5.7 Coal Dust

Coal dust is a form of particulate matter[1] and can affect air quality. Coal loaded onto trains consists of pieces and particles of differing size, including small particles, or dust. Wind and air moving over the train may cause coal dust to blow off the rail cars, disperse, and settle onto the ground or other surfaces. Coal dust can also be created from the movement and transfer of coal at an industrial facility. The deposition of coal dust can be a nuisance and affect the aesthetics, look, or cleanliness of surfaces.

This section provides an introduction to coal dust and describes existing conditions related to coal dust. It then describes impacts related to coal dust that could result from construction and operation of the Proposed Action and the No-Action Alternative. This section also presents the measures identified to mitigate impacts resulting from the Proposed Action.

5.7.1 Regulatory Setting

Laws and regulations relevant to coal dust are summarized in Table 5.7-1.

Table 5.7-1. Regulations, Statutes, and Guidelines Applicable to Coal Dust

Regulation, Statute, Guideline	Description
Federal	
Clean Air Act and Amendments	Enacted in 1970, as amended in 1977 and 1990, requires EPA to develop and enforce regulations to protect the public from air pollutants and their health impacts.
National Ambient Air Quality Standards	Specifies the maximum acceptable ambient concentrations for seven criteria air pollutants: CO, O_3, NO_2, SO_2, lead, PM10 and PM2.5. 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 a NAAQS are classified as nonattainment areas for that pollutant.
State	
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.

[1] Particulate matter is a complex mixture of extremely small particles and liquid droplets. Particulate matter pollution can be composed of a number of components, including nitrates, sulfates, organic chemicals, metals, soil, and dust particles.

Regulation, Statute, Guideline	Description
Local	
Southwest Clean Air Agency (SWCAA 400)	Regulates stationary sources of air pollution in Clark, Cowlitz, Lewis, Skamania, and Wahkiakum Counties.

Notes:
EPA = U.S. Environmental Protection Agency; CO = carbon monoxide; O_3 = ozone; NO_2 = nitrogen oxides; SO_2 = sulfur dioxide; PM2.5 = particulate matter up to 2.5 micrometers in size; PM10 = particulate matter up to 10 micrometers in size; NAAQS = National Ambient Air Quality Standards; WAC = Washington Administrative Code; RCW = Revised Code of Washington; SWCAA = Southwest Clean Air Agency

In occupational settings (such as coal mines), exposure to airborne coal dust is regulated by agencies such as the Occupational Safety and Health Administration and the Mine Safety and Health Administration. In nonoccupational settings (such as outdoor exposures) exposure to coal dust in combination with all other types of particulate matter and dust in the air is regulated by the U.S. Environmental Protection Agency (EPA). The federal[2] regulation that applies to particulate matter is part of the National Ambient Air Quality Standards (NAAQS). These standards apply to particle sizes with diameter of less than or equal to 10 micrometers (PM10) and particles with a mean diameter of less than or equal to 2.5 micrometers (PM2.5) (40 Code of Federal Regulations [CFR] 50). The NAAQS were established under the authority of the federal Clean Air Act to protect human health, including sensitive populations such as children and the elderly, with a margin of safety.

There are no federal or state guidelines or standards that identify acceptable levels of ambient dust deposition. Washington Administrative Code (WAC) 173-400-040(3) relates to fallout, but does not provide a reference level: “No person shall cause or allow the emissions of particulate matter from any source to be deposited beyond the property under direct control of the owner or operator of the source in sufficient quantity to interfere unreasonably with the use and enjoyment of the property upon which the material is deposited.” The New Zealand Ministry of Environment *Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions* (New Zealand Ministry of Environment 2001) cites acceptable levels of dust deposition and identifies two benchmarks for dust nuisance impacts[3] above current background levels.

- 4.0 grams per square meter per month (g/m^2/month) for industrial or sparsely populated locations. This equates to an approximate visible layer of dust on outdoor furniture or window sills.
- 2.0 g/m^2/month for sensitive residential locations. This is the benchmark used in the analysis.

A highly visible dust, such as black coal dust, will cause visible soiling at lower levels than other types of dust. British Columbia, Canada, has a less stringent maximum desirable level for average dustfall in a residential area of 5.1 g/m^2/month and for nonresidential areas of 8.7 g/m^2/month (British Columbia Ministry of Environment 2014).

[2] States are required to meet the national standards. A state can set more stringent ambient air quality standards within the state. Washington State adopts current federal NAAQS in state regulations (Chapter 173-476 WAC, Ambient Air Quality Standards).

[3] Refers to the level of dust deposition that affects the aesthetics, look, or cleanliness of surfaces but not the health of humans and the environment.

5.7.1.1 Railroad Coal Dust Requirements

The BNSF Railway Company (BNSF) Coal Loading Rule[4] requires all shippers at any Montana or Wyoming coal mine to take measures to load cars in a way that ensures coal dust losses in transit are reduced by at least 85% compared to rail cars where no remedial measures have been taken. This is most commonly done by loading coal rail cars with a modified loading chute that produces a coal bed with a rounded top. This shaped profile limits the loss of coal dust from wind while the train is moving. In addition to the shaped profile, topper agents (i.e., surfactants) are applied to the surface of the coal mound to limit coal dust loss. The topper agent is applied before leaving the coal mine area. The Safe Harbor provision in the BNSF Coal Loading Rule identifies five acceptable topper agents and application rates that BNSF states have been shown to reduce coal dust losses by at least 85% when used in conjunction with coal load profiling. A shipper can use any of the five approved topping agents.[5]

In 2014, BNSF constructed and began operating a surfactant spray facility along its main line in Pasco, Washington, where coal trains traveling west along the main line route through the Columbia River Gorge are sprayed with a topper agent to lessen potential coal dust release from rail cars.

On March 3, 2017, a consent decree was finalized between BNSF and the Sierra Club and other environmental groups to settle a lawsuit over alleged coal dust and petroleum coke (petcoke) emissions from rail cars operating on rail routes in Washington State. As part of the settlement agreement, BNSF will conduct a study on the feasibility of physical covers for coal and petcoke rail cars and pay $1 million to fund environmental projects across Washington State. BNSF will also clean up coal and petcoke materials on or adjacent to BSNF's right-of-way at five locations in Washington State. As outlined in the settlement, the Sierra Club and environmental groups agree not to bring similar litigation against BNSF for 5 years.

5.7.2 Study Area

The study area for direct impacts is the area in and near the project area that could be affected by construction and operation activities in the project area.

The study area for indirect impacts differs for each co-lead agency.

- **Cowlitz County and Ecology.** The areas within 1,000 feet of the Reynolds Lead and BNSF Spur.
- **Ecology only.** The areas within 1,000 feet of the rail routes for Proposed Action-related trains on BNSF main line routes in Washington State.

5.7.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts of coal dust associated with the construction and operation of the Proposed Action and the No-Action Alternative.

[4] For more information, see http://www.bnsf.com/customers/what-can-i-ship/coal/coal-dust.html.
[5] For more information, see http://www.bnsf.com/customers/what-can-i-ship/coal/include/dust-toppers.xls.

5.7.3.1 Information Sources

The following sources of information were used to identify the potential impacts of the Proposed Action and No-Action Alternative on coal dust in the study area.

- *Draft Environmental Impact Statement, Tongue River Railroad Company* (Surface Transportation Board 2015).
- *Millennium Coal Export Terminal, Longview, Washington, Air Quality Environmental Report* (URS Corporation 2015).
- *Final Report Environmental Evaluation of Fugitive Coal Dust Emissions from Coal Trains Goonyella, Blackwater and Moura Coal Rail Systems Queensland Rail Limited* (Connell Hatch 2008: 41).
- *Duralie Extension Project, Air Quality Assessment* (Heggies 2009).
- *Analysis of Carry-Back at the RG Tanna Coal Terminal (Draft), Exploration & Mining* (Commonwealth Scientific and Industrial Research Organisation 2007).
- *Diesel particulate matter and coal dust from trains in the Columbia River Gorge, Washington State* (Jaffe et al. 2015).
- *Inorganic composition of fine particles in mixed mineral dust– pollution plumes observed from airborne measurements during ACE-Asia* (Maxwell-Meier et al. 2004).
- Information from the Applicant about anticipated coal handling and transfer activities in the project area.
- Information from the *SEPA Rail Transportation Technical Report* (ICF and Hellerworx 2017) on the rail routes of Proposed Action-related trains through Washington State.
- *Coal Train PMCA Study, Appendix A, Gateway Pacific Terminal at Cherry Point: Train Emission and Coal Dust Assessment in Washington* (NewFields Companies, LLC 2016).

5.7.3.2 Impact Analysis

This section describes the methods used to evaluate potential coal dust impacts of operation of the Proposed Action. No coal would be handled or transported as part of construction of the Proposed Action.

For operations of the coal export terminal, air quality modeling was performed for the following primary sources of coal dust.

- Transfer and handling of the coal from rail cars to storage piles.
- Storage of coal in storage piles.[6]
- Transfer and handling of coal from storage piles to vessels.

For coal transport via rail to the proposed coal export terminal, air quality modeling was conducted to estimate fugitive coal dust emissions impacts from moving trains with uncovered rail cars. Emissions estimates were based on emissions equations for moving coal trains as developed in the reports by Connell Hatch (2008) with modifications based on a 2014 air quality monitoring study

[6] Fugitive emissions from storage piles are caused by wind erosion.

conducted in Cowlitz County for the Proposed Action and a 2015 coal dust monitoring study from uncovered rail cars in Whatcom County, Washington. These studies are described in more detail under *Indirect Impacts*.

Direct Impacts

Operation of the Proposed Action could result in coal dust emissions, including during the handling and transfer of coal related to rail unloading, ship loading, conveyor transfer, coal-pile development and removal, and wind erosion of coal piles. Coal transfers would occur in enclosed areas (e.g., rotary coal car dump facility) and open areas (e.g., coal storage piles).

