footnote b. For diesel fuel: 7000 Btu/hp-hr.  
<sup>5</sup> *Direct Emissions from Mobile Combustion Sources*, EPA, Office of Air and Radiation, EPA-430-K-08-004, May 2008. N<sub>2</sub>O and CH<sub>4</sub> from Table A-6.  
<sup>6</sup> Global Warming Potentials (GWPs):  
 CO<sub>2</sub> - 1  
 CH<sub>4</sub> - 25  
 N<sub>2</sub>O - 298

Emission Rates (tpy)													
	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e	
Full Build-Out													
Offsite	5.14E-02	2.24E-02	1.77E-03	7.93E-05	1.33E-03	1.10E-03	1.06E-03	2.39E-04	8.62E+00	6.75E-04	2.19E-04	8.70E+00	
Onsite	1.98E-03	8.66E-04	6.83E-05	3.06E-06	5.15E-05	4.23E-05	4.10E-05	9.21E-06	3.32E-01	2.60E-05	8.46E-06	3.36E-01	
Total	5.34E-02	2.33E-02	1.84E-03	8.23E-05	1.39E-03	1.14E-03	1.10E-03	2.48E-04	8.95E+00	7.01E-04	2.28E-04	9.03E+00	

**APPENDIX B  
CONSTRUCTION - 'NONROAD' MODEL EMISSIONS**

EPA's NONROAD Emissions Model  
Core Model ver 2008a, 07/06/09  
Jul 25 11:58:30: 2014  
MBTL

Options file used: C:\NONROAD\Projects\MBTL.OPT  
Total for year: 2014

City	SubSCC	HP	Population	THC-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust	Crankcase	Hot-Soaks	Diurnal	Displacement	Spillage	RunLoss	TankPerm	HosePerm	FuelCons.	Activity	LF	HPAvg
53015	2265003070	40	1.70E-03	1.53E-05	5.51E-04	4.18E-05	2.96E-02	6.10E-06	3.06E-04	0.00E+00	1.67E-07	7.96E-07	1.12E-05	6.70E-07	3.74E-07	0.00E+00	0.00E+00	3.01E+00	1.41E+00	7.80E-01	3.50E+01
53015	2265003070	75	6.63E-02	1.04E-03	3.81E-02	2.83E-03	1.92E+00	3.95E-04	1.96E-04	0.00E+00	6.50E-06	8.20E-05	7.25E-04	2.20E-05	1.78E-05	0.00E+00	1.95E+02	5.49E+01	7.80E+01	5.82E+01	5.92E+01
53015	2265003070	100	3.06E-02	8.13E-04	2.98E-02	2.22E-03	1.50E+00	3.09E-04	1.53E-04	0.00E+00	3.00E-06	3.79E-05	5.67E-04	1.72E-05	8.23E-06	0.00E+00	0.00E+00	1.53E+02	2.53E+01	7.80E+01	9.86E+01
53015	2265003070	175	1.19E-01	3.66E-03	1.34E-01	9.98E-03	6.76E+00	1.39E-03	6.90E-04	0.00E+00	1.17E-05	2.43E-04	2.55E-03	4.69E-05	3.20E-05	0.00E+00	6.88E+02	9.85E+01	7.80E+01	1.14E+02	1.14E+02
53015	2265003070	300	1.70E-03	1.14E-04	4.20E-03	3.12E-04	2.11E-01	4.36E-05	2.16E-05	0.00E+00	1.67E-07	7.61E-06	7.99E-05	6.70E-07	4.57E-07	0.00E+00	0.00E+00	2.15E+01	1.41E+00	7.80E+01	2.50E+02
53015	2267002057	40	3.32E-02	5.20E-05	1.84E-03	2.95E-04	1.52E-01	2.95E-06	1.60E-05	6.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E+01	1.37E+01	6.30E-01	2.90E-01
53015	2267002057	50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
53015	2267002057	75	2.23E-01	3.06E-03	8.60E-02	1.35E-02	2.40E+00	4.67E-05	2.42E-04	5.99E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.58E+02	9.20E+01	6.30E-01	6.59E-01
53015	2267002057	100	1.33E-03	2.21E-05	6.22E-04	1.74E-02	3.38E-07	1.75E-06	4.33E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.48E-01	6.30E-01	8.00E-01
53015	2267002057	175	2.65E-02	6.26E-04	1.76E-02	2.76E-03	4.92E-01	9.56E-06	4.94E-05	1.23E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.32E-01	1.10E+01	6.30E-01	1.13E-02
53015	2270002009	6	3.82E+00	2.92E-03	1.94E-02	2.14E-02	2.54E+00	5.47E-04	2.21E-03	3.10E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.25E+02	1.85E+03	4.30E-01	4.94E+00
53015	2270002009	11	1.71E+00	2.26E-03	1.50E-02	1.66E-02	1.97E+00	4.24E-04	1.71E-03	2.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E+02	8.26E+02	4.30E-01	8.55E+00
53015	2270002009	16	1.04E+00	1.87E-03	8.73E-03	1.63E-02	1.99E+00	4.28E-04	1.35E-03	2.03E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+02	5.02E+02	4.30E-01	1.42E+01
53015	2270002009	25	9.57E-02	2.47E-04	1.15E-03	2.15E-03	2.63E-01	5.65E-05	1.78E-04	2.68E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E+01	4.63E+01	4.30E-01	2.04E+01
53015	2270002015	6	4.11E-01	6.24E-04	5.13E-03	4.78E-03	6.57E-01	1.41E-04	9.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.82E+01	3.13E+02	5.90E-01	5.44E+00
53015	2270002015	11	7.72E-01	1.87E-03	1.54E-02	1.43E-02	1.97E+00	4.24E-04	1.29E-03	2.76E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E+02	5.87E+02	5.90E-01	8.69E+00
53015	2270002015	16	9.24E-01	2.79E-03	3.68E-02	2.76E-02	3.68E+00	7.91E-04	2.26E-03	4.08E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.26E+02	7.02E+02	5.90E-01	1.36E+01
53015	2270002015	25	1.66E+00	7.28E-03	3.95E-02	7.19E-02	5.88E-03	1.06E-05	5.88E-03	1.06E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.49E+02	1.26E+03	5.90E-01	1.37E+01
53015	2270002015	40	2.37E+00	8.94E-03	4.83E-02	1.58E-01	2.26E+01	4.40E-03	9.69E-03	1.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E+02	1.80E+03	5.90E-01	3.25E+01
53015	2270002015	50	2.19E+00	1.17E-02	6.31E-02	2.06E-01	2.95E+01	5.74E-03	1.26E-02	2.01E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E+03	1.67E+03	5.90E-01	4.58E+01
53015	2270002015	75	2.22E+00	1.88E-02	2.48E-01	2.48E-01	3.97E+01	8.05E-03	2.30E-02	2.40E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.51E+03	1.69E+03	4.30E-01	9.07E+01
53015	2270002015	100	6.07E+00	7.16E-02	7.40E-01	8.22E-01	1.51E+02	2.98E-02	1.10E-01	1.24E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E+04	4.62E+03	5.90E-01	8.48E+01
53015	2270002015	175	5.63E+00	8.40E-02	3.99E-01	1.01E+00	1.97E+02	3.89E-02	1.08E-01	1.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E+04	4.28E+03	5.90E-01	1.32E+02
53015	2270002015	300	1.92E+00	4.20E-02	1.70E-01	5.19E-01	1.11E+02	4.42E-02	6.31E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.78E+03	1.46E+03	5.90E-01	2.17E+02
53015	2270002015	600	5.70E-01	2.34E-02	1.59E-01	3.93E-01	6.35E+01	1.26E-02	2.72E-02	3.82E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.61E+03	4.33E+02	5.90E-01	4.21E+02
53015	2270002033	11	1.78E-02	1.85E-02	1.41E-04	1.57E-04	1.85E-02	3.97E-06	1.63E-05	2.37E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E+00	8.28E+00	4.30E-01	8.00E+00
53015	2270002033	16	2.73E-02	4.94E-05	2.28E-04	4.24E-04	5.15E-02	1.11E-05	3.53E-05	5.57E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.56E+00	1.27E+01	4.30E-01	1.45E+01
53015	2270002033	25	6.15E-02	1.80E-04	8.32E-04	1.54E-03	1.88E-01	4.04E-05	1.29E-04	2.03E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E+01	2.87E+01	4.30E-01	2.35E+01
53015	2270002033	40	1.05E+00	2.69E-03	1.22E-02	3.37E-02	4.29E+00	8.78E-04	2.61E-03	3.47E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.80E+02	4.88E+02	4.30E-01	3.15E+01
53015	2270002033	50	1.07E+00	6.24E-03	4.89E-02	1.78E-02	6.49E+00	1.28E-03	3.79E-03	5.05E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.52E+02	4.97E+02	4.30E-01	4.49E+01
53015	2270002033	75	1.73E+00	1.23E-02	6.46E-02	1.23E-01	1.39E+01	2.90E-03	1.19E-02	2.19E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E+03	8.06E+02	4.30E-01	6.18E+01
53015	2270002033	100	1.67E+00	1.71E-02	8.67E-02	1.63E-01	1.95E+01	4.00E-03	1.71E-02	3.29E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E+03	8.19E+02	4.30E-01	8.51E+01
53015	2270002033	175	2.58E+00	2.85E-02	1.07E-01	3.64E-01	3.95E+01	8.19E-03	2.41E-02	5.39E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.53E+03	1.20E+03	4.30E-01	1.32E+02
53015	2270002033	300	2.25E+00	4.12E-02	1.48E-01	5.47E-01	6.29E+01	1.27E-02	3.39E-02	7.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.57E+03	1.05E+03	4.30E-01	2.39E+02
53015	2270002033	600	1.29E+00	6.15E-02	1.88E-01	6.15E-01	6.77E+01	1.38E-02	3.33E-02	7.45E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.99E+03	6.03E+02	4.30E-01	4.47E+02
53015	2270002033	750	3.03E-01	1.42E-02	7.74E-02	2.22E-01	2.45E+01	4.98E-03	1.23E-02	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E+03	1.41E+02	4.30E-01	6.91E+02
53015	2270002033	1000	1.65E-01	1.39E-02	5.50E-02	1.93E-01	1.68E+01	9.71E-03	2.43E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.49E+03	7.71E+01	4.30E-01	8.69E+02
53015	2270002033	1200	2.73E-03	2.78E-04	1.10E-03	3.85E-03	3.36E-01	6.82E-05	1.94E-04	4.86E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.97E+01	1.27E+00	4.30E-01	1.05E+03
53015	2270002033	2000	5.47E-03	7.93E-04	3.14E-03	1.10E-02	9.59E-01	1.95E-04	5.54E-04	1.39E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.49E+01	2.55E+00	4.30E-01	1.50E+03
53015	2270002036	6	2.05E-02	4.89E-05	3.97E-04	3.77E-04	5.19E-02	1.12E-05	3.22E-05	8.72E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.60E+00	2.24E+01	5.90E-01	6.00E+00
53015	2270002036	11	1.13E-01	3.59E-04	2.91E-03	2.77E-03	3.81E-01	8.20E-05	2.37E-04	6.41E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E+01	1.24E+02	5.90E-01	7.97E+00
53015	2270002036	16	2.34E-01	9.77E-04	5.20E-03	9.73E-03	1.30E+00	2.79E-04	7.97E-04	1.73E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E+02	2.55E+02	5.90E-01	1

53015	2270002051	1200	1.43E-01	4.34E-02	2.21E-01	5.93E-01	9.46E+01	1.74E-02	3.83E-02	3.53E-04	0.00E+00	8.37E+03	2.35E+02	5.90E-01	1.15E+03							
53015	2270002051	2000	7.27E-01	3.41E-01	1.73E+00	4.66E+00	7.43E+02	1.36E-01	3.01E-01	2.77E-03	0.00E+00	6.57E+04	1.19E+03	5.90E-01	1.79E+03							
53015	2270002051	3000	1.78E-01	1.13E-01	5.75E-01	1.54E+00	2.46E+02	4.52E-02	9.97E-02	9.19E-04	0.00E+00	2.18E+04	2.92E+02	5.90E-01	2.42E+03							
53015	2270002057	16	5.47E-03	1.44E-05	7.92E-05	1.42E-04	1.89E-02	4.06E-06	1.16E-05	3.31E-08	0.00E+00	1.67E+00	3.62E+00	5.90E-01	1.35E+01							
53015	2270002057	25	6.15E-02	2.70E-04	1.48E-03	2.65E-03	3.53E-01	7.60E-05	2.18E-04	6.20E-07	0.00E+00	3.13E+01	4.07E+01	5.90E-01	2.25E+01							
53015	2270002057	40	1.42E+00	4.98E-03	2.78E-02	8.61E-02	1.22E-01	2.39E-03	5.50E-03	1.35E-05	0.00E+00	1.08E+03	9.42E+02	5.90E-01	3.34E+01							
53015	2270002057	50	1.58E+00	7.50E-03	4.18E-02	1.29E-01	1.83E+01	3.60E-03	8.27E-03	2.03E-05	0.00E+00	1.62E+03	1.05E+03	5.90E-01	4.51E+01							
53015	2270002057	75	3.14E+00	2.62E-02	2.34E-01	3.24E-01	4.94E+01	1.01E-02	3.18E-02	3.70E-04	0.00E+00	4.37E+03	2.08E+03	5.90E-01	6.14E+01							
53015	2270002057	100	1.80E+01	2.08E-01	2.01E+00	2.28E+00	3.94E+02	7.84E-02	3.05E-01	3.70E-03	0.00E+00	3.49E+04	1.19E+04	5.90E-01	8.56E+01							
53015	2270002057	175	9.23E+00	1.23E-01	5.82E-01	1.49E+00	2.68E+02	5.34E-02	1.49E-01	2.11E-03	0.00E+00	2.37E+04	6.11E+03	5.90E-01	1.26E+02							
53015	2270002057	300	4.78E-01	1.04E-02	4.25E-02	1.30E-01	2.53E+01	4.90E-03	1.05E-02	1.64E-04	0.00E+00	2.24E+03	3.17E+02	5.90E-01	2.29E+02							
53015	2270002057	600	6.30E-01	2.12E-02	1.47E-01	3.40E-01	5.03E+01	1.01E-02	2.41E-02	3.62E-04	0.00E+00	4.45E+03	4.17E+02	5.90E-01	3.46E+02							
53015	2270002060	11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00							
53015	2270002060	16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00							
53015	2270002060	25	1.37E-02	6.97E-05	3.78E-04	6.88E-04	9.18E-02	1.98E-05	5.63E-05	1.00E-07	0.00E+00	8.13E+00	1.04E+01	5.90E-01	2.28E+01							
53015	2270002060	40	7.20E-01	2.88E-03	1.56E-02	2.88E-02	7.30E+00	1.42E-03	4.92E-06	3.12E-03	0.00E+00	6.45E+02	5.48E+02	5.90E-01	3.44E+01							
53015	2270002060	50	8.27E-01	4.37E-03	2.36E-02	7.72E-02	1.11E+01	2.15E-03	4.73E-03	7.46E-06	0.00E+00	9.79E+02	6.29E+02	5.90E-01	4.54E+01							
53015	2270002060	75	1.17E+00	1.01E-02	5.15E-02	1.33E-01	2.12E+01	4.31E-03	1.23E-02	1.28E-04	0.00E+00	1.88E+03	8.89E+02	5.90E-01	6.17E+01							
53015	2270002060	100	5.02E+00	5.98E-02	6.18E-01	6.86E-01	1.27E+02	2.49E-02	9.20E-02	1.03E-03	0.00E+00	1.12E+04	3.82E+03	5.90E-01	8.55E+01							
53015	2270002060	175	1.27E+01	1.96E-01	9.29E-01	2.35E+00	4.59E+02	9.05E-02	2.51E-01	3.25E-03	0.00E+00	4.06E+04	9.67E+03	5.90E-01	1.36E+02							
53015	2270002060	300	1.21E+01	2.81E-01	1.14E+00	3.47E+00	7.40E+02	1.42E-01	2.96E-01	4.22E-03	0.00E+00	6.55E+04	9.23E+03	5.90E-01	2.30E+02							
53015	2270002060	600	8.90E+00	3.63E-01	2.47E+00	6.14E+00	9.91E+02	1.96E-01	4.24E-01	5.92E-03	0.00E+00	8.76E+04	6.77E+03	5.90E-01	4.19E+02							
53015	2270002060	750	6.72E-01	4.28E-02	4.07E-01	7.67E-01	1.24E+02	2.45E-02	6.88E-04	5.47E-02	0.00E+00	1.09E+04	5.12E+02	5.90E-01	6.92E+02							
53015	2270002060	1000	3.28E-01	4.54E-02	2.40E-01	6.64E-01	7.53E+01	1.49E-02	3.85E-02	6.86E-04	0.00E+00	6.67E+03	2.50E+02	5.90E-01	8.66E+02							
53015	2270002060	1200	6.83E-02	1.18E-02	6.25E-02	1.73E-01	1.96E+01	3.88E-03	1.00E-02	1.79E-04	0.00E+00	1.73E+03	5.20E+01	5.90E-01	1.08E+03							
53015	2270002060	2000	4.02E-01	1.20E-01	6.34E-01	1.75E+00	1.99E+02	3.94E-02	1.02E-01	1.81E-03	0.00E+00	1.76E+04	3.06E+02	5.90E-01	1.87E+03							
53015	2270002060	3000	1.50E-02	5.38E-03	2.85E-02	8.94E-02	8.94E+00	1.77E-03	4.57E-03	8.14E-05	0.00E+00	7.91E+02	1.14E+01	5.90E-01	2.24E+03							
53015	2270002069	40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00							
53015	2270002069	50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00							
53015	2270002069	75	1.52E-01	1.30E-03	1.30E-02	1.87E-02	3.19E+00	6.39E-04	1.64E-03	1.31E-05	0.00E+00	2.82E+02	1.42E+02	5.90E-01	5.80E+01							
53015	2270002069	100	4.35E+00	5.62E-02	6.31E-01	6.77E-01	1.39E+02	2.88E-02	9.57E-02	9.10E-04	0.00E+00	1.23E+04	4.07E+03	5.90E-01	8.79E+01							
53015	2270002069	175	9.84E+00	1.66E-01	6.18E-01	1.86E+00	4.37E+02	8.46E-02	2.35E-01	2.57E-03	0.00E+00	3.86E+04	9.21E+03	5.90E-01	1.36E+02							
53015	2270002069	300	8.52E+00	2.23E-01	9.06E-01	2.67E+00	6.55E+02	1.23E-01	2.51E-01	2.99E-03	0.00E+00	5.79E+04	7.97E+03	5.90E-01	2.26E+02							
53015	2270002069	600	4.31E+00	1.16E+00	3.19E+00	5.99E+02	1.17E-01	2.35E-01	2.95E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E+04	4.04E+03	5.90E-01	4.52E+02
53015	2270002069	750	1.70E+00	1.23E-01	1.17E+00	2.09E+00	3.93E+02	7.65E-02	1.58E-01	1.83E-03	0.00E+00	3.47E+04	1.59E+03	5.90E-01	7.07E+02							
53015	2270002069	1000	3.53E-01	5.68E-02	1.29E+00	8.52E-01	1.06E+02	2.07E-02	4.84E-02	7.67E-04	0.00E+00	9.39E+03	3.30E+02	5.90E-01	9.23E+02							
53015	2270002069	1200	6.12E-01	1.14E-01	5.81E-01	1.71E+00	2.13E+02	4.17E-02	9.70E-02	1.54E-03	0.00E+00	1.88E+04	5.73E+02	5.90E-01	1.07E+03							
53015	2270002069	2000	2.73E-03	7.03E-04	3.58E-03	1.05E-02	1.31E+00	2.56E-04	5.99E-04	9.49E-06	0.00E+00	1.16E+02	2.56E+00	5.90E-01	1.47E+03							
53015	2270006005	6	1.90E+01	1.32E-02	7.54E-02	9.35E-02	9.55E+00	2.05E-03	1.01E-02	1.84E-04	0.00E+00	8.47E+02	6.41E+03	4.30E-01	5.35E+00							
53015	2270006005	11	1.89E+01	2.07E-02	1.18E-01	1.47E-01	1.50E+01	3.23E-03	1.58E-02	2.89E-04	0.00E+00	1.33E+03	6.40E+03	4.30E-01	8.42E+00							
53015	2270006005	16	1.46E+01	2.30E-02	9.59E-02	1.70E-01	1.86E+01	4.01E-03	1.58E-02	3.36E-04	0.00E+00	1.65E+03	4.93E+03	4.30E-01	1.36E+01							
53015	2270006005	25	2.30E+01	5.70E-02	2.37E-01	4.61E+01	9.91E-03	3.90E-02	8.31E-04	0.00E+00</												

**APPENDIX C  
SUMMARY OF EMISSIONS**

Based on:

1 metric tonne = 1.1023 ton (short ton)

Facility Material Handling System Rating

Materials Handling System/Train Unload: 7500 metric tonnes/hr 8267 tons/hr  
Reclaim and Vessel Loading: 6500 metric tonnes/hr 7165 tons/hr

Projected Operation

Operating hours 365 days/yr

Full Build-Out

Coal Throughput 44 MM metric tons per year

49 MM tpy

Unit Trains 8 trains/day

Cars per Unit Train 125 cars/train

Coal per Car 122.1 tons/car

Onsite Tracks 8 number of tracks

840 ships/yr

Latest assumption on number of cargo ships Handymax size to move the coal (also see URS resource report on rail and transport Dec 2014)

tons of coal per ship 57,740 tons/vessel

Hours to Unload one unit train 1.85 hours

Source	Full Build-Out Pollutant Emissions (tpy)									
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	DPM	
<b>FUGITIVE SOURCES</b>										
<b>Coal Transfer (except piles):</b>										
Material Handling	-	-	-	-	5.25	1.84	0.28	-	-	
<b>Coal Piles:</b>										
Wind Erosion	-	-	-	-	1.08	0.92	0.14	-	-	
Material Handling	-	-	-	-	2.62	0.92	0.14	-	-	
<b>MOBILE SOURCES</b>										
<b>Maintenance/Operations Equipment</b>										
Combustion	4.36	1.42	0.36	0.19	0.38	0.31	0.31	0.01	0.38	
<b>Trains:</b>										
Combustion (Off-site)	17.5	7.63	0.60	0.027	0.45	0.37	0.36	0.08	0.45	
Fugitive (Off-site)	-	-	-	-	0.94	0.80	0.12	-	-	
Combustion (on-site)	11.57	4.00	0.48	0.01	0.30	0.25	0.24	0.04	0.21	
Combustion unloading train (On-site)	5.57	2.43	0.19	8.59E-03	0.14	0.12	0.12	2.58E-02	0.14	
Combustion Idle (On-site)	1.56	0.68	5.36E-02	2.40E-03	4.03E-02	3.32E-02	3.22E-02	7.22E-03	4.03E-02	
Combustion Switching (On-site)	4.44	0.90	0.23	3.17E-03	0.11	9.43E-02	9.15E-02	9.53E-03	2.69E-02	
Fugitive (On-site)	-	-	-	-	2.10	1.79	0.27	-	-	
<b>Ships:</b>										
Combustion (Off-site)	24.8	37.9	14.10	3.04	2.17	1.78	1.64	0.03	0.00	
Combustion (On-site)	23.3	65.9	15.32	4.52	1.27	1.05	1.02	0.08	0.56	
<b>Total - All Sources, Onsite and Offsite</b>										
	81.5	117	30.9	7.79	16.6	10.0	4.53	0.24	1.61	
<b>Total - Onsite Sources</b>										
	39.2	71.4	16.15	4.72	13.01	7.07	2.40	0.13	1.16	
Fugitives Only	-	-	-	-	11.05	5.46	0.83	-	-	
Facility Equipment Combustion Only	4.36	1.42	0.36	0.19	0.38	0.31	0.31	0.01	0.38	
Mobile Combustion Sources Only	39.20	71.36	16.15	4.72	1.96	1.61	1.57	0.13	1.16	
<b>PM From Combustion (tpy):</b>					<b>TSP</b>	<b>PM<sub>10</sub></b>	<b>PM<sub>2.5</sub></b>			
Total - Offsite Combustion					2.62	2.16	2.01			
Total - Onsite Combustion					1.80	1.48	1.45			
Total - Combustion					4.42	3.64	3.45			

	Full Build-Out Pollutant Emissions (tpy)								
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	DPM
<b>Trains (WA State except Cowlitz)</b>	2,209	963	76.1	3.40	57.3	47.1	45.7	10.25	57.3
<b>Ships (WA State except Cowlitz)</b>	113	172	64.0	13.8	9.84	8.09	7.46	0.147	9.84

Washington State Emissions in tons per year 2011 Emissions Inventory for Cowlitz County									
Select Sources (full summary in separate worksheet)	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	DPM
Point Sources	3,616	2,507	671	791	-	182	172	-	-
Non-Road Mobile (Land-based, non-locomotive)	389	3,718	592	1	-	48	46	-	24
Railroad	789	137	43	6	-	23	23	-	23
Ships (commercial marine vessels)	1,109	150	46	199	-	37	34	-	34
<b>Total All Source Categories</b>	<b>10,382</b>	<b>36,142</b>	<b>16,919</b>	<b>1,020</b>	<b>-</b>	<b>1,872</b>	<b>971</b>	<b>-</b>	<b>164</b>

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	DPM
Trains (Cowlitz County Total)	40.6	15.6	1.56	0.06	4.09	3.45	1.23	0.17	0.88
Vessels (Cowlitz County total)	48.1	103.9	29.4	7.56	3.44	2.83	2.66	0.11	0.56

**APPENDIX C  
SUMMARY OF EMISSIONS**

**Based on:**

1 metric tonne = 1.1023 ton (short ton)

Facility Material Handling System Rating

Materials Handling System/Train Unload: 7500 metric tonnes/hr 8267 tons/hr  
Reclaim and Vessel Loading: 6500 metric tonnes/hr 7165 tons/hr

Projected Operation

Operating hours 365 days/yr

Full Build-Out

Coal Throughput 44 MM metric tons per year  
49 MM tpy  
Unit Trains 8 trains/day  
Cars per Unit Train 125 cars/train  
Coal per Car 100 tons/car  
Onsite Tracks 8 number of tracks  
840 ships/yr  
tons of coal per ship 57,740 tons/vessel  
Hours to Unload one unit train 1.85 hours

Latest assumption on number of cargo ships Handymax size to move the coal (also see URS resource report on rail and transport Dec 2014)

Source	Full Build-Out Pollutant Emissions (tpy)									
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2e</sub>	
<b>FUGITIVE SOURCES</b>										
<b>Coal Transfer (except piles):</b>										
Material Handling	-	-	-	-	5.25	1.84	0.28	-	-	
<b>Coal Piles:</b>										
Wind Erosion	-	-	-	-	1.08	0.92	0.14	-	-	
Material Handling	-	-	-	-	2.62	0.92	0.14	-	-	
					3.71	1.84	0.28			
<b>MOBILE SOURCES</b>										
<b>Maintenance/Operations Equipment:</b>										
Combustion	4.36	1.40	0.36	0.19	0.38	0.31	0.31	0.01	995	
<b>Trains:</b>										
Combustion (Off-site)	17.5	7.63	0.60	0.03	0.45	0.37	0.36	0.08	2,959	
Fugitive (Off-site)	-	-	-	-	0.94	0.80	0.12	-	-	
Combustion (On-site)	5.57	2.43	0.19	8.59E-03	1.44E-01	0.12	0.12	2.58E-02	942	
Combustion Idle (On-site)	1.56	0.68	5.36E-02	2.40E-03	4.03E-02	3.32E-02	3.22E-02	7.22E-03	263	
Combustion Switching (On-site)	4.44	0.90	0.23	3.17E-03	0.11	9.43E-02	9.15E-02	9.53E-03	344	
Fugitive (On-site)	-	-	-	-	2.10	1.79	0.27	-	-	
<b>Ships: (for diesel PM this only includes tugs)</b>										
Combustion (Off-site)	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0	
Combustion (On-site)	14	39	1.46	3.08	0.56	0.46	0.46	3.30E-02	5,335	
<b>Total - All Sources, Onsite and Offsite</b>										
	47	52	3	3.31	17	9	2.61	0.16	10,839	
<b>Total - Onsite Sources</b>										
Fugitives Only	29.8	43.9	2.30	3.28	16.00	8.32	2.13	0.08	7,880	
Facility Equipment Combustion Only	4.36	1.40	0.36	0.19	0.38	0.31	0.31	0.01	995	
Mobile Combustion Sources Only	19.44	40.96	1.66	3.09	0.71	0.58	0.58	0.06	6,277.61	
<b>PM From Combustion (tpy):</b>					<b>TSP</b>	<b>PM<sub>10</sub></b>	<b>PM<sub>2.5</sub></b>			
Total - Offsite Combustion					0.45	0.37	0.36			

Total - Onsite Combustion	1.09	0.90	0.89
Total - Combustion	1.54	1.27	1.25

<b>Washington State Emissions in tons per year</b>										
2011 Emissions Inventory for Cowlitz County										
<b>Select Sources</b>										
<b>(full summary in separate worksheet)</b>	<b>NO<sub>x</sub></b>	<b>CO</b>	<b>VOC</b>	<b>SO<sub>2</sub></b>	<b>TSP</b>	<b>PM<sub>10</sub></b>	<b>PM<sub>2.5</sub></b>	<b>HAPS</b>	<b>CO<sub>2e</sub></b>	<b>DPM</b>
Point Sources	3,616	2,507	671	791	-	182	172	-	-	-
Non-Road Mobile (Land-based, non-locomotive)	389	3,718	592	1	-	48	46	-	-	24
Railroad	789	137	43	6	-	23	23	-	-	23
Ships (commercial marine vessels)	1,109	150	46	199	-	37	34	-	-	34
<b>Total All Source Categories</b>	<b>10,382</b>	<b>36,142</b>	<b>16,919</b>	<b>1,020</b>	<b>-</b>	<b>1,872</b>	<b>971</b>	<b>-</b>	<b>-</b>	<b>164</b>

**APPENDIX D  
PILE INFORMATION**

Bulk Density of Coal: **817** kg/m3 min (PRB coal; source Description of Facilities, September 2011)  
**929** kg/m3 max

Pile Dimensions:

	average L (ft)	Sfc W (ft)	Sfc Acres	Peak H (ft)	Mean H (ft)
Pile 1	2350	<b>233</b>	12.57	85	<b>25</b>
Pile 2	2350	<b>233</b>	12.57	85	<b>25</b>
Pile 3	2350	<b>233</b>	12.57	85	<b>25</b>
Pile 4	2350	<b>233</b>	12.57	85	<b>25</b>

From Millennium Coal Export Terminal, Applicant's Purpose and Need Description, Dec 2013  
 Coal pads vary between **2200** to **2500** ft in length  
**85** approximate coal stack height

	metric tonne	ton	
Pile 1	<b>367,000</b>	404,548	<i>(Stage 1 and 2)</i>
Pile 2	<b>394,000</b>	434,311	<i>(Stage 1 and 2)</i>
Pile 3	<b>375,000</b>	413,367	<i>(Full Build-Out Only)</i>
Pile 4	<b>368,000</b>	405,651	<i>(Full Build-Out Only)</i>

1,504,000 metric tonnes, total storage capacity

**Full Build-Out**

Annual Coal Throughput: 48,501,697 tpy

Average Pile Turnovers/yr: 29

Pile Throughput:

Pile 1	11,835,188 tpy
Pile 2	12,705,897 tpy
Pile 3	12,093,176 tpy
Pile 4	11,867,437 tpy

**APPENDIX E**  
**PILE - WIND EROSION**

(Methodology from AP-24, Section 13.2.5 and WRAP Fugitive Dust Handbook, Section 9.3)

**Industrial Wind Erosion**

**Wind Erosion (emissions from pile activity are covered in Materials Handling (MH) section)**

(Equation based on Western Regional Air Partnership [WRAP] Fugitive Dust Handbook, Section 9.3)

$$E(\text{lb TSP/ acre/ yr}) = 1.7 * \frac{s}{1.5} * \frac{365 * (365 - p)}{235} * \frac{f}{15} * r$$

Where:

s=	2.2	Silt Content, weight %. (Mean value from EPA AP-42, Section 13.2.4, Table 13.2.4-1, Coal-fired Power Plants (as received).)
p=	175	Number of Days with >= 0.01 inches of precipitation per year. (NCDC Climate Summary for Longview, 1931-2006.)
f=	8.78	Percentage of Time that the unobstructed wind speed exceeds 12 mph at mean pile height. (Calculated from Weyerhaeuser Mint Farm Met Station Data, 2001-2003 (wind speed monitor at 10 meter height; mean pile height (by exposed area) ~ 25 ft (7.6 m).)
r=		Particulate Matter Size Ratios (WRAP Fugitive Dust Handbook, Section 9.3).
	1	TSP
	0.85	PM10
	0.13	PM2.5

Uncontrolled Emission Rates:

TSP	431	lb/acre/yr
PM10	366	lb/acre/yr
PM2.5	56	lb/acre/yr

Controlled Emissions:

Control %: 90 WRAP Fugitive Dust Handbook, Table 9-4, Watering.

Exposed Pile Area	Acres
Pile 1	12.57
Pile 2	12.57
Pile 3	12.57
Pile 4	12.57

Total Area **Full Build-Out** 50.28 acres

Total Controlled Emissions:		
Pollutant	<b>Full Build-Out</b>	
TSP	1.08	tpy
PM10	0.92	tpy
PM2.5	0.14	tpy

**APPENDIX F  
MATERIAL HANDLING**

**Transfer Operations (Pile Construction, Pile Removal)**

(Methodology from AP-24, Section 13.2.4)  
**Aggregate Handling and Storage Piles**

$$E (lb / ton ) = k * 0.0032 * \left[ \frac{\left( \frac{U}{5} \right)^{1.3}}{\left( \frac{M}{2} \right)^{1.4}} \right]$$

Where:

k= 1 Aerodynamic Particle Size Multiplier. (EPA AP-42 Section 13.2.4.)  
 0.35 TSP  
 0.053 PM10  
 U= 5.04 Mean Wind Speed, mph. (Calculated from Weyerhaeuser Mint Farm Met Station Data, 2001-2003 (wind speed monitor at 10 meter height).)  
 M= 4.5 Material Moisture Content, percent. (Mean value from EPA AP-42, Section 13.2.4, Table 13.2.4-1, Coal-fired Power Plants (as received). This value fits range given in Description of Facilities, September 2011 (1-6% surface; 13-18% total).)

Uncontrolled Emission Rates:

TSP 1.04E-03 lb/ton  
 PM10 3.64E-04 lb/ton  
 PM2.5 5.51E-05 lb/ton

Controlled Emissions:

Control %: 90 WRAP Fugitive Dust Handbook, Table 9-4, Watering.

Natural Precipitation Mitigation Factor: (365-P)/365 EPA AP-42, Section 13.2.2

P= 175 Number of Days with >= 0.01 inches of precipitation per year. (NCDC Climate Summary for Longview, 1931-2006.)

Annual Coal Throughput: Full Build-Out 48501697 tpy  
 Annual Coal Throughput x2 (pile construct and reclaim): 97003394 tpy

Total Controlled Emissions:		
Pollutant	Full Build-Out	
TSP	2.62	tpy
PM10	0.92	tpy
PM2.5	0.14	tpy

**All Other Coal Handling Operations (Transfers, Conveyors)**

All enclosed operations with dry fogging. Equipment is cleaned using a wet scraping technique; assumed cleaning particulate emissions are zero.

Uncontrolled Emission Rates (same methodology as above):

TSP 1.04E-03 lb/ton  
PM10 3.64E-04 lb/ton  
PM2.5 5.51E-05 lb/ton

Controlled Emissions:

Changed from 99%. (ICF) This reduced efficiency is consistent with a similar proposed facility in Boardman, OR and the efficiency from watering alone is 90% and since the enclosure doesn't have negative pressure the additional benefit is small, so 95% is a more reasonable conservative assumption.

