

Appendix D
Air Data

Existing Air Quality Conditions

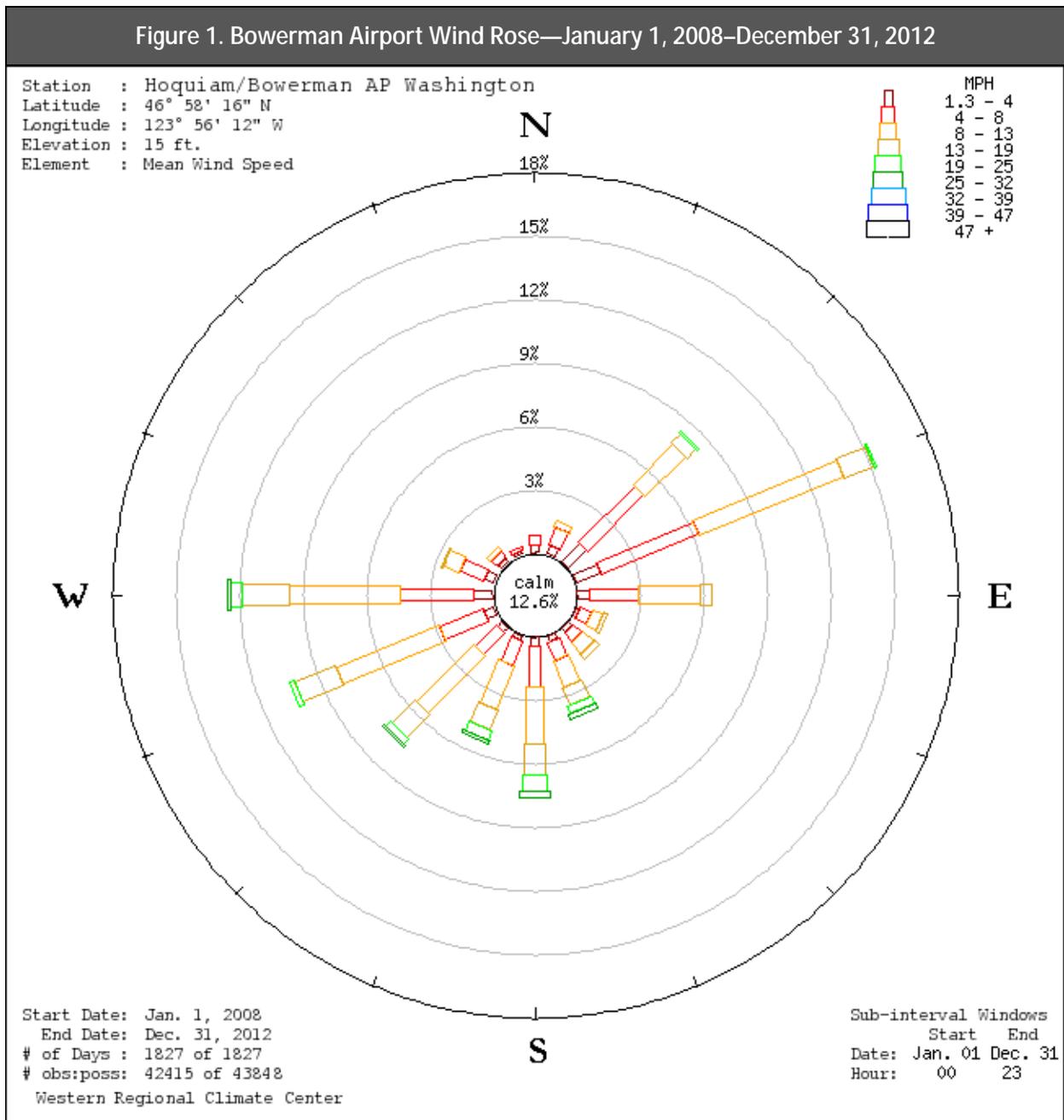
Wind Frequency, Speed, and Direction

Figure 1 shows the wind rose for Bowerman Field (Hoquiam Airport) in Hoquiam, Washington, located 3.8 miles west of the project site. The wind rose consists of 16 “spokes” whose positions correspond to the major compass directions, and indicate the frequency of wind blowing from each direction. Longer arms indicate that the wind originates more frequently from the illustrated direction. Colored bands within each arm indicate the proportion of time that the wind blows with a given speed. Prevailing winds near the project site come from the west in April through September and from the east-northeast in October through March (Desert Research Institute Western Regional Climate Center 2013a).