Coal dust emissions and deposition from full operations (44 million metric tons of coal per year) in the direct impact study area were estimated using the EPA standard regulatory air dispersion model, AERMOD (Version 15181). AERMOD was used because impacts would be localized, and the model is designed to assess emissions for multiple point, area, and volume sources in simple and complex terrain, and uses hourly local meteorological data. In addition, AERMOD estimates the deposition of particulates (such as coal dust) using information on the particulates' emissions rate and particle sizes.

Table 5.7-2 summarizes the sources of coal dust emissions and estimated annual average emissions rates used in the analysis.

Table 5.7-2. Coal Dust Total Suspended Particulates Emissions Rates at Full Terminal Operations

Operation	Annual Average Total Suspended Particulates Emissions Rate (tons per year)
Coal pile wind erosion	3.05
Coal pile development and removal	2.62
Vessel transfer and conveyors	5.25
Train unloading	3.68
Total	**14.60**

Coal dust emissions were characterized as two source types: volume and area. Coal transfer operations were characterized as volume sources, which included eight transfer towers, a rotary rail dump, surge bin work points, and two conveyors to load coal onto cargo vessels with emissions rates estimated based on EPA AP-42, Section 13.2.4. Area sources are used to model low-level ground releases. The coal piles were modeled as area sources with the emissions estimated following the EPA AP-42, Section 13.2.5 approach. The coal dust emissions from tandem rotary unloaders that would unload the coal were modeled as a volume source with emissions estimated following the EPA AP-42, Section 13.2.5 approach. Emissions rates in the project area used meteorological data from Weyerhaeuser's Mint Farm meteorological station (years 2001 to 2003), which is located approximately 0.5 mile southeast of the project area.

The modeling was completed for the deposition of the coal particles and a more conservative assumption about the effectiveness of full enclosures and spray/fogging for conveyors. A 95% reduction effectiveness was assumed for the enclosed conveyor and spray/fogging systems, which is consistent with a permit from the Oregon Department of Environmental Quality (2013) for the

Coyote Island Terminal proposal at the Port of Morrow. The analysis used particle size distribution data from mines in Australia (Katestone 2009).

The U.S. Geological Survey is preparing a study that identifies methods for determining potential impacts on aquatic resources from coal dust exposure. The study, not yet published, uses two locations along rail lines in the Columbia River in Washington State as examples. The study will consider diet and other pathways of exposure and also compare results to levels of concern determined in previous studies.

Indirect Impacts

For the transport of the coal via Proposed Action-related trains to the coal export terminal, air quality modeling was conducted based on the coal dust emissions estimated from a moving train with adjustments in the emissions rates based on the air quality monitoring studies described below. The modeling adjustments are described in the *SEPA Coal Technical Report* (ICF 2017). In the Columbia River Gorge, an additional adjustment was made to include an effective wind speed to determine the strength of the coal dust emissions.[7]

Over the past 10 years, air quality monitoring studies have collected information on the deposition and ambient concentration levels of coal dust associated with coal train operations. These studies have been conducted in various locations, including Australia, Canada, and the United States. However, the available documentation from these studies often does not provide information on all factors that affect coal dust emissions from trains.[8] However, as mentioned previously, two studies of coal dust from coal trains were recently completed: one in Cowlitz County for this EIS and the other in Whatcom County for a separate proposal.

Cowlitz County Field Study

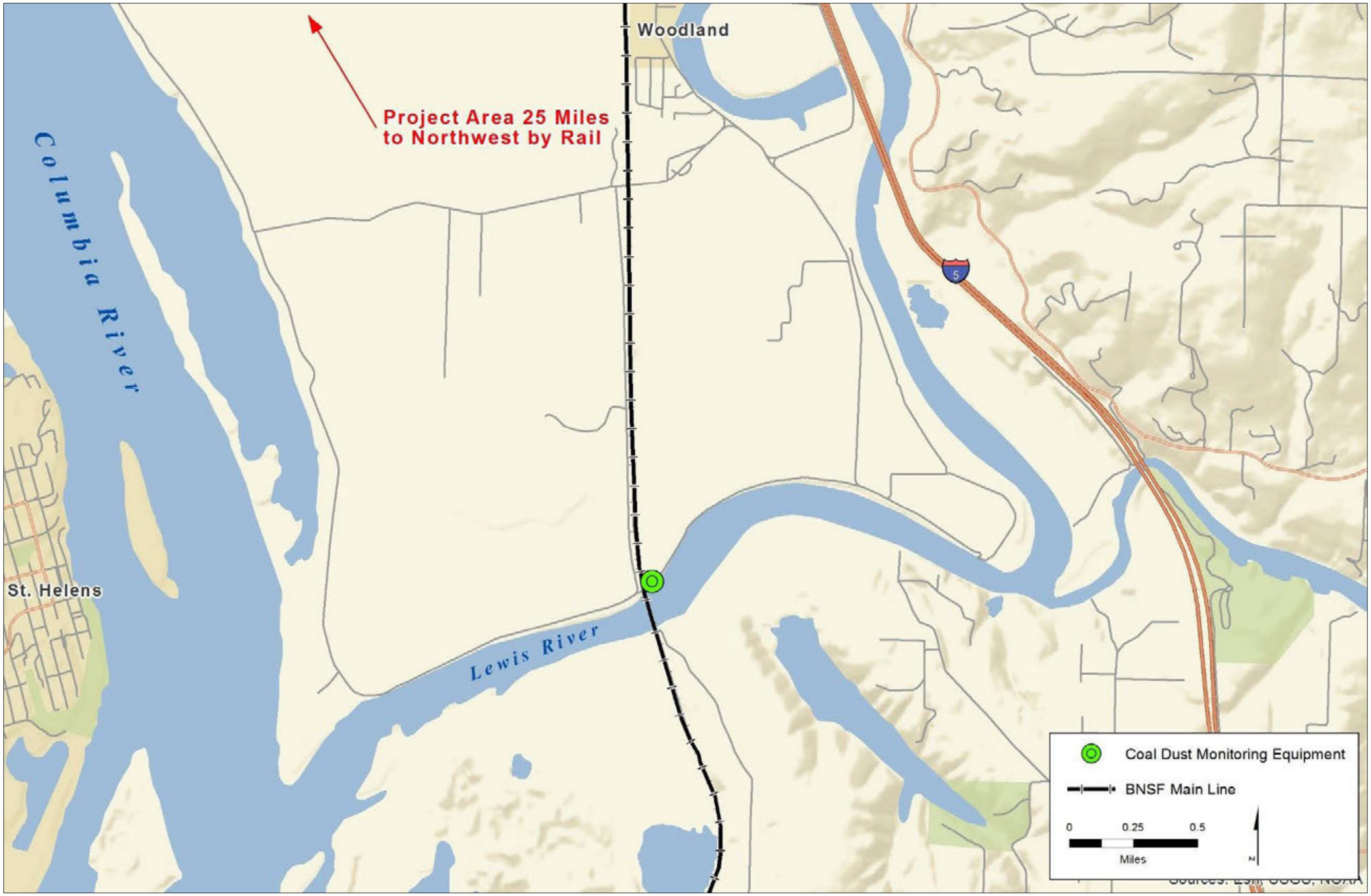
To supplement data from existing studies, a field study to inform this EIS was conducted in October 2014 to collect sample data on coal dust emitted from existing coal trains on the BNSF main line just north of the Lewis River in Cowlitz County where several loaded coal trains pass each day (Figure 5.7-1). In this area, freight trains generally travel at speeds of approximately 40 to 45 miles per hour. These data were used to improve knowledge regarding coal dust emissions and improve the reliability of the impact assessment.

The objective of the sampling program was to collect coal dust data at a location in Cowlitz County under conditions that were conducive to coal dust emissions from passing coal trains. The study measured fugitive coal dust emissions from passing trains with a set of air samplers on each side of the tracks, to measure the upwind background concentrations and deposition, and the downwind concentrations and deposition—the difference being the contributions of the passing trains. The *SEPA Coal Technical Report* contains detailed information on the study including the sampling program, laboratory analysis, quality assurance, and results.

[7] The effective wind speed is the speed of the train plus the component of the ambient wind in the direction of the train. If the wind component is opposite the direction of the train then the component is subtracted.

[8] Factors include rail car size, number of rail cars, shaping of the coal in the rail car, application and type of topping agent, distance over which the coal is transported, and meteorological conditions.

Figure 5.7-1. Coal Dust Monitoring Location



Data were collected during the first 2 weeks in October 2014. This analysis used the data collected during the field study to evaluate coal train emissions estimates based on studies in Australia, to verify their applicability to similar projects in the United States, and to evaluate the potential future impacts from the increased transport of coal to the proposed export terminal via rail.

Data collected at the site included the following.

- Continuous airborne particulate matter using a size-segregating laser-based optical scattering technique with data recorded at a 10-second time resolution. Measurements were made at the anticipated downwind (east) side of the tracks.
- Short-term particulate matter deposition using deposition plates on both sides of the tracks that sampled during triggered events with a train passage.
- Short-term airborne particulate matter on both sides of the tracks using impaction sampling techniques triggered during selected train passages.
- Integrated 24-hour airborne particulate matter using filter-based techniques with measurements primarily focused on the anticipated downwind (east) side of the tracks.
- Meteorological measurements of wind speed, wind direction, temperature, humidity and solar radiation at a 30-second time resolution to document the conditions during the sampling events.
- Train speed and video recording (documenting the number of coal cars, etc.).

During the study period, 23 coal trains were observed and samples were obtained for 22 of the trains. Of the 22 sample sets, 11 were submitted to the laboratory for full analyses, along with data from two noncoal freight trains for comparison.[9] Prior to the start of the study period, it was verified with the receivers of the coal (TransAlta Power Plant near Centralia and Westshore Terminals in British Columbia, Canada) that the coal was originating from the Powder River Basin and that surfactant was applied at the mine. At the time of this study the BNSF Pasco spray station was not yet operational and no additional surfactant material was being applied to the coal after leaving the mine.