Control %: 95

Natural Precipitation Mitigation Factor: (365-P)/365 EPA AP-42, Section 13.2.2

P= 175 Number of Days with >= 0.01 inches of precipitation per year. (NCDC Climate Summary for Longview, 1931-2006.)

Annual Coal Throughput: Full Build-Out 48501697 tpy

Emission/Transfer Points:

Rail Dump 1  
Transfer Tower 1 1  
Transfer Towers 2-4 1  
Transfer Towers 5-7 1  
Surge Bin (WP9) 1  
Surge Bin (WP10) 1  
Transfer Tower 8 1  
Conveyor to Ship 1

Total Controlled Emissions:		
Pollutant	<span style="background-color: #c6e0b4;">Full Build-Out</span>	
TSP	5.25	tpy
PM10	1.84	tpy
PM2.5	0.28	tpy

**APPENDIX G**  
**COAL CAR FUGITIVE EMISSIONS**

(Methodology from AP-24, Section 13.2.5 and WRAP Fugitive Dust Handbook, Section 9.3)

**Industrial Wind Erosion**

**Wind-related losses from Train Transport of Open Coal Cars**

(Equation based on WRAP Fugitive Dust Handbook, Section 9.3))

$$E(\text{lb TSP/ acre/ yr}) = 1.7 * \frac{s}{1.5} * \frac{365 * (365 - p)}{235} * \frac{f}{15} * r$$

Where:

s=	2.2	Silt Content, weight %. (Mean value from EPA AP-42, Section 13.2.4, Table 13.2.4-1, Coal-fired Power Plants (as received).)
p=	175	Number of Days with >= 0.01 inches of precipitation per year. (Calculated from Weyerhaeuser Mint Farm Met Station Data, 2001-2003. (Note: AP-42 Figure 13.2.2-1 shows 180 days, and NCDC Climate data indicates ~ 177 days.))
f (moving train)=	100	Percentage of Time that the unobstructed wind speed exceeds 12 mph at mean pile height. (Assumed 100% of time for moving train.)
f (sitting train)=	8.78	Percentage of Time that the unobstructed wind speed exceeds 12 mph at mean 'pile' height. (Calculated from Weyerhaeuser Mint Farm Met Station Data, 2001-2003 (wind speed monitor at 10 meter height; train car height with coal load = ~15 ft (4.6 m).)
r=		Particulate Matter Size Ratios (WRAP Fugitive Dust Handbook, Section 9.3).
	1	TSP
	0.85	PM10
	0.13	PM2.5

Uncontrolled Emission Rates for Moving Trains:

TSP	4905	lb/acre/yr
PM10	4170	lb/acre/yr
PM2.5	638	lb/acre/yr

Uncontrolled Emission Rates for Sitting Trains:

TSP	431	lb/acre/yr
PM10	366	lb/acre/yr
PM2.5	56	lb/acre/yr

Train car exposed surface area:	518 ft2
Area/coal amount (by 1 car):	4.24 ft2/ton coal

	<b>Full Build-Out</b>
Annual Coal Throughput:	48501697 tpy
Coal/car:	122.1 tons
Cars/train:	125 cars
Total Exposed Area:	4720 acres

	Off-site	Full Build-Out
Distance from main rail line to site:		0.71 miles
Time Moving Car Exposed:		0.71 hrs

Offsite Emissions:		
Pollutant	Full Build-Out	
TSP	0.94	tpy
PM10	0.80	tpy
PM2.5	0.12	tpy

	On-site	Full Build-Out	
Onsite loop distance:		0.00 miles	
Dumper facility loop:		13236 ft	Drawing 80552-500-ST-DAL-2019-00-RevA.pdf, WorleyParsons
		2.51 miles	
Total onsite distance for transport:		2.51 miles	Includes only loaded travel; assumes full cars for complete staging loop and dump loop distances.
Train Speed:		2 mph	
Time Moving Car Exposed:		1.36 hrs	
Waiting Time:		1.36 hrs	Heyl & Patterson, Martin Engineering (coal dumper and chute mnfrs), BNSF Railway [total time]; apply a conservative estimate for time waiting to unload.
Unloading Time:		2.60 hrs	Assume time of exposure during unloading is only 1/2 of total unloading time.
Time Sitting Car Exposed:		2.66 hrs	

Onsite Emissions:		
Pollutant	Full Build-Out	
TSP	2.10	tpy
PM10	1.79	tpy
PM2.5	0.27	tpy

**APPENDIX H  
LOCOMOTIVE EMISSIONS (Appendix H)**

Coal Throughput	Full Build-Out 48501697 tons/yr	=D:\Documents\millineum\URS Air Quality Studies for Millineum Coal Terminal\January 2015 appx L\4 - Air Quality Appendix L-Mod ICF.xlsx\Operations Summary (ICF)\1C17*1000000
Coal/car	122.1 tons	"=D:\Documents\millineum\URS Air Quality Studies for Millineum Coal Terminal\January 2015 appx L\4 - Air Quality Appendix L-Mod ICF.xlsx\Operations Summary (ICF)\1C20
Unit Trains (cars/train)	125 cars	"=D:\Documents\millineum\URS Air Quality Studies for Millineum Coal Terminal\January 2015 appx L\4 - Air Quality Appendix L-Mod ICF.xlsx\Operations Summary (ICF)\1C19
Unit Trains Required	2920 Trains/yr 3 Locomotives/Train (full) 3 Locomotives/Train (empty)	
Engine Size:	4400 hp/locomotive	<i>Electro-Motive Diesel, GE Transportation</i> ( <a href="http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives">http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives</a> ); GE AC4400CW (4400hp) or ElectroMotive Diesel SD70Ace (4300hp). Also consistent with DKS tra
Locomotive Fuel Use:	20.8 bhp-hr/gal	(conversion for large line-haul locomotive, <i>Emission Factors for Locomotives, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009.</i> )
Fuel Use per Train	Full Build-Out	
<b>ON SITE</b>		
Loaded Train:	4.6% Percent Load 607.2 hp 29 gallons/hr	Notch 1 setting and associated load @ 6 mph (202 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
Idle Train:	0.25% Percent Load 33 hp 2 gallons/hr	Idle setting and associated load (11 hp) @idle based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
<b>OFF SITE</b>		
Loaded Train:	9.9% Percent Load 1306.8 hp 63 gallons/hr	Notch 2 setting and associated load @ 12 mph (435 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
Empty Train:	9.9% Percent Load 1306.8 hp 63 gallons/hr	Assume same notch 2 setting as loaded (conservative)
<hr/>		
Longview Short Line (Longview Switching Company (LSC) Track)		
Offsite		
Distance from Main Rail Line to Site:	7.10 miles	distance from GIS drawings per Danny Stratten (ICF) Feb 2014
Travel Time to Site:	0.71 hrs	DKS travel speed average of 10 mph
Total Power:	5418516 hp-hr/yr	
Total Fuel Use:	260506 gallons/yr	
Onsite		
Onsite loop distance:	8727 ft	Per train average loop distance (Drawings 80552-500-GE-DLP-0020_RevA.pdf and 80552-500-ST-DAL-2019-00-RevA.pdf, WorleyParsons)
Travel Distance:	1.65 miles	(one loop onsite; does not include dump track time which is operated by electric indexing system)
Time per Train:	1.85 hours	time needed to unload the coal from 125 cars
Total Power:	1725554 hp-hr/yr	
Total Fuel Use:	82959 gallons/yr	
Total Fuel Use (On and Offsite)	343465 gallons/yr	

**Emission Factors (2028 full operation)**

	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
2028 National Locomotive Fleet Average (g/gal)	61	26.6	2.1	0.094	1.58	1.3	1.26	0.28	10217	0.80	0.26	10314

**Sources:**

<sup>1</sup> NOx, CO, VOC, SO2, PM10, PM2.5 2025 emission factors from: *Emission Factors for Locomotives*, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009, Table 5.6.7, Line-Haul Emission Factors. From text: PM<sub>2.5</sub> = 0.97\* PM<sub>10</sub>.

<sup>2</sup> SO2 emission factor using S content of 15 ppm

<sup>3</sup> TSP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Based on ratio of total particulate to PM10 in diesel engines, as given in Table 3.4-2.

<sup>4</sup> HAP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Total HAPs from Tables 3.4-3 and 3.4-4, sum of HAPs as indicated by footnote b. For diesel fuel: 7000 Btu/hp-hr.

<sup>5</sup> Direct Emissions from Mobile Combustion Sources, EPA, Office of Air and Radiation, EPA-430-K-08-004, May 2008. N<sub>2</sub>O and CH<sub>4</sub> from Table A-6.

<sup>6</sup> Global Warming Potentials (GWPs):

CO<sub>2</sub> - 1

CH<sub>4</sub> - 25

N<sub>2</sub>O - 298

**Emission Rates (tpy)**

Full Build-Out	NOx	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO2	CH4	N2O	CO2e
Offsite	18	7.6	0.60	0.03	0.45	0.37	0.36	0.08	2931	0.23	0.07	2959
Onsite	6	2.4	0.19	0.01	0.14	0.12	0.12	0.03	933	0.07	0.02	942
Total	23	10.1	0.79	0.04	0.60	0.49	0.48	0.11	3865	0.30	0.10	3902

**APPENDIX H2**

**LOCOMOTIVE EMISSIONS (Appendix H2) - Trains waiting to leave (on-site) 5 hours**

Coal Throughput	<b>Full Build-Out</b> 48501697 tons/yr	=D:\Documents\millineum\URS Air Quality Studies for Millineum Coal Terminal\January 2015 appx L\4 - Air Quality Appendix L-Mod ICF.xlsx\Operations Summary (ICF)\IC17*1000000
Coal/car	122.1 tons	=D:\Documents\millineum\URS Air Quality Studies for Millineum Coal Terminal\January 2015 appx L\4 - Air Quality Appendix L-Mod ICF.xlsx\Operations Summary (ICF)\IC20
Unit Trains (cars/train)	125 cars	=D:\Documents\millineum\URS Air Quality Studies for Millineum Coal Terminal\January 2015 appx L\4 - Air Quality Appendix L-Mod ICF.xlsx\Operations Summary (ICF)\IC19
Unit Trains Required	2920 Trains/yr 3 Locomotives/Train (full) 3 Locomotives/Train (empty)	
Engine Size:	4400 hp/locomotive	<i>Electro-Motive Diesel, GE Transportation</i> ( <a href="http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives">http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives</a> ); GE AC4400CW (4400hp) or ElectroMotive Diesel SD70Ace (4300hp). Also consistent with DKS traffic analysis
Locomotive Fuel Use:	20.8 bhp-hr/gal	(conversion for large line-haul locomotive, <i>Emission Factors for Locomotives, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009.</i> )
Fuel Use per Train	<b>Full Build-Out</b>	
ON SITE		
Idle Train:	0.25% Percent Load 33 hp 2 gallons/hr	Idle setting and associated load (11 hp) @idle based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
Onsite		
Time per Train:	5.00 hours	time idling
Total Power:	481800 hp-hr/yr	
Total Fuel Use:	23163 gallons/yr	
Total Fuel Use (Onsite, idle)	23163 gallons/yr	

**Emission Factors (2028 full operation)**

	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
2028 National Locomotive Fleet Avera (g/gal)	61	26.6	2.1	0.094	1.58	1.3	1.26	0.28	10217	0.80	0.26	10314

Sources:

<sup>1</sup>NOx, CO, VOC, SO2, PM10, PM2.5 2025 emission factors from: *Emission Factors for Locomotives*, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009. Table 5.6,7, Line-Haul Emission Factors. From text: PM<sub>2.5</sub> = 0.97\* PM<sub>10</sub>.

<sup>2</sup>SO2 emission factor using S content of 15 ppm

<sup>3</sup>TSP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Based on ratio of total particulate to PM10 in diesel engines, as given in Table 3.4-2.

<sup>4</sup>HAP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Total HAPs from Tables 3.4-3 and 3.4-4, sum of HAPs as indicated by footnote b. For diesel fuel: 7000 Btu/hp-hr.

<sup>5</sup>Direct Emissions from *Mobile Combustion Sources*, EPA, Office of Air and Radiation, EPA-430-K-08-004, May 2008. N<sub>2</sub>O and CH<sub>4</sub> from Table A-6.

<sup>6</sup>Global Warming Potentials (GWPs):  
CO<sub>2</sub> - 1  
CH<sub>4</sub> - 25  
N<sub>2</sub>O - 298

**Emission Rates (tpy)**

	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
Onsite	2	0.7	0.05	0.00	0.04	0.03	0.03	0.01	261	0.02	0.01	263
Total	2	0.7	0.05	0.00	0.04	0.03	0.03	0.01	261	0.02	0.01	263

**APPENDIX H3**

**SWITCH LOCOMOTIVE EMISSIONS (Appendix H3)**

Days/year **Full Build-Out** 365 Trains/yr  
 Hours/day 8 hours  
 1 Locomotives/Train (empty)

Engine Size: 4400 hp/locomotive *Electro-Motive Diesel, GE Transportation* (<http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives>); GE AC4400CW (4400hp) or ElectroMotive Diesel SD70Ace (4300hp). Also consistent with DKS traffic analysis  
 Locomotive Fuel Use: 20.8 bhp-hr/gal (conversion for large line-haul locomotive, *Emission Factors for Locomotives, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009* .)

Fuel Use per Train		Full Build-Out	
ON SITE			
Loaded Train:	4.6% Percent Load 1619.2 hp 78 gallons/hr	Notch 1 setting and associated load @ 6 mph (202 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)	
Idle Train:	0.25% Percent Load 11 hp 1 gallons/hr	Idle setting and associated load (11 hp) @idle based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)	
Empty Train:	9.9% Percent Load 435.6 hp 21 gallons/hr	Assume same notch 2 setting as loaded (conservative)	

g/gal												
Emission Factors (2028 full operation)	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
2028 National Locomotive Fleet Avera (g/gal)	61	26.6	2.1	0.094	1.58	1.3	1.26	0.28	10217	0.80	0.26	10314
2028 Large Switch (g/gal)	132	26.6	6.9	0.094	3.41	2.8	2.72	0.28	10217	0.80	0.26	10314

Sources:  
<sup>1</sup> NOx, CO, VOC, SO2, PM10, PM2.5 2028 emission factors from: *Emission Factors for Locomotives*, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009, Table 5,6,7, Line-Haul Emission Factors. From text: PM<sub>2.5</sub> = 0.97\* PM<sub>10</sub>.  
<sup>2</sup> SO2 emission factor using S content of 15 ppm  
<sup>3</sup> TSP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Based on ratio of total particulate to PM10 in diesel engines, as given in Table 3.4-2.  
<sup>4</sup> HAP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Total HAPs from Tables 3.4-3 and 3.4-4, sum of HAPs as indicated by footnote b. For diesel fuel: 7000 Btu/hp-hr.  
<sup>5</sup> Direct Emissions from Mobile Combustion Sources, EPA, Office of Air and Radiation, EPA-430-K-08-004, May 2008. N<sub>2</sub>O and CH<sub>4</sub> from Table A-6.  
<sup>6</sup> Global Warming Potentials (GWPs):  
 CO<sub>2</sub> - 1  
 CH<sub>4</sub> - 25  
 N<sub>2</sub>O - 298

Emission Rates (tpy)												
Full Build-Out	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
Switch - Move (50%)	0.11	2.26E-02	5.87E-03	7.99E-05	2.90E-03	2.38E-03	2.31E-03	2.41E-04	8.69	6.80E-04	2.21E-04	8.77
Switch - Idle (50%)	4.44	0.90	0.23	3.17E-03	0.11	9.43E-02	9.15E-02	9.53E-03	344.04	2.69E-02	8.76E-03	347.33
Total	4.56	0.92	0.24	3.25E-03	0.12	9.67E-02	9.38E-02	9.77E-03	353	2.76E-02	8.98E-03	356

**APPENDIX H**

**LOCOMOTIVE EMISSIONS (Appendix H) Emissions in Washington State Except Cowlitz Coun**

Locomotive Fuel Use **20.8** bhp-hr/gal (conversion for large line-haul locomotive *Emission Factors for Locomotives, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009.*)

Fuel Consumption  
 31,470,397 gallons 2028 fully operational (consistent with GHG analysis) for total train fuel consumption within state (diesel) other than in Cowlitz county per GHG report/analysis based on 402 miles inbound and 490.2 miles outbo  
 1,386,221 gallons additional fuel consumption within Cowlitz County main line (17.9 miles in bound to Longview Jct; 21.4 miles outbound from Longview Jct to north county li  
 total 32,856,619 gallons  
 Factors  
 453.6 grams per lb  
 2000 lb per ton

Emission Factors (2028 full operation)	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
2028 National Locomotive Fleet Avera (g/gal)	61	26.6	2.1	0.094	1.58	1.3	1.26	0.28	10217	0.80	0.26	10314

Sources:  
<sup>1</sup>NOx, CO, VOC, SO2, PM10, PM2.5 2025 emission factors from: *Emission Factors for Locomotives*, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009, Table 5.6,7, Line-Haul Emission Factors. From text:  $PM_{2.5} = 0.97 * PM_{10}$ .  
<sup>2</sup>SO2 emission factor using S content of 15 ppm  
<sup>3</sup>TSP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Based on ratio of total particulate to PM10 in diesel engines, as given in Table 3.4-2.  
<sup>4</sup>HAP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Total HAPs from Tables 3.4-3 and 3.4-4, sum of HAPs as indicated by footnote b. For diesel fuel: 7000 Btu/hp-hr.  
<sup>5</sup>Direct Emissions from Mobile Combustion Sources, EPA, Office of Air and Radiation, EPA-430-K-08-004, May 2008. N<sub>2</sub>O and CH<sub>4</sub> from Table A-6.  
<sup>6</sup>Global Warming Potentials (GWPs):  
 CO<sub>2</sub> - 1  
 CH<sub>4</sub> - 25  
 N<sub>2</sub>O - 298

Emission Rates (tpy)	NOx	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO2	CH4	N2O	CO2e
Full Build-Out Offsite	2,209	963	76	3	57	47	45.7	10.25	370035	29.0	9	373,565.85

**APPENDIX H  
LOCOMOTIVE EMISSIONS (No Action Alternative)**

Coal Moved	Full Build-Out 2,673,990 tons/yr	
Coal/car	122.1 tons	"=D:\Documents\millineum\URS Air Quality Studies for Millineum Coal Terminal\January 2015 appx L\4 - Air Quality Appendix L-Mod ICF.xlsx\Operations Summary (ICF)1C20
Unit Trains (cars/train)	30 cars	Same assumption as Noise Study
30-car Trains Required	730 Trains/yr 2 Locomotives/Train (full) 2 Locomotives/Train (empty)	
Engine Size:	4400 hp/locomotive	<i>Electro-Motive Diesel, GE Transportation</i> ( <a href="http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives">http://www.getransportation.com/locomotives/locomotives/ac4400-and-dash-series-locomotives</a> ); GE AC4400CW (4400hp) or ElectroMotive Diesel SD70Ace (4300hp). Also consistent with DKS traffic anal
Locomotive Fuel Use:	20.8 bhp-hr/gal	(conversion for large line-haul locomotive, <i>Emission Factors for Locomotives, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009.</i> )
Fuel Use per Train	Full Build-Out	
<b>ON SITE</b>		
Loaded Train:	4.6% Percent Load 404.8 hp 19 gallons/hr	Notch 1 setting and associated load @ 6 mph (202 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
Idle Train:	0.25% Percent Load 22 hp 1.1 gallons/hr	Idle setting and associated load (11 hp) @idle based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
<b>OFF SITE</b>		
Loaded Train:	9.9% Percent Load 871.2 hp 42 gallons/hr	Notch 2 setting and associated load @ 12 mph (435 hp) based on data from CARB Roseville Railyard Study for 4300 HP loco engine (October, 2004)
Empty Train:	9.9% Percent Load 871.2 hp 42 gallons/hr	Assume same notch 2 setting as loaded (conservative)
<hr/>		
Longview Short Line (Longview Switching Company (LSC) Track)		
Offsite		
Distance from Main Rail Line to Site:	7.10 miles	distance from GIS drawings per Danny Stratten (ICF) Feb 2014
Travel Time to Site:	0.71 hrs	DKS travel speed average of 10 mph
Total Power:	903086 hp-hr/yr	
Total Fuel Use:	43418 gallons/yr	
Onsite		
Time per Train:	0.44 hours	time needed to unload the coal from 125 cars under action is 1.85 hours, assume 30/125 *1.85 = 0.444 hours to unload No Action coal train
Total Power:	68544 hp-hr/yr	
Total Fuel Use:	3295 gallons/yr	
Total Fuel Use (On and Offsite)	46713 gallons/yr	

**Emission Factors (2028 full operation)**

	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
2028 National Locomotive Fleet Avera (g/gal)	61	26.6	2.1	0.094	1.58	1.3	1.26	0.28	10217	0.80	0.26	10314

Sources:  
<sup>1</sup>NOx, CO, VOC, SO2, PM10, PM2.5 2025 emission factors from: *Emission Factors for Locomotives*, EPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009, Table 5.6,7, Line-Haul Emission Factors. From text: PM<sub>2.5</sub> = 0.97\* PM<sub>10</sub>.  
<sup>2</sup>SO2 emission factor using S content of 15 ppm  
<sup>3</sup>TSP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Based on ratio of total particulate to PM10 in diesel engines, as given in Table 3.4-2.  
<sup>4</sup>HAP emission factor from: *EPA AP-42, Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines* (10/96). Total HAPs from Tables 3.4-3 and 3.4-4, sum of HAPs as indicated by footnote b. For diesel fuel: 7000 Btu/hp-hr.  
<sup>5</sup>Direct Emissions from Mobile Combustion Sources, EPA, Office of Air and Radiation, EPA-430-K-08-004, May 2008. N<sub>2</sub>O and CH<sub>4</sub> from Table A-6.  
<sup>6</sup>Global Warming Potentials (GWPs):  
 CO<sub>2</sub> - 1  
 CH<sub>4</sub> - 25  
 N<sub>2</sub>O - 298

**Emission Rates (tpy)**

	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	CO2	CH4	N2O	CO2e
Full Build-Out												
Offsite	3	1.3	0.10	0.004	0.08	0.06	0.06	0.01	489	0.04	0.01	493
Onsite	0	0.1	0.01	0.000	0.01	0.00	0.00	0.00	37	0.00	0.00	37
Total	3.14	1.4	0.11	0.005	0.08	0.07	0.06	0.01	526	0.04	0.01	531

**APPENDIX I  
CARGO VESSEL EMISSIONS**

Tugs/Ship	3	(Conservative estimate)
Tug Engine Size (propulsion)	4000 hp	
Tug Positioning Time	3 hrs/ship (in-out)	(Conservative estimate)
Tug Load Factor (Maneuvering)	31% Percent Load	(Engine load factor for Assist Tugs, from Port of Long Beach Air Emissions Inventory - 2011 (POLB, July 2012).)
Panamax Size Engine	16368 hp	
Handymax Size Engine	10153 hp	
Panamax auxiliary engine size	3039 hp	
Handymax Auxiliary Engine Size	1885 hp	
Main Engine Load (loaded in transit)	37% Percent Load	Main Engine Load (maneuvering)
Main Engine Load (unloaded in transit)	37% Percent Load	
Auxiliary Engine Load (transit)	17% Percent Load	Auxiliary Engine Load (maneuvering)
		45% Percent Load
		Auxiliary Engine Load (hoteling)
		10% Percent Load
Number of ship call in 2028	840	
Percent of calls by Panamax	80 percent	
Percent of call by Handymax	20 percent	
Ship Berth Time (Hoteling)	13 hrs	
Main Ship (Maneuvering)	1.0 hrs	
Transit Time within Cowittz county	0.90 hrs	Lower bound speeds in the open reaches of the Columbia River Channel are 12 knots, somewhat slower speeds when fully loaded (assume 10 knots). See: Marine Traffic Technical Report, Feb 2015, pages 37 and page 49.

Table II-6: OGV Auxiliary Engine Load Characteristics (percent load)  
Bulk Carrier/General Cargo  
Load Factor (%)  
Hoteling 10%  
Maneuvering 45%  
Transit 17%

ARB, 2011a. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" Appendix D, Emission Estimation Methodology for Ocean Going Vessels, May 2011  
Data [http://www.arb.ca.gov/msei/categories.htm#ogv\\_category](http://www.arb.ca.gov/msei/categories.htm#ogv_category)

Load Factors for Main Engine based on Propeller Law Equation assuming 11 knots transit in river and 4 knots maneuvering

Engine	Cruise	Transit	Maneuver
Propulsion	83%	37%	2%

At full cruise engines run at 83% of capacity with maximum speed of 15.3 knots  
Propeller equation  $LF = (AS/MS)^3$   
where LF = Load Factor (percent)  
AS = Actual Speed (knots)  
MS = Maximum Speed (knots)

**On-site**  
Coal Throughput **Full Operation (2028)** 48,501,697 tons/yr

Ships/yr (Panamax)	672 number	Annual Power (aux eng) 3,574,005 hp-hrs/yr	0.1 % S Marine Distillate Fuel (2015 onward)
		Annual Power (main eng) 219,987 hp-hrs/yr	0.1 % S Marine Distillate Fuel
Ships/yr (Handymax)	168 number	Annual Power (aux eng) 554,302 hp-hrs/yr	0.1 % S Marine Distillate Fuel
		Annual Power (main eng) 34,115 hp-hrs/yr	0.1 % S Marine Distillate Fuel (or 1000 ppm)
Tugs/yr	2,520 number	Annual Power 9,374,400 hp-hrs/yr	diesel low sulfur (15 ppm S)
<b>Off-site</b>			
Ships/yr (Panamax)		Annual Power (main) 7,363,914 hp-hrs/yr	0.1 % S Marine Distillate Fuel
		Annual Power (aux) 628,211	
Ships/yr (Handymax)		Annual Power (main) 1,141,964 hp-hrs/yr	0.1 % S Marine Distillate Fuel (or 1000 ppm)
		Annual Power (aux) 97,431	

Classification	DWT Range	Main Engine (kW)	Auxiliary Engine (kW)	Main Engine (hp)	Auxiliary Engine (kW)
HandyMax	40,000 - 60,000	7577	1407	10153-18	1885-38
PanaMax	60,000 - 100,000	12215	2268	16368.1	3039.12

Source: Sea-Web (<http://www.sea-web.com>)  
The sea-web data is produced by IHS Global Limited, headquartered in Bracknell, England. The data is based on Lloyd's Register of Ships Sea-web provided shi characteristics data for shios over 100 gross ton Based on the ships currently in service (2014) that have stopped at US ports.

**Low Speed Adjustment for Main Engine During Ship Maneuvering**  
Based on the Propeller law used to estimate ships propulsion loads, based on law that the propulsion pow varies by the cube of the speed. Transit speed was assumed to average 11 knots and maneuver speed 4 knot

Adjustment	Ratio Increase	NO <sub>x</sub>	CO	VOC	SO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO2
2% load		54.8	41.9	23.6		2.34				2853.6
20% load		11.9	4.2	0.7		0.32				869.1
Ratio Increase		4.6	10	31.6	1	7.29	7.29	7.29	31.62	3.28

Pollutant	Exponent (x)	Intercept (b)	Coefficient (a)
PM <sub>10</sub>	1.5	0.2951	0.0059
NO <sub>x</sub>	1.5	10.4496	0.1255
CO	1	0	0.8378
HC	1.5	0	0.0967
SO <sub>2</sub>			2.3735 only applies to fuel sulfur flow no adjustment for low loads
CO <sub>2</sub>	1	648.6	44.1

Slow speed adjustment Ratio of emission rates at 20% load to maneuvering Load emission rate (g/kW-hr) = a (fractional load)<sup>x</sup> + b

Source: USEPA, 2000, US Environmental Protection Agency, Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data, February, 2000, EPA420-R-00-002.

**Emission Factors**

	NO <sub>x</sub>	CO	VOC	SO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO2	CH4	N2O	CO2e
Maine Engine Maneuvering (g/kW-hr)	3.4	5.0	2.0	0.40	0.3041	0.25	0.23	0.00428	588	0.07	0.0004	590 g/kW-hr conversion to lb/hp-hr 0.001644
Maine Engine Maneuvering (lb/hp-hr)	0.006	0.00822	0.003	0.001	0.000500	0.000411	0.000378	0.000007	0.967	0.0001151	0.0000007	0.970
Aux Engine T4 Transit, Manuver, Hotel (g/kW-hr)	1.8	5.0	0.19	0.40	0.073	0.060	0.060	0.004	690.0	0.09	0.0004	692
Aux Engine T4 Transit, Manuver, Hotel (lb/hp-hr)	0.0030	0.0082	0.0003	0.0007	0.0001	0.0001	0.0001	0.00001	1.13	0.00015	0.00000	1.14
Main Engine Transit Mode (g/kW-hr)	3.4	5.0	2.0	0.40	0.3041	0.25	0.23	0.00428	588	0.07	0.0004	590
Main Engine Transit Mode (lb/hp-hr)	0.006	0.00822	0.00329	0.00066	0.00050	0.00041	0.00038	0.00001	0.967	0.000115	0.000001	0.970
Tug (Tier 4 compliant post 2016) (g/kW-hr)	1.8	5.0	0.19	0.40	0.073	0.060	0.060	0.004	690.0	0.09	0.0004	692
Tug (Tier 4 compliant post 2016) (lb/hp-hr)	0.003	0.00822	0.00031	0.00066	0.00012	0.00010	0.00010	0.000007	1.13	0.00015	0.00000	1.14

Source: ARB, 2011a. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" Appendix D, Emission Estimation Methodology for Ocean Going Vessels, May 2011. Tables II-6, II-7 (main engines) and Table II-8 Auxiliary Engine only for PM10, PM2.5 and C Other Emissions Factors from USEPA Marine Compression Ignition Exhaust Emission Standards for highest Tier engines (auxiliary and Tugs C2; main engine C3) all standards fully implemented by 2016 assume all engines by 2028 comply with these stan For C3 engines assume lowest engine speed which corresponds with highest emission rat See: <http://www.epa.gov/otaq/standards/nonroad/marine.html>

HAP Emission factors from: EPA AP-42, Section 3.4; Sum of HAPs factors from Table 3.4-3 and 3.4-4.  
Global Warming Potentials (GWPs):  
CO<sub>2</sub> - 1  
CH<sub>4</sub> - 25  
N<sub>2</sub>O - 298

Travel Distance: Ship Miles 11.35 miles Travel distance from berth site in Longview, west along Columbia River to Cowittz County line (one-way)

**Emission Rates (t/yr)**

	NO <sub>x</sub>	CO	VOC	SO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO2	CH4	N2O	CO2e
<b>2028 Operational Emissions Marine Vessels</b>												
Ships (Cargo and Tugs) - (Onsite)	23	66	15.3	4.5	1.3	1.0	1.0	0.08	8062	1.0	0.0047	8089
Ships (cargo transit) - (Offsite)	25	38	14.1	3.0	2.2	1.8	1.6	0.03	4523	0.5	0.0030	4537
Total	48	104	29.4	7.6	3.4	2.8	2.7	0.11	12584	1.6	0.01	12627

**APPENDIX I  
CARGO VESSEL EMISSIONS**

Tugs/Ship	3	(Conservative estimate)		
Tug Engine Size (propulsion)	4000 hp			
Tug Positioning Time	3 hrs/ship (in-out)	(Conservative estimate)		
Tug Load Factor (Maneuvering)	31% Percent Load	(Engine load factor for Assist Tugs, from Port of Long Beach Air Emissions Inventory - 2011 (POLB, July 2012).)		
Panamax Size Engine	hp			
Handymax Size Engine	hp			
Panamax auxiliary engine size	hp			
Handymax Auxiliary Engine Size	hp			
Main Engine Load (loaded in transit)	Percent Load	Main Engine Load (maneuvering)	2% Percent Load*	* Need to apply low load adjustment factor to main engine maneuvering
Main Engine Load (unloaded in transit)	Percent Load			Low load adjustment factor for low load maneuvering
Auxiliary Engine Load (transit)	17% Percent Load	Auxiliary Engine Load (maneuvering)	45% Percent Load	Auxiliary Engine Load (hoteling)
				10% Percent Load
Number of ship call in 2028	840			
Percent of calls by Panamax	80 percent			
Percent of call by Handymax	20 percent			
Ship Berth Time ((Hoteling)	13 hrs			
Main Ship (Maneuvering)	1.0 hrs			
Transit Time within Cowitz county	0.90 hrs			

Table II-5. OGV Auxiliary Engine Load Characteristics (percent load)

Bulk Carrier/General Cargo	
Load Factor (%)	
Hoteling	10%
Maneuvering	45%
Transit	17%

ARB, 2011a. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline".  
Appendix D. Emission Estimation Methodology for Ocean Going Vessels, May 2011.  
Data [http://www.arb.ca.gov/msei/categories.htm#ogv\\_category](http://www.arb.ca.gov/msei/categories.htm#ogv_category)

Load Factors for Main Engine based on Propeller Law Equation assuming 11 knots transit in river and 4 knots maneuvering

Engine	Cruise	Transit	Maneuver
Propulsion	83%	37%	2%

At full cruise engines run at 83% of capacity with maximum speed of 15.3 knots

Propeller equation  $LF = (AS/MS)^3$

where  $LF$  = Load Factor (percent)

$AS$  = Actual Speed (knots)

$MS$  = Maximum Speed (knots)

Classification	DWT Range	Main Engine (kW)	Auxiliary Engine (kW)	Main Engine (hp)	Auxiliary Engine (kW)
HandyMax	40,000 - 60,000	7577	1407	10133.18	1885.38
PanaMax	60,000 - 100,000	12215	2268	16368.1	3039.12

Source: Sea-Web (<http://www.sea-web.com>)

The sea-web data is produced by IHS Global Limited, headquartered in Bracknell, England. The data is based on Lloyd's Register of Ships Sea-ewb provided shi characteristics data for shios over 100 gross tons Based on the ships currently in service (2014) that have stopped at US ports.

**Low Speed Adjustment for Main Engine During Ship Maneuvering**

Based on the Propeller law used to estimate ships propulsion loads, based on law that the propulsion power varies by the cube of the speed. Transit speed was assumed to average 11 knots and maneuver speed 4 knots.

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>
2% load	54.8	41.9	23.6			2.34			2853.6
20% load	11.9	4.2	0.7			0.32			869.1
Adjustment Ratio Increase	4.6	10	31.6	1	7.29	7.29	7.29	31.62	3.28

Pollutant	Exponent (x)	Intercept (b)	Coefficient (a)	conversion
PM	1.5	0.2551	0.0059	590 g/kW-hr
NO <sub>x</sub>	1.5	10.4496	0.1255	to lb/hr-hr
CO	1	0	0.8378	0.001644
HC	1.5	0	0.0667	
SO <sub>2</sub>			2.3735	only applies to fuel sulfur flow no adjustment for low loads
CO <sub>2</sub>	1	648.6	44.1	

Source: USEPA, 2000. US Environmental Protection Agency. Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data, February, 2000. EPA420-R-00-002

Lower bound speeds in the open reaches of the Columbia River Channel are 12 knots, somewhat slower speeds when fully loaded (assumed 10 knots). See: Marine Traffic Technical Report, Feb 2015, pages 37 and page 49.