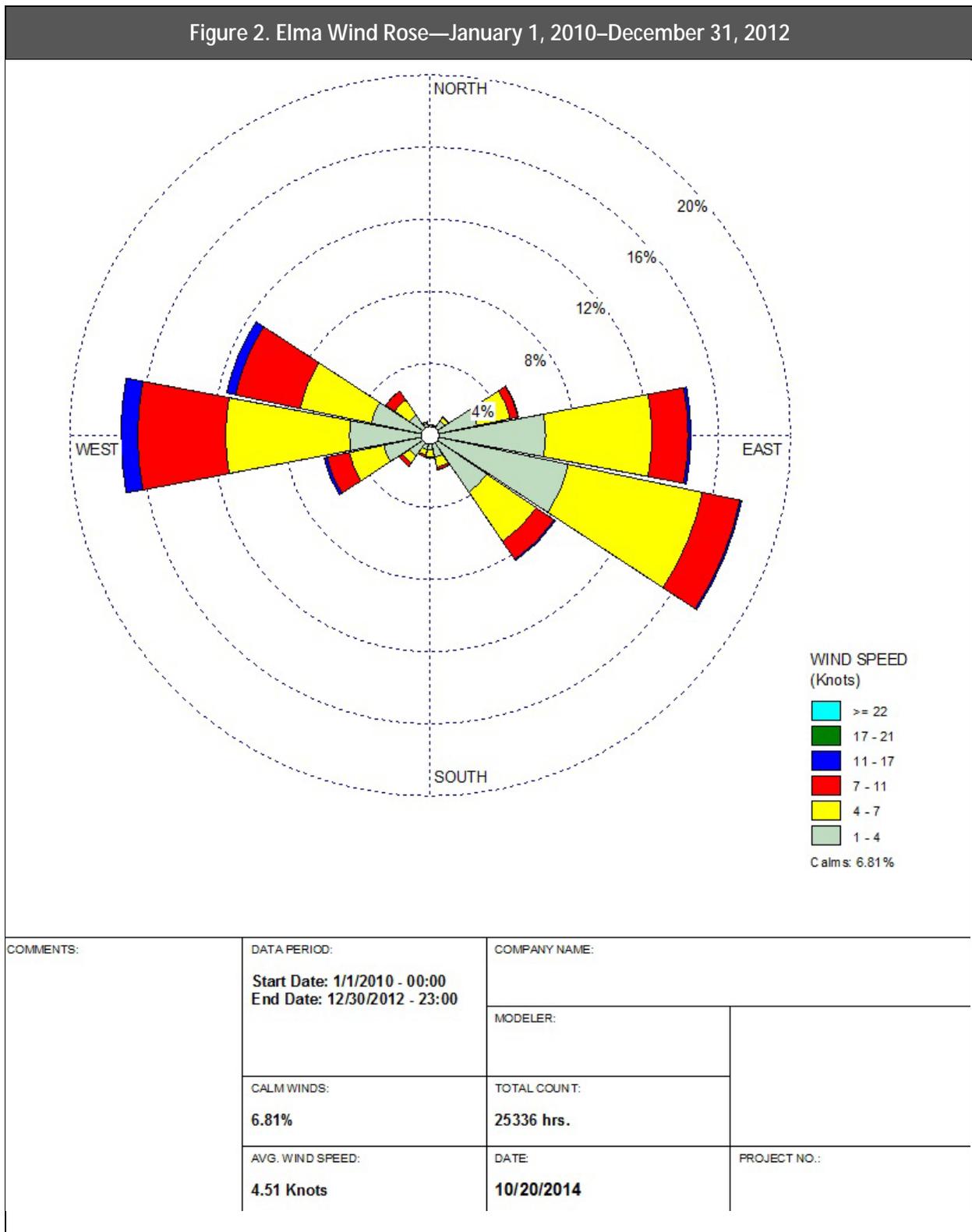
In the summer months, average wind speed is 8.5 miles per hour (mph); the winter months have stronger winds with an average wind speed of 10.7 mph. December and January have the highest average wind speed at 11 mph (Desert Research Institute Western Regional Climate Center 2013b). Annual average wind speed is 9.3 mph. Calm conditions (less than 1.3 mph) occur about 12.6% of the time, predominately during the night and averaging a little over 17% of all nighttime hours.