To determine the coal particle concentrations from the collected samples, analytical methods were developed to evaluate the coal particle concentrations in the three different types of measurements and collection devices: fallout of particles; airborne concentrations in the optical microscopy size range; and particles in the "respirable" size range. All data collected during the measurement program were processed and validated prior to using in the coal dust analysis.

Air quality modeling was performed using AERMOD for the periods in which wind direction was clearly across the rail line and when a complete set of deposition plates and impaction samplers were recorded at the study site. This resulted in four periods in which suitable measurements were made for comparison to modeling results. A key input to the modeling is the emissions factor used to characterize the amount of coal dust from a moving fully loaded coal rail car. The approach used the equation reported in the Connell Hatch study (2008). This equation has since been used in a number of environmental studies in Australia (GHD 2012; Heggies 2009).

[9] The other data were not analyzed because the train came to a complete stop on the section of track being studied.

The emissions factor for the rate of coal dust (total suspended particulates [TSP] sized) emitted is expressed in metric units of grams of TSP per kilometer or rail per metric ton of coal moved as follows.

$$\textit{Emissions Factor (loaded coal train)} = 0.0000378(V)^2 - 0.000126(V) + 0.000063$$

where V is the speed of the train (kilometer/hour)

This equation was developed from the analysis of coal dust loss (without mitigation) and a minimum air velocity needed for particle lift-off from a wind tunnel study over a variety of wind speeds. This emissions factor was further adjusted by 1.34 to account for the larger-sized rail cars used to transport coal in the United States (44.12 m^2) versus those used in Australia (30.37 m^2) (Connell Hatch 2008). Each loaded rail car was estimated to hold 122 tons of coal and an 85% emissions reduction effectiveness[10] was applied based on best practice of shaping the coal for transport by rail to minimize fugitive emissions and the application of a topping agent at the mine.

Emissions from empty coal cars were based on an analysis from a study at a coal export terminal at the Port of Gladstone, Australia. This study concluded the average amount of coal carry-back was 0.36 ton per car and the worst-case month was 0.93 ton per car following 2 months of heavy rainfall that increased the stickiness of the coal. The worst-case coal carry-back value was used in this assessment for empty rail cars. Emissions rates for each operational setting were calculated and used in the AERMOD dispersion model using the on-site monitored meteorological data.

Findings from the model were then used to adjust the emissions estimates to produce the best fit with the observed data. The revised emissions estimates were then adjusted to reflect the rail traffic for the Proposed Action and the impact assessed.

Whatcom County Field Study

To support the EIS for the proposed Gateway Pacific Coal Export Terminal in Whatcom County, Washington, a field study was conducted to collect data on coal dust and train emissions from passing loaded and unloaded coal trains on the BNSF main line in Whatcom County (NewFields Companies, LLC 2016). The particulate matter monitoring data were collected at Bow, Washington, during August and September 2015.[11] The data were reviewed to supplement knowledge regarding coal dust emissions and to improve the reliability of the assessment of potential impacts from Proposed Action-related trains. Because coal dust emissions are influenced by train speed, a subset of the fastest-moving loaded coals train was analyzed to determine what fraction of the monitored data collected was coal dust versus other forms of particulate matter. In addition, some empty coal and freight train data were analyzed for comparison with loaded coal trains. A total of 30 coal trains passed by the site during the study period at an average speed of 18 mph. The BNSF surfactant station near Pasco was in operation by the time of this study, so surfactant was likely applied to the rail cars. The *SEPA Coal Technical Report* contains detailed information on the analysis of the loaded and unloaded coal trains.

[10] BNSF tariffs require shippers to control coal dust emissions through use of load profiling and application of an approved topping agent or other measures to reduce emissions by at least 85% (BNSF Price List 6041-B and Appendices A and B, issued September 19, 2011).

[11] This was after the surfactant reapplication station near Pasco began operation in December 2014.

5.7.4 Existing Conditions

This section provides an introduction to coal dust and describes the existing conditions in the study area related to coal dust that could be affected by the construction and operation of the Proposed Action and the No-Action Alternative.

5.7.4.1 Introduction to Coal Dust

Coal dust is a form of particulate matter. Particulate matter is composed of small particles suspended in the air. There are both natural and human sources of particulate matter. Natural sources include dust storms and smoke from wildfires. Human sources include but are not limited to smoke from industrial emissions, agricultural activities, construction activities, wood smoke, vehicle engine exhaust, dust from unpaved roads, tobacco smoke, and coal dust.

Coal loaded into train cars is made up of pieces and particles of differing size, including small particles, or dust. The movement of the rail cars during transit creates vibrations that can break larger pieces of coal into smaller particles, creating more dust. Likewise, during transit, wind and air moving over rail cars may blow coal dust[12] off the rail cars, disperse it in the air before the dust settles onto the ground. Coal dust may also be generated and dispersed by wind during coal stockpiling and handling activities. The distance from the train or stockpile to where the dust settles on the ground varies depending primarily on the size of the particles, meteorological conditions including wind speed, and/or train speed.

Coal Dust and Human Health

From a human health perspective, inhalation of coal dust (particulate matter) is the primary exposure pathway of concern. Ingestion of coal dust is a potential, but less significant, exposure pathway. The principal characteristic of concern for particulate matter related to human health is particle size. Some particles are visible to the unaided eye as dust or smoke, but the smaller, invisible particles pose a human health risk. When particulate matter is inhaled, larger particles are filtered in the nose or throat by cilia and mucus, but small particles can pass through into the lungs. The smallest particles can enter the circulatory system, where they harden and inflame the arteries. Most of the smallest particles are produced by combustion, such as the burning of wood or fossil fuels, although some may also be present in dust, such as road dust and coal dust. Figure 5.7-2 illustrates typical small particle sizes.

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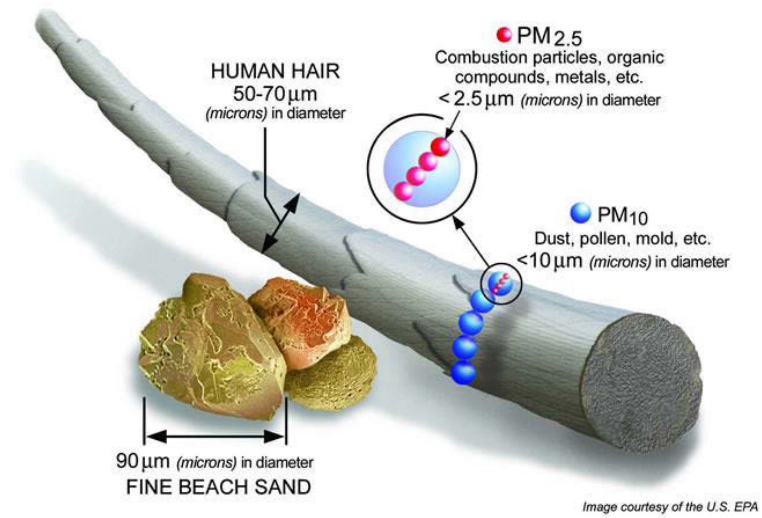
[12] Coal dust lost from rail cars is often referred to as fugitive coal dust. In the air quality regulatory context, emissions that are not emitted from a stack, vent, or other specific point that controls the discharge are known as fugitive emissions. For example, windblown dust is fugitive particulate matter.

Figure 5.7-2. Particulate Matter Particle Sizes



Source: U.S. Environmental Protection Agency 2013.

Because the health effects of particulate matter depend on particle size, scientists and regulatory agencies typically group small airborne particles into two categories based on particle size. The first category is *inhalable particles*, which includes PM10. For comparison, a human hair is approximately 70 micrometers (microns) in diameter. The second category is *inhalable fine particles*, which includes PM2.5. These particles are small enough to penetrate into the gas exchange regions of the lungs and are considered to pose the greatest risk to human health. The PM10 category includes PM2.5. As discussed in Section 5.7.1, *Regulatory Setting*, both sizes are regulated by federal law as criteria air pollutants. Particles smaller than 10 micrometers and larger than 2.5 micrometers are often referred to as *inhalable coarse particles*. Particulate matter is sometimes measured TSP. TSP measures particles of approximately 50 micrometers and smaller, and includes PM10 and PM2.5.

Coal dust contains large, visible particles and the smaller TSP, PM10, and PM2.5. The larger particles and TSP may result in nuisance impacts (impacts that affect the aesthetics, look, or cleanliness of surfaces). PM10 and PM2.5 have been determined to cause increased health hazard if the regulatory limits are exceeded (U.S. Environmental Protection Agency 2014). If any pollutant level exceeds regulatory limits, health impacts would depend on the concentration in the air, the duration of the exposure, and the number of times exposure occurs.

While coal dust impacts in coal mines have been widely studied, the health impacts of nonoccupational exposure to coal dust, such as coal dust from rail cars, have not been extensively studied. Some studies have found that communities near large coal-handling and processing facilities could have higher rates of respiratory complaints (Temple and Sykes 1992; Brabin et al. 1994). Others have found no difference between these communities and those farther away from coal facilities (Pless-Mulloli et al. 2000; Moffatt and Pless-Mulloli 2003).

The *Draft Environmental Impact Statement, Tongue River Railroad Company* (Surface Transportation Board 2015) considered human health impacts from coal dust inhalation for a proposed rail line in Montana. Using dispersion modeling, the study found the maximum annual average contribution of coal dust of 0.46 $\mu g/m^3$ per train round trip of PM10, and 0.09 $\mu g/m^3$ per train round trip of PM2.5. The per-train contribution to particulate matter of coal dust along the rail right-of-way for a 24-hour period was 1.85 $\mu g/m^3$ per train round trip for PM10, and 0.40 $\mu g/m^3$ per train round trip for PM2.5. Receptors used for modeling were placed every 10 meters out to 300 meters in a direction perpendicular to the rail track with maximum annual average concentrations found at either 40 or 50 meters. The study looked at human health impacts from coal dust ingestion by comparing concentration of coal dust and trace elements to federal health screening levels. The study concluded concentrations of coal dust constituents (including trace elements in coal and the chemical constituents of coal surfactants) in soil, dust, water, and fish would be below screening levels for human exposure for all evaluated pathways.