**On-site Full Operation (2028)**

Coal Throughput	48,501,697 tons/yr			
Ships/yr (Panamax)	number	hp-hrs/yr	0.1 %S Marine Distillate Fuel (2015 onward)	
Annual Power (aux eng)	hp-hrs/yr		0.1 %S Marine Distillate Fuel	
Annual Power (main eng)	hp-hrs/yr			
Ships/yr (Handymax)	number	hp-hrs/yr	0.1 %S Marine Distillate Fuel	
Annual Power (aux eng)	hp-hrs/yr		0.1 %S Marine Distillate Fuel (or 1000 ppm)	
Annual Power (main eng)	hp-hrs/yr			
Tugs/yr	2,520 number	hp-hrs/yr	diesel low sulfur (15 ppm S)	
Annual Power	9,374,400 hp-hrs/yr			
<b>Off-site</b>				
Ships/yr (Panamax)	Annual Power (main)	hp-hrs/yr	0.1 %S Marine Distillate Fuel	
(aux)	-	hp-hrs/yr		
Ships/yr (Handymax)	Annual Power (main)	hp-hrs/yr	0.1 %S Marine Distillate Fuel (or 1000 ppm)	
(aux)	-	hp-hrs/yr		

**Emission Factors**

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Main Engine Maneuvering (g/KW-hr)	3.4	5.0	2.0	0.40	0.3041	0.25	0.23	0.00428	588	0.07	0.0004	590 g/kW-hr
Main Engine Maneuvering (lb/hp-hr)	0.006	0.008	0.003	0.001	0.000500	0.000411	0.000378	0.000007	0.967	0.0001151	0.0000007	0.970
Aux Engine T4 Transit, Manover, Hotel (g/KW-hr)	1.8	5.0	0.19	0.40	0.073	0.060	0.004	0.004	690.0	0.09	0.0004	692
Aux Engine T4 Transit, Manover, Hotel (lb/hp-hr)	0.0030	0.0082	0.0003	0.0007	0.0001	0.0001	0.0001	0.00001	1.13	0.00015	0.00000	1.14
Main Engine Transit Mode (g/KW-hr)	3.4	5.0	2.0	0.40	0.3041	0.25	0.23	0.00428	588	0.07	0.0004	590
Main Engine Transit Mode (lb/hp-hr)	0.006	0.00822	0.00329	0.00066	0.00050	0.000411	0.00038	0.000011	0.967	0.000115	0.000001	0.970
Tug (Tier 4 compliant post 2016) (g/KW-hr)	1.8	5.0	0.19	0.40	0.073	0.060	0.004	0.004	690.0	0.09	0.0004	692
Tug (Tier 4 compliant post 2016) (lb/hp-hr)	0.003	0.00822	0.00031	0.00066	0.00012	0.00010	0.00010	0.000007	1.13	0.00015	0.00000	1.14

Source: ARB, 2011a. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline".  
Appendix D. Emission Estimation Methodology for Ocean Going Vessels, May 2011. Tables II-6, II-7 (main engines) and Table II-8 Auxiliary Engine only for PM10, PM2.5 and CO<sub>2</sub>.

Other Emissions Factors from USEPA Marine Compression Ignition Exhaust Emission Standards for highest Tier engines (auxiliary and Tugs C2, main engine C3) all standars fully implemented by 2016 assume all engines by 2028 comply with these standards

**APPENDIX I**  
**CARGO VESSEL EMISSIONS (CAP emissions within State of WA except Cowlitz County)**

Panamax Size Engine	16368 hp				
Handymax Size Engine	10153 hp				
Panamax auxiliary engine size	3039 hp				
Handymax Auxiliary Engine Size	1885 hp				
Main Engine Load (loaded in transit)	37% Percent Load	Main Engine Load (maneuvering)	2% Percent Load*	* Need to apply low load adjustment factor to main engine maneuvering	
Main Engine Load (unloaded in transit)	37% Percent Load			Low load adjustment factor for low load maneuvering	
Auxiliary Engine Load (transit)	17% Percent Load	Auxiliary Engine Load (maneuvering)	45% Percent Load	Auxiliary Engine Load (hoteling)	10% Percent Load
Number of ship call in 2028	840				
Percent of calls by Panamax	80 percent				
Percent of call by Handymax	20 percent				
Ship Berth Time (Hoteling)	13 hrs				
Main Ship (Maneuvering)	1.0 hrs				
Transit Time round trip Cowlitz county line to 3 nr	4.10 hrs	Lower bound speeds in the open reaches of the Columbia River Channel are 12 knots, somewhat slower speeds when moving upriver (assumed 10 knots).		See: Marine Traffic Technical Report, Feb 2015, pages 37 and page 49.	

**On-site** Full Operation (2028)

Ships/yr (Panamax)	672 number
Ships/yr (Handymax)	168 number

**Off-site**

Ships/yr (Panamax)	Annual Power (main) 33,406,867 hp-hrs/yr	0.1 %S Marine Distillate Fuel
	(aux) 2,849,919	
Ships/yr (Handymax)	Annual Power (main) 5,180,594 hp-hrs/yr	0.1 %S Marine Distillate Fuel (or 1000 ppm)
	(aux) 442,001	

**Emission Factors**

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Main Engine Maneuvering (g/KW-hr)	3.4	5.0	2.0	0.40	0.3041	0.25	0.23	0.00428	588	0.07	0.0004	590 g/KW-hr conversion to lb/hp-hr 0.001644
Main Engine Maneuvering (lb/hp-hr)	0.006	0.008	0.003	0.001	0.000500	0.000411	0.000378	0.000007	0.967	0.0001151	0.0000007	0.970
Aux Engine 14 Transit, Manuver Hotel (g/KW-hr)	1.8	5.0	0.19	0.40	0.073	0.060	0.060	0.004	690.0	0.09	0.0004	692
Aux Engine 14 Transit, Manuver Hotel (lb/hp-hr)	0.0030	0.0082	0.0003	0.0007	0.0001	0.0001	0.0001	0.0001	1.13	0.00015	0.00000	1.14
Main Engine Transit Mode (g/KW-hr)	3.4	5.0	2.0	0.40	0.3041	0.25	0.23	0.00428	588	0.07	0.0004	590
Main Engine Transit Mode (lb/hp-hr)	0.006	0.00822	0.00329	0.00066	0.00050	0.00041	0.00038	0.00001	0.967	0.000115	0.000001	0.970
Tug (Tier 4 compliant post 2016) (g/KW-hr)	1.8	5.0	0.19	0.40	0.073	0.060	0.060	0.004	690.0	0.09	0.0004	692
Tug (Tier 4 compliant post 2016) (lb/hp-hr)	0.003	0.00822	0.00031	0.00066	0.00012	0.00010	0.00010	0.00007	1.13	0.00015	0.00000	1.14

Source: ARB, 2011a. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" Appendix D, Emission Estimation Methodology for Ocean Going Vessels, May 2011. Tables II-6, II-7 (main engines) and Table II-8 Auxiliary Engine only for PM10, PM2.5 and CO2;

For C3 engines assume lowest engine speed which corresponds with highest emission rate. See: <http://www.epa.gov/otaq/standards/nonroad/marineci.htm>

HAP Emission factors from: EPA AP-42, Section 3.4; Sum of HAPs factors from Table 3.4-3 and 3.4-4. Global Warming Potentials (GWPs): CO<sub>2</sub> - 1, CH<sub>4</sub> - 25, N<sub>2</sub>O - 298

**Travel Distance:**

Ship Miles	51.49 miles	Travel distance from Cowlitz County line to 3 nautical miles beyond the mouth of the Columbia River (one-way)
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**Emission Rates (tpv)**

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
<b>2028 Operational Emissions Marine Vessels</b>												
Ships (cargo transit) - (Offsite)	113	172	64.0	13.8	9.8	8.1	7.5	0.15	20518	2.5	0.0138	20584
Total	113	172	64.0	13.8	9.8	8.1	7.5	0.15	20518	2.5	0.01	20584

Table II-5: OGV Auxiliary Engine Load Characteristics (percent load)

Bulk Carrier/General Cargo	
Load Factor (%)	
Hoteling	10%
Maneuvering	45%
Transit	17%

ARB, 2011a. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" Appendix D, Emission Estimation Methodology for Ocean Going Vessels, May 2011. Data [http://www.arb.ca.gov/msei/categories.htm#ogv\\_category](http://www.arb.ca.gov/msei/categories.htm#ogv_category)

Load Factors for Main Engine based on Propeller Law Equation assuming 11 knots transit in river and 4 knots maneuvering

Engine	Cruise	Transit	Maneuver
Propulsion	83%	37%	2%

At full cruise engines run at 83% of capacity with maximum speed of 15.3 knots  
Propeller equation  $LF = (AS/MS)^3$   
where LF = Load Factor (percent)  
AS = Actual Speed (knots)  
MS = Maximum Speed (knots)

Classification	DWT Range	Main Engine (kW)	Auxiliary Engine (kW)	Main Engine (hp)	Auxiliary Engine (kW)
HandyMax	40,000 - 60,000	7577	1407	10153.18	1885.38
PanaMax	60,000 - 100,000	12215	2268	16368.1	3039.12

Source: Sea-Web (<http://www.sea-web.com>)

The sea-web data is produced by IHS Global Limited, headquartered in Bracknell, England. The data is based on Lloyd's Register of Ships Sea-ewb provided shi characteristics data for shios over 100 gross tons. Based on the ships currently in service (2014) that have stopped at US ports.

**Low Speed Adjustment for Main Engine During Ship Maneuvering**  
Based on the Propeller law used to estimate ships propulsion loads, based on law that the propulsion power varies by the cube of the speed. Transit speed was assumed to average 11 knots and maneuver speed 4 knots.

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>
2% load	54.8	41.9	23.6			2.34			2853.6
20% load	11.9	4.2	0.7			0.32			869.1
Adjustment Ratio Increase	4.6	10	31.6	1	7.29	7.29	31.62	3.28	

Pollutant Exponent (x) Intercept (b) Coefficient (a)  
 PM 1.5 0.2551 0.0059  
 NO<sub>x</sub> 1.5 10.4496 0.1255  
 CO 1 0 0.8378  
 HC 1.5 0 0.0667  
 SO<sub>2</sub> 2.3735 only applies to fuel sulfur flow no adjustment for low loads  
 CO<sub>2</sub> 1 648.6 44.1

Slow speed adjustment Ratio of emission rates at 20% load to maneuvering Load emission rate (g/KW-hr) = a (fractional load)<sup>x</sup> + b

Source: USEPA, 2000. US Environmental Protection Agency, Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data, February, 2000. EPA420-R-00-002.

**APPENDIX I  
CARGO VESSEL EMISSIONS**

Tugs/Ship	3	(Conservative estimate)		
Tug Engine Size (propulsion)	4000 hp			
Tug Positioning Time	3 hrs/ship (in-out)	(Conservative estimate)		
Tug Load Factor (Maneuvering)	31% Percent Load	(Engine load factor for Assist Tugs, from Port of Long Beach Air Emissions Inventory - 2011 (POLB, July 2012).)		
Panamax Size Engine	16368 hp			
Handymax Size Engine	10153 hp			
Panamax auxiliary engine size	3039 hp			
Handymax Auxiliary Engine Size	1885 hp			
Main Engine Load (loaded in transit)	37% Percent Load	Main Engine Load (maneuvering)	2% Percent Load*	* Need to apply low load adjustment factor to main engine maneuvering
Main Engine Load (unloaded in transit)	37% Percent Load			Low load adjustment factor for low load maneuvering
Auxiliary Engine Load (transit)	17% Percent Load	Auxiliary Engine Load (maneuvering)	45% Percent Load	Auxiliary Engine Load (hoteling) 10% Percent Load

Number of ship call in 2028	26
Percent of calls by Panamax	0 percent
Percent of call by Handymax	100 percent
Ship Berth Time (Hoteling)	13 hrs
Main Ship (Maneuvering)	1.0 hrs
Transit Time within Cowlitz county	0.90 hrs

Lower bound speeds in the open reaches of the Columbia River Channel are 12 knots, somewhat slower speeds when fully loaded (assumed 10 knots). See: Marine Traffic Technical Report, Feb 2015, pages 37 and page 49.

**On-site**  
Coal Throughput 45,501,697 tons/yr

Ships/yr (Panamax)	0 number			
Annual Power (aux eng)	- hp-hrs/yr	0.1 %S Marine Distillate Fuel (2015 onward)		
Annual Power (main eng)	- hp-hrs/yr	0.1 %S Marine Distillate Fuel		
Ships/yr (Handymax)	26 number			
Annual Power (aux eng)	85,785 hp-hrs/yr	0.1 %S Marine Distillate Fuel		
Annual Power (main eng)	5,280 hp-hrs/yr	0.1 %S Marine Distillate Fuel (or 1000 ppm)		
Tugs/yr	78 number			
Annual Power	290,160 hp-hrs/yr	diesel low sulfur (15 ppm S)		
<b>Off-site</b>				
Ships/yr (Panamax)	- hp-hrs/yr	0.1 %S Marine Distillate Fuel		
Ships/yr (Handymax)	176,733 hp-hrs/yr	0.1 %S Marine Distillate Fuel (or 1000 ppm)		

**Emission Factors**

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Marine Engine Maneuvering (g/KW-hr)	3.4	5.0	2.0	0.40	0.3041	0.25	0.23	0.00428	588	0.07	0.0004	590 g/KW-hr
Marine Engine Maneuvering (lb/hp-hr)	0.006	0.00822	0.003	0.001	0.000000	0.000411	0.000378	0.000007	0.967	0.0001151	0.0000007	0.970
Aux Engine 14 Transit, Manuver, Hotel (g/KW-hr)	1.8	5.0	0.19	0.40	0.073	0.060	0.060	0.004	690.0	0.09	0.0004	692
Aux Engine 14 Transit, Manuver, Hotel (lb/hp-hr)	0.0030	0.0082	0.0003	0.0007	0.0001	0.0001	0.0001	0.0001	1.13	0.00015	0.00000	1.14
Main Engine Transit Mode (g/KW-hr)	3.4	5.0	2.0	0.40	0.3041	0.25	0.23	0.00428	588	0.07	0.0004	590
Main Engine Transit Mode (lb/hp-hr)	0.006	0.00822	0.00329	0.00066	0.00050	0.00041	0.00038	0.00001	0.967	0.000115	0.000001	0.970
Tug (Tier 4 compliant post 2016) (g/KW-hr)	1.8	5.0	0.19	0.40	0.073	0.060	0.060	0.004	690.0	0.09	0.0004	692
Tug (Tier 4 compliant post 2016) (lb/hp-hr)	0.003	0.00822	0.00031	0.00066	0.00012	0.00010	0.00010	0.00007	1.13	0.00015	0.00000	1.14

Source: ARB, 2011a. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" Appendix D, Emission Estimation Methodology for Ocean Going Vessels, May 2011. Tables II-6, II-7 (main engines) and Table II-8 Auxiliary Engine only for PM10, PM2.5 and CO2; Other Emissions Factors from USEPA Marine Compression Ignition Exhaust Emission Standards for highest Tier engines (auxiliary and Tugs C2; main engine C3) all standards fully implemented by 2016 assume all engines by 2028 comply with these standards For C3 engines assume lowest engine speed which corresponds with highest emission rate. See: <http://www.epa.gov/otaq/standards/nonroad/martrnec.htm>

HAP Emission factors from: EPA AP-42, Section 3.4; Sum of HAPs factors from Table 3.4-3 and 3.4-4.  
Global Warming Potentials (GWPs):  
CO<sub>2</sub> - 1  
CH<sub>4</sub> - 25  
N<sub>2</sub>O - 298

Travel Distance: Ship Miles 11.35 miles Travel distance from berth site in Longview, west along Columbia River to Cowlitz County line (one-way)

**Emission Rates (tpv)**

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
<b>2028 Operational Emissions Marine Vessels</b>												
Ships (Cargo and Tugs) - (Onsite)	0.6	1.8	0.3	0.1	0.02	0.03	0.03	0.00	221.61	0.03	0.00	222.4
Ships (cargo transit) - (Offsite)	0.5	0.8	0.3	0.1	0.05	0.04	0.03	0.00	93.97	0.01	0.00	94.3
Total	1.1	2.6	0.63	0.19	0.07	0.06	0.06	0.003	315.6	0.04	0.0002	316.6

Table II-5: OGV Auxiliary Engine Load Characteristics (percent load)

Bulk Cargo/General Cargo	
Load Factor (%)	
Hoteling	10%
Maneuvering	45%
Transit	17%

ARB, 2011a. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" Appendix D, Emission Estimation Methodology for Ocean Going Vessels, May 2011. Data [http://www.arb.ca.gov/msei/categories.htm#ogv\\_category](http://www.arb.ca.gov/msei/categories.htm#ogv_category)

Load Factors for Main Engine based on Propeller Law Equation assuming 11 knots transit in river and 4 knots maneuvering

Engine	Cruise	Transit	Maneuver
Propulsion	83%	37%	2%

At full cruise engines run at 83% of capacity with maximum speed of 15.3 knots

Propeller equation  $LF = (AS/MS)^3$   
where LF = Load Factor (percent)  
AS = Actual Speed (knots)  
MS = Maximum Speed (knots)

Classification	DWT Range	Main Engine (kW)	Auxiliary Engine (kW)	Main Engine (hp)	Auxiliary Engine (kW)
HandyMax	40,000 - 60,000	7577	1407	10153.18	1885.38
PanaMax	60,000 - 100,000	12215	2268	16368.1	3039.12

Source: Sea-Web (<http://www.sea-web.com>)

The sea-web data is produced by IHS Global Limited, headquartered in Bracknell, England. The data is based on Lloyd's Register of Ships Sea-ewb provided shi characteristics data for shios over 100 gross tons. Based on the ships currently in service (2014) that have stopped at US ports.

**Low Speed Adjustment for Main Engine During Ship Maneuvering**

Based on the Propeller law used to estimate ships propulsion loads, based on law that the propulsion power varies by the cube of the speed. Transit speed was assumed to average 11 knots and maneuver speed 4 knots.

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	HAPS	CO <sub>2</sub>
2% load	54.8	41.9	23.6			2.34			2853.6
20% load	11.9	4.2	0.7			0.32			869.1
Adjustment Ratio Increase	4.6	10	31.6	1	7.29	7.29	7.29	31.62	3.28

Source: USEPA, 2000. US Environmental Protection Agency, Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data, February, 2000. EPA420-R-00-002.

**Material Haul Traffic MTBL to Weyerhaeuser**

				Coal Moved	Full Build-Out			
					2,673,990	tons/yr		
Haul Trucks	SR432 @ 35mph	Number	Miles (RT) <sup>1</sup>	miles/year	Carrying Capacity of Haul Truck	51000	lbs/load	Based on 77,000 lb GVWR for a 26,000 lb curb weight haul truck
		104,862	2.0	209,725	Loads per year	104,862	trips per year	Large Capacity Dump Truck
					Round trip distance	2.0	trips per day	Weyerhaeuser to Milleneum
						287	miles	

Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH4	N2O	CO2eq	HAP
<b>2028</b>											
<b>Construction Annual</b>				<b>T/year</b>							
Combo Short Haul Truck @ 35mph	0.23	0.04	0.01	0.00	0.10	0.02	237.87	0.01	0.00	238.41	0.001
<b>Total:</b>	0.23	0.04	0.01	0.002	0.10	0.02	237.87	0.01	0.00	238.41	

Factors:

453.59	g/lb
2000	lbs/ton
5280	ft/mile
3.78541	l/gal

Global Warming Potentials (GWPs):

CO <sub>2</sub>	- 1
CH <sub>4</sub>	- 25
N <sub>2</sub> O	- 298

MOVES factors (g/mile) for surrogate idle were based on 2.5 mi/hr travel. So to get g/hr, multiply by 2.5 mi/hr. For onsite/idle, assume 0.25 hr. So factor is 2.5/.25 to get grams/trip.

mi/hr 2.5  
hr 0.25  
factor for 1/2 hr idle/trip 10

**Mobile Source - Moves run for Cowlitz County, WY, 2028**  
**Emission factors for Truck Exhaust**

Project Year	Emission factors for Truck Exhaust										Form	CO2eq
	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH <sub>4</sub>	N <sub>2</sub> O	Benzene		
<b>2018</b>												
Short Haul Combo - diesel @ 35mph (Urban un-restricted)	9.82E-01	1.71E-01	4.41E-02	8.86E-03	4.38E-01	9.24E-02	1.03E+03	6.01E-02	2.77E-03	9.16E-04		1.41E-02 1.03E+03
Short Haul Combo - diesel @ idle (Rural unrestricted)	6.00	0.42	0.24	0.02	1.48	0.35	1927.59	0.06	0.00	0.00		0.03 1930.06

**APPENDIX J  
OPERATIONS AND MAINTENANCE EQUIPMENT**

**Equipment Information**

Equipment Type	Estimated Engine Size (hp) Fuel	Number of Units Full Build-Out	EPA SCC Number	EPA NONROAD model combustion emission factor (tons/yr per unit)					
				THC-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Loader (miscellaneous use)	300 Diesel	1	2270002060	2.81E-01	1.14E+00	3.47E+00	7.40E+02	1.42E-01	2.96E-01
Bobcat (sump cleaning)	50 Diesel	2	2270002057	7.50E-03	4.18E-02	1.29E-01	1.83E+01	3.60E-03	8.27E-03
10-Ton Truck (sump cleaning)	300 Diesel	2	2270002051	3.06E-02	9.01E-02	3.12E-01	1.09E+02	1.86E-02	3.49E-02
Crane (miscellaneous use)	50 Diesel	1	2270002045	1.27E-05	6.42E-05	2.24E-04	3.15E-02	6.15E-06	1.34E-05
Forklift (miscellaneous use)	40 Propane	1	2267002057	5.20E-05	1.84E-03	2.95E-04	1.52E-01	2.95E-06	1.60E-05
Maintenance Trucks (eg. Ford F150)	300 Gasoline	4	2265003070	1.14E-04	4.20E-03	3.12E-04	2.11E-01	4.36E-05	2.16E-05

Note:

For PM<sub>10</sub>, PM<sub>2.5</sub>, and HAPs, use same emission ratio as emission factor ratios for Large Diesel Engines (see Construction worksheet): PM<sub>10</sub> and PM<sub>2.5</sub> ratio to TSP, and; HAPs ratio to CO.

**Annual Emissions (tpy)**

Full Build-Out (tpy)	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM10	PM2.5	HAPS	CO2e
Loader (miscellaneous use)	3.47	1.14	0.28	0.14	0.30	0.24	0.24	0.01	740
Bobcat (sump cleaning)	0.26	0.08	0.01	0.01	0.02	0.01	0.01	0.00	37
10-Ton Truck (sump cleaning)	0.62	0.18	0.06	0.04	0.07	0.06	0.06	0.00	218
Crane (miscellaneous use)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Forklift (miscellaneous use)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Maintenance Trucks (eg. Ford F150)	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1
<b>Full Build-Out Total (tpy)</b>	<b>4.36</b>	<b>1.42</b>	<b>0.36</b>	<b>0.19</b>	<b>0.38</b>	<b>0.31</b>	<b>0.31</b>	<b>0.01</b>	<b>996</b>

**APPENDIX J  
OPERATIONS AND MAINTENANCE EQUIPMENT**

**Equipment Information**

Equipment Type	Estimated Engine Size (hp) Fuel	Number of Units Full Build-Out	EPA SCC Number	EPA NONROAD model combustion emission factor (tons/yr per unit)					
				THC-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Loader (miscellaneous use)	300 Diesel	1	2270002060	2.81E-01	1.14E+00	3.47E+00	7.40E+02	1.42E-01	2.96E-01
Bobcat (sump cleaning)	50 Diesel	2	2270002057	7.50E-03	4.18E-02	1.29E-01	1.83E+01	3.60E-03	8.27E-03
10-Ton Truck (sump cleaning)	300 Diesel	2	2270002051	3.06E-02	9.01E-02	3.12E-01	1.09E+02	1.86E-02	3.49E-02
Crane (miscellaneous use)	50 Diesel	1	2270002045	1.27E-05	6.42E-05	2.24E-04	3.15E-02	6.15E-06	1.34E-05
Forklift (miscellaneous use)	40 Propane	0	2267002057	5.20E-05	1.84E-03	2.95E-04	1.52E-01	2.95E-06	1.60E-05
Maintenance Trucks (eg. Ford F150)	300 Gasoline	0	2265003070	1.14E-04	4.20E-03	3.12E-04	2.11E-01	4.36E-05	2.16E-05

Note:

For PM<sub>10</sub>, PM<sub>2.5</sub>, and HAPs, use same emission ratio as emission factor ratios for Large Diesel Engines (see Construction worksheet): PM<sub>10</sub> and PM<sub>2.5</sub> ratio to TSP, and; HAPs ratio to CO.

**Annual Emissions (tpy)**

Full Build-Out (tpy)	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP	PM10	PM2.5	HAPS	CO2e
Loader (miscellaneous use)	3.47	1.14	0.28	0.14	0.30	0.24	0.24	0.01	740
Bobcat (sump cleaning)	0.26	0.08	0.01	0.01	0.02	0.01	0.01	0.00	37
10-Ton Truck (sump cleaning)	0.62	0.18	0.06	0.04	0.07	0.06	0.06	0.00	218
Crane (miscellaneous use)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Forklift (miscellaneous use)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Maintenance Trucks (eg. Ford F150)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
<b>Full Build-Out Total (tpy)</b>	<b>4.36</b>	<b>1.40</b>	<b>0.36</b>	<b>0.19</b>	<b>0.38</b>	<b>0.31</b>	<b>0.31</b>	<b>0.01</b>	<b>995</b>

## APPENDIX K

### Washington State Emissions in tons per year

2011 Emissions Inventory

COWLITZ COUNTY EMISSIONS							
Category	CO	NOx	PM10	PM2.5	DSPM2.5	SO2	VOC
AIR	125	2	3	2		0	4
BOAT	887	74	5	5	0	0	298
CONS							549
CONST			523	55			
F_COMM	6	2	5	5		0	0
F_RES	5	13	0	0	0	3	1
FERT							
FIRE	68	1	7	6		1	16
FOOD	14		35	33			5
GAS_TRANS							696
GASSTN							138
LIVE							
MISC	8	1	2	2		0	2
NAT	3,361	59					11,443
NRM	3,718	389	48	46	24	1	592
OB_nonRES	117	6	24	21		0	7
OB_Res	162	8	38	33		1	22
ORM	22,852	4,281	157	130	83	13	1,649
POTW							2
PT	2,507	3,616	182	172	0	791	671
ROADS			381	93			
RR	137	789	23	23	23	6	43
RWC	2,026	31	290	290		5	346
SHIP	150	1,109	37	34	34	199	46
SOLV							390
TILL_HARV			109	22			
<b>Total</b>	<b>36,142</b>	<b>10,382</b>	<b>1,872</b>	<b>971</b>	<b>164</b>	<b>1,020</b>	<b>16,919</b>

Source: Compiled from data in Ecology's *Washington State 2011 County Emissions Inventory* (April 25, 2014) (<http://www.ecy.wa.gov/programs/air/EmissionInventory/AirEmissionInventory.htm>)

#### NOTES:

##### 1) Source Category Abbreviations

Abbreviation	Source Category Description
AIR	Aircraft: military, commercial, general aviation
BOAT	Recreational boats
CONS	Commercial and consumer solvents
CONST	Construction
F_COMM	Commercial fuel use: natural gas, oil, LPG
F_RES	Residential fuel use: natural gas, oil, LPG
FERT	Fertilizer application
FIRE	Wildfires
FOOD	Food and Kindred Products
GAS_TRANS	Aviation gas storage and transport, petroleum gas cans, bulk plants, and truck transport
GASSTN	Gasoline stations
LIVE	Livestock wastes
MISC	Structure and motor vehicle fires, Cremation, Dental alloy production, Bench scale reagents, Fluorescent lamps
NAT	Natural emissions from soil and vegetation
NRM	Nonroad mobile except locomotives
OB_nonRES	Agricultural and silvicultural burning
OB_Res	Residential outdoor burning: yard waste, trash
ORM	Onroad mobile sources
POTW	Publicly owned treatment works
PT	Point sources
ROADS	Paved and unpaved road dust
RR	Locomotives

RWC	Woodstoves, fireplaces, inserts
SHIP	Commercial marine vessels
SOLV	Dry cleaning, graphic arts, surface coating: industrial
TILL_HARV	Agricultural tilling and harvesting

## 2) Pollutant Abbreviations

<b>Abbreviation</b>	<b>Pollutant Name</b>
PM10	particulate matter less than or equal to 10 microns in diameter
PM2.5	particulate matter less than or equal to 2.5 microns in diameter
DSPM 2.5	particulate matter less than or equal to 2.5 microns in diameter from diesel combustior
SO2	sulfur dioxide
NOx	nitrogen oxides
VOC	volatile organic hydrocarbons
CO	carbon monoxide

Sum of emisRate - 55 mph

			Pollutant	
RoadType	yearID	FuelType	SourceType	PM2.5 Tirewear g/mi
Rural Restricted Access	2018	Diesel Fuel	Combination Long-haul Truck	3.90E-03
			Combination Short-haul Truck	3.51E-03
			Intercity Bus	3.09E-03
			Passenger Car	1.03E-03
			Passenger Truck	1.29E-03
			School Bus	1.88E-03
			Single Unit Long-haul Truck	2.21E-03
			Single Unit Short-haul Truck	2.00E-03
			Transit Bus	2.06E-03
			Motor Home	1.67E-03
			Refuse Truck	3.75E-03
			Light Commercial Truck	1.25E-03
		Gasoline	Combination Short-haul Truck	1.92E-03
			Motorcycle	5.15E-04
			Passenger Car	1.03E-03
			Passenger Truck	1.04E-03
			School Bus	1.88E-03
			Single Unit Long-haul Truck	1.52E-03
			Single Unit Short-haul Truck	1.52E-03
			Transit Bus	3.02E-03
			Motor Home	1.67E-03
			Refuse Truck	1.52E-03
			Light Commercial Truck	1.05E-03
		Compressed Natural Gas (CNG)	Transit Bus	2.06E-03
		Ethanol (E-85)	Passenger Car	1.03E-03
			Passenger Truck	1.03E-03
			Light Commercial Truck	1.03E-03
Rural Unrestricted Access	2018	Diesel Fuel	Combination Long-haul Truck	4.26E-03
			Combination Short-haul Truck	3.83E-03
			Intercity Bus	3.51E-03
			Passenger Car	1.17E-03
			Passenger Truck	1.46E-03
			School Bus	2.13E-03
			Single Unit Long-haul Truck	2.51E-03
			Single Unit Short-haul Truck	2.27E-03
			Transit Bus	2.34E-03
			Motor Home	1.90E-03
			Refuse Truck	4.26E-03
			Light Commercial Truck	1.42E-03
		Gasoline	Combination Short-haul Truck	2.10E-03
			Motorcycle	5.85E-04
			Passenger Car	1.17E-03

		Passenger Truck	1.18E-03
		School Bus	2.13E-03
		Single Unit Long-haul Truck	1.73E-03
		Single Unit Short-haul Truck	1.73E-03
		Transit Bus	3.43E-03
		Motor Home	1.90E-03
		Refuse Truck	1.73E-03
		Light Commercial Truck	1.20E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.34E-03
	Ethanol (E-85)	Passenger Car	1.17E-03
		Passenger Truck	1.17E-03
		Light Commercial Truck	1.17E-03
Urban Restricted Access	2018 Diesel Fuel	Combination Long-haul Truck	4.13E-03
		Combination Short-haul Truck	3.71E-03
		Intercity Bus	3.28E-03
		Passenger Car	1.09E-03
		Passenger Truck	1.37E-03
		School Bus	1.99E-03
		Single Unit Long-haul Truck	2.34E-03
		Single Unit Short-haul Truck	2.12E-03
		Transit Bus	2.19E-03
		Motor Home	1.77E-03
		Refuse Truck	3.99E-03
		Light Commercial Truck	1.33E-03
	Gasoline	Combination Short-haul Truck	2.03E-03
		Motorcycle	5.47E-04
		Passenger Car	1.09E-03
		Passenger Truck	1.10E-03
		School Bus	1.99E-03
		Single Unit Long-haul Truck	1.62E-03
		Single Unit Short-haul Truck	1.61E-03
		Transit Bus	3.21E-03
		Motor Home	1.77E-03
		Refuse Truck	1.62E-03
		Light Commercial Truck	1.12E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.19E-03
	Ethanol (E-85)	Passenger Car	1.09E-03
		Passenger Truck	1.09E-03
		Light Commercial Truck	1.09E-03
Urban Unrestricted Access	2018 Diesel Fuel	Combination Long-haul Truck	4.61E-03
		Combination Short-haul Truck	4.14E-03
		Intercity Bus	3.80E-03
		Passenger Car	1.27E-03
		Passenger Truck	1.58E-03
		School Bus	2.31E-03

	Single Unit Long-haul Truck	2.71E-03
	Single Unit Short-haul Truck	2.46E-03
	Transit Bus	2.53E-03
	Motor Home	2.05E-03
	Refuse Truck	4.61E-03
	Light Commercial Truck	1.54E-03
Gasoline	Combination Short-haul Truck	2.27E-03
	Motorcycle	6.33E-04
	Passenger Car	1.27E-03
	Passenger Truck	1.27E-03
	School Bus	2.30E-03
	Single Unit Long-haul Truck	1.87E-03
	Single Unit Short-haul Truck	1.87E-03
	Transit Bus	3.72E-03
	Motor Home	2.05E-03
	Refuse Truck	1.87E-03
	Light Commercial Truck	1.30E-03
Compressed Natural Gas (CNG)	Transit Bus	2.53E-03
Ethanol (E-85)	Passenger Car	1.27E-03
	Passenger Truck	1.27E-03
	Light Commercial Truck	1.27E-03

## RateUnit

PM2.5 g/mi	Brakewear g/mi	PM10 g/mi	Tirewear g/mi	PM10 g/mi	Brakewear g/mi	PM10 g/mi	Total Exh g/mi	VOC g/mi	SO2 g/mi	NOx g/mi	
4.90E-03			2.60E-02		3.92E-02		2.15E-01		2.52E-01	1.44E-02	5.75E+00
4.65E-03			2.34E-02		3.72E-02		1.58E-01		2.02E-01	1.36E-02	4.63E+00
4.08E-03			2.06E-02		3.26E-02		3.44E-01		4.29E-01	1.44E-02	9.54E+00
7.37E-04			6.86E-03		5.89E-03		3.82E-03		1.98E-02	2.49E-03	1.10E-01
1.13E-03			8.58E-03		9.04E-03		3.71E-02		1.18E-01	5.04E-03	9.23E-01
4.17E-03			1.25E-02		3.34E-02		2.65E-01		5.10E-01	9.18E-03	5.52E+00
4.35E-03			1.47E-02		3.48E-02		8.92E-02		1.85E-01	7.25E-03	1.85E+00
3.87E-03			1.33E-02		3.10E-02		1.07E-01		2.09E-01	7.81E-03	2.26E+00
2.61E-03			1.37E-02		2.09E-02		3.06E-01		4.38E-01	1.31E-02	7.76E+00
3.11E-03			1.11E-02		2.49E-02		1.75E-01		3.57E-01	8.84E-03	3.63E+00
4.49E-03			2.50E-02		3.59E-02		1.68E-01		2.03E-01	1.40E-02	4.63E+00
1.19E-03			8.33E-03		9.55E-03		4.39E-02		1.36E-01	4.72E-03	9.54E-01
3.24E-03			1.28E-02		2.59E-02		3.61E-01		2.47E+00	9.98E-03	1.10E+01
5.67E-05			3.43E-03		4.54E-04		3.59E-02		5.46E-01	2.63E-03	8.78E-01
7.37E-04			6.86E-03		5.89E-03		6.87E-03		3.39E-02	1.92E-03	1.89E-01
1.18E-03			6.91E-03		9.48E-03		9.46E-03		7.07E-02	2.56E-03	3.77E-01
4.17E-03			1.25E-02		3.33E-02		1.96E-01		1.28E+00	6.89E-03	5.86E+00
2.97E-03			1.02E-02		2.37E-02		2.09E-01		7.73E-01	6.08E-03	4.63E+00
2.91E-03			1.01E-02		2.32E-02		4.58E-02		1.95E-01	6.25E-03	1.07E+00
4.21E-03			2.02E-02		3.37E-02		6.01E-02		3.61E-01	9.13E-03	1.50E+00
3.11E-03			1.11E-02		2.49E-02		1.09E-01		5.31E-01	6.77E-03	2.49E+00
1.93E-03			1.01E-02		1.54E-02		2.33E-01		8.36E-01	9.93E-03	5.16E+00
1.24E-03			7.03E-03		9.92E-03		8.41E-03		5.84E-02	2.50E-03	3.36E-01
2.61E-03			1.37E-02		2.09E-02		6.65E-02		4.35E-01	7.16E-03	4.23E+00
7.37E-04			6.86E-03		5.89E-03		2.85E-03		1.96E-02	2.17E-03	7.68E-02
1.19E-03			6.86E-03		9.49E-03		3.93E-03		3.09E-02	2.77E-03	1.29E-01
1.25E-03			6.86E-03		9.96E-03		3.57E-03		2.86E-02	2.69E-03	1.20E-01
7.50E-03			2.84E-02		6.00E-02		2.21E-01		2.77E-01	1.42E-02	5.78E+00
7.03E-03			2.55E-02		5.63E-02		1.60E-01		2.20E-01	1.33E-02	4.58E+00
6.81E-03			2.34E-02		5.45E-02		3.54E-01		4.85E-01	1.36E-02	9.09E+00
1.30E-03			7.80E-03		1.04E-02		2.82E-03		1.54E-02	2.42E-03	9.03E-02
2.01E-03			9.74E-03		1.61E-02		3.76E-02		1.24E-01	4.95E-03	9.00E-01
5.95E-03			1.42E-02		4.76E-02		2.70E-01		5.54E-01	7.50E-03	4.50E+00
6.29E-03			1.67E-02		5.03E-02		9.30E-02		2.12E-01	6.32E-03	1.69E+00
5.63E-03			1.51E-02		4.50E-02		1.13E-01		2.41E-01	6.88E-03	2.08E+00
4.28E-03			1.56E-02		3.42E-02		2.86E-01		4.54E-01	1.14E-02	6.85E+00
4.62E-03			1.27E-02		3.69E-02		1.89E-01		4.12E-01	7.30E-03	3.07E+00
7.54E-03			2.84E-02		6.03E-02		1.67E-01		2.25E-01	1.30E-02	4.41E+00
2.04E-03			9.47E-03		1.63E-02		4.52E-02		1.46E-01	4.71E-03	9.40E-01
4.70E-03			1.40E-02		3.76E-02		2.41E-01		2.43E+00	9.70E-03	1.06E+01
1.07E-04			3.90E-03		8.58E-04		2.45E-02		5.69E-01	2.54E-03	8.85E-01
1.30E-03			7.80E-03		1.04E-02		4.60E-03		2.95E-02	1.87E-03	1.65E-01