Figure 2 shows the wind rose for Elma, Washington, which is located along the Puget Sound & Pacific Railroad (PS&P) rail line, approximately halfway between the project site and Centralia, Washington. Prevailing winds in Elma come from the west in April through September and from the east-southeast in October through March.

In the summer months, average wind speed is 6.4 mph; during the winter months, a lower average wind speed of 4.6 mph prevails at this inland location. Annual average wind speed is nearly half of that in Grays Harbor at 5.2 mph; however, calm conditions are less frequent, occurring about 6.8% of the time.



Source: Washington State Department of Ecology 2014a



Source: Washington State Department of Ecology 2014b

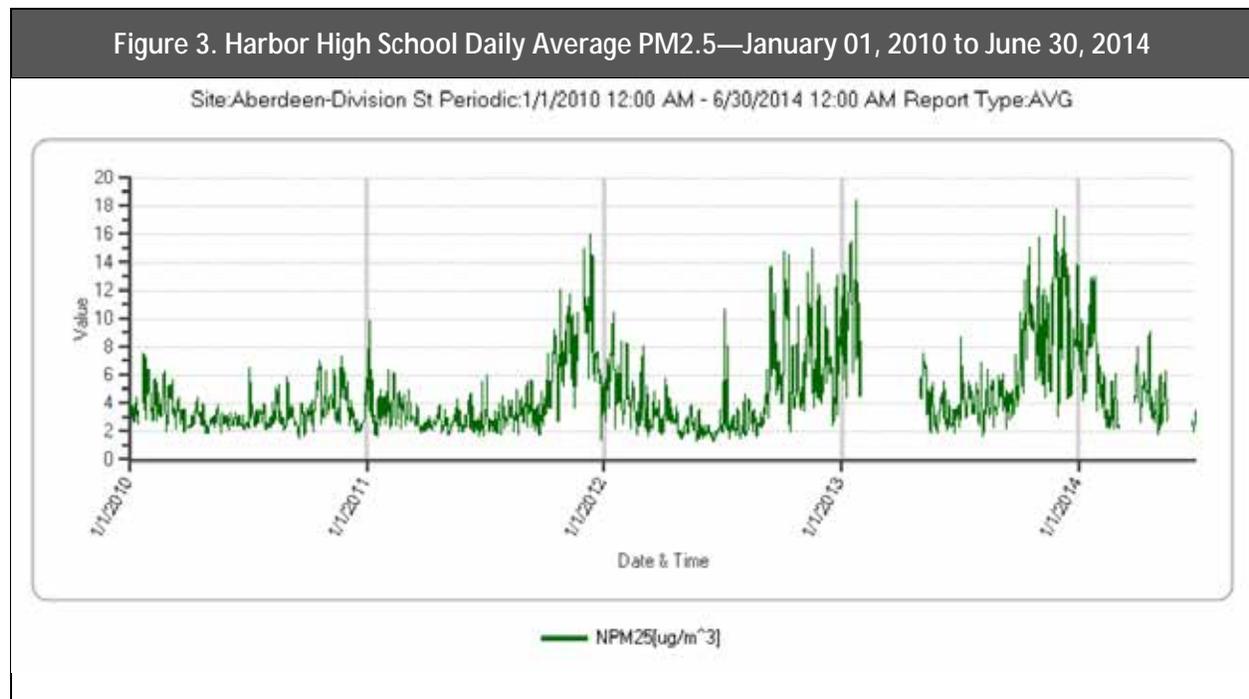
PM2.5 Monitoring in the Study Area

Three monitoring sites provide data on particulates less than 2.5 micrometers in diameter (PM2.5) in the study area: the Washington State Department of Ecology (Ecology) Harbor High School monitoring site and one site each in Chehalis and Oakville.