Emissions, Dispersion, and Deposition of Coal Dust

Rail cars and coal-handling facilities generate and emit coal dust. The total amount of fugitive coal dust released by a rail car depends on the following factors.

- Coal type and composition
- Coal moisture content
- Ambient wind speed and direction
- Precipitation falling on the coal
- Topper agents or dust suppressants
- Size of the top opening of the rail car
- Shape (profile) of the coal surface in the car
- Position of the car in the train
- Time and distance traveled
- Train speed

The amount of fugitive coal dust released by a coal-handling facility depends on the following factors.

- Transfer or handling process
- Enclosures or other physical barriers
- Additional controls, such as spraying/fogging
- Shape (profile) of coal pile
- Moisture and silt loading content of the coal
- Ambient wind speed
- Rainfall

Coal dust and other forms of particulate matter do not remain in the air indefinitely. Eventually, these particles settle out of the air and deposit on the ground. Coal dust may be deposited directly onto the rail ballast, along the rail right-of-way, or in adjacent areas. Where the coal dust lands (the distance from and the direction from the rail right-of-way) depends on particle size, wind speed, and other meteorological conditions. Human exposure to deposited coal dust can occur by human ingestion of soil, sediment, surface water, groundwater, agricultural products, fish, or other animals that have ingested soil or water tainted by coal dust deposits. Ecological impacts can occur by exposure of plants and animals to coal dust and its constituents in soil, sediment, surface water, and groundwater. Deposited coal dust could also cause nuisance impacts. Airborne coal dust may be deposited on houses, automobiles, boats, outdoor furniture, and other property.

Airborne coal dust dispersion can be predicted using mathematical models that describe the physical processes to simulate the particulate matter concentration. These models, known as dispersion models, take into account the time-varying sources of emissions, as well as meteorological and seasonal conditions. The models require reasonable estimates of emissions rates to yield reliable estimates of the dispersion and deposition of particulate matter. As discussed below, this analysis used a dispersion model to assess coal dust deposition from the Proposed Action.

Coal Dust Emissions from Rail Cars

Most coal dust from rail cars comes directly from the surface of the coal pile in the rail car (Queensland Rail 2008). Smaller amounts may come from coal that has fallen onto the surfaces of the car or the wheel assemblies during loading.

A study funded by the U.S. rail industry (Calvin et al. 1993) estimated a train operating under clear, dry, sunny conditions lost between 0.17% (shaped profile) and 0.34% (unshaped profile) of the total coal load, with no use of surfactants or topper agents. These estimates were based on measuring the weight of the cars after loading and again at the end of the trip. The study did not provide information on the particle sizes associated with this emissions of coal dust. The *Draft Environmental Impact Statement, Tongue River Railroad Company* (Surface Transportation Board 2015) notes that weighing cars before and after a trip does not account for the effects of the moisture content of coal. Some types of coal contain large amounts of water, up to more than 60% by weight in some lignite coals, and this technique is unreliable for estimating coal dust emissions because coal may dry out and become lighter during transport.

More recently, Ferreira et al. (2003) conducted full-scale measurements of coal dust emitted from coal trains. They placed dust-collecting instruments onto rail cars carrying coal from a port to a power station in Portugal. Some of the rail cars were equipped with mechanical covers that partially covered the coal load but left some of the coal exposed. Ferreira et al. found that these cars lost less than 0.001% of the loaded coal over a 220-mile trip with an average speed between 34 and 37 miles per hour.

An industry study conducted in Queensland, Australia also found the amount of coal dust emitted by rail cars to be small. This study, prepared on behalf of Queensland Rail Limited (now Aurizon), used a mathematical model (Witt et al. 1999) to predict the emissions of TSP-sized coal dust from trains moving on the Goonyella, Blackwater, and Moura rail systems in Queensland. The model estimated that these rail cars would lose an average of 0.0035% of their total load. For cars carrying approximately 90 tons of coal, typical for the cars in the study, this amounted to an average of about

6 pounds of coal dust lost per car, over trips between 100 and 300 miles in length (Queensland Rail 2008).

Witt et al. (1999) developed a computational fluid dynamics model that takes into account the effects of wind direction and velocity. Experimental measurements of dust lift-off from the surface in a wind tunnel at different travel speeds were used by Witt et al. (1999) to characterize the dust emissions rate. Based on the experimental data, Witt et al. developed a model for predicting the mass and particle size distribution lifted at different air speeds. The Queensland Rail (2008) study modified the equations that were developed by Witt et al. (1999) based on the emissions reported by Ferreira et al. (2003), as a function of train speed for particle size distributions. These equations were developed in the absence of any significant moisture. As such, the Queensland Rail study equations provide a conservative estimate because, by wetting the coal, surface precipitation tends to reduce actual emissions. This study did not include adjustments for the use of other dust control techniques such as covers or chemical topper agents.

The BNSF/UP Super Trial (BNSF Railway Company 2010) reported reductions in coal dust emissions using chemical topper agents. BNSF has imposed a tariff (a schedule of shipping rates and requirements) that requires coal shippers in Wyoming and Montana to control coal dust emissions from rail cars. One method allowed by the tariff is to use one of topper agents (surfactants) that, along with shaping the load profile, have been shown to reduce average coal dust emissions by at least 85%.

Airborne Coal Dust Dispersion

The concentration of coal dust in the air does not remain constant. Like all forms of particulate matter, coal dust disperses over time. Some studies that examine the movement of coal dust in the air use monitoring equipment to estimate the concentration of particulate matter. Others use mathematical dispersion models that describe the physical processes to simulate the particulate matter concentration.

The *Draft Environmental Impact Statement for Tongue River Railroad Company* (Surface Transportation Board 2015) used the AERMOD model to assess both air quality (ambient concentrations of particulate matter) and deposition. Results from the modeling showed a maximum increase in annual PM10 from coal dust emitted by trains of 6.1 micrograms per cubic meter ($\mu g/m^3$) at a distance of 50 meters from the rail line. The maximum annual increase in PM2.5 was 1.2 $\mu g/m^3$ at 50 meters from the rail line. Both of these increases would be insufficient to lead to a violation of NAAQS for either PM2.5 or PM10.

In another coal dust study, the *Pollution Reduction Program 4. - Particulate Emissions from Coal Trains* report (Australian Rail Track Corporation 2012) measured TSP, PM10, and PM2.5 concentrations as loaded and unloaded coal trains passed the monitors (4 meters from the nearest of four tracks) and compared these measurements with the concentration of particulate matter when no train was present. ARTC found that both loaded and unloaded coal trains were associated with higher measured concentrations of particulate matter. On average, coal trains increased the concentration of PM10 by as much as 7.6 $\mu g/m^3$ and the concentration of PM2.5 by as much as 2.1 $\mu g/m^3$ as the train passed by the monitor. The ARTC study did not analyze the measured particulate matter to determine the proportion of coal dust.

The Queensland, Australia Department of Science, Information Technology, Innovation and the Arts (DSITIA) conducted a 1-month study of dust at three sites in the Brisbane suburb of Tennyson. This study was conducted in response to community concern over dust from coal trains (Department of Science, Information Technology, Innovation and the Arts 2012). The monitoring site closest to the rail line was 6 meters (20 feet) from the track. The DSITIA study found that the major component of deposited dust was mineral dust (not coal dust), ranging between 40 and 50%. Coal accounted for 10 to 20% of deposited dust in the samples. Measurement of airborne dust levels indicated particulate matter concentrations increased by an average of less than 5 $\mu g/m^3$ when the train was passing by the monitor. The DSITIA study measured airborne dust concentrations as PM20 (particles with a diameter less than 20 micrometers), so the concentrations of PM10 and PM2.5 would have been lower.

Airborne Coal Dust Deposition

Coal dust emitted to the atmosphere settles out of the air and deposits on the ground. Coal dust may be deposited directly onto the rail ballast, along the right-of-way, or in adjacent areas. Where the coal dust lands (the distance from and the direction from the rail right-of-way) depends on particle size, wind speed, and other meteorological conditions.

A Queensland, Australia study of the deposition of coal dust along rail lines over a 6-month period found that the maximum deposition of coal dust (TSP size and smaller) occurred at approximately 3 meters (10 feet) from the edge of the track (Queensland Government Safety in Mines Testing and Research Station 2007).

An assessment for the *Draft Environmental Impact Statement, Tongue River Railroad Company* (Surface Transportation Board 2015) evaluated the amount of airborne coal dust deposition by particle size and mass. Particles larger than 250 micrometers deposit very quickly after being blown from a rail car and will deposit within the right-of-way of the railroad. The study concluded that these larger particles would deposit mostly within 5 meters (approximately 16.4 feet) of the center of the rail line and would not be likely to deposit outside of the rail right-of-way, even under unusually windy conditions.

Ecological Impacts of Coal Dust

The *Draft Environmental Impact Statement, Tongue River Railroad Company* (Surface Transportation Board 2015) evaluated the potential ecological impacts of coal dust. The following presents the methods and findings of the study. The study used an air dispersion and deposition model combined with a fate and transport model to estimate concentrations of coal dust in soil, water, and sediment. Coal from the proposed source mine in the Powder River Basin, Otter Creek, was used to characterize the trace metals in the coal. The study then compared estimated soil, sediment, and water concentrations of trace metals based on coal dust deposition modeling with EPA ecological soil screening levels to evaluate soil exposure for ecological receptors, including plants, soil invertebrates, avian wildlife, and mammalian wildlife (U.S. Environmental Protection Agency 2005). Freshwater screening values account for ecological impacts from fish exposure (U.S. Environmental Protection Agency 2013d). To evaluate the movement of dust to soil and subsequently to sediment and surface water, the study used the area-wide average deposition rate of particulates 250 micrometers in diameter and smaller. The study did not explicitly model particles of aerodynamic diameter 250 micrometers and larger because particles of this size would not deposit outside of the right-of-way. The study followed EPA risk assessment guidance to assume that 100% of the chemical constituents in coal dust are bioavailable (U.S. Environmental Protection Agency 2007). The study found that none of the chemical concentrations estimated for soil would result in values greater than the EPA ecological soil screening levels for plants, soil invertebrates, avian wildlife, or mammalian wildlife.