2.10E-03	7.85E-03	1.68E-02	5.66E-03	6.15E-02	2.47E-03	3.21E-01
5.95E-03	1.42E-02	4.76E-02	6.57E-02	1.07E+00	5.69E-03	4.79E+00
4.11E-03	1.15E-02	3.29E-02	2.36E-02	6.60E-01	5.31E-03	4.18E+00
4.10E-03	1.15E-02	3.28E-02	1.08E-02	1.71E-01	5.55E-03	9.75E-01
6.79E-03	2.29E-02	5.44E-02	2.83E-02	3.35E-01	8.01E-03	1.31E+00
4.62E-03	1.27E-02	3.69E-02	2.28E-02	4.40E-01	5.73E-03	2.17E+00
3.07E-03	1.15E-02	2.46E-02	1.01E-01	8.31E-01	9.33E-03	4.92E+00
2.11E-03	7.98E-03	1.69E-02	5.44E-03	5.23E-02	2.47E-03	2.96E-01
4.28E-03	1.56E-02	3.42E-02	4.72E-02	4.01E-01	6.28E-03	3.70E+00
1.30E-03	7.80E-03	1.04E-02	2.02E-03	1.62E-02	2.12E-03	6.38E-02
2.11E-03	7.80E-03	1.69E-02	2.48E-03	2.44E-02	2.68E-03	9.86E-02
2.12E-03	7.80E-03	1.70E-02	2.44E-03	2.35E-02	2.65E-03	9.46E-02
7.21E-03	2.75E-02	5.77E-02	2.27E-01	2.66E-01	1.44E-02	5.77E+00
6.76E-03	2.47E-02	5.40E-02	1.66E-01	2.13E-01	1.36E-02	4.61E+00
5.73E-03	2.19E-02	4.58E-02	3.59E-01	4.55E-01	1.42E-02	9.39E+00
1.03E-03	7.29E-03	8.21E-03	3.78E-03	1.88E-02	2.49E-03	1.03E-01
1.58E-03	9.11E-03	1.26E-02	3.80E-02	1.22E-01	5.03E-03	9.23E-01
5.33E-03	1.33E-02	4.26E-02	2.81E-01	5.48E-01	9.02E-03	5.36E+00
5.42E-03	1.56E-02	4.33E-02	9.48E-02	1.98E-01	7.42E-03	1.90E+00
4.84E-03	1.42E-02	3.87E-02	1.14E-01	2.25E-01	7.93E-03	2.30E+00
3.68E-03	1.46E-02	2.95E-02	3.17E-01	4.59E-01	1.29E-02	7.62E+00
3.93E-03	1.18E-02	3.15E-02	1.86E-01	3.85E-01	8.70E-03	3.56E+00
6.43E-03	2.66E-02	5.14E-02	1.76E-01	2.14E-01	1.38E-02	4.58E+00
1.65E-03	8.85E-03	1.32E-02	4.51E-02	1.42E-01	4.72E-03	9.54E-01
4.48E-03	1.35E-02	3.59E-02	3.47E-01	2.58E+00	1.00E-02	1.08E+01
8.12E-05	3.65E-03	6.50E-04	3.67E-02	5.62E-01	2.60E-03	8.75E-01
1.03E-03	7.29E-03	8.21E-03	6.87E-03	3.32E-02	1.92E-03	1.81E-01
1.66E-03	7.35E-03	1.33E-02	9.43E-03	6.84E-02	2.53E-03	3.57E-01
5.33E-03	1.33E-02	4.26E-02	1.86E-01	1.32E+00	6.90E-03	5.81E+00
3.58E-03	1.08E-02	2.87E-02	2.14E-01	8.40E-01	6.24E-03	4.72E+00
3.55E-03	1.08E-02	2.84E-02	4.64E-02	2.11E-01	6.39E-03	1.09E+00
5.87E-03	2.14E-02	4.70E-02	5.84E-02	3.76E-01	9.08E-03	1.49E+00
3.93E-03	1.18E-02	3.15E-02	1.10E-01	5.57E-01	6.78E-03	2.49E+00
2.61E-03	1.08E-02	2.09E-02	2.32E-01	8.97E-01	9.92E-03	5.17E+00
1.72E-03	7.46E-03	1.37E-02	8.26E-03	5.66E-02	2.49E-03	3.18E-01
3.68E-03	1.46E-02	2.95E-02	6.61E-02	4.50E-01	7.12E-03	4.20E+00
1.03E-03	7.29E-03	8.21E-03	2.83E-03	1.89E-02	2.17E-03	7.25E-02
1.66E-03	7.29E-03	1.33E-02	3.91E-03	2.91E-02	2.75E-03	1.18E-01
1.72E-03	7.29E-03	1.38E-02	3.50E-03	2.69E-02	2.67E-03	1.09E-01
1.40E-02	3.07E-02	1.12E-01	2.54E-01	3.17E-01	1.47E-02	6.07E+00
1.28E-02	2.76E-02	1.03E-01	1.83E-01	2.52E-01	1.38E-02	4.78E+00
1.21E-02	2.53E-02	9.68E-02	4.05E-01	5.55E-01	1.42E-02	9.43E+00
2.01E-03	8.43E-03	1.61E-02	2.89E-03	1.54E-02	2.54E-03	8.58E-02
3.13E-03	1.05E-02	2.51E-02	4.03E-02	1.39E-01	5.13E-03	9.59E-01
8.19E-03	1.54E-02	6.55E-02	3.01E-01	6.23E-01	7.74E-03	4.68E+00

9.74E-03	1.81E-02	7.79E-02	1.07E-01	2.47E-01	7.11E-03	1.92E+00
8.67E-03	1.64E-02	6.94E-02	1.30E-01	2.81E-01	7.68E-03	2.34E+00
6.72E-03	1.69E-02	5.37E-02	3.13E-01	4.96E-01	1.14E-02	7.03E+00
6.92E-03	1.37E-02	5.53E-02	2.16E-01	4.82E-01	7.97E-03	3.37E+00
1.30E-02	3.08E-02	1.04E-01	1.92E-01	2.55E-01	1.35E-02	4.62E+00
3.19E-03	1.02E-02	2.55E-02	4.87E-02	1.64E-01	4.88E-03	1.00E+00
7.97E-03	1.51E-02	6.38E-02	2.41E-01	2.80E+00	1.02E-02	1.08E+01
1.72E-04	4.22E-03	1.37E-03	2.35E-02	6.17E-01	2.50E-03	8.45E-01
2.01E-03	8.43E-03	1.61E-02	4.67E-03	3.12E-02	1.97E-03	1.61E-01
3.30E-03	8.50E-03	2.64E-02	5.46E-03	6.40E-02	2.56E-03	3.07E-01
8.19E-03	1.54E-02	6.55E-02	6.23E-02	1.23E+00	5.84E-03	4.71E+00
6.02E-03	1.25E-02	4.82E-02	2.43E-02	8.46E-01	5.74E-03	4.32E+00
6.05E-03	1.25E-02	4.84E-02	1.06E-02	2.18E-01	6.01E-03	1.01E+00
1.05E-02	2.48E-02	8.42E-02	2.76E-02	3.82E-01	8.14E-03	1.31E+00
6.92E-03	1.37E-02	5.53E-02	2.18E-02	5.40E-01	6.11E-03	2.23E+00
4.84E-03	1.25E-02	3.87E-02	1.03E-01	1.04E+00	9.81E-03	5.07E+00
3.32E-03	8.63E-03	2.65E-02	5.23E-03	5.49E-02	2.56E-03	2.83E-01
6.72E-03	1.69E-02	5.37E-02	4.56E-02	4.51E-01	6.39E-03	3.68E+00
2.01E-03	8.43E-03	1.61E-02	2.07E-03	1.64E-02	2.22E-03	6.08E-02
3.30E-03	8.43E-03	2.64E-02	2.40E-03	2.41E-02	2.78E-03	9.10E-02
3.33E-03	8.43E-03	2.67E-02	2.35E-03	2.31E-02	2.75E-03	8.72E-02

CO g/mi	Methane (CH4) g/mi	N2O g/mi	Benzene g/mi	Formaldehyde g/mi	CO2 Equivalent g/mi	PM2.5 g/mi	Total Exh	NOx
1.27E+00	2.77E-02	1.42E-03	1.90E-03	2.12E-02	1.64E+03	1.98E-01	5.75E+00	
1.01E+00	2.92E-02	1.42E-03	1.53E-03	1.76E-02	1.56E+03	1.45E-01	4.63E+00	
1.96E+00	2.04E-02	1.36E-03	3.25E-03	3.41E-02	1.61E+03	3.17E-01	9.54E+00	
1.85E+00	8.79E-03	2.77E-04	1.78E-04	2.49E-03	2.87E+02	3.52E-03	1.10E-01	
1.76E+00	1.99E-02	1.04E-03	9.80E-04	1.14E-02	5.78E+02	3.41E-02	9.23E-01	
1.55E+00	2.30E-02	1.36E-03	3.97E-03	4.14E-02	1.03E+03	2.44E-01	5.52E+00	
6.85E-01	3.03E-02	1.36E-03	1.51E-03	1.75E-02	8.34E+02	8.21E-02	1.85E+00	
7.94E-01	3.01E-02	1.36E-03	1.70E-03	1.94E-02	8.95E+02	9.84E-02	2.26E+00	
2.46E+00	2.46E-02	1.36E-03	3.36E-03	3.55E-02	1.49E+03	2.82E-01	7.76E+00	
1.16E+00	2.65E-02	1.36E-03	2.80E-03	3.01E-02	1.00E+03	1.61E-01	3.63E+00	
9.91E-01	2.75E-02	1.36E-03	1.52E-03	1.74E-02	1.60E+03	1.55E-01	4.63E+00	
1.91E+00	1.81E-02	9.49E-04	1.12E-03	1.26E-02	5.39E+02	4.04E-02	9.54E-01	
1.27E+02	1.33E-01	1.34E-02	8.09E-02	3.10E-02	1.51E+03	3.19E-01	1.10E+01	
1.32E+01	2.33E-02	1.41E-03	2.34E-02	8.41E-03	3.96E+02	3.18E-02	8.78E-01	
2.53E+00	3.39E-03	8.62E-04	1.17E-03	4.33E-04	2.89E+02	6.08E-03	1.89E-01	
4.09E+00	5.68E-03	1.51E-03	2.51E-03	9.27E-04	3.85E+02	8.37E-03	3.77E-01	
5.19E+01	6.10E-02	1.15E-02	4.18E-02	1.59E-02	1.04E+03	1.73E-01	5.86E+00	
2.85E+01	2.57E-02	1.81E-02	2.46E-02	9.31E-03	9.21E+02	1.85E-01	4.63E+00	
7.75E+00	3.97E-03	4.94E-03	6.27E-03	2.27E-03	9.41E+02	4.05E-02	1.07E+00	
1.33E+01	7.56E-03	5.08E-03	1.00E-02	3.59E-03	1.37E+03	5.32E-02	1.50E+00	
2.18E+01	1.62E-02	8.72E-03	1.68E-02	6.25E-03	1.02E+03	9.65E-02	2.49E+00	
3.49E+01	2.23E-02	2.08E-02	2.54E-02	9.51E-03	1.50E+03	2.06E-01	5.16E+00	
3.71E+00	5.23E-03	1.52E-03	2.09E-03	7.66E-04	3.77E+02	7.44E-03	3.36E-01	
7.37E+00	3.90E+00	2.76E-02	6.92E-04	1.93E-01	1.46E+03	5.89E-02	4.23E+00	
1.62E+00	5.40E-03	6.37E-04	3.56E-04	4.39E-04	2.83E+02	2.52E-03	7.68E-02	
2.16E+00	9.95E-03	8.43E-04	5.84E-04	7.26E-04	3.61E+02	3.47E-03	1.29E-01	
1.95E+00	9.01E-03	8.40E-04	5.38E-04	6.59E-04	3.50E+02	3.16E-03	1.20E-01	
1.35E+00	3.17E-02	1.66E-03	2.11E-03	2.37E-02	1.61E+03	2.04E-01	5.78E+00	
1.07E+00	3.35E-02	1.66E-03	1.70E-03	1.97E-02	1.52E+03	1.47E-01	4.58E+00	
2.11E+00	2.42E-02	1.66E-03	3.72E-03	3.90E-02	1.52E+03	3.25E-01	9.09E+00	
1.15E+00	6.09E-03	3.38E-04	1.32E-04	1.81E-03	2.79E+02	2.60E-03	9.03E-02	
1.32E+00	1.99E-02	1.26E-03	1.03E-03	1.19E-02	5.68E+02	3.46E-02	9.00E-01	
1.58E+00	2.55E-02	1.66E-03	4.35E-03	4.54E-02	8.42E+02	2.48E-01	4.50E+00	
7.56E-01	3.58E-02	1.66E-03	1.75E-03	2.04E-02	7.26E+02	8.56E-02	1.69E+00	
8.78E-01	3.56E-02	1.66E-03	1.98E-03	2.27E-02	7.88E+02	1.04E-01	2.08E+00	
2.38E+00	2.73E-02	1.66E-03	3.52E-03	3.73E-02	1.29E+03	2.63E-01	6.85E+00	
1.28E+00	3.15E-02	1.66E-03	3.27E-03	3.52E-02	8.28E+02	1.74E-01	3.07E+00	
1.07E+00	3.26E-02	1.66E-03	1.74E-03	2.00E-02	1.49E+03	1.54E-01	4.41E+00	
1.48E+00	1.75E-02	1.16E-03	1.19E-03	1.33E-02	5.37E+02	4.16E-02	9.40E-01	
1.18E+02	1.31E-01	1.57E-02	7.97E-02	3.06E-02	1.47E+03	2.13E-01	1.06E+01	
1.33E+01	2.44E-02	1.72E-03	2.44E-02	8.79E-03	3.83E+02	2.17E-02	8.85E-01	
1.65E+00	2.52E-03	1.05E-03	9.86E-04	3.65E-04	2.82E+02	4.07E-03	1.65E-01	

2.68E+00	4.02E-03	1.84E-03	2.12E-03	7.84E-04	3.73E+02	5.01E-03	3.21E-01
3.51E+01	5.07E-02	1.40E-02	3.49E-02	1.33E-02	8.61E+02	5.81E-02	4.79E+00
2.12E+01	2.17E-02	2.21E-02	2.10E-02	7.93E-03	8.06E+02	2.09E-02	4.18E+00
6.48E+00	3.44E-03	6.03E-03	5.51E-03	1.99E-03	8.36E+02	9.60E-03	9.75E-01
1.14E+01	7.02E-03	6.20E-03	9.57E-03	3.44E-03	1.21E+03	2.50E-02	1.31E+00
1.56E+01	1.32E-02	1.06E-02	1.39E-02	5.17E-03	8.65E+02	2.02E-02	2.17E+00
3.26E+01	2.18E-02	2.53E-02	2.55E-02	9.55E-03	1.41E+03	8.90E-02	4.92E+00
2.63E+00	3.91E-03	1.85E-03	1.82E-03	6.68E-04	3.72E+02	4.81E-03	2.96E-01
6.38E+00	3.67E+00	3.37E-02	6.46E-04	1.75E-01	1.29E+03	4.17E-02	3.70E+00
1.02E+00	3.88E-03	7.77E-04	2.71E-04	3.30E-04	2.75E+02	1.78E-03	6.38E-02
1.30E+00	6.70E-03	1.03E-03	4.27E-04	5.23E-04	3.49E+02	2.20E-03	9.86E-02
1.24E+00	6.32E-03	1.03E-03	4.08E-04	4.93E-04	3.45E+02	2.16E-03	9.46E-02
1.32E+00	3.02E-02	1.57E-03	2.02E-03	2.26E-02	1.63E+03	2.08E-01	5.77E+00
1.05E+00	3.18E-02	1.56E-03	1.63E-03	1.88E-02	1.55E+03	1.53E-01	4.61E+00
2.04E+00	2.22E-02	1.49E-03	3.46E-03	3.63E-02	1.59E+03	3.30E-01	9.39E+00
1.77E+00	8.10E-03	3.05E-04	1.67E-04	2.32E-03	2.87E+02	3.48E-03	1.03E-01
1.71E+00	2.04E-02	1.14E-03	1.02E-03	1.18E-02	5.76E+02	3.49E-02	9.23E-01
1.64E+00	2.51E-02	1.49E-03	4.28E-03	4.47E-02	1.01E+03	2.58E-01	5.36E+00
7.26E-01	3.28E-02	1.50E-03	1.62E-03	1.89E-02	8.53E+02	8.72E-02	1.90E+00
8.40E-01	3.26E-02	1.50E-03	1.83E-03	2.09E-02	9.09E+02	1.05E-01	2.30E+00
2.53E+00	2.68E-02	1.50E-03	3.53E-03	3.74E-02	1.46E+03	2.92E-01	7.62E+00
1.23E+00	2.89E-02	1.50E-03	3.02E-03	3.25E-02	9.87E+02	1.71E-01	3.56E+00
1.04E+00	2.99E-02	1.50E-03	1.62E-03	1.86E-02	1.58E+03	1.62E-01	4.58E+00
1.85E+00	1.82E-02	1.04E-03	1.16E-03	1.30E-02	5.38E+02	4.15E-02	9.54E-01
1.25E+02	1.39E-01	1.48E-02	8.47E-02	3.25E-02	1.51E+03	3.07E-01	1.08E+01
1.32E+01	2.40E-02	1.55E-03	2.41E-02	8.67E-03	3.92E+02	3.25E-02	8.75E-01
2.43E+00	3.18E-03	9.49E-04	1.14E-03	4.21E-04	2.89E+02	6.08E-03	1.81E-01
3.87E+00	5.24E-03	1.66E-03	2.41E-03	8.91E-04	3.82E+02	8.34E-03	3.57E-01
4.94E+01	6.30E-02	1.26E-02	4.33E-02	1.65E-02	1.04E+03	1.64E-01	5.81E+00
2.89E+01	2.76E-02	1.99E-02	2.69E-02	1.02E-02	9.45E+02	1.90E-01	4.72E+00
7.97E+00	4.29E-03	5.44E-03	6.91E-03	2.51E-03	9.63E+02	4.11E-02	1.09E+00
1.33E+01	7.87E-03	5.59E-03	1.07E-02	3.84E-03	1.37E+03	5.16E-02	1.49E+00
2.13E+01	1.68E-02	9.60E-03	1.79E-02	6.63E-03	1.02E+03	9.72E-02	2.49E+00
3.50E+01	2.35E-02	2.29E-02	2.75E-02	1.03E-02	1.50E+03	2.06E-01	5.17E+00
3.51E+00	4.83E-03	1.67E-03	2.01E-03	7.38E-04	3.75E+02	7.30E-03	3.18E-01
7.39E+00	4.11E+00	3.04E-02	7.24E-04	1.98E-01	1.46E+03	5.85E-02	4.20E+00
1.56E+00	5.02E-03	7.01E-04	3.36E-04	4.14E-04	2.83E+02	2.50E-03	7.25E-02
2.03E+00	9.08E-03	9.27E-04	5.42E-04	6.70E-04	3.58E+02	3.46E-03	1.18E-01
1.81E+00	8.12E-03	9.24E-04	4.95E-04	6.03E-04	3.48E+02	3.10E-03	1.09E-01
1.49E+00	3.81E-02	2.07E-03	2.45E-03	2.75E-02	1.68E+03	2.34E-01	6.07E+00
1.18E+00	4.01E-02	2.07E-03	1.97E-03	2.29E-02	1.58E+03	1.68E-01	4.78E+00
2.34E+00	2.87E-02	2.07E-03	4.28E-03	4.49E-02	1.59E+03	3.73E-01	9.43E+00
1.17E+00	5.76E-03	4.21E-04	1.29E-04	1.76E-03	2.93E+02	2.66E-03	8.58E-02
1.39E+00	2.20E-02	1.58E-03	1.16E-03	1.33E-02	5.88E+02	3.71E-02	9.59E-01
1.70E+00	2.89E-02	2.07E-03	4.90E-03	5.12E-02	8.70E+02	2.76E-01	4.68E+00

8.46E-01	4.22E-02	2.07E-03	2.05E-03	2.39E-02	8.18E+02	9.82E-02	1.92E+00
9.82E-01	4.20E-02	2.07E-03	2.32E-03	2.66E-02	8.81E+02	1.20E-01	2.34E+00
2.50E+00	3.11E-02	2.07E-03	3.87E-03	4.11E-02	1.29E+03	2.88E-01	7.03E+00
1.43E+00	3.73E-02	2.07E-03	3.84E-03	4.13E-02	9.04E+02	1.99E-01	3.37E+00
1.17E+00	3.84E-02	2.07E-03	1.99E-03	2.30E-02	1.54E+03	1.76E-01	4.62E+00
1.57E+00	1.90E-02	1.44E-03	1.34E-03	1.49E-02	5.57E+02	4.48E-02	1.00E+00
1.21E+02	1.50E-01	1.96E-02	9.22E-02	3.54E-02	1.54E+03	2.13E-01	1.08E+01
1.32E+01	2.66E-02	2.14E-03	2.66E-02	9.59E-03	3.78E+02	2.08E-02	8.45E-01
1.71E+00	2.48E-03	1.31E-03	1.03E-03	3.83E-04	2.96E+02	4.13E-03	1.61E-01
2.68E+00	3.86E-03	2.29E-03	2.19E-03	8.13E-04	3.86E+02	4.83E-03	3.07E-01
3.47E+01	5.85E-02	1.74E-02	4.06E-02	1.55E-02	8.86E+02	5.51E-02	4.71E+00
2.32E+01	2.71E-02	2.75E-02	2.74E-02	1.03E-02	8.72E+02	2.15E-02	4.32E+00
7.16E+00	4.38E-03	7.52E-03	7.34E-03	2.66E-03	9.06E+02	9.38E-03	1.01E+00
1.15E+01	8.04E-03	7.73E-03	1.15E-02	4.15E-03	1.23E+03	2.44E-02	1.31E+00
1.66E+01	1.61E-02	1.33E-02	1.76E-02	6.54E-03	9.23E+02	1.93E-02	2.23E+00
3.46E+01	2.62E-02	3.16E-02	3.28E-02	1.23E-02	1.49E+03	9.11E-02	5.07E+00
2.65E+00	3.83E-03	2.31E-03	1.91E-03	7.01E-04	3.86E+02	4.63E-03	2.83E-01
6.45E+00	4.31E+00	4.20E-02	7.45E-04	1.92E-01	1.33E+03	4.03E-02	3.68E+00
1.05E+00	3.75E-03	9.69E-04	2.69E-04	3.27E-04	2.89E+02	1.83E-03	6.08E-02
1.28E+00	6.22E-03	1.28E-03	4.11E-04	5.01E-04	3.62E+02	2.12E-03	9.10E-02
1.23E+00	5.87E-03	1.28E-03	3.93E-04	4.71E-04	3.58E+02	2.08E-03	8.72E-02

Sum of emisRate - 35 mph

RoadType	yearID	FuelType	SourceType	Pollutant
				PM2.5 Tirewear
				g/mi
Rural Restricted Access	2018	Diesel Fuel	Combination Long-haul Truck	4.39E-03
			Combination Short-haul Truck	3.94E-03
			Intercity Bus	3.44E-03
			Passenger Car	1.15E-03
			Passenger Truck	1.43E-03
			School Bus	2.09E-03
			Single Unit Long-haul Truck	2.46E-03
			Single Unit Short-haul Truck	2.23E-03
			Transit Bus	2.29E-03
			Motor Home	1.86E-03
			Refuse Truck	4.18E-03
			Light Commercial Truck	1.39E-03
		Gasoline	Combination Short-haul Truck	2.16E-03
			Motorcycle	5.73E-04
			Passenger Car	1.15E-03
			Passenger Truck	1.15E-03
			School Bus	2.09E-03
			Single Unit Long-haul Truck	1.70E-03
			Single Unit Short-haul Truck	1.69E-03
			Transit Bus	3.37E-03
			Motor Home	1.86E-03
			Refuse Truck	1.69E-03
			Light Commercial Truck	1.17E-03
		Compressed Natural Gas (CNG)	Transit Bus	2.29E-03
		Ethanol (E-85)	Passenger Car	1.15E-03
			Passenger Truck	1.15E-03
			Light Commercial Truck	1.15E-03
Rural Unrestricted Access	2018	Diesel Fuel	Combination Long-haul Truck	4.89E-03
			Combination Short-haul Truck	4.39E-03
			Intercity Bus	4.03E-03
			Passenger Car	1.34E-03
			Passenger Truck	1.68E-03
			School Bus	2.44E-03
			Single Unit Long-haul Truck	2.88E-03
			Single Unit Short-haul Truck	2.61E-03
			Transit Bus	2.68E-03
			Motor Home	2.18E-03
			Refuse Truck	4.89E-03
			Light Commercial Truck	1.63E-03
		Gasoline	Combination Short-haul Truck	2.40E-03
			Motorcycle	6.71E-04
			Passenger Car	1.34E-03

		Passenger Truck	1.35E-03
		School Bus	2.44E-03
		Single Unit Long-haul Truck	1.99E-03
		Single Unit Short-haul Truck	1.98E-03
		Transit Bus	3.94E-03
		Motor Home	2.18E-03
		Refuse Truck	1.98E-03
		Light Commercial Truck	1.37E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.68E-03
	Ethanol (E-85)	Passenger Car	1.34E-03
		Passenger Truck	1.34E-03
		Light Commercial Truck	1.34E-03
Urban Restricted Access	2018 Diesel Fuel	Combination Long-haul Truck	4.70E-03
		Combination Short-haul Truck	4.22E-03
		Intercity Bus	3.71E-03
		Passenger Car	1.24E-03
		Passenger Truck	1.55E-03
		School Bus	2.25E-03
		Single Unit Long-haul Truck	2.65E-03
		Single Unit Short-haul Truck	2.40E-03
		Transit Bus	2.47E-03
		Motor Home	2.01E-03
		Refuse Truck	4.51E-03
		Light Commercial Truck	1.50E-03
	Gasoline	Combination Short-haul Truck	2.31E-03
		Motorcycle	6.19E-04
		Passenger Car	1.24E-03
		Passenger Truck	1.25E-03
		School Bus	2.25E-03
		Single Unit Long-haul Truck	1.83E-03
		Single Unit Short-haul Truck	1.83E-03
		Transit Bus	3.63E-03
		Motor Home	2.01E-03
		Refuse Truck	1.83E-03
		Light Commercial Truck	1.27E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.47E-03
	Ethanol (E-85)	Passenger Car	1.24E-03
		Passenger Truck	1.24E-03
		Light Commercial Truck	1.24E-03
Urban Unrestricted Access	2018 Diesel Fuel	Combination Long-haul Truck	5.58E-03
		Combination Short-haul Truck	5.02E-03
		Intercity Bus	4.60E-03
		Passenger Car	1.53E-03
		Passenger Truck	1.92E-03
		School Bus	2.79E-03

	Single Unit Long-haul Truck	3.29E-03
	Single Unit Short-haul Truck	2.98E-03
	Transit Bus	3.07E-03
	Motor Home	2.49E-03
	Refuse Truck	5.59E-03
	Light Commercial Truck	1.86E-03
Gasoline	Combination Short-haul Truck	2.75E-03
	Motorcycle	7.67E-04
	Passenger Car	1.53E-03
	Passenger Truck	1.54E-03
	School Bus	2.79E-03
	Single Unit Long-haul Truck	2.27E-03
	Single Unit Short-haul Truck	2.26E-03
	Transit Bus	4.50E-03
	Motor Home	2.49E-03
	Refuse Truck	2.27E-03
	Light Commercial Truck	1.57E-03
Compressed Natural Gas (CNG)	Transit Bus	3.07E-03
Ethanol (E-85)	Passenger Car	1.53E-03
	Passenger Truck	1.53E-03
	Light Commercial Truck	1.53E-03

## RateUnit

PM2.5 g/mi	Brakewear g/mi	PM10 g/mi	Tirewear g/mi	PM10 g/mi	Brakewear g/mi	PM10 g/mi	Total Exh g/mi	VOC g/mi	SO2 g/mi	NOx g/mi	
1.19E-02			2.93E-02			9.53E-02	2.52E-01		2.79E-01	1.50E-02	6.01E+00
1.09E-02			2.63E-02			8.70E-02	1.83E-01		2.23E-01	1.43E-02	4.85E+00
9.98E-03			2.29E-02			7.98E-02	3.92E-01		4.73E-01	1.49E-02	9.81E+00
1.54E-03			7.64E-03			1.24E-02	3.73E-03		1.98E-02	2.57E-03	1.07E-01
2.33E-03			9.55E-03			1.86E-02	3.88E-02		1.28E-01	5.18E-03	9.76E-01
7.47E-03			1.39E-02			5.97E-02	2.97E-01		5.80E-01	9.88E-03	6.03E+00
7.92E-03			1.64E-02			6.34E-02	9.71E-02		2.08E-01	7.85E-03	2.04E+00
6.99E-03			1.48E-02			5.59E-02	1.17E-01		2.36E-01	8.43E-03	2.47E+00
6.42E-03			1.53E-02			5.13E-02	3.45E-01		4.66E-01	1.36E-02	8.10E+00
5.48E-03			1.24E-02			4.38E-02	1.92E-01		4.06E-01	9.55E-03	3.96E+00
1.09E-02			2.79E-02			8.75E-02	1.94E-01		2.23E-01	1.47E-02	4.90E+00
2.42E-03			9.28E-03			1.94E-02	4.64E-02		1.49E-01	4.87E-03	1.01E+00
6.72E-03			1.44E-02			5.38E-02	3.34E-01		2.98E+00	1.06E-02	1.11E+01
1.24E-04			3.82E-03			9.92E-04	3.38E-02		5.75E-01	2.57E-03	8.24E-01
1.54E-03			7.64E-03			1.24E-02	6.55E-03		3.51E-02	1.98E-03	1.87E-01
2.45E-03			7.70E-03			1.96E-02	8.76E-03		7.32E-02	2.63E-03	3.68E-01
7.46E-03			1.39E-02			5.97E-02	1.70E-01		1.54E+00	7.15E-03	5.84E+00
4.90E-03			1.13E-02			3.92E-02	1.54E-01		9.81E-01	6.24E-03	4.48E+00
4.87E-03			1.13E-02			3.89E-02	3.50E-02		2.46E-01	6.46E-03	1.04E+00
1.00E-02			2.24E-02			8.01E-02	5.12E-02		4.37E-01	9.51E-03	1.51E+00
5.48E-03			1.24E-02			4.38E-02	8.68E-02		6.50E-01	7.01E-03	2.46E+00
3.94E-03			1.13E-02			3.15E-02	1.93E-01		1.12E+00	1.05E-02	5.28E+00
2.52E-03			7.82E-03			2.02E-02	7.78E-03		6.13E-02	2.58E-03	3.29E-01
6.42E-03			1.53E-02			5.13E-02	5.59E-02		5.23E-01	7.46E-03	4.28E+00
1.54E-03			7.64E-03			1.24E-02	2.76E-03		1.98E-02	2.24E-03	7.51E-02
2.46E-03			7.64E-03			1.96E-02	3.66E-03		3.07E-02	2.85E-03	1.24E-01
2.54E-03			7.64E-03			2.03E-02	3.33E-03		2.87E-02	2.78E-03	1.16E-01
1.67E-02			3.26E-02			1.33E-01	2.76E-01		3.13E-01	1.51E-02	6.14E+00
1.52E-02			2.93E-02			1.21E-01	1.97E-01		2.48E-01	1.42E-02	4.89E+00
1.51E-02			2.68E-02			1.21E-01	4.30E-01		5.50E-01	1.43E-02	9.45E+00
2.50E-03			8.94E-03			2.00E-02	2.95E-03		1.63E-02	2.54E-03	8.81E-02
3.97E-03			1.12E-02			3.18E-02	3.92E-02		1.38E-01	5.16E-03	9.85E-01
1.00E-02			1.63E-02			8.03E-02	2.82E-01		5.75E-01	7.39E-03	4.55E+00
1.13E-02			1.92E-02			9.03E-02	1.06E-01		2.47E-01	7.35E-03	1.98E+00
1.00E-02			1.74E-02			8.01E-02	1.30E-01		2.81E-01	7.92E-03	2.40E+00
9.18E-03			1.79E-02			7.34E-02	3.17E-01		4.32E-01	1.05E-02	6.46E+00
7.97E-03			1.45E-02			6.37E-02	2.13E-01		4.84E-01	8.35E-03	3.52E+00
1.66E-02			3.26E-02			1.32E-01	2.10E-01		2.55E-01	1.41E-02	4.77E+00
4.02E-03			1.09E-02			3.22E-02	4.77E-02		1.63E-01	4.92E-03	1.03E+00
9.28E-03			1.60E-02			7.42E-02	2.46E-01		3.12E+00	1.05E-02	1.08E+01
2.17E-04			4.47E-03			1.74E-03	2.34E-02		6.05E-01	2.41E-03	7.72E-01
2.50E-03			8.94E-03			2.00E-02	4.81E-03		3.24E-02	1.96E-03	1.64E-01