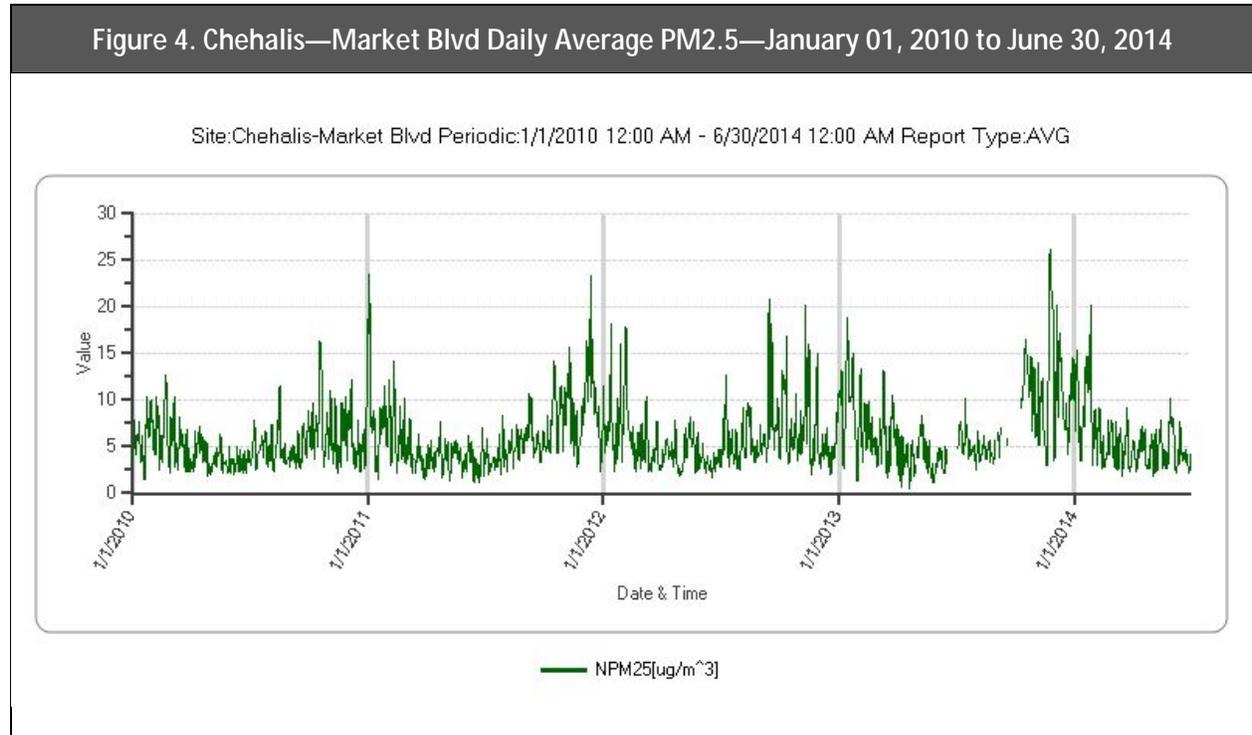
The Harbor High School monitoring site, approximately 1 mile from the project site, is representative of particulate matter levels near the project site and in Hoquiam and Aberdeen. Ecology has identified that the sources contributing to PM2.5 measured by this monitoring site are from home heating and mobile sources (cars and trucks). It is used by Ecology primarily to call for curtailment, if needed, during the home heating season. Figure 3 shows the daily average PM2.5 monitoring over the past 4.5 years at this monitoring site. The highest measured 24-hour concentration is just over 18 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), well below the PM2.5 air quality standard of $35 \mu\text{g}/\text{m}^3$.

Two PM2.5 monitoring sites located in Chehalis and Oakville are representative of particulate matter levels along the PS&P rail line. Monitored data collected from January 1, 2010 through June 30, 2014, are shown in Figures 4 and 5.