Concentrations of coal dust constituents in surface water were estimated based on the average deposition from air over a modeled watershed and subsequent runoff and erosion into a modeled water body. Nearly all of the estimated values for water in the model were well below available EPA freshwater screening benchmarks (U.S. Environmental Protection Agency 2013). The study found barium is the only coal dust constituent analyzed for which predicted concentration (10.1 micrograms per liter) would exceed the freshwater screening benchmark of 4.0 micrograms per liter. The study concluded that the concentration of barium from coal dust in freshwater would be unlikely to exceed the screening benchmark. The findings of the study found estimates of coal dust constituent concentrations in soil, sediment, and surface water were below screening levels for ecological exposure, with the exception of values for barium in surface water.

Based on the use of several conservative assumptions, the analysis overestimated the likely concentration of barium in surface water. Furthermore, when barium is released to water, the compound will precipitate, or come out of solution, as barium sulfate, which has low solubility in water. Therefore, the study did not expect that concentrations of soluble barium in surface water would exceed benchmark or screening levels.

Safety Impacts of Coal Dust

The *Draft Environmental Impact Statement, Tongue River Railroad Company* (Surface Transportation Board 2015) considered the potential for impacts from coal dust on safety through the fouling of railroad ballast. The Surface Transportation Board concluded that there is evidence that coal dust can harm the stability of railroad ballast. The study concluded higher levels of coal train traffic would result in more frequent impacts than lower traffic levels. Impacts at locations near the tracks would be greater than at locations farther away. Impacts from trains carrying coal with a shaped load profile and to which a topper agent has been applied would be less than impacts from trains carrying untreated coal.

Nuisance Impacts of Coal Dust

The potential for nuisance impacts (such as visible coal dust accumulating on window sills and outdoor furniture) at a specific location would be affected by many factors, including train traffic levels, train speed, coal dust emissions reduction measures in use, distance from the track, and local topographic and meteorological conditions. The *Draft Environmental Impact Statement, Tongue River Railroad Company* (Surface Transportation Board 2015) found higher levels of coal train traffic would result in more frequent impacts than lower traffic levels. Impacts at locations near the tracks would be greater than at locations farther away. Impacts from trains carrying coal with a shaped load profile and to which a topper agent was applied would have less impacts than trains carrying untreated coal.

5.7.4.2 Existing Conditions in the Study Area

The following describes the existing coal dust conditions in the study area.

Applicant's Leased Area

The existing bulk product terminal in the Applicant's leased area currently receives 1 to 2 coal trains per week, consisting of 25 to 30 coal rail cars. Coal is stored in silos in the Applicant's leased area, adjacent to the project area, and transferred via truck to the Weyerhaeuser facility, located 1 mile to the southeast. The coal is stored in silos; coal dust emissions are estimated to be small and confined almost entirely within the Applicant's leased area. Operations at the existing bulk product terminal are in compliance with the air permit issued by the Southwest Clean Air Agency.

Cowlitz County

Approximately 2 loaded coal trains, each consisting of approximately 125 cars, operate daily along the northbound BNSF main line in Cowlitz County (Western Organization of Resource Councils 2014).

Cowlitz County is classified as an attainment area or unclassified[13] for both PM10 and PM2.5. Of these two pollutants only PM2.5 is currently being monitored. Refer to Section 5.6, *Air Quality*, for additional information.

The PM2.5 monitoring station located at 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 estimated 24-hour design value in 2014 was 18 microns per cubic meter. While not a reference instrument, it is considered a strong indicator of the relative PM2.5 concentration of 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.

EPA compiles a comprehensive National Emissions Inventory every 3 years. This inventory includes emissions of air toxics from industrial, commercial, mobile, and area sources, and is used by EPA in their National Air Toxics Assessment (NATA). The most recent (2011) NATA showed Cowlitz County had 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 averages of 40 cancers per million (U.S. Environmental Protection Agency 2015). However, NATA does not quantify cancer risk associated with exposure to diesel particulate matter. For more information on NATA and diesel particulate matter, refer to Section 5.6, *Air Quality*.

[13] The U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (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. Unclassified is an area with not enough air quality monitoring data has been collected to classify the area.

Washington State

In 2014, approximately 2 to 4 loaded coal trains, each consisting of approximately 125 cars, operated daily in Washington State beyond Cowlitz County, mainly along the BNSF main line (Western Organization of Resource Councils 2014; *The Herald* 2013). Section 5.6, *Air Quality*, describes existing air quality conditions for PM10 and PM2.5 along Proposed Action-related rail routes.

5.7.5 Impacts

This section describes the potential direct and indirect impacts related to coal dust that would result from construction and operation of the Proposed Action and the No-Action Alternative.

5.7.5.1 Proposed Action

This section describes the potential impacts that could occur in the study area as a result of construction and operation of the Proposed Action.

At full operation, Proposed Action-related trains would add 8 loaded and 8 empty coal trains per day (16 total trains per day) to the rail lines between the Powder River Basin or the Uinta Basin and the project area. In the project area, unloading facilities would unload coal from rail cars within an enclosed structure. The unloading facilities would contain equipment to rotate rail cars and discharge the coal from the rail cars into a large hopper. As the tandem rotary dumper rotates the rail cars and begins to unload the coal into hoppers beneath the dumper, sprayers would spray water to avoid and minimize dust dispersion within the enclosed structure.

A network of belt conveyors would transport coal from the rail car unloading facilities to the stockpile area, and from the stockpile area to the vessel-loading facilities, or from rail cars directly to the vessel-loading facilities. All transfer stations and approximately one-third of the conveyors would be enclosed. The stockpile area and vessel-loading conveyors would not be enclosed due to their operational requirements. The coal stockpile area would have a dust suppression system. Vessels would be loaded using shiploaders that would include enclosed boom and loading spout. The loading spout would also be telescopic and would be inserted below the deck of the vessel during vessel loading to minimize dust dispersion.

Construction

Construction of the Proposed Action would not result in direct or indirect impacts related to coal dust because construction would not include any coal-handling or transport activities.

Operations—Direct Impacts

Operation of the Proposed Action could result in the following direct impact. Operations-related activities are described in Chapter 2, *Project Objectives, Proposed Action*, *and Alternatives*.

Emit and Deposit Coal Dust In and Near the Project Area

Operation of the Proposed Action would emit coal dust from coal handling and transport activities in the project area.[14] Table 5.7-3 illustrates the estimated maximum annual and monthly coal dust deposition at or beyond the project area boundary.

Table 5.7-3. Estimated Maximum Annual and Monthly Coal Dust Deposition

Location	Maximum Annual Deposition (g/m^2/year)	Maximum Monthly Deposition (g/m^2/month)	Benchmark Used for Analysis (g/m^2/month)[a]
Project area boundary (fence line) near Mt. Solo Road	1.99	0.40	2.00

Notes:
[a] Source: New Zealand Ministry of Environment 2001
g/m^2 = grams per square meter

The estimated maximum monthly coal dust deposition (0.40 g/m^2/month) would be at the project area boundary near Mt. Solo Road (Figure 5.7-3). This estimated deposition would be below the benchmark used for the analysis (2.0 g/m^2/month).

The estimated maximum annual coal dust deposition (1.99 g/m^2/year) also would be at the project area boundary near Mt. Solo Road (Figure 5.7-4). Within a few thousand feet of the project area, the annual deposition is estimated at 0.1 g/m^2; within 2.4 miles, it is estimated at 0.01 g/m^2.

Operations—Indirect Impacts

Operation of the Proposed Action would result in the following indirect impacts. Operations-related activities are described in Chapter 2, *Project Objectives, Proposed Action*, *and Alternatives*.

Cowlitz County

A dispersion model was performed to assess coal dust deposition from Proposed Action-related trains along the Reynolds Lead and BNSF Spur and along the BNSF main line in Cowlitz County based on existing freight train speeds.

[14] All sources of coal dust emissions were included in the modeling.