4.14E-03	9.01E-03	3.31E-02	5.79E-03	6.66E-02	2.56E-03	3.10E-01
1.00E-02	1.63E-02	8.03E-02	6.19E-02	1.39E+00	5.31E-03	3.96E+00
6.83E-03	1.32E-02	5.47E-02	2.36E-02	9.36E-01	5.64E-03	4.05E+00
6.87E-03	1.32E-02	5.50E-02	9.61E-03	2.40E-01	5.94E-03	9.55E-01
1.42E-02	2.63E-02	1.14E-01	2.84E-02	4.32E-01	7.58E-03	1.15E+00
7.97E-03	1.45E-02	6.37E-02	2.12E-02	5.95E-01	6.10E-03	2.14E+00
5.92E-03	1.32E-02	4.73E-02	1.01E-01	1.21E+00	1.02E-02	5.10E+00
4.15E-03	9.15E-03	3.32E-02	5.58E-03	5.78E-02	2.56E-03	2.86E-01
9.18E-03	1.79E-02	7.34E-02	3.42E-02	5.06E-01	5.95E-03	3.25E+00
2.50E-03	8.94E-03	2.00E-02	2.13E-03	1.71E-02	2.22E-03	6.23E-02
4.15E-03	8.94E-03	3.32E-02	2.56E-03	2.49E-02	2.77E-03	9.29E-02
4.17E-03	8.94E-03	3.34E-02	2.52E-03	2.41E-02	2.75E-03	8.95E-02
1.53E-02	3.14E-02	1.22E-01	2.69E-01	2.99E-01	1.50E-02	6.04E+00
1.39E-02	2.82E-02	1.11E-01	1.94E-01	2.38E-01	1.42E-02	4.84E+00
1.26E-02	2.48E-02	1.01E-01	4.15E-01	5.09E-01	1.47E-02	9.64E+00
1.98E-03	8.25E-03	1.58E-02	3.66E-03	1.86E-02	2.57E-03	9.89E-02
2.99E-03	1.03E-02	2.39E-02	4.00E-02	1.34E-01	5.18E-03	9.82E-01
9.21E-03	1.50E-02	7.37E-02	3.19E-01	6.35E-01	9.75E-03	5.88E+00
9.57E-03	1.77E-02	7.66E-02	1.05E-01	2.27E-01	8.12E-03	2.11E+00
8.48E-03	1.60E-02	6.79E-02	1.26E-01	2.58E-01	8.64E-03	2.54E+00
8.10E-03	1.65E-02	6.48E-02	3.62E-01	4.94E-01	1.34E-02	7.97E+00
6.71E-03	1.34E-02	5.37E-02	2.06E-01	4.45E-01	9.45E-03	3.90E+00
1.40E-02	3.01E-02	1.12E-01	2.06E-01	2.39E-01	1.46E-02	4.87E+00
3.10E-03	1.00E-02	2.48E-02	4.80E-02	1.56E-01	4.87E-03	1.01E+00
8.51E-03	1.54E-02	6.81E-02	3.14E-01	3.16E+00	1.06E-02	1.10E+01
1.61E-04	4.13E-03	1.29E-03	3.46E-02	5.97E-01	2.53E-03	8.14E-01
1.98E-03	8.25E-03	1.58E-02	6.52E-03	3.44E-02	1.99E-03	1.77E-01
3.16E-03	8.31E-03	2.53E-02	8.65E-03	7.07E-02	2.61E-03	3.43E-01
9.21E-03	1.50E-02	7.37E-02	1.56E-01	1.62E+00	7.18E-03	5.77E+00
5.84E-03	1.22E-02	4.67E-02	1.56E-01	1.08E+00	6.45E-03	4.58E+00
5.85E-03	1.22E-02	4.68E-02	3.48E-02	2.71E-01	6.66E-03	1.06E+00
1.26E-02	2.42E-02	1.01E-01	4.81E-02	4.63E-01	9.49E-03	1.50E+00
6.71E-03	1.34E-02	5.37E-02	8.56E-02	6.94E-01	7.06E-03	2.46E+00
4.97E-03	1.22E-02	3.98E-02	1.88E-01	1.22E+00	1.06E-02	5.29E+00
3.24E-03	8.44E-03	2.59E-02	7.53E-03	5.94E-02	2.57E-03	3.08E-01
8.10E-03	1.65E-02	6.48E-02	5.43E-02	5.51E-01	7.44E-03	4.25E+00
1.98E-03	8.25E-03	1.58E-02	2.73E-03	1.89E-02	2.25E-03	6.95E-02
3.16E-03	8.25E-03	2.53E-02	3.62E-03	2.85E-02	2.83E-03	1.11E-01
3.25E-03	8.25E-03	2.60E-02	3.23E-03	2.65E-02	2.76E-03	1.03E-01
2.90E-02	3.72E-02	2.32E-01	3.42E-01	3.83E-01	1.63E-02	6.70E+00
2.62E-02	3.34E-02	2.10E-01	2.43E-01	3.02E-01	1.54E-02	5.30E+00
2.54E-02	3.07E-02	2.03E-01	5.30E-01	6.70E-01	1.55E-02	1.01E+01
4.06E-03	1.02E-02	3.25E-02	3.11E-03	1.70E-02	2.76E-03	8.26E-02
6.43E-03	1.28E-02	5.14E-02	4.43E-02	1.65E-01	5.55E-03	1.10E+00
1.46E-02	1.86E-02	1.17E-01	3.28E-01	6.79E-01	7.71E-03	4.83E+00

1.79E-02	2.19E-02	1.43E-01	1.29E-01	3.09E-01	8.84E-03	2.41E+00
1.59E-02	1.99E-02	1.27E-01	1.59E-01	3.51E-01	9.43E-03	2.88E+00
1.43E-02	2.04E-02	1.15E-01	3.66E-01	4.83E-01	1.02E-02	6.59E+00
1.24E-02	1.66E-02	9.90E-02	2.59E-01	6.08E-01	9.69E-03	4.12E+00
2.74E-02	3.73E-02	2.20E-01	2.59E-01	3.08E-01	1.52E-02	5.21E+00
6.51E-03	1.24E-02	5.21E-02	5.45E-02	1.95E-01	5.29E-03	1.16E+00
1.55E-02	1.83E-02	1.24E-01	2.52E-01	3.90E+00	1.15E-02	1.12E+01
3.57E-04	5.11E-03	2.86E-03	2.27E-02	6.88E-01	2.36E-03	6.84E-01
4.06E-03	1.02E-02	3.25E-02	5.05E-03	3.61E-02	2.14E-03	1.61E-01
6.75E-03	1.03E-02	5.40E-02	5.78E-03	7.31E-02	2.75E-03	2.94E-01
1.46E-02	1.86E-02	1.17E-01	5.65E-02	1.74E+00	5.38E-03	3.55E+00
1.05E-02	1.51E-02	8.39E-02	2.47E-02	1.29E+00	6.35E-03	4.19E+00
1.06E-02	1.51E-02	8.47E-02	8.86E-03	3.30E-01	6.73E-03	9.99E-01
2.21E-02	3.00E-02	1.77E-01	2.75E-02	5.33E-01	7.62E-03	1.08E+00
1.24E-02	1.66E-02	9.90E-02	1.95E-02	7.91E-01	6.77E-03	2.22E+00
9.40E-03	1.51E-02	7.52E-02	1.05E-01	1.65E+00	1.12E-02	5.39E+00
6.76E-03	1.05E-02	5.41E-02	5.56E-03	6.45E-02	2.75E-03	2.72E-01
1.43E-02	2.04E-02	1.15E-01	2.72E-02	6.15E-01	5.98E-03	3.06E+00
4.06E-03	1.02E-02	3.25E-02	2.26E-03	1.80E-02	2.42E-03	5.88E-02
6.76E-03	1.02E-02	5.41E-02	2.57E-03	2.53E-02	2.98E-03	8.35E-02
6.79E-03	1.02E-02	5.44E-02	2.52E-03	2.45E-02	2.96E-03	8.05E-02

CO g/mi	Methane (CH4) g/mi	N2O g/mi	Benzene g/mi	Formaldehyde g/mi	CO2 Equivalent g/mi	PM2.5 g/mi	Total Exh	NOx
1.38E+00	3.26E-02	1.72E-03	2.13E-03	2.39E-02	1.71E+03	2.32E-01	6.01E+00	
1.10E+00	3.43E-02	1.72E-03	1.71E-03	1.98E-02	1.64E+03	1.68E-01	4.85E+00	
2.12E+00	2.37E-02	1.63E-03	3.60E-03	3.78E-02	1.67E+03	3.61E-01	9.81E+00	
1.81E+00	8.59E-03	3.32E-04	1.77E-04	2.46E-03	2.96E+02	3.43E-03	1.07E-01	
1.78E+00	2.13E-02	1.24E-03	1.07E-03	1.24E-02	5.94E+02	3.57E-02	9.76E-01	
1.71E+00	2.65E-02	1.63E-03	4.53E-03	4.72E-02	1.11E+03	2.73E-01	6.03E+00	
7.41E-01	3.47E-02	1.63E-03	1.70E-03	1.98E-02	9.03E+02	8.93E-02	2.04E+00	
8.59E-01	3.45E-02	1.63E-03	1.92E-03	2.20E-02	9.66E+02	1.08E-01	2.47E+00	
2.62E+00	2.86E-02	1.63E-03	3.59E-03	3.81E-02	1.54E+03	3.17E-01	8.10E+00	
1.27E+00	3.04E-02	1.63E-03	3.19E-03	3.43E-02	1.08E+03	1.77E-01	3.96E+00	
1.08E+00	3.19E-02	1.63E-03	1.69E-03	1.94E-02	1.68E+03	1.79E-01	4.90E+00	
1.94E+00	1.91E-02	1.14E-03	1.22E-03	1.37E-02	5.56E+02	4.27E-02	1.01E+00	
1.35E+02	1.60E-01	1.63E-02	9.84E-02	3.78E-02	1.60E+03	2.95E-01	1.11E+01	
1.28E+01	2.46E-02	1.69E-03	2.47E-02	8.89E-03	3.88E+02	2.99E-02	8.24E-01	
2.50E+00	3.38E-03	1.03E-03	1.21E-03	4.46E-04	2.98E+02	5.80E-03	1.87E-01	
4.00E+00	5.57E-03	1.81E-03	2.59E-03	9.56E-04	3.96E+02	7.75E-03	3.68E-01	
5.53E+01	7.35E-02	1.37E-02	5.09E-02	1.94E-02	1.08E+03	1.51E-01	5.84E+00	
3.03E+01	3.15E-02	2.17E-02	3.19E-02	1.21E-02	9.46E+02	1.36E-01	4.48E+00	
8.34E+00	5.01E-03	5.93E-03	8.36E-03	3.04E-03	9.74E+02	3.10E-02	1.04E+00	
1.45E+01	9.25E-03	6.09E-03	1.30E-02	4.68E-03	1.43E+03	4.53E-02	1.51E+00	
2.34E+01	1.96E-02	1.05E-02	2.13E-02	7.93E-03	1.06E+03	7.68E-02	2.46E+00	
3.88E+01	2.85E-02	2.49E-02	3.52E-02	1.32E-02	1.59E+03	1.70E-01	5.28E+00	
3.65E+00	5.24E-03	1.82E-03	2.19E-03	8.04E-04	3.89E+02	6.88E-03	3.29E-01	
8.06E+00	4.92E+00	3.31E-02	8.56E-04	2.25E-01	1.54E+03	4.95E-02	4.28E+00	
1.59E+00	5.32E-03	7.64E-04	3.55E-04	4.38E-04	2.91E+02	2.44E-03	7.51E-02	
2.08E+00	9.60E-03	1.01E-03	5.74E-04	7.12E-04	3.70E+02	3.24E-03	1.24E-01	
1.89E+00	8.75E-03	1.01E-03	5.31E-04	6.51E-04	3.61E+02	2.94E-03	1.16E-01	
1.50E+00	3.81E-02	2.05E-03	2.41E-03	2.72E-02	1.72E+03	2.54E-01	6.14E+00	
1.19E+00	4.02E-02	2.05E-03	1.94E-03	2.26E-02	1.63E+03	1.82E-01	4.89E+00	
2.35E+00	2.90E-02	2.05E-03	4.24E-03	4.46E-02	1.61E+03	3.96E-01	9.45E+00	
1.25E+00	6.27E-03	4.18E-04	1.39E-04	1.90E-03	2.92E+02	2.71E-03	8.81E-02	
1.44E+00	2.19E-02	1.56E-03	1.15E-03	1.32E-02	5.92E+02	3.61E-02	9.85E-01	
1.53E+00	2.62E-02	2.05E-03	4.52E-03	4.72E-02	8.30E+02	2.59E-01	4.55E+00	
8.41E-01	4.22E-02	2.05E-03	2.05E-03	2.39E-02	8.45E+02	9.74E-02	1.98E+00	
9.77E-01	4.21E-02	2.05E-03	2.31E-03	2.65E-02	9.09E+02	1.19E-01	2.40E+00	
2.24E+00	2.84E-02	2.05E-03	3.37E-03	3.59E-02	1.18E+03	2.92E-01	6.46E+00	
1.44E+00	3.73E-02	2.05E-03	3.85E-03	4.14E-02	9.47E+02	1.96E-01	3.52E+00	
1.20E+00	3.91E-02	2.05E-03	1.99E-03	2.30E-02	1.61E+03	1.93E-01	4.77E+00	
1.64E+00	1.91E-02	1.43E-03	1.33E-03	1.48E-02	5.61E+02	4.39E-02	1.03E+00	
1.31E+02	1.68E-01	1.94E-02	1.03E-01	3.97E-02	1.59E+03	2.18E-01	1.08E+01	
1.23E+01	2.61E-02	2.12E-03	2.61E-02	9.41E-03	3.64E+02	2.07E-02	7.72E-01	
1.82E+00	2.66E-03	1.30E-03	1.08E-03	4.01E-04	2.95E+02	4.26E-03	1.64E-01	

2.82E+00	4.11E-03	2.27E-03	2.30E-03	8.51E-04	3.85E+02	5.12E-03	3.10E-01
3.62E+01	6.59E-02	1.73E-02	4.64E-02	1.77E-02	8.05E+02	5.48E-02	3.96E+00
2.47E+01	2.98E-02	2.73E-02	3.06E-02	1.16E-02	8.57E+02	2.08E-02	4.05E+00
7.56E+00	4.87E-03	7.45E-03	8.27E-03	3.01E-03	8.96E+02	8.50E-03	9.55E-01
1.13E+01	9.20E-03	7.66E-03	1.39E-02	5.04E-03	1.14E+03	2.51E-02	1.15E+00
1.80E+01	1.78E-02	1.32E-02	1.98E-02	7.34E-03	9.22E+02	1.88E-02	2.14E+00
3.83E+01	3.02E-02	3.13E-02	3.86E-02	1.45E-02	1.54E+03	8.90E-02	5.10E+00
2.80E+00	4.15E-03	2.29E-03	2.03E-03	7.46E-04	3.85E+02	4.94E-03	2.86E-01
6.33E+00	5.08E+00	4.17E-02	8.60E-04	2.08E-01	1.26E+03	3.02E-02	3.25E+00
1.12E+00	4.04E-03	9.60E-04	2.86E-04	3.50E-04	2.88E+02	1.88E-03	6.23E-02
1.36E+00	6.62E-03	1.27E-03	4.33E-04	5.30E-04	3.61E+02	2.26E-03	9.29E-02
1.31E+00	6.30E-03	1.27E-03	4.16E-04	5.02E-04	3.57E+02	2.23E-03	8.95E-02
1.45E+00	3.60E-02	1.92E-03	2.30E-03	2.58E-02	1.71E+03	2.47E-01	6.04E+00
1.16E+00	3.79E-02	1.92E-03	1.84E-03	2.15E-02	1.63E+03	1.79E-01	4.84E+00
2.24E+00	2.62E-02	1.82E-03	3.90E-03	4.10E-02	1.65E+03	3.82E-01	9.64E+00
1.71E+00	7.73E-03	3.71E-04	1.63E-04	2.26E-03	2.97E+02	3.37E-03	9.89E-02
1.72E+00	2.19E-02	1.39E-03	1.12E-03	1.29E-02	5.94E+02	3.68E-02	9.82E-01
1.83E+00	2.94E-02	1.82E-03	4.97E-03	5.19E-02	1.09E+03	2.94E-01	5.88E+00
7.97E-01	3.82E-02	1.82E-03	1.87E-03	2.18E-02	9.34E+02	9.63E-02	2.11E+00
9.22E-01	3.80E-02	1.82E-03	2.11E-03	2.41E-02	9.90E+02	1.16E-01	2.54E+00
2.72E+00	3.16E-02	1.82E-03	3.82E-03	4.07E-02	1.51E+03	3.33E-01	7.97E+00
1.36E+00	3.36E-02	1.82E-03	3.50E-03	3.77E-02	1.07E+03	1.90E-01	3.90E+00
1.14E+00	3.53E-02	1.82E-03	1.83E-03	2.12E-02	1.67E+03	1.90E-01	4.87E+00
1.86E+00	1.93E-02	1.27E-03	1.28E-03	1.43E-02	5.56E+02	4.42E-02	1.01E+00
1.34E+02	1.70E-01	1.81E-02	1.04E-01	4.01E-02	1.61E+03	2.78E-01	1.10E+01
1.28E+01	2.56E-02	1.89E-03	2.57E-02	9.26E-03	3.81E+02	3.06E-02	8.14E-01
2.37E+00	3.12E-03	1.16E-03	1.17E-03	4.33E-04	2.99E+02	5.77E-03	1.77E-01
3.73E+00	5.03E-03	2.02E-03	2.48E-03	9.16E-04	3.93E+02	7.65E-03	3.43E-01
5.25E+01	7.71E-02	1.54E-02	5.37E-02	2.05E-02	1.09E+03	1.38E-01	5.77E+00
3.11E+01	3.44E-02	2.43E-02	3.54E-02	1.34E-02	9.78E+02	1.38E-01	4.58E+00
8.67E+00	5.50E-03	6.63E-03	9.36E-03	3.40E-03	1.00E+03	3.08E-02	1.06E+00
1.45E+01	9.80E-03	6.81E-03	1.41E-02	5.09E-03	1.43E+03	4.25E-02	1.50E+00
2.29E+01	2.08E-02	1.17E-02	2.31E-02	8.57E-03	1.07E+03	7.58E-02	2.46E+00
3.93E+01	3.05E-02	2.78E-02	3.88E-02	1.46E-02	1.60E+03	1.66E-01	5.29E+00
3.40E+00	4.75E-03	2.03E-03	2.11E-03	7.75E-04	3.87E+02	6.66E-03	3.08E-01
8.16E+00	5.29E+00	3.70E-02	9.12E-04	2.34E-01	1.55E+03	4.80E-02	4.25E+00
1.51E+00	4.86E-03	8.54E-04	3.30E-04	4.07E-04	2.92E+02	2.41E-03	6.95E-02
1.91E+00	8.49E-03	1.13E-03	5.20E-04	6.42E-04	3.68E+02	3.20E-03	1.11E-01
1.72E+00	7.65E-03	1.13E-03	4.78E-04	5.82E-04	3.59E+02	2.85E-03	1.03E-01
1.75E+00	4.93E-02	2.77E-03	2.99E-03	3.39E-02	1.86E+03	3.14E-01	6.70E+00
1.39E+00	5.19E-02	2.77E-03	2.40E-03	2.81E-02	1.77E+03	2.24E-01	5.30E+00
2.75E+00	3.70E-02	2.76E-03	5.20E-03	5.48E-02	1.73E+03	4.88E-01	1.01E+01
1.33E+00	6.03E-03	5.63E-04	1.41E-04	1.90E-03	3.18E+02	2.86E-03	8.26E-02
1.60E+00	2.57E-02	2.11E-03	1.37E-03	1.58E-02	6.36E+02	4.08E-02	1.10E+00
1.66E+00	3.11E-02	2.76E-03	5.35E-03	5.58E-02	8.67E+02	3.02E-01	4.83E+00

9.96E-01	5.35E-02	2.77E-03	2.57E-03	3.00E-02	1.02E+03	1.19E-01	2.41E+00
1.16E+00	5.34E-02	2.77E-03	2.90E-03	3.33E-02	1.08E+03	1.46E-01	2.88E+00
2.35E+00	3.41E-02	2.76E-03	3.80E-03	4.07E-02	1.15E+03	3.36E-01	6.59E+00
1.71E+00	4.74E-02	2.77E-03	4.84E-03	5.22E-02	1.10E+03	2.39E-01	4.12E+00
1.39E+00	4.95E-02	2.77E-03	2.43E-03	2.83E-02	1.74E+03	2.38E-01	5.21E+00
1.83E+00	2.20E-02	1.93E-03	1.59E-03	1.76E-02	6.04E+02	5.02E-02	1.16E+00
1.40E+02	2.10E-01	2.62E-02	1.30E-01	4.98E-02	1.75E+03	2.23E-01	1.12E+01
1.20E+01	2.99E-02	2.86E-03	2.99E-02	1.08E-02	3.56E+02	2.00E-02	6.84E-01
1.96E+00	2.71E-03	1.75E-03	1.19E-03	4.44E-04	3.22E+02	4.47E-03	1.61E-01
2.93E+00	4.06E-03	3.06E-03	2.51E-03	9.33E-04	4.14E+02	5.11E-03	2.94E-01
3.61E+01	8.23E-02	2.33E-02	5.86E-02	2.24E-02	8.19E+02	5.00E-02	3.55E+00
2.87E+01	4.02E-02	3.68E-02	4.29E-02	1.62E-02	9.67E+02	2.18E-02	4.19E+00
8.87E+00	6.69E-03	1.00E-02	1.18E-02	4.31E-03	1.02E+03	7.84E-03	9.99E-01
1.13E+01	1.14E-02	1.03E-02	1.81E-02	6.59E-03	1.15E+03	2.43E-02	1.08E+00
2.02E+01	2.35E-02	1.77E-02	2.70E-02	1.00E-02	1.02E+03	1.72E-02	2.22E+00
4.34E+01	3.95E-02	4.22E-02	5.36E-02	2.02E-02	1.70E+03	9.30E-02	5.39E+00
2.93E+00	4.25E-03	3.09E-03	2.27E-03	8.35E-04	4.15E+02	4.92E-03	2.72E-01
6.42E+00	6.47E+00	5.62E-02	1.08E-03	2.44E-01	1.31E+03	2.41E-02	3.06E+00
1.20E+00	4.00E-03	1.30E-03	2.92E-04	3.59E-04	3.14E+02	2.00E-03	5.88E-02
1.38E+00	6.21E-03	1.71E-03	4.26E-04	5.19E-04	3.87E+02	2.27E-03	8.35E-02
1.35E+00	5.93E-03	1.71E-03	4.12E-04	4.94E-04	3.85E+02	2.22E-03	8.05E-02

Sum of emisRate - 2.5 mph

RoadType	yearID	FuelType	SourceType	Pollutant
				PM2.5 Tirewear g/mi
Rural Restricted Access	2018	Diesel Fuel	Combination Long-haul Truck	3.92E-03
			Combination Short-haul Truck	3.52E-03
			Intercity Bus	3.00E-03
			Passenger Car	9.99E-04
			Passenger Truck	1.25E-03
			School Bus	1.82E-03
			Single Unit Long-haul Truck	2.14E-03
			Single Unit Short-haul Truck	1.94E-03
			Transit Bus	2.00E-03
			Motor Home	1.62E-03
			Refuse Truck	3.64E-03
			Light Commercial Truck	1.21E-03
		Gasoline	Combination Short-haul Truck	1.93E-03
			Motorcycle	5.00E-04
			Passenger Car	9.99E-04
			Passenger Truck	1.01E-03
			School Bus	1.82E-03
			Single Unit Long-haul Truck	1.48E-03
			Single Unit Short-haul Truck	1.47E-03
			Transit Bus	2.93E-03
			Motor Home	1.62E-03
			Refuse Truck	1.48E-03
			Light Commercial Truck	1.02E-03
		Compressed Natural Gas (CNG)	Transit Bus	2.00E-03
		Ethanol (E-85)	Passenger Car	9.99E-04
			Passenger Truck	9.99E-04
			Light Commercial Truck	9.99E-04
Rural Unrestricted Access	2018	Diesel Fuel	Combination Long-haul Truck	4.62E-03
			Combination Short-haul Truck	4.15E-03
			Intercity Bus	3.81E-03
			Passenger Car	1.27E-03
			Passenger Truck	1.59E-03
			School Bus	2.31E-03
			Single Unit Long-haul Truck	2.72E-03
			Single Unit Short-haul Truck	2.46E-03
			Transit Bus	2.54E-03
			Motor Home	2.06E-03
			Refuse Truck	4.62E-03
			Light Commercial Truck	1.54E-03
		Gasoline	Combination Short-haul Truck	2.27E-03
			Motorcycle	6.34E-04
			Passenger Car	1.27E-03

		Passenger Truck	1.28E-03
		School Bus	2.31E-03
		Single Unit Long-haul Truck	1.88E-03
		Single Unit Short-haul Truck	1.87E-03
		Transit Bus	3.72E-03
		Motor Home	2.06E-03
		Refuse Truck	1.87E-03
		Light Commercial Truck	1.30E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.54E-03
	Ethanol (E-85)	Passenger Car	1.27E-03
		Passenger Truck	1.27E-03
		Light Commercial Truck	1.27E-03
Urban Restricted Access	2018 Diesel Fuel	Combination Long-haul Truck	4.34E-03
		Combination Short-haul Truck	3.90E-03
		Intercity Bus	3.35E-03
		Passenger Car	1.12E-03
		Passenger Truck	1.39E-03
		School Bus	2.03E-03
		Single Unit Long-haul Truck	2.39E-03
		Single Unit Short-haul Truck	2.17E-03
		Transit Bus	2.23E-03
		Motor Home	1.81E-03
		Refuse Truck	4.07E-03
		Light Commercial Truck	1.35E-03
	Gasoline	Combination Short-haul Truck	2.14E-03
		Motorcycle	5.58E-04
		Passenger Car	1.12E-03
		Passenger Truck	1.12E-03
		School Bus	2.03E-03
		Single Unit Long-haul Truck	1.65E-03
		Single Unit Short-haul Truck	1.65E-03
		Transit Bus	3.27E-03
		Motor Home	1.81E-03
		Refuse Truck	1.65E-03
		Light Commercial Truck	1.14E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.23E-03
	Ethanol (E-85)	Passenger Car	1.12E-03
		Passenger Truck	1.12E-03
		Light Commercial Truck	1.12E-03
Urban Unrestricted Access	2018 Diesel Fuel	Combination Long-haul Truck	5.87E-03
		Combination Short-haul Truck	5.27E-03
		Intercity Bus	4.84E-03
		Passenger Car	1.61E-03
		Passenger Truck	2.01E-03
		School Bus	2.94E-03

	Single Unit Long-haul Truck	3.45E-03
	Single Unit Short-haul Truck	3.13E-03
	Transit Bus	3.22E-03
	Motor Home	2.61E-03
	Refuse Truck	5.87E-03
	Light Commercial Truck	1.96E-03
Gasoline	Combination Short-haul Truck	2.89E-03
	Motorcycle	8.05E-04
	Passenger Car	1.61E-03
	Passenger Truck	1.62E-03
	School Bus	2.93E-03
	Single Unit Long-haul Truck	2.38E-03
	Single Unit Short-haul Truck	2.38E-03
	Transit Bus	4.73E-03
	Motor Home	2.61E-03
	Refuse Truck	2.38E-03
	Light Commercial Truck	1.65E-03
Compressed Natural Gas (CNG)	Transit Bus	3.22E-03
Ethanol (E-85)	Passenger Car	1.61E-03
	Passenger Truck	1.61E-03
	Light Commercial Truck	1.61E-03

## RateUnit

PM2.5 g/mi	Brakewear g/mi	PM10 g/mi	Tirewear g/mi	PM10 g/mi	Brakewear g/mi	PM10 g/mi	Total Exh g/mi	VOC g/mi	SO2 g/mi	NOx g/mi
1.16E-02			2.61E-02			9.25E-02	2.83E-01	3.61E-01	1.70E-02	7.02E+00
1.04E-02			2.35E-02			8.29E-02	2.07E-01	2.85E-01	1.62E-02	5.68E+00
8.95E-03			2.00E-02			7.16E-02	4.40E-01	5.89E-01	1.70E-02	1.15E+01
1.74E-03			6.66E-03			1.39E-02	4.26E-03	2.32E-02	2.97E-03	1.20E-01
2.63E-03			8.32E-03			2.11E-02	4.90E-02	1.59E-01	5.91E-03	1.13E+00
6.79E-03			1.21E-02			5.43E-02	3.62E-01	7.12E-01	1.17E-02	7.36E+00
7.44E-03			1.43E-02			5.95E-02	1.19E-01	2.59E-01	9.20E-03	2.48E+00
6.51E-03			1.29E-02			5.21E-02	1.43E-01	2.94E-01	9.82E-03	2.98E+00
5.78E-03			1.33E-02			4.63E-02	3.89E-01	5.94E-01	1.57E-02	9.82E+00
4.78E-03			1.08E-02			3.83E-02	2.38E-01	5.02E-01	1.13E-02	4.86E+00
1.00E-02			2.43E-02			8.02E-02	2.15E-01	2.80E-01	1.66E-02	5.69E+00
2.71E-03			8.09E-03			2.17E-02	5.85E-02	1.85E-01	5.55E-03	1.18E+00
6.23E-03			1.29E-02			4.98E-02	3.91E-01	3.11E+00	1.15E-02	1.21E+01
1.65E-04			3.33E-03			1.32E-03	3.46E-02	6.92E-01	2.91E-03	8.97E-01
1.74E-03			6.66E-03			1.39E-02	7.31E-03	4.18E-02	2.30E-03	2.05E-01
2.86E-03			6.71E-03			2.29E-02	9.43E-03	8.69E-02	3.05E-03	4.11E-01
6.78E-03			1.21E-02			5.43E-02	2.12E-01	1.71E+00	8.12E-03	6.51E+00
4.59E-03			9.86E-03			3.68E-02	1.86E-01	1.10E+00	7.06E-03	4.98E+00
4.52E-03			9.83E-03			3.62E-02	4.21E-02	2.71E-01	7.24E-03	1.14E+00
8.96E-03			1.96E-02			7.17E-02	6.16E-02	4.63E-01	1.05E-02	1.64E+00
4.78E-03			1.08E-02			3.83E-02	1.02E-01	7.24E-01	7.97E-03	2.74E+00
3.45E-03			9.84E-03			2.76E-02	2.24E-01	1.14E+00	1.14E-02	5.63E+00
2.89E-03			6.82E-03			2.31E-02	8.64E-03	7.22E-02	3.00E-03	3.68E-01
5.78E-03			1.33E-02			4.63E-02	6.74E-02	5.53E-01	8.23E-03	4.66E+00
1.74E-03			6.66E-03			1.39E-02	3.14E-03	2.31E-02	2.61E-03	8.36E-02
2.86E-03			6.66E-03			2.29E-02	3.95E-03	3.62E-02	3.31E-03	1.43E-01
2.91E-03			6.66E-03			2.33E-02	3.70E-03	3.39E-02	3.22E-03	1.34E-01
2.07E-02			3.08E-02			1.66E-01	3.35E-01	4.41E-01	1.77E-02	7.53E+00
1.85E-02			2.77E-02			1.48E-01	2.41E-01	3.47E-01	1.68E-02	6.00E+00
1.68E-02			2.54E-02			1.35E-01	5.23E-01	7.45E-01	1.69E-02	1.15E+01
3.49E-03			8.45E-03			2.79E-02	3.55E-03	1.91E-02	3.11E-03	9.36E-02
5.40E-03			1.06E-02			4.32E-02	5.59E-02	1.90E-01	6.15E-03	1.19E+00
1.15E-02			1.54E-02			9.17E-02	4.15E-01	8.66E-01	1.03E-02	6.51E+00
1.33E-02			1.81E-02			1.07E-01	1.48E-01	3.47E-01	9.64E-03	2.71E+00
1.17E-02			1.64E-02			9.39E-02	1.80E-01	3.95E-01	1.02E-02	3.23E+00
1.06E-02			1.69E-02			8.48E-02	4.20E-01	6.74E-01	1.40E-02	9.21E+00
8.91E-03			1.37E-02			7.13E-02	2.99E-01	6.75E-01	1.09E-02	4.78E+00
1.86E-02			3.08E-02			1.49E-01	2.40E-01	3.30E-01	1.56E-02	5.50E+00
5.47E-03			1.03E-02			4.38E-02	6.78E-02	2.25E-01	5.87E-03	1.27E+00
1.09E-02			1.51E-02			8.74E-02	2.82E-01	3.54E+00	1.19E-02	1.20E+01
3.26E-04			4.23E-03			2.61E-03	2.63E-02	8.01E-01	2.85E-03	8.77E-01
3.49E-03			8.45E-03			2.79E-02	5.67E-03	4.04E-02	2.41E-03	1.76E-01

5.80E-03	8.52E-03	4.64E-02	6.28E-03	8.18E-02	3.13E-03	3.35E-01
1.15E-02	1.54E-02	9.16E-02	8.00E-02	1.78E+00	7.14E-03	5.24E+00
7.93E-03	1.25E-02	6.35E-02	3.18E-02	1.30E+00	7.13E-03	4.88E+00
7.94E-03	1.25E-02	6.36E-02	1.24E-02	3.23E-01	7.36E-03	1.13E+00
1.64E-02	2.48E-02	1.31E-01	3.09E-02	5.22E-01	9.65E-03	1.45E+00
8.91E-03	1.37E-02	7.13E-02	2.79E-02	7.97E-01	7.63E-03	2.56E+00
6.49E-03	1.25E-02	5.19E-02	1.09E-01	1.28E+00	1.10E-02	5.40E+00
5.78E-03	8.65E-03	4.63E-02	6.03E-03	7.02E-02	3.14E-03	3.10E-01
1.06E-02	1.69E-02	8.48E-02	4.67E-02	6.11E-01	7.57E-03	4.09E+00
3.49E-03	8.45E-03	2.79E-02	2.56E-03	2.03E-02	2.73E-03	6.63E-02
5.81E-03	8.45E-03	4.65E-02	2.76E-03	2.94E-02	3.40E-03	1.01E-01
5.82E-03	8.45E-03	4.66E-02	2.73E-03	2.83E-02	3.37E-03	9.70E-02
1.69E-02	2.90E-02	1.35E-01	3.17E-01	4.07E-01	1.73E-02	7.25E+00
1.52E-02	2.60E-02	1.22E-01	2.30E-01	3.21E-01	1.65E-02	5.82E+00
1.28E-02	2.23E-02	1.03E-01	4.85E-01	6.66E-01	1.70E-02	1.16E+01
2.46E-03	7.44E-03	1.97E-02	4.26E-03	2.19E-02	3.06E-03	1.09E-01
3.74E-03	9.29E-03	2.99E-02	5.27E-02	1.74E-01	6.03E-03	1.16E+00
9.40E-03	1.35E-02	7.52E-02	4.08E-01	8.21E-01	1.18E-02	7.37E+00
9.95E-03	1.59E-02	7.96E-02	1.35E-01	2.99E-01	9.86E-03	2.68E+00
8.77E-03	1.44E-02	7.01E-02	1.63E-01	3.39E-01	1.04E-02	3.18E+00
8.32E-03	1.49E-02	6.65E-02	4.25E-01	6.60E-01	1.57E-02	9.92E+00
6.60E-03	1.21E-02	5.28E-02	2.68E-01	5.80E-01	1.15E-02	4.93E+00
1.46E-02	2.71E-02	1.17E-01	2.37E-01	3.15E-01	1.67E-02	5.80E+00
3.84E-03	9.03E-03	3.07E-02	6.33E-02	2.04E-01	5.68E-03	1.22E+00
9.03E-03	1.42E-02	7.23E-02	3.70E-01	3.42E+00	1.18E-02	1.21E+01
2.30E-04	3.72E-03	1.84E-03	3.59E-02	7.48E-01	2.91E-03	8.95E-01
2.46E-03	7.44E-03	1.97E-02	7.40E-03	4.19E-02	2.37E-03	1.93E-01
4.04E-03	7.49E-03	3.23E-02	9.38E-03	8.54E-02	3.10E-03	3.79E-01
9.40E-03	1.35E-02	7.52E-02	1.97E-01	1.87E+00	8.34E-03	6.53E+00
6.03E-03	1.10E-02	4.82E-02	1.93E-01	1.28E+00	7.54E-03	5.22E+00
6.01E-03	1.10E-02	4.80E-02	4.29E-02	3.15E-01	7.68E-03	1.20E+00
1.29E-02	2.18E-02	1.03E-01	5.85E-02	5.08E-01	1.06E-02	1.65E+00
6.60E-03	1.21E-02	5.28E-02	1.02E-01	8.07E-01	8.21E-03	2.79E+00
4.98E-03	1.10E-02	3.99E-02	2.22E-01	1.31E+00	1.16E-02	5.71E+00
4.08E-03	7.61E-03	3.26E-02	8.40E-03	7.13E-02	3.06E-03	3.40E-01
8.32E-03	1.49E-02	6.65E-02	6.68E-02	6.02E-01	8.34E-03	4.67E+00
2.46E-03	7.44E-03	1.97E-02	3.15E-03	2.23E-02	2.68E-03	7.64E-02
4.05E-03	7.44E-03	3.24E-02	3.93E-03	3.37E-02	3.36E-03	1.25E-01
4.11E-03	7.44E-03	3.29E-02	3.60E-03	3.15E-02	3.29E-03	1.17E-01
4.82E-02	3.91E-02	3.86E-01	5.04E-01	6.60E-01	2.18E-02	9.51E+00
4.31E-02	3.51E-02	3.45E-01	3.60E-01	5.16E-01	2.08E-02	7.51E+00
3.89E-02	3.22E-02	3.11E-01	7.81E-01	1.11E+00	2.07E-02	1.40E+01
7.18E-03	1.07E-02	5.74E-02	4.33E-03	2.25E-02	3.93E-03	8.84E-02
1.12E-02	1.34E-02	8.92E-02	7.72E-02	2.76E-01	7.57E-03	1.57E+00
2.16E-02	1.96E-02	1.73E-01	5.90E-01	1.25E+00	1.27E-02	8.27E+00