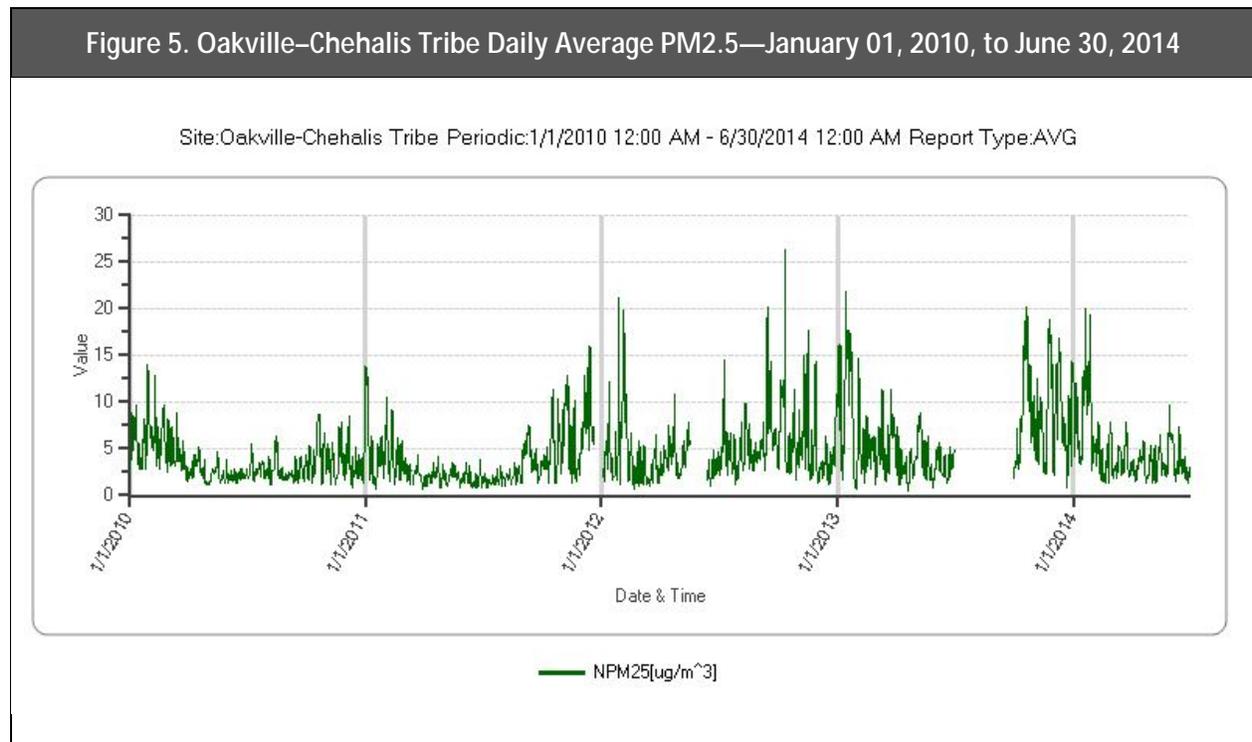
Figures 3 through 5 show how PM2.5 emissions peak in the fall and winter months and that the higher concentrations (above $20 \mu\text{g}/\text{m}^3$) are relatively infrequent.



Source: Washington State Department of Ecology 2014a



Source: Washington State Department of Ecology 2014c



Source: Washington State Department of Ecology 2014b

Table 1 provides a statistical summary of Figures 3, 4, and 5 through 2013. The highest measured 24-hour concentration was at the Chehalis site at a little over 26 $\mu\text{g}/\text{m}^3$.

Table 1. PM_{2.5} Concentrations ($\mu\text{g}/\text{m}^3$) in and near the Study Area

| Parameter | Monitoring Station | | |
|----------------|--------------------|-------------|-------------|
| | Harbor High School | Chehalis | Oakville |
| 2010 | | | |
| Minimum | 1.6 | 1.5 | 0.9 |
| Maximum | 7.6 | 16.4 | 14 |
| Average | 3.4 | 5.2 | 3.6 |
| Number | 357 | 365 | 364 |
| Data[%] | 98% | 100% | 100% |
| 2011 | | | |
| Minimum | 1.4 | 1.1 | 0.6 |
| Maximum | 16 | 23.5 | 16 |
| Average | 4.2 | 5.9 | 3.6 |
| Number | 355 | 363 | 352 |
| Data[%] | 97% | 99% | 96% |
| 2012 | | | |
| Minimum | 1.3 | 1.6 | 0.7 |
| Maximum | 15 | 20.9 | 26.4 |
| Average | 4.5 | 5.8 | 5.0 |
| Number | 365 | 365 | 337 |
| Data[%] | 100% | 100% | 92% |
| 2013 | | | |
| Minimum | 1.7 | 0.5 | 0.5 |
| Maximum | 18.4 | 26.1 | 21.8 |
| Average | 6.6 | 7.1 | 6.3 |
| Number | 276 | 314 | 272 |
| Data[%] | 76% | 86% | 75% |