Figure 5.7-3. Estimated Maximum Monthly Coal Dust Deposition

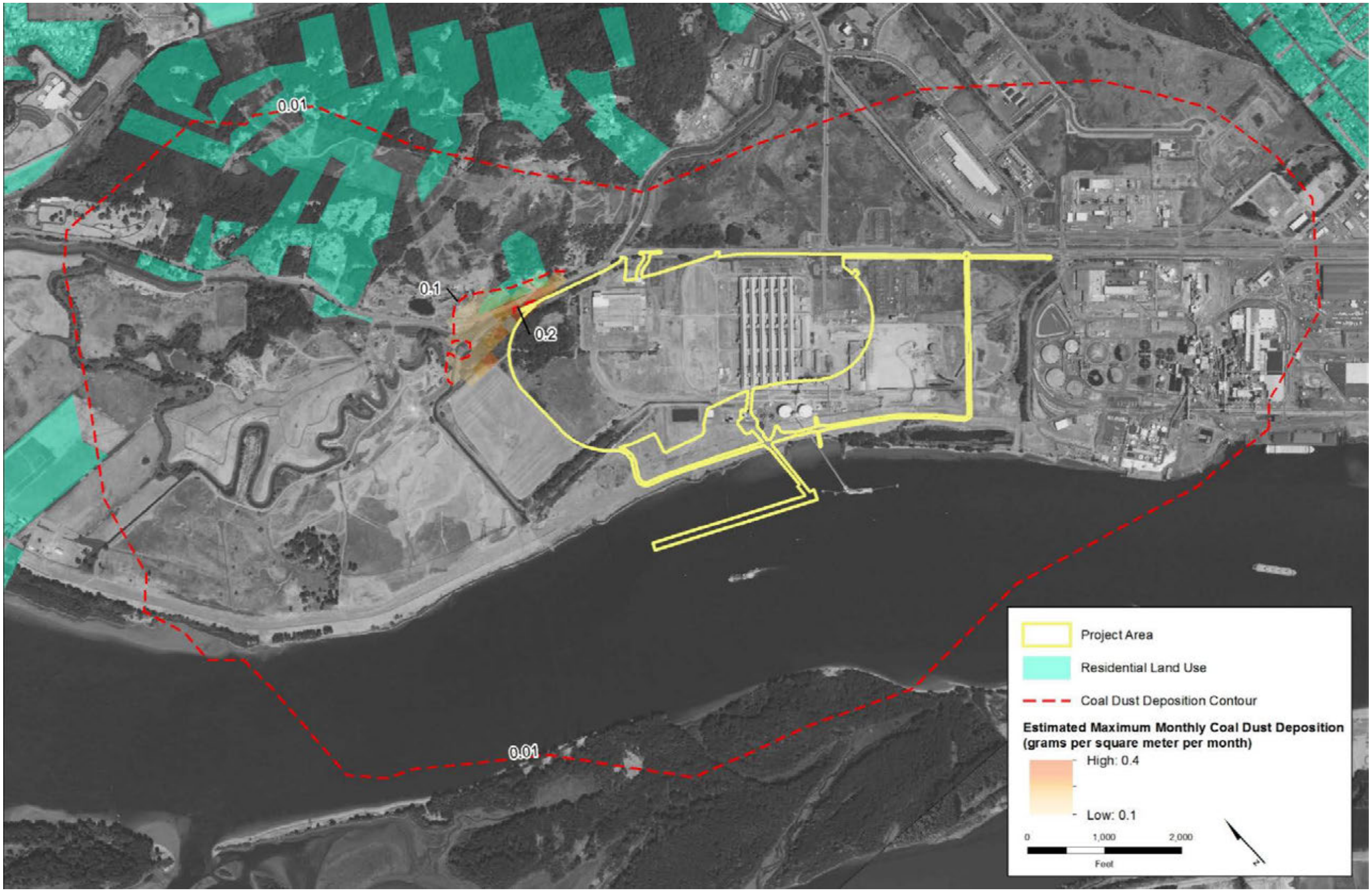
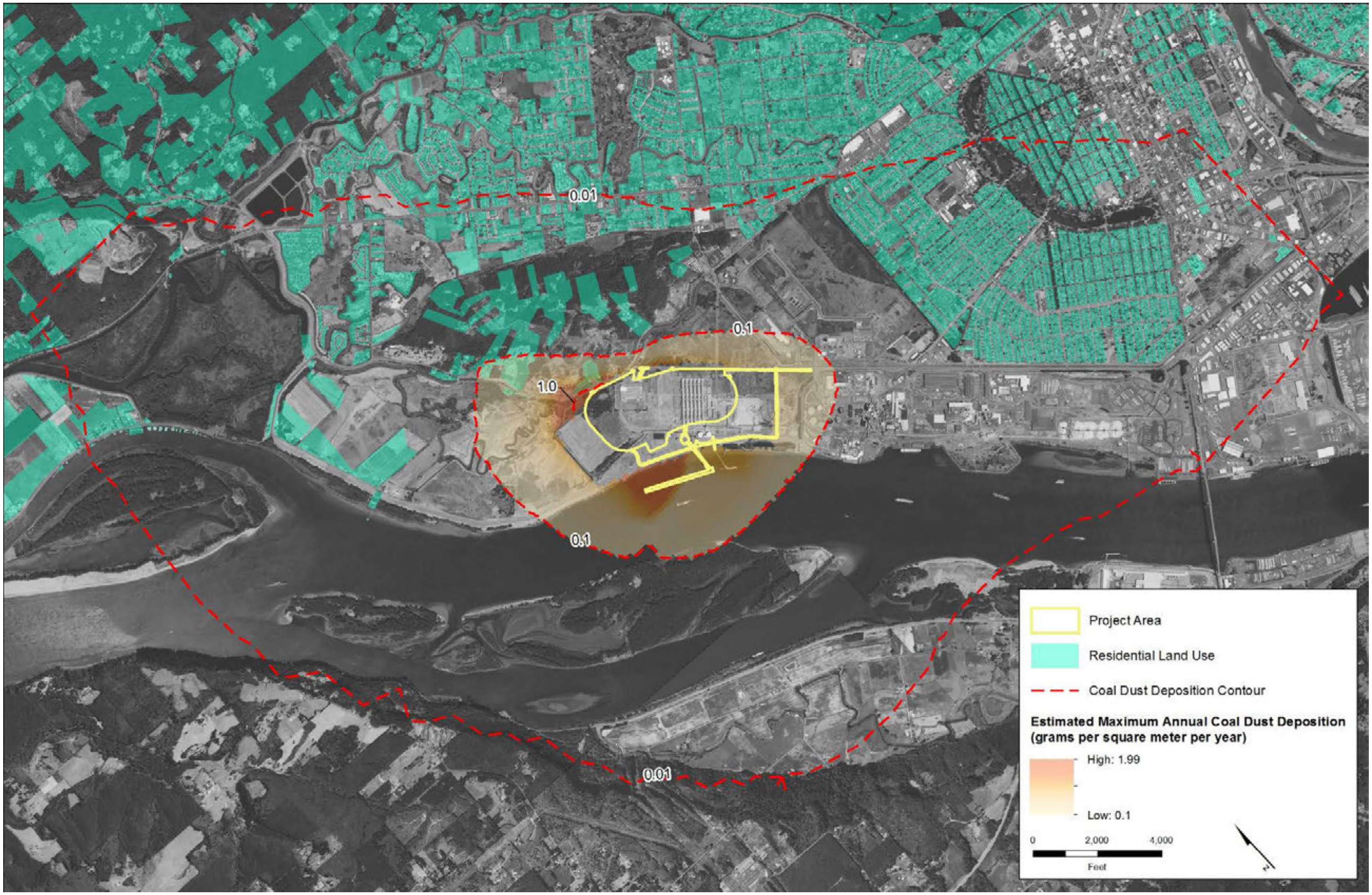


Figure 5.7-4. Estimated Maximum Annual Coal Dust Deposition



- **Reynolds Lead and BNSF Spur**. Adding modeled emissions of PM10 and PM2.5 due to coal dust from Proposed Action-related trains to background levels results in total concentrations below the NAAQS at 100 feet from the rail line (Table 5.7-4). The estimated maximum modeled 24-hour increase in PM10 concentration is 0.28 μg/m^3; the estimated maximum increase in 24-hour PM2.5 due to coal dust is 0.05 μg/m^3. The estimated annual PM2.5 concentration would increase 0.01 μg/m^3. Concentrations would decline by approximately 50% at approximately 160 feet from the rail line. The closest residence is located approximately 180 feet from the north side of the Reynolds Lead.

Table 5.7-4. Estimated Maximum PM10 and PM2.5 Concentrations for Coal Particles Only (100 Feet from Rail Line) —Reynolds Lead and BNSF Spur

Pollutant	Averaging Period	Maximum Modeled Impact (μg/m^3)	Background[a] (μg/m^3)	Total Concentration (μg/m^3)	NAAQS (μg/m^3)
PM10	24 hour[b]	0.28	28	28.28	150
PM2.5	24 hour[c]	0.05	16	16.05	35
	Annual[d]	0.01	5.3	5.31	12

Notes:
[a] Background concentrations are monitoring design values from Northwest International Air Quality Environmental Science and Technology Consortium (2015).
[b] The PM10 24-hour modeled impact is 3-year average of the second-highest concentrations.
[c] The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of the daily maximum concentrations.
[d] Modeled annual impact is the annual average over 3 modeled years.
NAAQS = National Ambient Air Quality Standards; μg/m^3 = micrograms per cubic meter

Table 5.7-5 reports the estimated maximum increase in deposition along the Reynolds Lead and BNSF Spur at the closest residence (approximately 180 feet from the Reynolds Lead). The estimated maximum monthly deposition would be below the benchmark used for the analysis (New Zealand Ministry of Environment 2001). These concentrations would decrease by 50% at approximately 340 feet from the Reynolds Lead and BNSF Spur.

Table 5.7-5. Estimated Coal Dust Deposition—Reynolds Lead and BNSF Spur

Distance (feet)	Average Maximum Monthly Deposition (g/m^2/month)	Maximum Monthly Deposition (g/m^2/month)	Benchmark Used for the Analysis (g/m^2/month)[a]
180	0.013	0.017	2.0
340	0.006	0.008	2.0

Notes:
[a] Source: New Zealand Ministry of Environment 2001
g/m^2/month = grams per square meter per month

- **BNSF Main Line.** Adding modeled emissions of PM10 and PM2.5 due to coal dust from Proposed Action-related trains to background levels results in total concentrations below the NAAQS at the closest residences (Table 5.7-6). While some receptors are as close as 50 feet, others are more than 100 feet from the BNSF main line and therefore would have lower concentrations than the 100-foot concentration shown in Table 5.7-6. These estimated concentrations are higher than estimates for the Reynolds Lead because higher train speeds on the main line[15] enhance the lift-off of coal particles from open rail cars. However, in all cases, these concentrations are below NAAQS.