2.80E-02	2.30E-02	2.24E-01	2.22E-01	5.32E-01	1.40E-02	4.03E+00
2.46E-02	2.09E-02	1.97E-01	2.71E-01	6.07E-01	1.47E-02	4.72E+00
2.19E-02	2.15E-02	1.75E-01	5.81E-01	9.26E-01	1.55E-02	1.12E+01
1.84E-02	1.74E-02	1.47E-01	4.46E-01	1.04E+00	1.51E-02	6.76E+00
4.19E-02	3.92E-02	3.36E-01	3.59E-01	4.83E-01	1.88E-02	6.83E+00
1.13E-02	1.30E-02	9.04E-02	9.47E-02	3.27E-01	7.26E-03	1.69E+00
2.46E-02	1.92E-02	1.96E-01	3.16E-01	5.37E+00	1.48E-02	1.36E+01
6.77E-04	5.37E-03	5.42E-03	2.71E-02	1.09E+00	3.02E-03	7.71E-01
7.18E-03	1.07E-02	5.74E-02	6.84E-03	5.32E-02	3.06E-03	1.79E-01
1.20E-02	1.08E-02	9.58E-02	6.80E-03	1.05E-01	3.87E-03	3.21E-01
2.16E-02	1.96E-02	1.73E-01	8.00E-02	2.72E+00	8.41E-03	5.19E+00
1.60E-02	1.59E-02	1.28E-01	3.91E-02	2.24E+00	9.48E-03	5.68E+00
1.61E-02	1.59E-02	1.29E-01	1.27E-02	5.56E-01	9.83E-03	1.33E+00
3.36E-02	3.15E-02	2.69E-01	3.07E-02	7.80E-01	1.10E-02	1.49E+00
1.84E-02	1.74E-02	1.47E-01	2.85E-02	1.32E+00	9.93E-03	2.97E+00
1.39E-02	1.59E-02	1.11E-01	1.24E-01	2.20E+00	1.36E-02	6.17E+00
1.19E-02	1.10E-02	9.56E-02	6.54E-03	9.19E-02	3.90E-03	3.00E-01
2.19E-02	2.15E-02	1.75E-01	4.03E-02	8.95E-01	8.63E-03	4.22E+00
7.18E-03	1.07E-02	5.74E-02	3.16E-03	2.44E-02	3.46E-03	6.32E-02
1.20E-02	1.07E-02	9.60E-02	3.02E-03	3.31E-02	4.20E-03	8.76E-02
1.20E-02	1.07E-02	9.62E-02	2.97E-03	3.21E-02	4.19E-03	8.45E-02

CO g/mi	Methane (CH4) g/mi	N2O g/mi	Benzene g/mi	Formaldehyde g/mi	CO2 Equivalent g/mi	PM2.5 g/mi	Total Exh	NOx
1.59E+00	4.29E-02	2.60E-03	2.78E-03	3.13E-02	1.93E+03	2.60E-01	7.02E+00	
1.27E+00	4.51E-02	2.59E-03	2.22E-03	2.59E-02	1.86E+03	1.90E-01	5.68E+00	
2.40E+00	3.02E-02	2.40E-03	4.52E-03	4.74E-02	1.90E+03	4.05E-01	1.15E+01	
2.06E+00	9.94E-03	4.89E-04	2.06E-04	2.87E-03	3.43E+02	3.92E-03	1.20E-01	
2.09E+00	2.65E-02	1.83E-03	1.33E-03	1.54E-02	6.77E+02	4.51E-02	1.13E+00	
1.93E+00	3.36E-02	2.40E-03	5.56E-03	5.82E-02	1.32E+03	3.33E-01	7.36E+00	
8.55E-01	4.42E-02	2.40E-03	2.13E-03	2.49E-02	1.06E+03	1.10E-01	2.48E+00	
9.89E-01	4.40E-02	2.40E-03	2.41E-03	2.76E-02	1.13E+03	1.32E-01	2.98E+00	
3.01E+00	3.64E-02	2.40E-03	4.60E-03	4.88E-02	1.78E+03	3.58E-01	9.82E+00	
1.45E+00	3.86E-02	2.40E-03	3.95E-03	4.26E-02	1.29E+03	2.19E-01	4.86E+00	
1.21E+00	4.09E-02	2.40E-03	2.15E-03	2.48E-02	1.90E+03	1.98E-01	5.69E+00	
2.31E+00	2.38E-02	1.67E-03	1.52E-03	1.71E-02	6.34E+02	5.39E-02	1.18E+00	
1.37E+02	1.67E-01	2.45E-02	1.03E-01	3.94E-02	1.74E+03	3.46E-01	1.21E+01	
1.48E+01	2.97E-02	2.49E-03	2.98E-02	1.07E-02	4.40E+02	3.06E-02	8.97E-01	
2.84E+00	3.94E-03	1.52E-03	1.44E-03	5.31E-04	3.47E+02	6.47E-03	2.05E-01	
4.61E+00	6.59E-03	2.66E-03	3.07E-03	1.13E-03	4.60E+02	8.35E-03	4.11E-01	
6.00E+01	8.15E-02	2.02E-02	5.63E-02	2.15E-02	1.23E+03	1.88E-01	6.51E+00	
3.16E+01	3.51E-02	3.19E-02	3.56E-02	1.35E-02	1.07E+03	1.64E-01	4.98E+00	
8.50E+00	5.49E-03	8.72E-03	9.17E-03	3.33E-03	1.09E+03	3.73E-02	1.14E+00	
1.47E+01	9.72E-03	8.97E-03	1.35E-02	4.87E-03	1.58E+03	5.45E-02	1.64E+00	
2.49E+01	2.18E-02	1.54E-02	2.37E-02	8.80E-03	1.20E+03	8.98E-02	2.74E+00	
3.85E+01	2.91E-02	3.66E-02	3.55E-02	1.33E-02	1.72E+03	1.98E-01	5.63E+00	
4.22E+00	6.19E-03	2.68E-03	2.58E-03	9.46E-04	4.52E+02	7.64E-03	3.68E-01	
8.09E+00	5.15E+00	4.87E-02	9.01E-04	2.40E-01	1.70E+03	5.96E-02	4.66E+00	
1.80E+00	6.18E-03	1.12E-03	4.13E-04	5.11E-04	3.39E+02	2.77E-03	8.36E-02	
2.40E+00	1.14E-02	1.49E-03	6.77E-04	8.43E-04	4.31E+02	3.49E-03	1.43E-01	
2.22E+00	1.05E-02	1.48E-03	6.30E-04	7.75E-04	4.19E+02	3.27E-03	1.34E-01	
1.86E+00	5.53E-02	3.42E-03	3.46E-03	3.90E-02	2.01E+03	3.08E-01	7.53E+00	
1.48E+00	5.82E-02	3.42E-03	2.76E-03	3.23E-02	1.93E+03	2.21E-01	6.00E+00	
2.85E+00	4.00E-02	3.41E-03	5.78E-03	6.09E-02	1.89E+03	4.81E-01	1.15E+01	
1.40E+00	6.83E-03	6.97E-04	1.59E-04	2.14E-03	3.59E+02	3.27E-03	9.36E-02	
1.77E+00	3.00E-02	2.61E-03	1.59E-03	1.83E-02	7.05E+02	5.14E-02	1.19E+00	
2.15E+00	4.11E-02	3.42E-03	6.82E-03	7.13E-02	1.16E+03	3.82E-01	6.51E+00	
1.08E+00	6.07E-02	3.42E-03	2.89E-03	3.38E-02	1.11E+03	1.36E-01	2.71E+00	
1.25E+00	6.05E-02	3.42E-03	3.27E-03	3.76E-02	1.17E+03	1.66E-01	3.23E+00	
3.12E+00	4.46E-02	3.42E-03	5.29E-03	5.64E-02	1.58E+03	3.86E-01	9.21E+00	
1.83E+00	5.35E-02	3.42E-03	5.39E-03	5.81E-02	1.24E+03	2.75E-01	4.78E+00	
1.38E+00	5.05E-02	3.42E-03	2.61E-03	3.01E-02	1.78E+03	2.21E-01	5.50E+00	
2.01E+00	2.58E-02	2.39E-03	1.84E-03	2.04E-02	6.70E+02	6.24E-02	1.27E+00	
1.33E+02	1.90E-01	3.24E-02	1.17E-01	4.50E-02	1.81E+03	2.49E-01	1.20E+01	
1.53E+01	3.47E-02	3.54E-03	3.48E-02	1.25E-02	4.30E+02	2.32E-02	8.77E-01	
2.05E+00	3.05E-03	2.17E-03	1.34E-03	4.96E-04	3.63E+02	5.01E-03	1.76E-01	

3.24E+00	4.73E-03	3.79E-03	2.80E-03	1.04E-03	4.72E+02	5.55E-03	3.35E-01
4.23E+01	8.46E-02	2.88E-02	5.94E-02	2.27E-02	1.09E+03	7.08E-02	5.24E+00
2.80E+01	4.02E-02	4.55E-02	4.27E-02	1.61E-02	1.09E+03	2.81E-02	4.88E+00
8.34E+00	6.47E-03	1.24E-02	1.13E-02	4.13E-03	1.11E+03	1.10E-02	1.13E+00
1.31E+01	1.10E-02	1.28E-02	1.65E-02	5.97E-03	1.46E+03	2.74E-02	1.45E+00
2.02E+01	2.35E-02	2.19E-02	2.68E-02	9.96E-03	1.16E+03	2.47E-02	2.56E+00
3.71E+01	3.18E-02	5.22E-02	4.05E-02	1.52E-02	1.67E+03	9.66E-02	5.40E+00
3.17E+00	4.73E-03	3.82E-03	2.44E-03	8.98E-04	4.73E+02	5.34E-03	3.10E-01
7.32E+00	6.06E+00	6.95E-02	1.03E-03	2.54E-01	1.60E+03	4.13E-02	4.09E+00
1.24E+00	4.51E-03	1.60E-03	3.28E-04	4.03E-04	3.55E+02	2.26E-03	6.63E-02
1.54E+00	7.46E-03	2.12E-03	4.99E-04	6.11E-04	4.42E+02	2.45E-03	1.01E-01
1.48E+00	7.07E-03	2.11E-03	4.78E-04	5.76E-04	4.39E+02	2.41E-03	9.70E-02
1.75E+00	5.02E-02	3.07E-03	3.18E-03	3.58E-02	1.97E+03	2.91E-01	7.25E+00
1.39E+00	5.28E-02	3.07E-03	2.53E-03	2.96E-02	1.89E+03	2.12E-01	5.82E+00
2.62E+00	3.53E-02	2.84E-03	5.14E-03	5.41E-02	1.91E+03	4.46E-01	1.16E+01
1.94E+00	8.84E-03	5.78E-04	1.90E-04	2.62E-03	3.53E+02	3.91E-03	1.09E-01
2.06E+00	2.84E-02	2.16E-03	1.45E-03	1.68E-02	6.92E+02	4.85E-02	1.16E+00
2.17E+00	3.93E-02	2.84E-03	6.44E-03	6.74E-02	1.33E+03	3.76E-01	7.37E+00
9.63E-01	5.14E-02	2.84E-03	2.47E-03	2.88E-02	1.13E+03	1.24E-01	2.68E+00
1.11E+00	5.13E-02	2.84E-03	2.79E-03	3.20E-02	1.19E+03	1.50E-01	3.18E+00
3.25E+00	4.26E-02	2.84E-03	5.15E-03	5.48E-02	1.78E+03	3.91E-01	9.92E+00
1.62E+00	4.53E-02	2.84E-03	4.59E-03	4.94E-02	1.31E+03	2.47E-01	4.93E+00
1.34E+00	4.80E-02	2.84E-03	2.46E-03	2.84E-02	1.91E+03	2.18E-01	5.80E+00
2.26E+00	2.48E-02	1.98E-03	1.67E-03	1.87E-02	6.49E+02	5.82E-02	1.22E+00
1.35E+02	1.84E-01	2.90E-02	1.13E-01	4.34E-02	1.79E+03	3.27E-01	1.21E+01
1.51E+01	3.23E-02	2.94E-03	3.23E-02	1.17E-02	4.39E+02	3.18E-02	8.95E-01
2.71E+00	3.65E-03	1.80E-03	1.42E-03	5.26E-04	3.57E+02	6.55E-03	1.93E-01
4.30E+00	5.92E-03	3.15E-03	2.98E-03	1.10E-03	4.67E+02	8.30E-03	3.79E-01
5.65E+01	8.86E-02	2.39E-02	6.18E-02	2.36E-02	1.26E+03	1.74E-01	6.53E+00
3.30E+01	4.03E-02	3.78E-02	4.19E-02	1.58E-02	1.15E+03	1.71E-01	5.22E+00
9.05E+00	6.35E-03	1.03E-02	1.09E-02	3.96E-03	1.16E+03	3.80E-02	1.20E+00
1.48E+01	1.07E-02	1.06E-02	1.54E-02	5.55E-03	1.60E+03	5.17E-02	1.65E+00
2.45E+01	2.40E-02	1.82E-02	2.68E-02	9.96E-03	1.24E+03	9.04E-02	2.79E+00
3.93E+01	3.24E-02	4.34E-02	4.13E-02	1.55E-02	1.75E+03	1.96E-01	5.71E+00
3.94E+00	5.59E-03	3.17E-03	2.52E-03	9.26E-04	4.61E+02	7.43E-03	3.40E-01
8.25E+00	5.77E+00	5.77E-02	9.97E-04	2.56E-01	1.73E+03	5.91E-02	4.67E+00
1.71E+00	5.61E-03	1.33E-03	3.86E-04	4.76E-04	3.49E+02	2.79E-03	7.64E-02
2.20E+00	9.94E-03	1.76E-03	6.12E-04	7.57E-04	4.37E+02	3.48E-03	1.25E-01
2.01E+00	9.03E-03	1.75E-03	5.65E-04	6.90E-04	4.27E+02	3.19E-03	1.17E-01
2.58E+00	8.83E-02	5.71E-03	5.27E-03	5.98E-02	2.48E+03	4.63E-01	9.51E+00
2.06E+00	9.30E-02	5.70E-03	4.19E-03	4.94E-02	2.38E+03	3.31E-01	7.51E+00
3.96E+00	6.28E-02	5.69E-03	8.67E-03	9.15E-02	2.32E+03	7.19E-01	1.40E+01
1.66E+00	6.93E-03	1.16E-03	1.80E-04	2.36E-03	4.53E+02	3.99E-03	8.84E-02
2.30E+00	4.27E-02	4.35E-03	2.30E-03	2.64E-02	8.69E+02	7.11E-02	1.57E+00
2.80E+00	6.01E-02	5.69E-03	9.90E-03	1.04E-01	1.43E+03	5.42E-01	8.27E+00

1.54E+00	9.47E-02	5.70E-03	4.45E-03	5.22E-02	1.62E+03	2.04E-01	4.03E+00
1.79E+00	9.46E-02	5.71E-03	5.05E-03	5.81E-02	1.68E+03	2.49E-01	4.72E+00
3.90E+00	6.60E-02	5.70E-03	7.34E-03	7.86E-02	1.75E+03	5.34E-01	1.12E+01
2.62E+00	8.39E-02	5.70E-03	8.34E-03	9.00E-02	1.72E+03	4.10E-01	6.76E+00
1.87E+00	7.86E-02	5.70E-03	3.89E-03	4.52E-02	2.15E+03	3.31E-01	6.83E+00
2.64E+00	3.57E-02	3.98E-03	2.67E-03	2.95E-02	8.29E+02	8.71E-02	1.69E+00
1.52E+02	2.88E-01	5.40E-02	1.79E-01	6.87E-02	2.25E+03	2.80E-01	1.36E+01
1.65E+01	4.76E-02	5.91E-03	4.77E-02	1.72E-02	4.57E+02	2.40E-02	7.71E-01
2.50E+00	3.48E-03	3.61E-03	1.74E-03	6.50E-04	4.61E+02	6.05E-03	1.79E-01
3.73E+00	5.06E-03	6.32E-03	3.56E-03	1.33E-03	5.85E+02	6.02E-03	3.21E-01
4.60E+01	1.29E-01	4.80E-02	9.18E-02	3.51E-02	1.28E+03	7.08E-02	5.19E+00
3.81E+01	6.76E-02	7.59E-02	7.50E-02	2.84E-02	1.45E+03	3.46E-02	5.68E+00
1.15E+01	1.11E-02	2.07E-02	2.04E-02	7.43E-03	1.48E+03	1.12E-02	1.33E+00
1.43E+01	1.66E-02	2.13E-02	2.66E-02	9.67E-03	1.66E+03	2.71E-02	1.49E+00
2.61E+01	3.84E-02	3.66E-02	4.58E-02	1.70E-02	1.51E+03	2.52E-02	2.97E+00
4.65E+01	5.17E-02	8.71E-02	7.21E-02	2.72E-02	2.07E+03	1.10E-01	6.17E+00
3.69E+00	5.34E-03	6.36E-03	3.19E-03	1.18E-03	5.88E+02	5.79E-03	3.00E-01
8.10E+00	9.46E+00	1.16E-01	1.57E-03	3.54E-01	1.90E+03	3.57E-02	4.22E+00
1.50E+00	4.87E-03	2.67E-03	3.77E-04	4.65E-04	4.50E+02	2.79E-03	6.32E-02
1.69E+00	7.22E-03	3.53E-03	5.30E-04	6.46E-04	5.47E+02	2.67E-03	8.76E-02
1.66E+00	6.88E-03	3.52E-03	5.11E-04	6.11E-04	5.45E+02	2.63E-03	8.45E-02

Sum of emisRate - 35 mph

RoadType	yearID	FuelType	SourceType	Pollutant
				PM2.5 Tirewear
				g/mi
Rural Restricted Access	2028	Diesel Fuel	Combination Long-haul Truck	4.39E-03
			Combination Short-haul Truck	3.92E-03
			Intercity Bus	3.44E-03
			Passenger Car	1.15E-03
			Passenger Truck	1.44E-03
			School Bus	2.09E-03
			Single Unit Long-haul Truck	2.46E-03
			Single Unit Short-haul Truck	2.19E-03
			Transit Bus	2.29E-03
			Motor Home	1.86E-03
			Refuse Truck	4.21E-03
			Light Commercial Truck	1.39E-03
		Gasoline	Combination Short-haul Truck	4.49E-03
			Motorcycle	5.73E-04
			Passenger Car	1.15E-03
			Passenger Truck	1.15E-03
			School Bus	2.09E-03
			Single Unit Long-haul Truck	1.69E-03
			Single Unit Short-haul Truck	1.69E-03
			Transit Bus	3.37E-03
			Motor Home	1.86E-03
			Refuse Truck	1.59E-03
			Light Commercial Truck	1.17E-03
		Compressed Natural Gas (CNG)	Transit Bus	2.29E-03
		Ethanol (E-85)	Passenger Car	1.15E-03
			Passenger Truck	1.15E-03
			Light Commercial Truck	1.15E-03
Rural Unrestricted Access	2028	Diesel Fuel	Combination Long-haul Truck	4.88E-03
			Combination Short-haul Truck	4.36E-03
			Intercity Bus	4.03E-03
			Passenger Car	1.34E-03
			Passenger Truck	1.68E-03
			School Bus	2.44E-03
			Single Unit Long-haul Truck	2.88E-03
			Single Unit Short-haul Truck	2.57E-03
			Transit Bus	2.68E-03
			Motor Home	2.18E-03
			Refuse Truck	4.92E-03
			Light Commercial Truck	1.62E-03
		Gasoline	Combination Short-haul Truck	4.99E-03
			Motorcycle	6.71E-04
			Passenger Car	1.34E-03

		Passenger Truck	1.35E-03
		School Bus	2.44E-03
		Single Unit Long-haul Truck	1.98E-03
		Single Unit Short-haul Truck	1.98E-03
		Transit Bus	3.94E-03
		Motor Home	2.18E-03
		Refuse Truck	1.87E-03
		Light Commercial Truck	1.37E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.68E-03
	Ethanol (E-85)	Passenger Car	1.34E-03
		Passenger Truck	1.34E-03
		Light Commercial Truck	1.34E-03
Urban Restricted Access	2028 Diesel Fuel	Combination Long-haul Truck	4.70E-03
		Combination Short-haul Truck	4.20E-03
		Intercity Bus	3.71E-03
		Passenger Car	1.24E-03
		Passenger Truck	1.55E-03
		School Bus	2.25E-03
		Single Unit Long-haul Truck	2.65E-03
		Single Unit Short-haul Truck	2.37E-03
		Transit Bus	2.47E-03
		Motor Home	2.01E-03
		Refuse Truck	4.54E-03
		Light Commercial Truck	1.50E-03
	Gasoline	Combination Short-haul Truck	4.81E-03
		Motorcycle	6.19E-04
		Passenger Car	1.24E-03
		Passenger Truck	1.25E-03
		School Bus	2.25E-03
		Single Unit Long-haul Truck	1.82E-03
		Single Unit Short-haul Truck	1.82E-03
		Transit Bus	3.64E-03
		Motor Home	2.01E-03
		Refuse Truck	1.72E-03
		Light Commercial Truck	1.27E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.47E-03
	Ethanol (E-85)	Passenger Car	1.24E-03
		Passenger Truck	1.24E-03
		Light Commercial Truck	1.24E-03
Urban Unrestricted Access	2028 Diesel Fuel	Combination Long-haul Truck	5.58E-03
		Combination Short-haul Truck	4.98E-03
		Intercity Bus	4.60E-03
		Passenger Car	1.53E-03
		Passenger Truck	1.92E-03
		School Bus	2.79E-03

	Single Unit Long-haul Truck	3.29E-03
	Single Unit Short-haul Truck	2.93E-03
	Transit Bus	3.07E-03
	Motor Home	2.49E-03
	Refuse Truck	5.63E-03
	Light Commercial Truck	1.86E-03
Gasoline	Combination Short-haul Truck	5.71E-03
	Motorcycle	7.67E-04
	Passenger Car	1.53E-03
	Passenger Truck	1.54E-03
	School Bus	2.79E-03
	Single Unit Long-haul Truck	2.26E-03
	Single Unit Short-haul Truck	2.26E-03
	Transit Bus	4.51E-03
	Motor Home	2.49E-03
	Refuse Truck	2.13E-03
	Light Commercial Truck	1.57E-03
Compressed Natural Gas (CNG)	Transit Bus	3.07E-03
Ethanol (E-85)	Passenger Car	1.53E-03
	Passenger Truck	1.53E-03
	Light Commercial Truck	1.53E-03

## RateUnit

PM2.5	Brakewear	PM10 Tirewear	PM10 Brakewear	PM10	Total Exh	VOC	SO2	NOx	
g/mi	g/mi	g/mi	g/mi	g/mi	g/mi	g/mi	g/mi	g/mi	
1.19E-02		2.93E-02	9.53E-02		6.81E-02		1.01E-01	1.38E-02	2.11E+00
1.08E-02		2.61E-02	8.65E-02		3.96E-02		7.73E-02	1.33E-02	1.57E+00
9.98E-03		2.29E-02	7.98E-02		1.14E-01		1.76E-01	1.40E-02	3.19E+00
1.54E-03		7.64E-03	1.24E-02		3.23E-03		1.06E-02	1.81E-03	5.70E-02
2.32E-03		9.59E-03	1.86E-02		1.12E-02		3.60E-02	4.37E-03	3.38E-01
7.47E-03		1.39E-02	5.97E-02		7.43E-02		1.96E-01	9.20E-03	2.08E+00
7.91E-03		1.64E-02	6.33E-02		2.15E-02		6.34E-02	7.43E-03	7.80E-01
6.84E-03		1.46E-02	5.47E-02		2.17E-02		6.29E-02	7.91E-03	8.23E-01
6.42E-03		1.53E-02	5.13E-02		8.52E-02		1.41E-01	1.27E-02	2.46E+00
5.48E-03		1.24E-02	4.38E-02		4.65E-02		1.27E-01	8.93E-03	1.41E+00
1.10E-02		2.80E-02	8.80E-02		4.09E-02		7.22E-02	1.40E-02	1.56E+00
2.42E-03		9.25E-03	1.94E-02		1.10E-02		3.64E-02	3.94E-03	3.10E-01
1.21E-02		2.99E-02	9.71E-02		1.35E-01		7.83E-01	1.06E-02	3.05E+00
1.24E-04		3.82E-03	9.92E-04		3.25E-02		5.02E-01	2.58E-03	8.07E-01
1.54E-03		7.64E-03	1.24E-02		3.18E-03		1.15E-02	1.41E-03	5.31E-02
2.45E-03		7.70E-03	1.96E-02		5.01E-03		2.18E-02	1.92E-03	1.12E-01
7.45E-03		1.39E-02	5.96E-02		3.99E-02		2.48E-01	6.93E-03	8.29E-01
4.78E-03		1.13E-02	3.83E-02		1.86E-01		6.71E-01	6.25E-03	3.70E+00
4.86E-03		1.13E-02	3.89E-02		2.34E-02		1.10E-01	6.28E-03	4.04E-01
1.00E-02		2.25E-02	8.01E-02		3.60E-02		2.53E-01	9.27E-03	7.52E-01
5.48E-03		1.24E-02	4.38E-02		4.12E-02		2.19E-01	6.82E-03	6.98E-01
2.71E-03		1.06E-02	2.16E-02		5.51E-02		2.83E-01	1.01E-02	8.62E-01
2.52E-03		7.82E-03	2.02E-02		4.82E-03		2.05E-02	1.91E-03	1.12E-01
6.42E-03		1.53E-02	5.13E-02		1.20E-02		1.71E-01	7.29E-03	2.12E+00
1.54E-03		7.64E-03	1.24E-02		1.99E-03		1.35E-02	1.62E-03	4.41E-02
2.46E-03		7.64E-03	1.96E-02		2.88E-03		2.16E-02	2.15E-03	7.91E-02
2.54E-03		7.64E-03	2.03E-02		2.63E-03		2.00E-02	2.09E-03	7.29E-02
1.67E-02		3.26E-02	1.33E-01		7.46E-02		1.13E-01	1.39E-02	2.18E+00
1.51E-02		2.91E-02	1.21E-01		4.30E-02		8.58E-02	1.33E-02	1.61E+00
1.51E-02		2.68E-02	1.21E-01		1.27E-01		2.04E-01	1.35E-02	3.13E+00
2.50E-03		8.94E-03	2.00E-02		2.62E-03		8.17E-03	1.79E-03	4.13E-02
3.97E-03		1.12E-02	3.17E-02		1.12E-02		3.79E-02	4.35E-03	3.45E-01
1.00E-02		1.63E-02	8.03E-02		7.35E-02		1.90E-01	6.89E-03	1.62E+00
1.13E-02		1.92E-02	9.01E-02		2.28E-02		7.40E-02	6.95E-03	7.79E-01
9.79E-03		1.71E-02	7.83E-02		2.35E-02		7.36E-02	7.44E-03	8.22E-01
9.18E-03		1.79E-02	7.34E-02		8.04E-02		1.31E-01	9.75E-03	1.98E+00
7.97E-03		1.45E-02	6.37E-02		5.13E-02		1.49E-01	7.81E-03	1.31E+00
1.66E-02		3.28E-02	1.33E-01		4.38E-02		8.13E-02	1.33E-02	1.55E+00
4.02E-03		1.08E-02	3.22E-02		1.11E-02		3.82E-02	3.98E-03	3.15E-01
1.70E-02		3.33E-02	1.36E-01		7.26E-02		8.47E-01	1.06E-02	3.03E+00
2.17E-04		4.47E-03	1.74E-03		2.24E-02		5.27E-01	2.42E-03	7.57E-01
2.50E-03		8.94E-03	2.00E-02		2.56E-03		9.13E-03	1.40E-03	3.84E-02

4.14E-03	9.01E-03	3.31E-02	3.61E-03	1.64E-02	1.87E-03	7.98E-02
1.00E-02	1.63E-02	8.02E-02	1.09E-02	2.30E-01	5.15E-03	5.90E-01
6.67E-03	1.32E-02	5.34E-02	1.56E-02	6.55E-01	5.65E-03	3.40E+00
6.86E-03	1.32E-02	5.49E-02	7.93E-03	1.07E-01	5.78E-03	3.69E-01
1.42E-02	2.63E-02	1.14E-01	2.02E-02	2.54E-01	7.39E-03	5.81E-01
7.97E-03	1.45E-02	6.37E-02	1.10E-02	2.03E-01	5.93E-03	6.24E-01
4.06E-03	1.24E-02	3.25E-02	3.03E-02	2.98E-01	9.77E-03	8.27E-01
4.16E-03	9.15E-03	3.32E-02	3.74E-03	1.64E-02	1.89E-03	8.49E-02
9.18E-03	1.79E-02	7.34E-02	7.51E-03	1.86E-01	5.81E-03	1.63E+00
2.50E-03	8.94E-03	2.00E-02	1.61E-03	1.11E-02	1.60E-03	3.16E-02
4.15E-03	8.94E-03	3.32E-02	2.11E-03	1.63E-02	2.09E-03	5.36E-02
4.17E-03	8.94E-03	3.34E-02	2.07E-03	1.58E-02	2.07E-03	5.12E-02
1.53E-02	3.13E-02	1.22E-01	7.27E-02	1.08E-01	1.38E-02	2.14E+00
1.38E-02	2.80E-02	1.11E-01	4.21E-02	8.25E-02	1.33E-02	1.59E+00
1.26E-02	2.48E-02	1.01E-01	1.21E-01	1.89E-01	1.38E-02	3.16E+00
1.98E-03	8.25E-03	1.58E-02	3.16E-03	9.68E-03	1.81E-03	5.00E-02
2.99E-03	1.03E-02	2.39E-02	1.15E-02	3.74E-02	4.37E-03	3.42E-01
9.21E-03	1.50E-02	7.37E-02	7.97E-02	2.13E-01	9.08E-03	2.06E+00
9.55E-03	1.77E-02	7.64E-02	2.29E-02	6.91E-02	7.68E-03	8.15E-01
8.29E-03	1.58E-02	6.63E-02	2.32E-02	6.85E-02	8.11E-03	8.53E-01
8.10E-03	1.65E-02	6.48E-02	8.99E-02	1.51E-01	1.25E-02	2.43E+00
6.71E-03	1.34E-02	5.37E-02	4.96E-02	1.39E-01	8.84E-03	1.42E+00
1.40E-02	3.03E-02	1.12E-01	4.31E-02	7.69E-02	1.38E-02	1.57E+00
3.10E-03	9.99E-03	2.48E-02	1.13E-02	3.75E-02	3.95E-03	3.11E-01
1.56E-02	3.21E-02	1.25E-01	1.28E-01	8.80E-01	1.07E-02	3.07E+00
1.61E-04	4.13E-03	1.29E-03	3.32E-02	5.21E-01	2.54E-03	7.97E-01
1.98E-03	8.25E-03	1.58E-02	3.11E-03	1.07E-02	1.42E-03	4.65E-02
3.16E-03	8.31E-03	2.53E-02	4.95E-03	1.98E-02	1.91E-03	9.80E-02
9.19E-03	1.50E-02	7.36E-02	3.73E-02	2.69E-01	6.96E-03	8.39E-01
5.71E-03	1.21E-02	4.56E-02	1.88E-01	7.61E-01	6.46E-03	3.79E+00
5.84E-03	1.22E-02	4.67E-02	2.31E-02	1.21E-01	6.47E-03	4.13E-01
1.26E-02	2.42E-02	1.01E-01	3.43E-02	2.69E-01	9.25E-03	7.53E-01
6.71E-03	1.34E-02	5.37E-02	4.08E-02	2.37E-01	6.86E-03	7.08E-01
3.41E-03	1.15E-02	2.73E-02	5.45E-02	3.04E-01	1.01E-02	8.64E-01
3.24E-03	8.44E-03	2.59E-02	4.67E-03	1.86E-02	1.90E-03	9.87E-02
8.10E-03	1.65E-02	6.48E-02	1.17E-02	1.87E-01	7.27E-03	2.12E+00
1.98E-03	8.25E-03	1.58E-02	1.95E-03	1.26E-02	1.63E-03	3.85E-02
3.16E-03	8.25E-03	2.53E-02	2.84E-03	1.97E-02	2.13E-03	6.82E-02
3.25E-03	8.25E-03	2.60E-02	2.55E-03	1.81E-02	2.08E-03	6.22E-02
2.90E-02	3.72E-02	2.32E-01	9.19E-02	1.39E-01	1.51E-02	2.42E+00
2.61E-02	3.32E-02	2.09E-01	5.25E-02	1.05E-01	1.44E-02	1.78E+00
2.54E-02	3.07E-02	2.03E-01	1.56E-01	2.50E-01	1.45E-02	3.40E+00
4.06E-03	1.02E-02	3.25E-02	2.76E-03	8.08E-03	1.95E-03	3.60E-02
6.42E-03	1.28E-02	5.14E-02	1.27E-02	4.46E-02	4.68E-03	3.93E-01
1.46E-02	1.86E-02	1.17E-01	8.39E-02	2.24E-01	7.21E-03	1.71E+00

1.79E-02	2.19E-02	1.43E-01	2.71E-02	9.27E-02	8.36E-03	9.41E-01
1.55E-02	1.96E-02	1.24E-01	2.79E-02	9.24E-02	8.86E-03	9.82E-01
1.43E-02	2.04E-02	1.15E-01	9.31E-02	1.49E-01	9.47E-03	2.04E+00
1.24E-02	1.66E-02	9.90E-02	6.02E-02	1.87E-01	9.06E-03	1.53E+00
2.76E-02	3.75E-02	2.21E-01	5.35E-02	9.81E-02	1.44E-02	1.73E+00
6.52E-03	1.24E-02	5.21E-02	1.24E-02	4.46E-02	4.29E-03	3.56E-01
2.95E-02	3.80E-02	2.36E-01	7.82E-02	1.21E+00	1.16E-02	3.20E+00
3.57E-04	5.11E-03	2.86E-03	2.17E-02	5.99E-01	2.36E-03	6.70E-01
4.06E-03	1.02E-02	3.25E-02	2.70E-03	9.15E-03	1.52E-03	3.35E-02
6.75E-03	1.03E-02	5.40E-02	3.62E-03	1.61E-02	2.01E-03	6.97E-02
1.46E-02	1.86E-02	1.17E-01	8.42E-03	2.96E-01	5.23E-03	5.28E-01
1.02E-02	1.51E-02	8.19E-02	1.36E-02	9.53E-01	6.36E-03	3.47E+00
1.06E-02	1.51E-02	8.46E-02	7.13E-03	1.46E-01	6.54E-03	3.83E-01
2.21E-02	3.00E-02	1.77E-01	1.90E-02	3.16E-01	7.43E-03	5.51E-01
1.24E-02	1.66E-02	9.90E-02	9.41E-03	2.73E-01	6.58E-03	6.38E-01
6.46E-03	1.42E-02	5.17E-02	3.17E-02	3.92E-01	1.08E-02	8.73E-01
6.76E-03	1.05E-02	5.41E-02	3.73E-03	1.63E-02	2.04E-03	7.50E-02
1.43E-02	2.04E-02	1.15E-01	6.32E-03	2.45E-01	5.84E-03	1.54E+00
4.06E-03	1.02E-02	3.25E-02	1.69E-03	1.12E-02	1.75E-03	2.74E-02
6.76E-03	1.02E-02	5.41E-02	2.11E-03	1.60E-02	2.25E-03	4.56E-02
6.79E-03	1.02E-02	5.44E-02	2.07E-03	1.55E-02	2.22E-03	4.36E-02

CO g/mi	Methane (CH4) g/mi	N2O g/mi	Benzene g/mi	Formaldehyde g/mi	CO2 Equivalent g/mi	PM2.5 g/mi	Total Ex	NOx
4.84E-01	3.85E-02	1.72E-03	7.72E-04	1.09E-02	1.60E+03	6.27E-02	2.11E+00	
3.83E-01	3.91E-02	1.72E-03	6.04E-04	9.24E-03	1.55E+03	3.65E-02	1.57E+00	
7.89E-01	3.44E-02	1.63E-03	1.34E-03	1.62E-02	1.61E+03	1.04E-01	3.19E+00	
1.39E+00	9.24E-03	3.32E-04	1.13E-04	1.89E-03	2.10E+02	2.98E-03	5.70E-02	
8.48E-01	2.34E-02	1.26E-03	3.60E-04	5.52E-03	5.08E+02	1.03E-02	3.38E-01	
6.99E-01	3.68E-02	1.63E-03	1.57E-03	1.87E-02	1.06E+03	6.84E-02	2.08E+00	
3.19E-01	3.87E-02	1.63E-03	5.94E-04	9.12E-03	8.64E+02	1.97E-02	7.80E-01	
3.26E-01	3.88E-02	1.63E-03	5.94E-04	9.12E-03	9.20E+02	2.00E-02	8.23E-01	
7.35E-01	3.70E-02	1.63E-03	1.10E-03	1.40E-02	1.47E+03	7.84E-02	2.46E+00	
5.08E-01	3.83E-02	1.63E-03	1.05E-03	1.36E-02	1.03E+03	4.28E-02	1.41E+00	
3.45E-01	3.71E-02	1.63E-03	5.44E-04	8.48E-03	1.62E+03	3.77E-02	1.56E+00	
9.75E-01	2.13E-02	1.13E-03	3.56E-04	5.30E-03	4.58E+02	1.02E-02	3.10E-01	
2.35E+01	7.93E-03	1.23E-02	2.90E-02	1.05E-02	1.59E+03	1.19E-01	3.05E+00	
1.16E+01	2.46E-02	1.68E-03	2.18E-02	7.86E-03	3.88E+02	2.87E-02	8.07E-01	
1.43E+00	1.92E-03	7.85E-04	4.27E-04	1.52E-04	2.12E+02	2.81E-03	5.31E-02	
2.09E+00	2.87E-03	9.55E-04	8.35E-04	3.01E-04	2.89E+02	4.44E-03	1.12E-01	
6.04E+00	2.23E-03	4.85E-03	7.38E-03	2.60E-03	1.04E+03	3.53E-02	8.29E-01	
1.68E+01	7.67E-03	2.32E-02	2.09E-02	8.02E-03	9.45E+02	1.65E-01	3.70E+00	
2.92E+00	1.16E-03	2.91E-03	3.38E-03	1.18E-03	9.43E+02	2.07E-02	4.04E-01	
5.34E+00	2.15E-03	3.30E-03	6.56E-03	2.25E-03	1.39E+03	3.19E-02	7.52E-01	
5.22E+00	1.85E-03	4.26E-03	6.22E-03	2.18E-03	1.03E+03	3.64E-02	6.98E-01	
5.02E+00	2.24E-03	5.68E-03	6.52E-03	2.31E-03	1.52E+03	4.88E-02	8.62E-01	
1.98E+00	2.72E-03	1.04E-03	7.81E-04	2.81E-04	2.88E+02	4.26E-03	1.12E-01	
6.41E+00	2.64E+00	3.31E-02	3.64E-04	4.80E-02	1.45E+03	1.06E-02	2.12E+00	
1.09E+00	3.25E-03	7.83E-04	2.60E-04	3.02E-04	2.11E+02	1.76E-03	4.41E-02	
1.47E+00	5.11E-03	8.77E-04	4.35E-04	5.18E-04	2.80E+02	2.55E-03	7.91E-02	
1.33E+00	4.65E-03	8.77E-04	3.98E-04	4.71E-04	2.71E+02	2.33E-03	7.29E-02	
5.37E-01	4.50E-02	2.05E-03	8.95E-04	1.26E-02	1.61E+03	6.86E-02	2.18E+00	
4.26E-01	4.57E-02	2.05E-03	7.02E-04	1.08E-02	1.55E+03	3.96E-02	1.61E+00	
8.92E-01	4.23E-02	2.05E-03	1.60E-03	1.95E-02	1.55E+03	1.16E-01	3.13E+00	
9.29E-01	6.74E-03	4.18E-04	8.27E-05	1.38E-03	2.08E+02	2.41E-03	4.13E-02	
6.38E-01	2.45E-02	1.58E-03	3.80E-04	5.81E-03	5.06E+02	1.03E-02	3.45E-01	
6.17E-01	3.63E-02	2.05E-03	1.56E-03	1.85E-02	7.94E+02	6.76E-02	1.62E+00	
3.65E-01	4.72E-02	2.05E-03	7.22E-04	1.11E-02	8.09E+02	2.10E-02	7.79E-01	
3.74E-01	4.74E-02	2.05E-03	7.23E-04	1.11E-02	8.66E+02	2.16E-02	8.22E-01	
6.39E-01	3.69E-02	2.05E-03	1.06E-03	1.36E-02	1.13E+03	7.39E-02	1.98E+00	
5.76E-01	4.71E-02	2.05E-03	1.28E-03	1.66E-02	9.04E+02	4.72E-02	1.31E+00	
3.99E-01	4.55E-02	2.05E-03	6.63E-04	1.04E-02	1.55E+03	4.03E-02	1.55E+00	
7.46E-01	2.17E-02	1.42E-03	3.72E-04	5.50E-03	4.62E+02	1.02E-02	3.15E-01	
2.55E+01	8.71E-03	1.47E-02	3.18E-02	1.15E-02	1.59E+03	6.42E-02	3.03E+00	
1.12E+01	2.60E-02	2.12E-03	2.31E-02	8.33E-03	3.65E+02	1.98E-02	7.57E-01	
9.61E-01	1.40E-03	9.87E-04	3.17E-04	1.12E-04	2.10E+02	2.26E-03	3.84E-02	

1.38E+00	1.96E-03	1.20E-03	5.91E-04	2.12E-04	2.81E+02	3.19E-03	7.98E-02
4.54E+00	2.28E-03	6.10E-03	7.52E-03	2.68E-03	7.75E+02	9.60E-03	5.90E-01
1.67E+01	7.56E-03	2.92E-02	2.06E-02	7.91E-03	8.57E+02	1.38E-02	3.40E+00
2.88E+00	1.14E-03	3.65E-03	3.36E-03	1.18E-03	8.68E+02	7.02E-03	3.69E-01
4.38E+00	2.49E-03	4.15E-03	7.62E-03	2.67E-03	1.11E+03	1.79E-02	5.81E-01
5.09E+00	1.77E-03	5.35E-03	5.97E-03	2.10E-03	8.92E+02	9.75E-03	6.24E-01
5.33E+00	2.52E-03	7.14E-03	7.29E-03	2.60E-03	1.47E+03	2.68E-02	8.27E-01
1.43E+00	1.98E-03	1.31E-03	5.90E-04	2.12E-04	2.85E+02	3.31E-03	8.49E-02
5.22E+00	3.02E+00	4.17E-02	4.09E-04	4.84E-02	1.18E+03	6.64E-03	1.63E+00
7.34E-01	2.38E-03	9.85E-04	1.97E-04	2.21E-04	2.09E+02	1.42E-03	3.16E-02
9.41E-01	3.44E-03	1.10E-03	3.02E-04	3.48E-04	2.72E+02	1.86E-03	5.36E-02
9.02E-01	3.28E-03	1.10E-03	2.89E-04	3.32E-04	2.69E+02	1.83E-03	5.12E-02
5.14E-01	4.25E-02	1.92E-03	8.46E-04	1.19E-02	1.60E+03	6.69E-02	2.14E+00
4.07E-01	4.31E-02	1.92E-03	6.64E-04	1.02E-02	1.55E+03	3.88E-02	1.59E+00
8.38E-01	3.81E-02	1.83E-03	1.46E-03	1.77E-02	1.59E+03	1.11E-01	3.16E+00
1.30E+00	8.31E-03	3.71E-04	1.02E-04	1.70E-03	2.11E+02	2.91E-03	5.00E-02
8.06E-01	2.43E-02	1.41E-03	3.75E-04	5.74E-03	5.08E+02	1.06E-02	3.42E-01
7.47E-01	4.08E-02	1.83E-03	1.73E-03	2.06E-02	1.05E+03	7.33E-02	2.06E+00
3.42E-01	4.27E-02	1.83E-03	6.54E-04	1.00E-02	8.94E+02	2.11E-02	8.15E-01
3.49E-01	4.28E-02	1.83E-03	6.55E-04	1.01E-02	9.43E+02	2.13E-02	8.53E-01
7.73E-01	4.10E-02	1.83E-03	1.19E-03	1.53E-02	1.44E+03	8.27E-02	2.43E+00
5.42E-01	4.25E-02	1.83E-03	1.16E-03	1.50E-02	1.02E+03	4.57E-02	1.42E+00
3.71E-01	4.11E-02	1.83E-03	6.01E-04	9.38E-03	1.60E+03	3.97E-02	1.57E+00
9.10E-01	2.17E-02	1.26E-03	3.67E-04	5.44E-03	4.58E+02	1.04E-02	3.11E-01
2.50E+01	9.09E-03	1.37E-02	3.32E-02	1.20E-02	1.61E+03	1.13E-01	3.07E+00
1.16E+01	2.56E-02	1.88E-03	2.27E-02	8.19E-03	3.82E+02	2.94E-02	7.97E-01
1.34E+00	1.73E-03	8.77E-04	3.86E-04	1.38E-04	2.13E+02	2.76E-03	4.65E-02
1.93E+00	2.54E-03	1.07E-03	7.44E-04	2.68E-04	2.87E+02	4.38E-03	9.80E-02
6.40E+00	2.51E-03	5.43E-03	8.29E-03	2.93E-03	1.05E+03	3.30E-02	8.39E-01
1.80E+01	8.80E-03	2.60E-02	2.40E-02	9.21E-03	9.78E+02	1.67E-01	3.79E+00
3.12E+00	1.32E-03	3.25E-03	3.84E-03	1.35E-03	9.72E+02	2.05E-02	4.13E-01
5.62E+00	2.40E-03	3.69E-03	7.32E-03	2.53E-03	1.39E+03	3.03E-02	7.53E-01
5.55E+00	2.09E-03	4.76E-03	7.01E-03	2.46E-03	1.03E+03	3.61E-02	7.08E-01
5.29E+00	2.54E-03	6.35E-03	7.34E-03	2.62E-03	1.53E+03	4.82E-02	8.64E-01
1.82E+00	2.39E-03	1.16E-03	6.94E-04	2.49E-04	2.86E+02	4.14E-03	9.87E-02
6.70E+00	2.93E+00	3.70E-02	4.02E-04	5.12E-02	1.46E+03	1.04E-02	2.12E+00
1.02E+00	2.92E-03	8.76E-04	2.37E-04	2.72E-04	2.11E+02	1.72E-03	3.85E-02
1.35E+00	4.49E-03	9.81E-04	3.86E-04	4.55E-04	2.78E+02	2.51E-03	6.82E-02
1.20E+00	4.04E-03	9.81E-04	3.49E-04	4.09E-04	2.70E+02	2.26E-03	6.22E-02
6.30E-01	5.82E-02	2.77E-03	1.14E-03	1.62E-02	1.75E+03	8.45E-02	2.42E+00
4.99E-01	5.91E-02	2.77E-03	8.99E-04	1.38E-02	1.68E+03	4.83E-02	1.78E+00
1.04E+00	5.40E-02	2.77E-03	2.00E-03	2.44E-02	1.67E+03	1.43E-01	3.40E+00
9.75E-01	6.47E-03	5.63E-04	7.96E-05	1.33E-03	2.27E+02	2.54E-03	3.60E-02
6.93E-01	2.90E-02	2.13E-03	4.51E-04	6.89E-03	5.44E+02	1.16E-02	3.93E-01
6.63E-01	4.31E-02	2.77E-03	1.85E-03	2.20E-02	8.30E+02	7.72E-02	1.71E+00

4.27E-01	5.98E-02	2.77E-03	9.12E-04	1.40E-02	9.73E+02	2.50E-02	9.41E-01
4.38E-01	6.01E-02	2.77E-03	9.16E-04	1.41E-02	1.03E+03	2.57E-02	9.82E-01
6.74E-01	4.43E-02	2.77E-03	1.24E-03	1.60E-02	1.10E+03	8.57E-02	2.04E+00
6.77E-01	5.98E-02	2.77E-03	1.62E-03	2.10E-02	1.05E+03	5.54E-02	1.53E+00
4.64E-01	5.76E-02	2.77E-03	8.37E-04	1.31E-02	1.67E+03	4.93E-02	1.73E+00
8.04E-01	2.53E-02	1.91E-03	4.37E-04	6.44E-03	4.98E+02	1.14E-02	3.56E-01
3.06E+01	1.29E-02	1.98E-02	4.71E-02	1.71E-02	1.74E+03	6.92E-02	3.20E+00
1.09E+01	2.98E-02	2.85E-03	2.64E-02	9.54E-03	3.57E+02	1.92E-02	6.70E-01
1.01E+00	1.35E-03	1.33E-03	3.08E-04	1.09E-04	2.29E+02	2.39E-03	3.35E-02
1.39E+00	1.82E-03	1.62E-03	5.64E-04	2.03E-04	3.02E+02	3.20E-03	6.97E-02
4.68E+00	3.15E-03	8.23E-03	1.04E-02	3.73E-03	7.88E+02	7.45E-03	5.28E-01
1.95E+01	1.13E-02	3.94E-02	3.07E-02	1.18E-02	9.67E+02	1.20E-02	3.47E+00
3.40E+00	1.68E-03	4.93E-03	4.96E-03	1.76E-03	9.84E+02	6.31E-03	3.83E-01
4.65E+00	3.42E-03	5.59E-03	1.04E-02	3.69E-03	1.12E+03	1.68E-02	5.51E-01
5.99E+00	2.59E-03	7.22E-03	8.73E-03	3.10E-03	9.91E+02	8.32E-03	6.38E-01
6.38E+00	3.66E-03	9.63E-03	1.05E-02	3.80E-03	1.62E+03	2.80E-02	8.73E-01
1.46E+00	1.87E-03	1.76E-03	5.76E-04	2.06E-04	3.07E+02	3.30E-03	7.50E-02
5.50E+00	4.10E+00	5.62E-02	5.50E-04	6.06E-02	1.22E+03	5.59E-03	1.54E+00
7.72E-01	2.29E-03	1.33E-03	1.93E-04	2.14E-04	2.27E+02	1.50E-03	2.74E-02
9.44E-01	3.18E-03	1.49E-03	2.83E-04	3.21E-04	2.92E+02	1.87E-03	4.56E-02
9.16E-01	3.04E-03	1.49E-03	2.72E-04	3.07E-04	2.89E+02	1.83E-03	4.36E-02

Sum of emisRate			Pollutant	
RoadType	yearID	FuelType	SourceType	g/mi
Rural Restricted Access	2038	Diesel Fuel	Combination Long-haul Truck	4.39E-03
			Combination Short-haul Truck	3.92E-03
			Intercity Bus	3.44E-03
			Passenger Car	1.15E-03
			Passenger Truck	1.44E-03
			School Bus	2.09E-03
			Single Unit Long-haul Truck	2.46E-03
			Single Unit Short-haul Truck	2.19E-03
			Transit Bus	2.29E-03
			Motor Home	1.86E-03
		Refuse Truck	4.21E-03	
		Gasoline	Light Commercial Truck	1.39E-03
			Motorcycle	5.73E-04
			Passenger Car	1.15E-03
			Passenger Truck	1.15E-03
			School Bus	2.08E-03
			Single Unit Short-haul Truck	1.69E-03
			Transit Bus	3.37E-03
			Motor Home	1.86E-03
			Refuse Truck	1.58E-03
Light Commercial Truck	1.17E-03			
Compressed Natural Gas (CNG)	Transit Bus	2.29E-03		
	Ethanol (E-85)	Passenger Car	1.15E-03	
Rural Unrestricted Access	2038	Diesel Fuel	Passenger Truck	1.15E-03
			Light Commercial Truck	1.15E-03
			Combination Long-haul Truck	4.88E-03
			Combination Short-haul Truck	4.36E-03
			Intercity Bus	4.03E-03
			Passenger Car	1.34E-03
			Passenger Truck	1.68E-03
			School Bus	2.44E-03
			Single Unit Long-haul Truck	2.88E-03
			Single Unit Short-haul Truck	2.56E-03
		Transit Bus	2.68E-03	
		Motor Home	2.18E-03	
		Refuse Truck	4.92E-03	
		Gasoline	Light Commercial Truck	1.62E-03
			Motorcycle	6.71E-04
			Passenger Car	1.34E-03
			Passenger Truck	1.35E-03
			School Bus	2.44E-03
			Single Unit Short-haul Truck	1.98E-03

		Transit Bus	3.94E-03
		Motor Home	2.18E-03
		Refuse Truck	1.85E-03
		Light Commercial Truck	1.37E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.68E-03
	Ethanol (E-85)	Passenger Car	1.34E-03
		Passenger Truck	1.34E-03
		Light Commercial Truck	1.34E-03
Urban Restricted Access	2038 Diesel Fuel	Combination Long-haul Truck	4.70E-03
		Combination Short-haul Truck	4.20E-03
		Intercity Bus	3.71E-03
		Passenger Car	1.24E-03
		Passenger Truck	1.55E-03
		School Bus	2.25E-03
		Single Unit Long-haul Truck	2.65E-03
		Single Unit Short-haul Truck	2.37E-03
		Transit Bus	2.47E-03
		Motor Home	2.01E-03
		Refuse Truck	4.54E-03
		Light Commercial Truck	1.50E-03
	Gasoline	Motorcycle	6.19E-04
		Passenger Car	1.24E-03
		Passenger Truck	1.25E-03
		School Bus	2.25E-03
		Single Unit Short-haul Truck	1.82E-03
		Transit Bus	3.64E-03
		Motor Home	2.01E-03
		Refuse Truck	1.71E-03
		Light Commercial Truck	1.27E-03
	Compressed Natural Gas (CNG)	Transit Bus	2.47E-03
	Ethanol (E-85)	Passenger Car	1.24E-03
		Passenger Truck	1.24E-03
		Light Commercial Truck	1.24E-03
Urban Unrestricted Access	2038 Diesel Fuel	Combination Long-haul Truck	5.58E-03
		Combination Short-haul Truck	4.98E-03
		Intercity Bus	4.60E-03
		Passenger Car	1.53E-03
		Passenger Truck	1.92E-03
		School Bus	2.79E-03
		Single Unit Long-haul Truck	3.29E-03
		Single Unit Short-haul Truck	2.93E-03
		Transit Bus	3.07E-03
		Motor Home	2.49E-03
		Refuse Truck	5.63E-03
		Light Commercial Truck	1.86E-03

Gasoline	Motorcycle	7.67E-04
	Passenger Car	1.53E-03
	Passenger Truck	1.54E-03
	School Bus	2.79E-03
	Single Unit Short-haul Truck	2.26E-03
	Transit Bus	4.51E-03
	Motor Home	2.49E-03
	Refuse Truck	2.12E-03
	Light Commercial Truck	1.57E-03
Compressed Natural Gas (CNG)	Transit Bus	3.07E-03
Ethanol (E-85)	Passenger Car	1.53E-03
	Passenger Truck	1.53E-03
	Light Commercial Truck	1.53E-03

## RateUnit

PM2.5 g/mi	Brakewear g/mi	PM10 g/mi	Tirewear g/mi	PM10 g/mi	Brakewear g/mi	PM10 g/mi	Total Exh g/mi	VOC g/mi	SO2 g/mi	NOx g/mi	
1.19E-02			2.93E-02			9.53E-02	2.82E-02		6.16E-02	1.35E-02	1.29E+00
1.08E-02			2.61E-02			8.64E-02	2.49E-02		6.01E-02	1.32E-02	1.24E+00
9.98E-03			2.29E-02			7.98E-02	2.49E-02		6.08E-02	1.36E-02	1.22E+00
1.54E-03			7.64E-03			1.24E-02	2.46E-03		5.55E-03	1.51E-03	2.96E-02
2.32E-03			9.59E-03			1.86E-02	7.82E-03		2.32E-02	4.13E-03	1.91E-01
7.47E-03			1.39E-02			5.97E-02	1.39E-02		5.37E-02	8.84E-03	9.61E-01
7.90E-03			1.64E-02			6.32E-02	1.36E-02		4.70E-02	7.36E-03	6.31E-01
6.82E-03			1.46E-02			5.46E-02	1.34E-02		4.65E-02	7.83E-03	6.46E-01
6.42E-03			1.53E-02			5.13E-02	2.41E-02		5.86E-02	1.23E-02	1.29E+00
5.48E-03			1.24E-02			4.38E-02	1.35E-02		5.32E-02	8.68E-03	7.84E-01
1.10E-02			2.80E-02			8.80E-02	2.81E-02		5.95E-02	1.38E-02	1.29E+00
2.42E-03			9.25E-03			1.94E-02	6.89E-03		2.03E-02	3.67E-03	1.61E-01
1.24E-04			3.82E-03			9.92E-04	3.22E-02		4.78E-01	2.59E-03	8.05E-01
1.54E-03			7.64E-03			1.24E-02	2.28E-03		6.88E-03	1.18E-03	3.24E-02
2.45E-03			7.70E-03			1.96E-02	3.73E-03		1.05E-02	1.64E-03	5.12E-02
7.45E-03			1.39E-02			5.96E-02	3.06E-02		1.86E-01	6.83E-03	5.32E-01
4.86E-03			1.13E-02			3.89E-02	2.27E-02		9.54E-02	6.26E-03	3.33E-01
1.00E-02			2.25E-02			8.02E-02	3.54E-02		2.35E-01	9.21E-03	6.68E-01
5.48E-03			1.24E-02			4.38E-02	3.19E-02		1.64E-01	6.74E-03	4.26E-01
2.54E-03			1.05E-02			2.03E-02	3.51E-02		1.62E-01	1.00E-02	1.55E-01
2.52E-03			7.82E-03			2.02E-02	3.69E-03		1.03E-02	1.64E-03	5.23E-02
6.42E-03			1.53E-02			5.13E-02	3.40E-03		1.03E-01	7.26E-03	1.62E+00
1.54E-03			7.64E-03			1.24E-02	1.43E-03		8.64E-03	1.35E-03	2.79E-02
2.46E-03			7.64E-03			1.96E-02	2.25E-03		1.27E-02	1.84E-03	4.15E-02
2.54E-03			7.64E-03			2.03E-02	2.06E-03		1.19E-02	1.78E-03	3.78E-02
1.67E-02			3.26E-02			1.33E-01	3.04E-02		6.80E-02	1.35E-02	1.33E+00
1.51E-02			2.91E-02			1.21E-01	2.67E-02		6.63E-02	1.32E-02	1.27E+00
1.51E-02			2.68E-02			1.21E-01	2.68E-02		6.80E-02	1.30E-02	1.22E+00
2.50E-03			8.94E-03			2.00E-02	1.99E-03		4.41E-03	1.49E-03	1.84E-02
3.97E-03			1.12E-02			3.17E-02	7.88E-03		2.52E-02	4.12E-03	1.98E-01
1.00E-02			1.63E-02			8.03E-02	1.31E-02		4.92E-02	6.63E-03	7.67E-01
1.13E-02			1.92E-02			9.01E-02	1.41E-02		5.42E-02	6.89E-03	6.34E-01
9.77E-03			1.71E-02			7.82E-02	1.42E-02		5.39E-02	7.37E-03	6.48E-01
9.18E-03			1.79E-02			7.34E-02	2.19E-02		5.32E-02	9.48E-03	1.06E+00
7.97E-03			1.45E-02			6.37E-02	1.42E-02		5.97E-02	7.59E-03	7.43E-01
1.66E-02			3.28E-02			1.33E-01	2.96E-02		6.62E-02	1.32E-02	1.28E+00
4.02E-03			1.08E-02			3.22E-02	6.94E-03		2.18E-02	3.70E-03	1.66E-01
2.17E-04			4.47E-03			1.74E-03	2.22E-02		5.02E-01	2.43E-03	7.54E-01
2.50E-03			8.94E-03			2.00E-02	1.85E-03		5.54E-03	1.17E-03	2.01E-02
4.14E-03			9.01E-03			3.31E-02	2.75E-03		8.01E-03	1.59E-03	3.20E-02
1.00E-02			1.63E-02			8.01E-02	9.89E-03		1.67E-01	5.09E-03	3.78E-01
6.86E-03			1.32E-02			5.49E-02	7.93E-03		9.17E-02	5.76E-03	3.02E-01

1.42E-02	2.63E-02	1.14E-01	2.01E-02	2.33E-01	7.34E-03	5.17E-01
7.97E-03	1.45E-02	6.37E-02	1.02E-02	1.49E-01	5.86E-03	3.77E-01
3.81E-03	1.23E-02	3.05E-02	2.19E-02	1.60E-01	9.68E-03	1.33E-01
4.16E-03	9.15E-03	3.32E-02	2.93E-03	8.18E-03	1.63E-03	3.48E-02
9.18E-03	1.79E-02	7.34E-02	2.25E-03	1.21E-01	5.79E-03	1.26E+00
2.50E-03	8.94E-03	2.00E-02	1.16E-03	7.26E-03	1.33E-03	1.73E-02
4.15E-03	8.94E-03	3.32E-02	1.66E-03	1.01E-02	1.79E-03	2.54E-02
4.17E-03	8.94E-03	3.34E-02	1.63E-03	9.81E-03	1.77E-03	2.41E-02
1.53E-02	3.13E-02	1.22E-01	2.99E-02	6.55E-02	1.35E-02	1.31E+00
1.38E-02	2.80E-02	1.11E-01	2.63E-02	6.39E-02	1.32E-02	1.26E+00
1.26E-02	2.48E-02	1.01E-01	2.61E-02	6.43E-02	1.34E-02	1.22E+00
1.98E-03	8.25E-03	1.58E-02	2.40E-03	5.14E-03	1.52E-03	2.44E-02
2.99E-03	1.04E-02	2.39E-02	8.05E-03	2.44E-02	4.13E-03	1.94E-01
9.21E-03	1.50E-02	7.37E-02	1.46E-02	5.76E-02	8.73E-03	9.68E-01
9.55E-03	1.77E-02	7.64E-02	1.45E-02	5.11E-02	7.62E-03	6.61E-01
8.28E-03	1.58E-02	6.62E-02	1.43E-02	5.05E-02	8.03E-03	6.70E-01
8.10E-03	1.65E-02	6.48E-02	2.51E-02	6.20E-02	1.21E-02	1.29E+00
6.71E-03	1.34E-02	5.37E-02	1.42E-02	5.71E-02	8.59E-03	7.91E-01
1.40E-02	3.03E-02	1.12E-01	2.95E-02	6.30E-02	1.37E-02	1.29E+00
3.10E-03	9.99E-03	2.48E-02	7.05E-03	2.11E-02	3.67E-03	1.62E-01
1.61E-04	4.13E-03	1.29E-03	3.29E-02	4.96E-01	2.54E-03	7.95E-01
1.98E-03	8.25E-03	1.58E-02	2.23E-03	6.39E-03	1.18E-03	2.68E-02
3.16E-03	8.31E-03	2.53E-02	3.68E-03	9.62E-03	1.63E-03	4.28E-02
9.19E-03	1.50E-02	7.35E-02	2.84E-02	1.99E-01	6.87E-03	5.38E-01
5.84E-03	1.22E-02	4.67E-02	2.25E-02	1.04E-01	6.45E-03	3.41E-01
1.26E-02	2.42E-02	1.01E-01	3.37E-02	2.49E-01	9.19E-03	6.70E-01
6.71E-03	1.34E-02	5.37E-02	3.13E-02	1.75E-01	6.78E-03	4.31E-01
3.20E-03	1.14E-02	2.56E-02	3.45E-02	1.67E-01	1.01E-02	1.50E-01
3.24E-03	8.44E-03	2.59E-02	3.59E-03	9.34E-03	1.64E-03	4.35E-02
8.10E-03	1.65E-02	6.48E-02	3.35E-03	1.15E-01	7.24E-03	1.63E+00
1.98E-03	8.25E-03	1.58E-02	1.40E-03	8.15E-03	1.35E-03	2.30E-02
3.16E-03	8.25E-03	2.53E-02	2.22E-03	1.17E-02	1.82E-03	3.45E-02
3.25E-03	8.25E-03	2.60E-02	2.00E-03	1.09E-02	1.77E-03	3.11E-02
2.90E-02	3.72E-02	2.32E-01	3.71E-02	8.28E-02	1.48E-02	1.50E+00
2.61E-02	3.32E-02	2.09E-01	3.23E-02	8.09E-02	1.43E-02	1.43E+00
2.54E-02	3.07E-02	2.03E-01	3.23E-02	8.20E-02	1.41E-02	1.36E+00
4.06E-03	1.02E-02	3.25E-02	2.10E-03	4.41E-03	1.63E-03	1.44E-02
6.42E-03	1.28E-02	5.14E-02	8.95E-03	2.99E-02	4.43E-03	2.28E-01
1.46E-02	1.86E-02	1.17E-01	1.45E-02	5.66E-02	6.94E-03	8.10E-01
1.79E-02	2.19E-02	1.43E-01	1.67E-02	6.80E-02	8.29E-03	7.68E-01
1.55E-02	1.95E-02	1.24E-01	1.67E-02	6.76E-02	8.77E-03	7.75E-01
1.43E-02	2.04E-02	1.15E-01	2.47E-02	5.99E-02	9.21E-03	1.09E+00
1.24E-02	1.66E-02	9.90E-02	1.62E-02	7.43E-02	8.81E-03	8.67E-01
2.76E-02	3.75E-02	2.21E-01	3.60E-02	7.95E-02	1.43E-02	1.43E+00
6.52E-03	1.24E-02	5.21E-02	7.83E-03	2.56E-02	3.99E-03	1.91E-01

3.57E-04	5.11E-03	2.86E-03	2.16E-02	5.70E-01	2.37E-03	6.68E-01
4.06E-03	1.02E-02	3.25E-02	1.94E-03	5.58E-03	1.27E-03	1.57E-02
6.75E-03	1.03E-02	5.40E-02	2.76E-03	7.84E-03	1.71E-03	2.57E-02
1.46E-02	1.86E-02	1.17E-01	7.68E-03	2.07E-01	5.17E-03	3.39E-01
1.06E-02	1.51E-02	8.45E-02	7.14E-03	1.23E-01	6.53E-03	3.13E-01
2.21E-02	3.00E-02	1.77E-01	1.86E-02	2.87E-01	7.38E-03	4.90E-01
1.24E-02	1.66E-02	9.90E-02	8.75E-03	1.93E-01	6.51E-03	3.86E-01
6.06E-03	1.41E-02	4.85E-02	2.23E-02	1.90E-01	1.07E-02	1.38E-01
6.76E-03	1.05E-02	5.41E-02	2.92E-03	8.05E-03	1.75E-03	2.84E-02
1.43E-02	2.04E-02	1.15E-01	2.15E-03	1.68E-01	5.82E-03	1.19E+00
4.06E-03	1.02E-02	3.25E-02	1.22E-03	7.44E-03	1.45E-03	1.35E-02
6.76E-03	1.02E-02	5.41E-02	1.66E-03	1.01E-02	1.92E-03	2.03E-02
6.79E-03	1.02E-02	5.44E-02	1.63E-03	9.85E-03	1.90E-03	1.93E-02

CO g/mi	Methane (CH4) g/mi	N2O g/mi	Benzene g/mi	Formaldehyde g/mi	CO2 Equivalent g/mi	PM2.5 g/mi	Total Exh	NOx
3.03E-01	3.96E-02	1.72E-03	4.74E-04	7.98E-03	1.57E+03	2.59E-02	1.29E+00	
3.03E-01	3.95E-02	1.72E-03	4.73E-04	7.97E-03	1.54E+03	2.29E-02	1.24E+00	
2.95E-01	3.85E-02	1.63E-03	4.61E-04	7.76E-03	1.58E+03	2.29E-02	1.22E+00	
9.21E-01	4.47E-03	3.32E-04	5.36E-05	9.03E-04	1.76E+02	2.26E-03	2.96E-02	
5.48E-01	2.09E-02	1.26E-03	2.50E-04	4.22E-03	4.82E+02	7.19E-03	1.91E-01	
2.91E-01	4.03E-02	1.63E-03	4.82E-04	8.13E-03	1.03E+03	1.28E-02	9.61E-01	
2.69E-01	3.91E-02	1.63E-03	4.68E-04	7.89E-03	8.57E+02	1.26E-02	6.31E-01	
2.74E-01	3.91E-02	1.63E-03	4.68E-04	7.89E-03	9.12E+02	1.24E-02	6.46E-01	
2.95E-01	3.85E-02	1.63E-03	4.61E-04	7.77E-03	1.44E+03	2.22E-02	1.29E+00	
2.88E-01	4.01E-02	1.63E-03	4.80E-04	8.08E-03	1.01E+03	1.25E-02	7.84E-01	
2.89E-01	3.74E-02	1.63E-03	4.47E-04	7.53E-03	1.61E+03	2.59E-02	1.29E+00	
6.10E-01	1.82E-02	1.13E-03	2.18E-04	3.67E-03	4.27E+02	6.34E-03	1.61E-01	
1.11E+01	2.46E-02	1.68E-03	2.08E-02	7.57E-03	3.88E+02	2.85E-02	8.05E-01	
9.11E-01	1.23E-03	7.86E-04	2.32E-04	8.29E-05	1.77E+02	2.02E-03	3.24E-02	
1.24E+00	1.57E-03	8.97E-04	3.69E-04	1.32E-04	2.45E+02	3.30E-03	5.12E-02	
3.99E+00	1.47E-03	2.77E-03	4.90E-03	1.70E-03	1.02E+03	2.71E-02	5.32E-01	
2.33E+00	9.98E-04	2.66E-03	2.75E-03	9.63E-04	9.38E+02	2.01E-02	3.33E-01	
4.74E+00	1.91E-03	2.70E-03	5.87E-03	2.02E-03	1.38E+03	3.13E-02	6.68E-01	
3.22E+00	1.19E-03	2.70E-03	3.92E-03	1.35E-03	1.01E+03	2.82E-02	4.26E-01	
1.27E+00	6.43E-04	2.66E-03	2.09E-03	6.28E-04	1.50E+03	3.10E-02	1.55E-01	
1.16E+00	1.54E-03	9.70E-04	3.56E-04	1.27E-04	2.47E+02	3.26E-03	5.23E-02	
6.19E+00	2.13E+00	3.31E-02	2.60E-04	1.67E-02	1.43E+03	3.01E-03	1.62E+00	
6.97E-01	2.08E-03	7.86E-04	1.50E-04	1.65E-04	1.75E+02	1.26E-03	2.79E-02	
9.35E-01	2.79E-03	8.61E-04	2.27E-04	2.55E-04	2.39E+02	1.99E-03	4.15E-02	
8.39E-01	2.55E-03	8.61E-04	2.09E-04	2.33E-04	2.32E+02	1.82E-03	3.78E-02	
3.40E-01	4.63E-02	2.05E-03	5.54E-04	9.34E-03	1.58E+03	2.80E-02	1.33E+00	
3.39E-01	4.63E-02	2.05E-03	5.54E-04	9.33E-03	1.53E+03	2.46E-02	1.27E+00	
3.44E-01	4.73E-02	2.05E-03	5.66E-04	9.53E-03	1.52E+03	2.47E-02	1.22E+00	
5.76E-01	3.26E-03	4.18E-04	3.90E-05	6.58E-04	1.74E+02	1.83E-03	1.84E-02	
4.14E-01	2.30E-02	1.58E-03	2.75E-04	4.64E-03	4.80E+02	7.25E-03	1.98E-01	
2.55E-01	3.97E-02	2.05E-03	4.76E-04	8.02E-03	7.73E+02	1.20E-02	7.67E-01	
3.09E-01	4.76E-02	2.05E-03	5.70E-04	9.61E-03	8.03E+02	1.30E-02	6.34E-01	
3.14E-01	4.77E-02	2.05E-03	5.71E-04	9.63E-03	8.58E+02	1.31E-02	6.48E-01	
2.63E-01	3.84E-02	2.05E-03	4.60E-04	7.75E-03	1.10E+03	2.01E-02	1.06E+00	
3.27E-01	4.92E-02	2.05E-03	5.89E-04	9.92E-03	8.84E+02	1.30E-02	7.43E-01	
3.37E-01	4.58E-02	2.05E-03	5.48E-04	9.24E-03	1.53E+03	2.73E-02	1.28E+00	
4.59E-01	1.98E-02	1.42E-03	2.37E-04	3.99E-03	4.31E+02	6.39E-03	1.66E-01	
1.07E+01	2.61E-02	2.12E-03	2.20E-02	8.02E-03	3.65E+02	1.97E-02	7.54E-01	
7.70E-01	8.94E-04	9.88E-04	1.71E-04	6.04E-05	1.75E+02	1.63E-03	2.01E-02	
7.69E-01	1.08E-03	1.13E-03	2.54E-04	9.00E-05	2.39E+02	2.44E-03	3.20E-02	
3.00E+00	1.48E-03	3.48E-03	4.95E-03	1.74E-03	7.63E+02	8.74E-03	3.78E-01	
2.26E+00	9.72E-04	3.34E-03	2.71E-03	9.53E-04	8.64E+02	7.02E-03	3.02E-01	