Table 5.7-6. Estimated Maximum PM10 and PM2.5 Concentrations—BNSF Main Line, Cowlitz County

Pollutant	Averaging Period	Distance from Rail Line (feet)	Modeled Impact (μg/m³)	Background[a] (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)
PM10	24 hours[b]	50	30.0	28.0	58.0	150
		100	23.0	28.0	51.0	150
PM2.5	24 hours[c]	50	4.5	21.0	25.5	35
		100	3.8	21.0	24.8	35
	Annual[d]	50	2.1	5.9	8.0	12
		100	1.7	5.9	7.6	12

Notes:
[a] Background concentrations are monitoring design values for Woodland, Washington (Northwest International Air Quality Environmental Science and Technology Consortium 2015).
[b] The PM10 24-hour modeled impact is 3-year average of the second-highest concentration.
[c] The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of the daily maximum concentrations. The modeled impact is different than the annual average due to day-to-day variation in meteorology.
[d] Modeled impact is the annual average over the 3 modeled years. The modeled impact is different than the 24-hour average due to day-to-day variation in meteorology.
NAAQS = National Ambient Air Quality Standards; μg/m³ = micrograms per cubic meter

The estimated maximum monthly coal dust deposition along the BNSF main line in Cowlitz County would be above the benchmark used for the analysis at certain distances (Table 5.7-7). These estimated depositions are higher than estimates for the Reynolds Lead and BNSF Spur because higher train speeds on the main line enhance the lift-off of coal particles from open rail cars. The estimated maximum monthly deposition is slightly above the benchmark used for the analysis at 100 feet (New Zealand Ministry of Environment 2001).[16] As a result, residents who live along the main line could experience nuisance levels which may include visible soiling on window sills, outdoor furniture, and other property.

[15] Based on the near maximum coal train speed of 50 miles per hour observed during the coal dust monitoring (Figure 5.7-1).

[16] These modeled results are comparable to those found during recent monitoring conducted by Corporation of Delta (2014) that reported coal dust deposition amounts ranging from 2 to 10 g/m²/month (July 2013, April 2014, and October 2014) for an average of six 125-car loaded coal trains passing each day at an average speed of 35 miles per hour (Brotherston 2014). The dust fall monitor was located 66 feet from the BNSF main line.

Table 5.7-7. Estimated Coal Dust Deposition—BNSF Main Line, Cowlitz County[a]

Distance (feet)	Average Maximum Monthly Deposition (g/m^2/month)	Maximum Monthly Deposition (g/m^2/month)	Benchmark Used for the Analysis[b] (g/m^2/month)
50	**2.2**	**3.1**	2.0
100	1.4	**2.3**	2.0
150	1.0	1.8	2.0

Notes:
[a] **Bolded, shaded gray** indicates the estimated deposition would be higher than the benchmark used for the analysis.
[b] Source: New Zealand Ministry of Environment 2001
g/m^2/month = grams per square meter per month

Table 5.7-8 compares the maximum trace element concentrations found in coal dust with their respective acceptable source impact levels (ASIL).

Table 5.7-8. Estimated Maximum Concentrations of Trace Elements Compared with Acceptable Source Impact Levels—BNSF Main Line, Cowlitz County

Substance[a]	Maximum Concentration ($\mu g/m^3$)	ASIL ($\mu g/m^3$)	Averaging Time	Percentage of ASIL (%)
Arsenic and inorganic arsenic compounds	0.000062	0.000303	Annual	20.4
Beryllium and compounds	0.000007	0.000417	Annual	1.8
Cadmium and compounds	0.000002	0.000238	Annual	0.7
Chromium (VI)[b]	0.0000047	0.00000667	Annual	70.4
Cobalt as metal dust and fume	0.00013	0.1	24 hour	0.1
Copper, dusts and mists	0.0015	100.0	1 hour	0.002
Lead compounds	0.000038	0.0833	1 year	0.046
Manganese dust and compounds	0.00093	0.04	24 hour	2.3
Mercury, aryl and inorganic	0.000005	0.09	24 hour	0.005
Nickel and compounds	0.000031	0.0042	Annual	0.74
Selenium compounds	0.000065	20.0	24 hour	0.0003
Vanadium compounds	0.000732	0.2	24 hour	0.37
Crystal silica (PM4 -respirable) daily average	0.94[c]	3.0	8 hour	31

Notes:
[a] The fraction of trace elements found in coal is based on the maximum fraction of these elements found in two Powder River Basin coal beds (Stricker et al. 2007) in combination with the coal dust air quality modeling.
[b] Chromium (VI) is likely substantially lower than as shown in the table because the percent of chromium as chromium (VI) was conservatively assumed the same as coal fly ash, which is a post-combustion coal residual. Combustion is known to substantially increase the percentage of chromium as chromium (VI) (Stam et al. 2011).
[c] Based on analysis of coal dust sample from field program. Total crystal silica fraction in coal dust is the sum of the crystal silica quartz and silicate fractions.
ASIL = acceptable source impact level; $\mu g/m^3$ = micrograms per cubic meter

ASILs are screening concentrations for toxic air pollutant in the ambient air, and are based on the levels established in Washington Administrative Code (WAC) 173-460-150 for stationary sources, but are shown here for comparison purposes. As shown in Table 5.7-8, all predicted maximum concentrations of trace elements found in coal dust along the BNSF main line in Cowlitz County would be less than their respective ASILs.

BNSF Main Line in Columbia River Gorge

A dispersion model was run to assess the potential coal dust concentration and deposition from the Proposed Action-related to loaded trains traveling along the BNSF main line in the Columbia River Gorge. The model assumed an average 50-mph train speed operating on the BNSF main line near Dallesport, Washington, using readily available 2014 meteorological data from The Dalles, Oregon. Further details can be found in the *SEPA Coal Technical Report*.

Adding modeled concentrations of PM10 and PM2.5 due to coal dust from Proposed Action-related trains to background levels results in total concentrations below the NAAQS at a distance of 50 and 100 feet from the rail line (Table 5.7-9). Estimated concentrations are lower than those estimated for the BNSF main line in Cowlitz County because of the higher average wind speeds in the Columbia River Gorge, which increases dispersion, although the full effect is offset by the coal dust lift-off when the wind is blowing toward the train. In all cases, these concentrations remain below the NAAQS.

Table 5.7-9. Estimated Maximum PM10 and PM2.5 Concentrations—BNSF Main Line, Columbia River Gorge

Pollutant	Averaging Period	Distance from Rail Line (feet)	Modeled Impact ($\mu g/m^3$)	Background[a] ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM10	24 hours[b]	50	18.8	56.0	74.8	150
		100	14.1	56.0	70.1	150
PM2.5	24 hours[c]	50	2.9	19.0	21.9	35
		100	2.2	19.0	21.2	35
	Annual[d]	50	0.94	6.1	7.0	12
		100	0.75	6.1	6.9	12

Notes:
[a] Background concentrations are monitoring design values for Columbia Hills Historical State Park, Washington (Northwest International Air Quality Environmental Science and Technology Consortium 2015).
[b] The PM10 24-hour modeled impact is the high 2nd high concentration.
[c] The PM2.5 24-hour modeled impact is the 98th percentile of the daily maximum concentrations.
[d] Modeled impact is the annual average.
$\mu g/m^3$ = micrograms per cubic meter

The estimated maximum monthly coal dust deposition along the BNSF main line in the Columbia River Gorge would be above the benchmark used for the analysis at 50 feet (Table 5.7-10). The deposition amounts are similar to those found along the BNSF main line in Cowlitz County. Estimated maximum monthly deposition would occur during June.

Table 5.7-10. Estimated Coal Dust Deposition—BNSF Main Line, Columbia River Gorge

Distance (feet)	Average Maximum Monthly Deposition (g/m^2/month)	Maximum Monthly Deposition (g/m^2/month)	Benchmark Used for Analysis (g/m^2/month)
50	**2.2**	**2.6**	2.0
100	1.5	1.9	2.0
150	1.0	1.4	2.0

Notes:
[a] **Bolded, shaded gray** indicates the estimated deposition would be higher than the benchmark used for the analysis.
[b] Source: New Zealand Ministry of Environment 2001
g/m^2/month = grams per square meter per month

Washington State (Outside Cowlitz County and Columbia River Gorge)

The AERMOD air dispersion model was run to assess the potential coal dust concentration and deposition from both loaded and unloaded Proposed Action-related trains traveling along the BNSF main line from the Washington–Idaho border to just prior to entering the Columbia River Gorge using 3 years of Moses Lake, Washington, meteorological data (2010 through 2012). Adding modeled emissions of PM10 and PM2.5 due to coal dust from Proposed Action-related trains to background levels results in total concentrations below the NAAQS at a distance of 100 feet from the rail line (Table 5.7-11). These concentrations would decrease by 50% another 100 feet away from the rail line.

Table 5.7-11. Estimated Maximum PM10 and PM2.5 Concentrations (100 Feet from Rail Line) —BNSF Main Line, Washington State (Outside Cowlitz County and Columbia River Gorge)

Pollutant	Averaging Period	Modeled Impact (μg/m³)	Background[a] (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)
PM10	24 hour[b]	24.4	101.0	125.4	150
PM2.5	24 hour[c]	2.83	24.2	27.0	35
	Annual[d]	0.93	8.9	9.83	12

Notes:
[a] Background for PM10 is the maximum highest second high 24-hour average over the 3-year period (2012–2014) from Kennewick or Spokane. The background PM2.5 from the Spokane monitor from the 2012–2014 period.
[b] The PM10 24-hour modeled impact is 3-year average of the second-highest concentration.
[c] The PM2.5 24-hour modeled impact is the 3-year average of the 98th percentile of the daily maximum concentrations. The modeled impact is different than the annual average due to day-to-day variation in meteorology.
[d] Modeled impact is the annual average over the 3 modeled years based on Moses Lake meteorological data (2010–2012). The modeled impact is different than the 24-hour average due to day-to-day variation in meteorology.
NAAQS = National Ambient Air Quality Standards; μg/m³ = micrograms per cubic meter

The maximum monthly coal dust deposition (for both loaded and unloaded coal trains) along the BNSF main line in Washington State (outside of Cowlitz County and the Columbia River Gorge) would be below the benchmark used for the analysis (Table 5.7-12). The results show the increase in deposition for receptors located about 100 and 200 feet from the rail line.