3.90E+00	2.21E-03	3.39E-03	6.80E-03	2.39E-03	1.10E+03	1.78E-02	5.17E-01
3.09E+00	1.11E-03	3.39E-03	3.72E-03	1.28E-03	8.78E+02	9.02E-03	3.77E-01
1.25E+00	6.84E-04	3.34E-03	2.19E-03	6.70E-04	1.45E+03	1.94E-02	1.33E-01
7.83E-01	1.12E-03	1.22E-03	2.59E-04	9.19E-05	2.44E+02	2.59E-03	3.48E-02
5.08E+00	2.51E+00	4.17E-02	3.07E-04	1.97E-02	1.17E+03	1.99E-03	1.26E+00
4.36E-01	1.51E-03	9.88E-04	1.14E-04	1.20E-04	1.73E+02	1.02E-03	1.73E-02
5.72E-01	1.92E-03	1.08E-03	1.63E-04	1.73E-04	2.33E+02	1.47E-03	2.54E-02
5.46E-01	1.84E-03	1.08E-03	1.56E-04	1.66E-04	2.30E+02	1.44E-03	2.41E-02
3.24E-01	4.37E-02	1.92E-03	5.23E-04	8.81E-03	1.57E+03	2.75E-02	1.31E+00
3.24E-01	4.36E-02	1.92E-03	5.22E-04	8.80E-03	1.54E+03	2.42E-02	1.26E+00
3.17E-01	4.26E-02	1.83E-03	5.10E-04	8.59E-03	1.56E+03	2.40E-02	1.22E+00
8.50E-01	4.02E-03	3.71E-04	4.82E-05	8.12E-04	1.76E+02	2.21E-03	2.44E-02
5.21E-01	2.22E-02	1.41E-03	2.65E-04	4.47E-03	4.81E+02	7.40E-03	1.94E-01
3.10E-01	4.46E-02	1.83E-03	5.34E-04	9.00E-03	1.02E+03	1.34E-02	9.68E-01
2.89E-01	4.31E-02	1.83E-03	5.16E-04	8.69E-03	8.87E+02	1.33E-02	6.61E-01
2.93E-01	4.31E-02	1.83E-03	5.16E-04	8.70E-03	9.35E+02	1.31E-02	6.70E-01
3.16E-01	4.27E-02	1.83E-03	5.11E-04	8.61E-03	1.41E+03	2.31E-02	1.29E+00
3.06E-01	4.44E-02	1.83E-03	5.31E-04	8.95E-03	1.00E+03	1.30E-02	7.91E-01
3.12E-01	4.14E-02	1.83E-03	4.96E-04	8.36E-03	1.59E+03	2.71E-02	1.29E+00
5.66E-01	1.91E-02	1.26E-03	2.29E-04	3.86E-03	4.28E+02	6.48E-03	1.62E-01
1.11E+01	2.56E-02	1.88E-03	2.16E-02	7.88E-03	3.82E+02	2.91E-02	7.95E-01
8.40E-01	1.10E-03	8.79E-04	2.09E-04	7.45E-05	1.77E+02	1.97E-03	2.68E-02
1.13E+00	1.39E-03	1.00E-03	3.27E-04	1.17E-04	2.44E+02	3.26E-03	4.28E-02
4.22E+00	1.64E-03	3.10E-03	5.48E-03	1.91E-03	1.03E+03	2.52E-02	5.38E-01
2.48E+00	1.13E-03	2.97E-03	3.12E-03	1.10E-03	9.67E+02	1.99E-02	3.41E-01
5.00E+00	2.14E-03	3.01E-03	6.55E-03	2.27E-03	1.38E+03	2.98E-02	6.70E-01
3.41E+00	1.33E-03	3.02E-03	4.40E-03	1.52E-03	1.02E+03	2.77E-02	4.31E-01
1.33E+00	7.10E-04	2.97E-03	2.27E-03	6.96E-04	1.51E+03	3.06E-02	1.50E-01
1.04E+00	1.35E-03	1.08E-03	3.12E-04	1.11E-04	2.45E+02	3.17E-03	4.35E-02
6.51E+00	2.39E+00	3.70E-02	2.92E-04	1.87E-02	1.44E+03	2.97E-03	1.63E+00
6.42E-01	1.87E-03	8.79E-04	1.37E-04	1.48E-04	1.76E+02	1.23E-03	2.30E-02
8.47E-01	2.47E-03	9.63E-04	2.04E-04	2.25E-04	2.37E+02	1.96E-03	3.45E-02
7.48E-01	2.23E-03	9.63E-04	1.86E-04	2.03E-04	2.31E+02	1.77E-03	3.11E-02
3.99E-01	5.98E-02	2.77E-03	7.16E-04	1.21E-02	1.72E+03	3.41E-02	1.50E+00
3.99E-01	5.98E-02	2.77E-03	7.16E-04	1.21E-02	1.67E+03	2.97E-02	1.43E+00
4.01E-01	6.04E-02	2.77E-03	7.23E-04	1.22E-02	1.64E+03	2.97E-02	1.36E+00
5.82E-01	3.13E-03	5.63E-04	3.75E-05	6.32E-04	1.90E+02	1.93E-03	1.44E-02
4.50E-01	2.78E-02	2.13E-03	3.32E-04	5.60E-03	5.16E+02	8.24E-03	2.28E-01
2.69E-01	4.72E-02	2.77E-03	5.65E-04	9.51E-03	8.09E+02	1.33E-02	8.10E-01
3.61E-01	6.03E-02	2.77E-03	7.22E-04	1.22E-02	9.66E+02	1.54E-02	7.68E-01
3.67E-01	6.06E-02	2.77E-03	7.25E-04	1.22E-02	1.02E+03	1.54E-02	7.75E-01
2.78E-01	4.62E-02	2.77E-03	5.53E-04	9.32E-03	1.07E+03	2.28E-02	1.09E+00
3.81E-01	6.25E-02	2.77E-03	7.48E-04	1.26E-02	1.03E+03	1.49E-02	8.67E-01
3.92E-01	5.80E-02	2.77E-03	6.94E-04	1.17E-02	1.66E+03	3.31E-02	1.43E+00
4.90E-01	2.36E-02	1.91E-03	2.83E-04	4.77E-03	4.65E+02	7.20E-03	1.91E-01

1.04E+01	2.99E-02	2.85E-03	2.52E-02	9.18E-03	3.57E+02	1.91E-02	6.68E-01
5.75E-01	8.58E-04	1.33E-03	1.65E-04	5.80E-05	1.91E+02	1.72E-03	1.57E-02
7.53E-01	1.02E-03	1.52E-03	2.38E-04	8.39E-05	2.57E+02	2.44E-03	2.57E-02
3.09E+00	2.04E-03	4.69E-03	6.80E-03	2.42E-03	7.75E+02	6.80E-03	3.39E-01
2.68E+00	1.43E-03	4.50E-03	3.98E-03	1.41E-03	9.79E+02	6.31E-03	3.13E-01
4.14E+00	3.03E-03	4.57E-03	9.30E-03	3.31E-03	1.11E+03	1.65E-02	4.90E-01
3.63E+00	1.62E-03	4.58E-03	5.39E-03	1.89E-03	9.76E+02	7.74E-03	3.86E-01
1.51E+00	9.68E-04	4.50E-03	3.01E-03	9.59E-04	1.60E+03	1.97E-02	1.38E-01
7.76E-01	1.06E-03	1.65E-03	2.44E-04	8.62E-05	2.63E+02	2.58E-03	2.84E-02
5.39E+00	3.48E+00	5.62E-02	4.25E-04	2.72E-02	1.20E+03	1.90E-03	1.19E+00
4.40E-01	1.45E-03	1.33E-03	1.12E-04	1.15E-04	1.89E+02	1.08E-03	1.35E-02
5.59E-01	1.80E-03	1.46E-03	1.55E-04	1.61E-04	2.50E+02	1.47E-03	2.03E-02
5.41E-01	1.73E-03	1.46E-03	1.50E-04	1.55E-04	2.47E+02	1.44E-03	1.93E-02
						2.43E-02	0.00E+00
						1.72E-02	0.00E+00
						9.30E-02	0.00E+00
						4.92E-03	0.00E+00
						2.41E-02	0.00E+00
						2.00E-03	0.00E+00
						2.27E-03	0.00E+00
						2.22E-03	0.00E+00

**MBTL EIS -- GRADE CROSSING EMISSIONS INVENTORY -- SUMMARY OF EXHAUST EMISSIONS BY GRADE CROSSING (TONS/YEAR)**

Pollutants (tons/year)	2018		2028		2038	
	No Action	Incremental Increase	No Action	Incremental Increase	No Action	Incremental Increase
<b>Criteria Pollutants</b>						
CO	3.28E-02	4.70E-02	3.60E-02	9.37E-01	1.30E-02	2.78E-01
NOx	5.19E-03	7.43E-03	3.62E-03	9.42E-02	1.29E-03	2.74E-02
PM10	6.31E-04	9.03E-04	1.02E-03	2.64E-02	5.17E-04	1.10E-02
PM2.5	2.33E-04	3.34E-04	2.44E-04	6.33E-03	1.07E-04	2.28E-03
SO2	3.19E-05	4.56E-05	5.03E-05	1.31E-03	2.40E-05	5.12E-04
VOC	1.04E-03	1.49E-03	8.72E-04	2.27E-02	3.51E-04	7.48E-03
<b>Hazardous Pollutants</b>						
Acetaldehyde	7.20E-05	1.03E-04	6.05E-05	1.57E-03	2.44E-05	5.19E-04
Acrolein	1.04E-05	1.49E-05	8.72E-06	2.27E-04	3.51E-06	7.48E-05
Benzene	1.34E-05	1.92E-05	1.13E-05	2.93E-04	4.53E-06	9.66E-05
1,3-Butadiene	8.31E-07	1.19E-06	6.98E-07	1.81E-05	2.81E-07	5.99E-06
Ethylbenzene	6.51E-06	9.32E-06	5.47E-06	1.42E-04	2.20E-06	4.69E-05
Formaldehyde	2.26E-04	3.23E-04	1.90E-04	4.93E-03	7.64E-05	1.63E-03
n-Hexane	5.62E-06	8.04E-06	4.72E-06	1.23E-04	1.90E-06	4.05E-05
Toluene	3.12E-05	4.46E-05	2.62E-05	6.80E-04	1.05E-05	2.24E-04
Xylene	3.95E-05	5.65E-05	3.32E-05	8.62E-04	1.33E-05	2.84E-04

MTBL EIS grade xing emission calcs\_04132015.xls

**Commuter traffic**

Assume a mean travel time of 24.1 minutes (<http://quickfacts.census.gov/qfd/states/53/53015.html>)

Assumed each worker is a single occupant; Used the on-road average emission rate for 2018 MOVES - 35 mph.

Labor	Number	Time (min) - round trip	Speed (miles/hr)	Days/year	miles/year	miles/day
Phase 1&2 Peak Employees	200	48.2	35	753.0952	4234905	5623.333

**Assume a 50/50 Split between gasoline and E-85**

Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH4	N2O	CO2eq
2018										
<b>Construction Annual</b>				<b>T/year</b>						
Passenger Vehicle - Gas+E-85	5.13E-01	2.16E-01	4.12E-02	1.06E-02	7.38E+00	1.26E-01	1.48E+03	1.57E-02	7.11E-03	1.49E+03
<b>Construction Max Day</b>				<b>lbs/day</b>						
Passenger Vehicle - Gas+E-85	1.36E+00	5.75E-01	1.09E-01	2.82E-02	1.96E+01	3.35E-01	3.94E+03	4.16E-02	1.89E-02	3.94E+03

**Conversion Factors:**

453.59	g/lb
2000	lbs/ton
5280	ft/mile
3.78541	l/gal
24	hrs/day
Global Warming Potentials (GWPs):	CO <sub>2</sub> - 1
	CH <sub>4</sub> - 25
	N <sub>2</sub> O - 298

**Mobile Source - Moves run for Cowlitz County, WY, 2018**

**Emission factors for Commuting Vehicles Exhaust**

Emission Factors for Commuting Vehicles												
Emission Factors (gm/mile)												
Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH <sub>4</sub>	N <sub>2</sub> O	Benzene	Form	CO2eq
2018												
Passenger Gas (at 35mph)	1.61E-01	4.77E-02	1.01E-02	2.14E-03	1.96	3.61E-02	321.38	2.71E-03	1.75E-03	1.19E-03	4.44E-04	321.97
Passenger E-85 (at35 mph)	5.88E-02	4.50E-02	7.59E-03	2.42E-03	1.20	1.80E-02	313.88	4.00E-03	1.30E-03	2.92E-04	3.59E-04	314.37

**Commuter traffic**

Assume a mean travel time of 24.1 minutes (<http://quickfacts.census.gov/qfd/states/53/53015.html>)

Assumed each worker is a single occupant; Used the on-road average emission rate for 2018 MOVES - 35 mph.

Labor	Number	75	Time (min) - round trip	Speed (miles/hr)	Days/year	miles/year	miles/day
Employees: 5 day/week	14		48.2	35	260	102344.67	
Employees: 7 day/week	61		48.2	35	294	504244.3	
Total						606588.97	

**Assume a 50/50 Split between gasoline and E-85 (tons per year)**

Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH4	N2O	CO2eq
2018										
<b>Construction Annual</b>				<b>T/year</b>						
Passenger Vehicle - Gas+E-85	0.073440066	0.030989402	0.005901277	0.0015225	1.0568848	0.0180747	212.38476	0.0022439	0.00101911	212.74455

**Conversion Factors:**

453.59	g/lb
2000	lbs/ton
5280	ft/mile
3.78541	l/gal
24	hrs/day
Global Warming Potentials (GWPs)	CO <sub>2</sub> - 1
	CH <sub>4</sub> - 25
	N <sub>2</sub> O - 298

**Mobile Source - Moves run for Cowlitz County, WY, 2018**

**Emission factors for Commuting Vehicles Exhaust**

Emission Factors for Commuting Vehicles												
Emission Factors (gm/mile)												
Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH <sub>4</sub>	N <sub>2</sub> O	Benzene	Form	CO2eq
2018												
Passenger Gas (at 35mph)	1.61E-01	4.77E-02	1.01E-02	2.14E-03	1.96	3.61E-02	321.38	2.71E-03	1.75E-03	1.19E-03	4.44E-04	321.97
Passenger E-85 (at35 mph)	5.88E-02	4.50E-02	7.59E-03	2.42E-03	1.20	1.80E-02	313.88	4.00E-03	1.30E-03	2.92E-04	3.59E-04	314.37

**Commuter traffic**

Assume a mean travel time of 24.1 minutes (<http://quickfacts.census.gov/qfd/states/53/53015.html>).

Assumed each worker is a single occupant; Used the on-road average emission rate for 2028 MOVES - 35 mph.

Labor	Number	Time (min) - round trip	Speed (miles/hr)	Days/year	miles/year	miles/day
Employees: 5 day/week	25	48.2	35	260	182758.3333	
Employees: 7 day/week	110	48.2	35	294	909293	
<b>Total</b>					<b>1092051.333</b>	

**Assume a 50/50 Split between gasoline and E-85**

Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH4	N2O	CO2eq
<b>2028</b>										
<b>Construction Annual</b>				<b>T/year</b>						
Passenger Vehicle - Gas+E-85	0.037	0.054	0.009	0.002	1.073	0.012	274.24	0.0022	0.0016	274.77

**Conversion Factors:**

453.59	g/lb
2000	lbs/ton
5280	ft/mile
3.78541	l/gal
24	hrs/day
Global Warming Potentials (GWPs)	CO <sub>2</sub> - 1
	CH <sub>4</sub> - 25
	N <sub>2</sub> O - 298

**Mobile Source - Moves run for Cowlitz County, WY, 2028**

**Emission factors for Commuting Vehicles Exhaust**

Emission Factors for Commuting Vehicles												
Emission Factors (gm/mile)												
Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH4	N2O	Benzene	Form	CO2eq
2028												
Passenger Gas (at 35mph)	3.35E-02	4.54E-02	7.98E-03	1.52E-03	1.01	9.15E-03	228.62	1.35E-03	1.33E-03	3.08E-04	1.09E-04	229.05
Passenger E-85 (at35 mph)	2.74E-02	4.44E-02	7.09E-03	1.75E-03	0.77	1.12E-02	227.01	2.29E-03	1.33E-03	1.93E-04	2.14E-04	227.46

**Commuter traffic**

Assume a mean travel time of 24.1 minutes (<http://quickfacts.census.gov/qfd/states/53/53015.html>)

Assumed each worker is a single occupant; Used the on-road average emission rate for 2038 MOVES - 35 mph.

Labor	Number	Time (min) - round trip	Speed (miles/hr)	Days/year	miles/year	miles/day
Employees: 5 day/week	135	48.2	35	260	182758.3	
Employees: 7 day/week	25	48.2	35	294	909293	
<b>Total</b>	110				1092051	

**Assume a 50/50 Split between gasoline and E-85**

Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH4	N2O	CO2eq
<b>2038</b>										
<b>Construction Annual</b>				<b>T/year</b>						
Passenger Vehicle - Gas+E-85	0.0171	0.0406	0.0078	0.0011	0.4673	0.0048	157.8767	0.0006	0.0010	158.2

**Conversion Factors:**

453.59	g/lb
2000	lbs/ton
5280	ft/mile
3.78541	l/gal
24	hrs/day

Global Warming Potentials (GWPs):	CO <sub>2</sub> - 1
	CH <sub>4</sub> - 25
	N <sub>2</sub> O - 298

**Mobile Source - Moves run for Cowlitz County, WY, 2038**

**Emission factors for Commuting Vehicles Exhaust**

Emission Factors for Commuting Vehicles												
Emission Factors (gm/mile)												
Project Year	NOx	PM10	PM2.5	SO2	CO	VOC	CO2	CH <sub>4</sub>	N <sub>2</sub> O	Benzene	Form	CO2eq
2038												
Passenger Gas (at 35mph)	2.84E-02	6.75E-02	1.09E-02	1.75E-03	0.78	8.05E-03	262.30	1.06E-03	1.65E-03	2.44E-04	8.62E-05	262.82
Passenger E-85 (at 35 mph)	0.00E+00	0.00E+00	2.00E-03	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00

Source	Construction Emissions (tpy) [Maximum per Year]								
	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	DPM
<i>COMBUSTION SOURCES</i>									
Equipment (Onsite)	24.6	9.04	2.23	0.95	2.34	1.93	1.93	0.05	2.34
Haul Trucks (Onsite & Offsite)	13.43	2.92	0.585	0.040	0.77	0.63	0.44	0.015	0.77
Passenger Vehicles (Offsite)	0.53	7.46	0.129	0.0107	0.218	0.218	0.042		
Barges (Offsite)	59.04	15.68	1.511	0.028	1.29	1.06	1.06	0.08	1.29
Total Combustion Sources	97.59	35.1	4.46	1.03	4.62	3.84	3.47	0.14	4.40
Total (on-site and off-site)	38.5	19.4	2.9	1.0	3.3	2.8	2.4	0.1	3.1
<i>FUGITIVE SOURCES</i>									
Controlled Fugitive Earthwork	-	-	-	-	12.0	5.87	1.22	-	
Total Fugitive Sources	-	-	-	-	12.0	5.87	1.22	-	
Total - All Construction Sources	97.6	35.1	4.46	1.03	16.6	9.70	4.69	0.14	4.40

Source	Construction Emissions (lb/day) [Maximum daily]								
	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	DPM
<i>COMBUSTION SOURCES</i>									
Equipment (Onsite)	229.6	82.9	20.4	8.67	21.5	17.66	17.66	0.42	21.5
Haul Trucks (Onsite & Offsite)	165.22	38.41	7.93	0.48	12.45	10.24	6.29	0.19	12.45
Passenger Vehicles (Offsite)	1.431	20.033	0.349	0.029		0.583	0.113		
Barges (Offsite)	454.7	120.8	11.6	0.21	9.90	8.14	8.14	0.61	9.9
Total Combustion Sources	850.9	262.1	40.3	9.40	43.8	36.6	32.2	1.22	43.8
Total minus barges	396.22	141.33	28.66	9.18	33.94	28.48	24.07	0.61	33.94
	54.7	14.4	3.1	0.2	6.1	5	2.6	0.1	
	284.26	97.29	23.49	8.87	27.59	22.66	20.26	0.52	21.49
<i>FUGITIVE SOURCES</i>									
Controlled Fugitive Earthwork	-	-	-	-	66.7	32.6	6.8	-	
Total Fugitive Sources	-	-	-	-	66.7	32.6	6.80	-	
Total - All Construction Sources	850.9	262.1	40.3	9.40	110.5	69.2	39.0	1.22	43.8

Facility Only (Material Handling, Maintenance and On-site Equipment) Pollutant Emissions (tpy)

Source	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPs	DPM
<i>FUGITIVE SOURCES</i>									
<b>Coal Transfer (except piles):</b>									
Material Handling	-	-	-	-	5.25	1.84	0.28	-	-
<b>Coal Piles:</b>									
Wind Erosion	-	-	-	-	1.08	0.92	0.14	-	-
Material Handling	-	-	-	-	2.62	0.92	0.14	-	-
<i>MOBILE SOURCES</i>									
<b>Maintenance/Operations Equipment:</b>									
Combustion	4.36	1.42	0.36	0.19	0.38	0.31	0.31	7.15E-03	0.38
<b>Total - onsite</b>	<b>4.36</b>	<b>1.42</b>	<b>0.36</b>	<b>0.19</b>	<b>9.33</b>	<b>3.99</b>	<b>0.87</b>	<b>7.15E-03</b>	<b>0.38</b>

On-Site Ship and Train Pollutant Emissions (tpy)									
Source	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPs	DPM
<b>Trains:</b>									
Combustion (On-site)	11.57	4.00	0.48	1.42E-02	0.30	0.25	0.24	4.26E-02	0.21
Fugitive (On-site)	-	-	-	-	2.10	1.79	0.27	-	-
<b>Ships:</b>									
Combustion (On-site)	23.3	65.9	15.3	4.52	1.27	1.05	1.02	7.58E-02	0.56
<b>Total - transport</b>	<b>34.8</b>	<b>69.9</b>	<b>15.8</b>	<b>4.54</b>	<b>3.68</b>	<b>3.08</b>	<b>1.53</b>	<b>3.75E-02</b>	<b>0.77</b>

Total Pollutant Emissions (tpy)									
Source	NOx	CO	VOC	SO2	TSP	PM10	PM2.5	HAPS	DPM
<i>FUGITIVE SOURCES</i>									
<b>Coal Transfer (except piles):</b>									
Material Handling	-	-	-	-	5.25	1.84	0.28	-	-
<b>Coal Piles:</b>									
Wind Erosion	-	-	-	-	1.08	0.92	0.14	-	-
Material Handling	-	-	-	-	2.62	0.92	0.14	-	-

**MOBILE SOURCES****Maintenance/Operations Equipment:**

Combustion	4.36	1.42	0.36	0.19	0.38	0.31	0.31	7.15E-03	0.38
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**Trains:**

Combustion (Off-site)	17.5	7.6	0.60	2.70E-02	0.45	0.37	0.36	0.08	0.45
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Fugitive (Off-site)	-	-	-	-	0.94	0.80	0.12	-	-
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Combustion (On-site)	11.6	4.00	0.48	1.42E-02	0.30	0.25	0.24	4.26E-02	0.21
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Fugitive (On-site)	-	-	-	-	2.10	1.79	0.27	-	-
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**Ships:**

Combustion (Off-site)	24.8	37.9	14.1	3.04	2.17	1.78	1.64	3.25E-02	0.00
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Combustion (On-site)	23.3	65.9	15.3	4.52	1.27	1.05	1.02	0.08	0.56
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<b>Total - All Sources, Onsite and Offsite</b>	<b>81.5</b>	<b>116.9</b>	<b>30.9</b>	<b>7.79</b>	<b>16.6</b>	<b>10.0</b>	<b>4.53</b>	<b>0.24</b>	<b>1.61</b>
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Appendix O: Volatile Organic Compounds and Hazardous Air Pollutants

**Table O-1.** Principal List of Toxic Air Contaminants<sup>a</sup> Speciation Profiles for Gasoline, Diesel and Distillate Fuel Combustion Sources

Pollutant	CAS Number	Weight Percent						
		TOG Profile No. 2116	TOG Profile No. 504	TOG Profile No. 818	PM <sub>10</sub> Profile No. 112	PM <sub>10</sub> Profile No. 114	PM <sub>10</sub> Profile No. 119	PM <sub>10</sub> Profile No. 400
Acetaldehyde	75070	0.25	—	7.4	—	—	—	—
Acrolein	107208	0.12	—	—	—	—	—	—
Benzene	71432	2.2	2.1	2.0	—	—	—	—
1,3 butadiene	106990	0.48	—	—	—	—	—	—
Formaldehyde	50000	1.4	0.10	15	—	—	—	—
Xylenes	1210	4.3	1.1	1.0	—	—	—	—
Naphthalene	91203	0.04	0.07	0.085	—	—	—	—
n-Hexane	110543	1.4	1.6	0.16	—	—	—	—
Propylene	115071	2.7	4.6	2.6	—	—	—	—
Toluene	108883	5.1	2.2	1.5	—	—	—	—
Arsenic	7440382	—	—	—	0.54	0.54	—	—
Cadmium	7440439	—	—	—	0.05	0.05	—	—
Lead	7439921	—	—	—	0.55	0.55	—	0.003
Manganese	7439965	—	—	—	—	—	—	0.05
Mercury	7439976	—	—	—	—	—	—	—
Nickel	7440020	—	—	—	0.05	0.05	—	0.05
Styrene	100425	0.11	—	—	—	—	—	—
Sulfates	9960	—	—	—	25	25	15	45
Vanadium	7440622	—	—	—	—	—	0.55	—
Hexavalent Chromium	18540299	—	—	—	0.027	0.027	—	0.0025
Zinc	7440666	—	—	—	0.55	0.55	—	0.05
Applicable Emission Sources:		Motor Vehicles - gasoline	Ship main engines - residual or distillate oil	Ship aux. engines, tugboats, construction equipment - diesel fuel	Ship main engines - distillate oil	Ship aux. engines - diesel fuel	Tugboats - engine, construction equipment - diesel fuel	Motor Vehicles - vehicles - gasoline

Notes:

## Appendix O: Volatile Organic Compounds and Hazardous Air Pollutants

<sup>a</sup> Toxic air contaminants cumulatively contributing less than 0.1 percent to the total cancer risk, chronic hazard index, or acute hazard index are not included.

TOG – total organic gas; CAS – Chemical Abstract Service

VOC is equal to TOG + methane + ethane

Source: CARB (2015), speciation profiles for organic gases and particulate matter.

Available for download at: <http://www.arb.ca.gov/ei/speciate/speciate.htm#specprof>

### List of Hazardous Air Pollutants

#### NAME

1,1,2,2-Tetrachloroethane  
1,1,2-Trichloroethane  
1,1-Dimethylhydrazine  
  
1,2,4-Trichlorobenzene  
  
1,2-Dibromo-3-chloropropane  
  
1,2-Diphenylhydrazine  
1,2-Epoxybutane  
1,2-Propylenimine (2-Methyl aziridine)  
1,3-Butadiene  
1,3-Dichloropropene  
1,3-Propane sultone  
1,4-Dichlorobenzene  
1,4-Dioxane (1,4-Diethyleneoxide)  
2,2,4-Trimethylpentane - Original HAP list  
has incorrect CAS# 580841  
2,4,5-Trichlorophenol  
2,4,6-Trichlorophenol  
2,4-D, salts and esters  
  
2,4-Dinitrophenol  
  
2,4-Dinitrotoluene  
2,4-Toluene diisocyanate  
2-Acetylaminofluorene  
2-Chloroacetophenone  
2-Nitropropane  
3,3'-Dichlorobenzidine  
3,3'-Dimethoxybenzidine  
3,3-Dimethylbenzidine  
4,4'-Methylene bis(2-chloroaniline)  
4,4'-Methylenedianiline  
4,6-Dinitro-o-cresol, and salts  
4-Aminobiphenyl  
4-Dimethylaminoazobenzene (Dimethyl  
aminoazobenzene)  
4-Nitrobiphenyl  
4-Nitrophenol

## Appendix O: Volatile Organic Compounds and Hazardous Air Pollutants

Acetaldehyde  
Acetamide  
Acetonitrile  
Acetophenone  
Acrolein  
Acrylamide  
Acrylic acid  
Acrylonitrile  
Allyl chloride  
Aniline  
Antimony compounds  
Arsenic compounds (inorganic including arsine)  
Asbestos  
Benzene (including benzene from gasoline)  
Benzidine  
Benzotrichloride  
Benzyl chloride  
Beryllium compounds  
beta-Propiolactone  
Biphenyl  
bis(2-Ethylhexyl)phthalate (DEHP)  
  
bis(Chloromethyl)ether  
  
Bromoform  
Cadmium compounds  
Calcium cyanamide  
Captan  
Carbaryl  
Carbon disulfide  
Carbon tetrachloride  
Carbonyl sulfide  
Catechol  
Chloramben  
Chlordane  
Chlorine  
Chloroacetic acid  
Chlorobenzene  
Chlorobenzilate  
Chloroform  
Chloromethyl methyl ether  
Chloroprene  
Chromium compounds  
Cobalt compounds  
Coke oven emissions  
Cresols/cresylic acid (isomers and mixture)  
Cumene  
Cyanide compounds  
DDE (p,p'-DDE) - CAS# 3547044 in original list  
Diazomethane

## Appendix O: Volatile Organic Compounds and Hazardous Air Pollutants

Dibenzofuran  
Dibutyl phthalate  
Dichloroethyl ether (bis(2-Chloroethyl)ether)  
Dichlorvos  
Diethanolamine  
Diethyl sulfate  
Dimethyl formamide  
Dimethyl phthalate  
Dimethyl sulfate  
Dimethylcarbamoyl chloride  
Epichlorohydrin (1-Chloro-2,3-epoxypropane)  
Ethyl acrylate  
Ethyl carbamate (Urethane)  
Ethyl chloride (Chloroethane)  
Ethylbenzene  
  
Ethylene dibromide (Dibromoethane)  
  
Ethylene dichloride (1,2-Dichloroethane)  
Ethylene glycol  
Ethylene imine (Aziridine)  
Ethylene oxide  
Ethylene thiourea  
Ethylidene dichloride (1,1-Dichloroethane)  
Fine mineral fibers  
Formaldehyde  
Glycol ethers - Note the glycol ether ethylene glycol monobutyl ether (EGBE or butyl cellosolve solvent, CAS # 111762), was delisted 11/29/04)  
Heptachlor  
Hexachlorobenzene  
Hexachlorobutadiene  
Hexachlorocyclopentadiene  
Hexachloroethane  
Hexamethylene diisocyanate  
Hexamethylphosphoramide  
Hexane (n-Hexane)  
Hydrazine  
Hydrochloric acid  
Hydrogen fluoride (Hydrofluoric acid)  
Hydroquinone  
Isophorone  
Lead compounds  
Lindane (all isomers)  
m-Cresol (cresol isomer)  
m-Xylene (xylene isomer)  
Maleic anhydride  
Manganese compounds  
Mercury compounds

## Appendix O: Volatile Organic Compounds and Hazardous Air Pollutants

Methanol  
Methoxychlor  
Methyl bromide (Bromomethane)  
Methyl chloride (Chloromethane)  
Methyl chloroform (1,1,1-Trichloroethane)  
~~Methyl ethyl ketone (2-Butanone)~~ - Delisted  
12/13/05  
Methyl hydrazine  
Methyl iodide (Iodomethane)  
Methyl isobutyl ketone (Hexone)  
Methyl isocyanate  
Methyl methacrylate  
Methyl tert-butyl ether (MTBE)  
Methylene chloride (Dichloromethane)  
Methylene diphenyl diisocyanate (MDI) -  
Current candidate for delisting  
N,N-Dimethylaniline  
Naphthalene  
Nickel compounds  
Nitrobenzene  
N-Nitrosodimethylamine  
N-Nitrosomorpholine  
N-Nitroso-N-methylurea  
o-Anisidine  
o-Cresol (cresol isomer)  
o-Toluidine  
o-Xylene (xylene isomer)  
p-Cresol (cresol isomer)  
p-Phenylenediamine  
p-Xylene (xylene isomer)  
Parathion  
Pentachloronitrobenzene (Quintobenzene)  
Pentachlorophenol  
Phenol  
Phosgene  
Phosphine  
Phosphorus  
Phthalic anhydride  
Polychlorinated biphenyls (Aroclors)  
Polycyclic organic matter (includes dioxins  
and furans)  
Propionaldehyde  
Propoxur (Baygon)  
Propylene dichloride (1,2-Dichloropropane)  
Propylene oxide  
Quinoline  
Quinone  
Radionuclides (including radon)  
Selenium compounds

## Appendix O: Volatile Organic Compounds and Hazardous Air Pollutants

Styrene
Styrene oxide
Tetrachloroethylene (Perchloroethylene)
Titanium tetrachloride
Toluene
Toluene-2,4-diamine
Toxaphene (chlorinated camphene)
Trichloroethylene
Triethylamine
Trifluralin
Vinyl acetate
Vinyl bromide
Vinyl chloride
Vinylidene chloride (1,1-Dichloroethylene)
Xylenes (isomers and mixture)