Maximum monthly deposition occurs during December, but would be below the benchmark used for the analysis. The predicted maximum deposition of trace metals would be similar to the levels reported for Cowlitz County, which were not predicted to exceed the ASIL for any substance.

Table 5.7-12. Estimated Coal Dust Deposition (Loaded and Unloaded Trains)—BNSF Main Line, Washington State (Outside Cowlitz County and Columbia Gorge)

Distance (feet)	Average Maximum Monthly Deposition (g/m^2/month)	Maximum Monthly Deposition (g/m^2/month)	Benchmark Used for the Analysis (g/m^2/month)[a]
100	0.73	0.88	2.0
200	0.27	0.52	2.0

Notes:
[a] Source: New Zealand Ministry of Environment 2001
g/m^2/month = grams per square meter per month

Impact Summary

The coal dust analysis made the following conclusions.

- **Project area.** Estimated maximum monthly deposition of coal dust at the project area boundary would be 0.40 g/m^2/month, which is **below** the benchmark of 2.0 g/m^2/month (New Zealand Ministry of Environment 2001) used for this analysis.
- **Reynolds Lead and BNSF Spur, Cowlitz County:**
    - Estimated maximum PM10 and PM2.5 concentrations from coal dust emissions plus background 100 feet from the rail line would be 28.28 $\mu g/m^3$ for PM10 and 16.05 $\mu g/m^3$ (24-hour) and 5.31 $\mu g/m^3$ (annual) for PM2.5, which are **below** the applicable NAAQS.
    - Estimated maximum and average monthly deposition of coal dust 180 feet from the rail line would be 0.017 and 0.013 g/m^2/month, which are **below** the benchmark of 2.0 g/m^2/month (New Zealand Ministry of Environment 2001) used for this analysis.
- **BNSF Main Line, Cowlitz County:**
    - Estimated maximum PM10 and PM2.5 concentrations from coal dust emissions plus background 50 feet from the rail line would be 58.0 $\mu g/m^3$ for PM10 and 25.5 $\mu g/m^3$ (24-hour) and 8.0 $\mu g/m^3$ (annual) for PM2.5, which are **below** the applicable NAAQS.
    - Estimated maximum (at 100 feet) and average (at 50 feet) monthly deposition of coal dust would be 2.3 and 2.2 g/m^2/month, which are **above** the benchmark of 2.0 g/m^2/month (New Zealand Ministry of Environment 2001) used for this analysis.
- **BNSF Main Line, Columbia River Gorge:**
    - Estimated maximum PM10 and PM2.5 concentrations from coal dust emissions plus background at 50 feet from the rail line would be 74.8 $\mu g/m^3$ for PM10 and 21.9 $\mu g/m^3$ (24-hour) and 7.0 $\mu g/m^3$ (annual) for PM2.5, which are **below** the applicable NAAQS.
    - Estimated maximum (at 50 feet) and average (at 50 feet) monthly deposition of coal dust would be 2.6 and 2.2 g/m^2/month, which are **above** the benchmark of 2.0 g/m^2/month (New Zealand Ministry of Environment 2001) used for this analysis.

- **BNSF Main Line, Washington State (outside Cowlitz County and the Columbia River Gorge):**
  - Estimated maximum PM10 and PM2.5 concentrations from coal dust emissions plus background at 100 feet would be 125.4 $\mu g/m^3$ for PM10 and 27.0 $\mu g/m^3$ (24-hour) and 9.83 $\mu g/m^3$ (annual) for PM2.5, which are **below** the applicable NAAQS.
  - Estimated maximum and average monthly deposition of coal dust at 100 feet would be 0.88 and 0.73 g/m^2/month, which are **below** the benchmark of 2.0 g/m^2/month (New Zealand Ministry of Environment 2001) used for this analysis.

In 2015, a study was published that evaluated PM2.5 concentrations during the passing of a coal train on the BNSF main line in the Columbia River Gorge in Washington State (Jaffe et al. 2015). The study evaluated 2-minute average PM2.5 concentrations. After 2 minutes, PM2.5 concentrations returned to background levels. The study was conducted before the BNSF surfactant facility in Pasco began operation, and would be expected to have impacts similar to those modeled for the Proposed Action, which estimated coal dust emissions without additional surfactant applied in Pasco. Jaffe et al. (2015) monitored the maximum 2-minute concentration from a single unit coal train measured at 130 feet downwind of the coal train. As shown in Table 5.7-6, the maximum modeled 24-hour PM2.5 concentration was 3.8 $\mu g/m^3$ at 100 feet for a Proposed Action-related train, which is similar to results found by Jaffe (2.6 $\mu g/m^3$) if 8 unit trains are considered and expressing in terms of the regulatory averaging period of 24-hour concentration. Thus, the findings of Jaffe and the results of the analysis for the Proposed Action are generally consistent.

Overall, the impacts of PM10 and PM2.5 emissions due to coal dust from Proposed Action-related rail transport of coal would not be significant because emissions would be below applicable federal standards. The average and maximum monthly deposition of coal dust on the BNSF main line in Cowlitz County (at 50 and 100 feet, respectively) and Columbia River Gorge (at 50 feet) was estimated to be above the benchmark used for the analysis. Because no state or federal standards apply to deposition of coal dust, this impact is not considered significant.

5.7.5.2 No-Action Alternative

Under the No-Action Alternative, the Applicant would not construct the coal export terminal and impacts related to coal dust from construction and operation of the Proposed Action would not occur. The Applicant would continue with current and future 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. Petroleum coke transfer would have minimal coal dust emissions because the material is stored in a building and the transfer from vessel occurs through vacuum unloader.

5.7.6 Required Plans and Permits

Coal dust has no separate permitting requirements. The following required permit would be required in relation to air quality (including coal dust) 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 requirements of Washington's Clean Air Act apply statewide (Chapter 70.94 Revised Code of Washington [RCW]). Businesses located in Cowlitz County are regulated by the Southwest Clean Air Agency. The agency 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.[17] It is anticipated these levels would 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.

5.7.7 Proposed Mitigation Measures

This section describes the proposed mitigation measures that would reduce impacts related to coal dust from operation of the Proposed Action. These mitigation measures would be implemented in addition to project design measures, best management practices, and compliance with environmental permits, plans, and authorizations that are assumed as part of the Proposed Action.

5.7.7.1 Voluntary Mitigation

The Applicant has committed to implementing the following measure to mitigate impacts related to coal dust.

- To address coal dust emissions from rail cars, the Applicant will not receive coal trains unless the coal has been appropriately shaped in the rail cars and surfactant applied at the mine area.

5.7.7.2 Applicant Mitigation

The Applicant will implement the following measures to mitigate impacts related to coal dust.

MM CDUST-1. Monitor and Reduce Coal Dust Emissions in the Project Area.

To address coal dust emissions, the Applicant will monitor coal dust during operation of the Proposed Action at locations approved by the SWCAA. A method for measuring coal dust concentration and deposition will be defined by SWCAA. If coal dust levels exceed nuisance levels, as determined by SWCAA, the Applicant will take further action to reduce coal dust emissions. Potential locations to monitor coal dust concentration and deposition will be along the facility fence line in close proximity to the coal piles, where the rail line enters the facility and operation of the rotary dumper occurs, and at a location near the closest residences to the project area, if agreed to by the property owner(s). The Applicant will conduct monthly reviews of the concentration and deposition data and maintain a record of data for at least 5 years after full operations, unless otherwise determined by SWCAA. If measured concentrations exceed particulate matter (PM) air quality standards, the Applicant will report this information to SWCAA, Cowlitz County and Ecology. The Applicant will gather 1 year of fence line data on PM2.5 and PM10 prior to beginning operations and maintain the data as reference. These data will be reported to the SWCAA, Cowlitz County, and Ecology.

[17] Other criteria air pollutants have higher emissions thresholds.

MM CDUST-2. Establish Reporting Process for Coal Dust Complaints in Cowlitz County.

To address coal dust emissions, the Applicant will meet with the Southwest Clean Air Agency prior to the start of operations to design and implement a coal dust awareness and investigation system for community members in Cowlitz County. The system will receive complaints or concerns, investigate, respond, resolve and report findings to the complainant and Southwest Clean Air Agency. The system will be available in both English and Spanish during operation of the Proposed Action. The Applicant will operate the system or provide funding for Southwest Clean Air Agency to operate the system. A report will be submitted annually to Cowlitz County and the City of Longview and posted on Southwest Clean Air Agency website.

MM CDUST-3. Reduce Coal Dust Emissions from Rail Cars.

To address coal dust emissions, the Applicant will not receive coal trains unless surfactant has been applied at the BNSF surfactant facility in Pasco, Washington for BNSF trains traveling through Pasco. While other measures to control emissions are allowed by BNSF, those measures were not analyzed in this EIS and would require additional environmental review. For trains that will not have surfactant applied at the BNSF surfactant facility in Pasco, before beginning operations, the Applicant will work with rail companies to implement advanced technology for application of surfactants along the rail routes for Proposed Action-related trains.

MM CDUST-4. Provide Information to the Columbia River Gorge Commission.

To address statewide and regional public interests and concern of coal dust emissions, the Applicant will attend at least one Columbia River Gorge Commission public meeting per year and be available to present information on coal dust emissions and rail traffic related to the Proposed Action and discuss concerns.

5.7.7.3 Other Measures to be Considered

The following measure could be implemented to mitigate impacts related to coal dust.

- BNSF should conduct a dust monitoring study along BNSF main line in Cowlitz County to evaluate coal dust emissions from coal trains, and if necessary, take further actions to reduce such emissions.

5.7.8 Unavoidable and Significant Adverse Environmental Effects

Compliance with laws and implementation of the mitigation measures described above would reduce impacts related to coal dust. There would be no unavoidable and significant adverse environmental impacts from coal dust.