Source: Washington State Department of Ecology 2014b

Proposed Action

Criteria Air Pollutants and Toxic Air Pollutants

Construction

Tables 2 through 4 illustrate annual construction emissions for Phase 1 and 2.

Table 2. Annual Construction Emission (tons/year)—Phase 1

| Sources | CO | NO_x | SO_x | VOC | PM10 | PM2.5 | CO_{2e} |
|--|-------------|-----------------------|-----------------------|-------------|-------------|--------------|------------------------|
| Wind erosion | | | | | 0.01 | <0.01 | |
| Pad construction activity | | | | | 1.94 | 0.51 | |
| Excavation | 0.32 | 0.72 | 0.0019 | 0.08 | 0.05 | 0.04 | 273 |
| <i>Total earth moving activities</i> | <i>0.32</i> | <i>0.72</i> | <i>0.0019</i> | <i>0.08</i> | <i>2.00</i> | <i>0.55</i> | <i>273</i> |
| Pile driving | 0.02 | 0.03 | 0.0001 | 0.00 | 0.002 | 0.002 | 8 |
| Mechanical | 0.10 | 0.21 | 0.0002 | 0.03 | 0.015 | 0.014 | 36 |
| General construction | 1.12 | 1.63 | 0.0024 | 2.46 | 0.14 | 0.13 | 334 |
| Off-site passenger vehicles | 0.27 | 0.12 | 0.001 | 0.02 | 0.01 | 0.01 | 53 |
| Total Emissions | 1.83 | 2.71 | 0.005 | 2.59 | 2.17 | 0.71 | 704 |
| General Conformity <i>de minimis</i> levels for ozone maintenance areas (CFR 93.153) | 100 | 100 | 100 | 100 | 100 | 100 | |

CFR = Code of Federal Regulations

Table 3. Annual Construction Emission (tons/year)—Phase 2

| Sources | CO | NO_x | SO_x | VOC | PM10 | PM2.5 | CO_{2e} |
|--|-------------|-----------------------|-----------------------|-------------|-------------|--------------|------------------------|
| Wind erosion | | | | | <0.01 | <0.01 | |
| Pad construction activity | | | | | 0.16 | 0.04 | |
| Excavation | 0.08 | 0.18 | <0.001 | 0.02 | 0.01 | 0.01 | 68 |
| <i>Total earth moving activities</i> | <i>0.08</i> | <i>0.18</i> | <i><0.001</i> | <i>0.02</i> | <i>0.18</i> | <i>0.05</i> | <i>68</i> |
| Pile driving | 0.02 | 0.05 | <0.001 | 0.01 | 0.00 | 0.00 | 11 |
| Mechanical | 0.04 | 0.08 | <0.001 | 0.01 | 0.01 | 0.01 | 13 |
| General construction | 0.28 | 0.41 | 0.001 | 2.27 | 0.03 | 0.03 | 84 |
| Off-site passenger vehicles | 0.03 | 0.01 | <0.001 | <0.01 | <0.01 | <0.01 | 7 |
| Total Emissions | 0.45 | 0.73 | 0.001 | 2.31 | 0.22 | 0.09 | 183 |
| General Conformity <i>de minimis</i> levels for ozone maintenance areas (CFR 93.153) | 100 | 100 | 100 | 100 | 100 | 100 | |

CFR = Code of Federal Regulations

Table 4. Maximum Daily Construction Emissions (pounds/day)—Phase 1

| Sources | CO | NO_x | SO_x | VOC | PM10 | PM2.5 |
|-----------------------------|--------------|-----------------------|-----------------------|--------------|-------------|--------------|
| Excavation | 13.41 | 26.77 | 0.07 | 3.17 | 1.93 | 1.56 |
| General construction | 45.95 | 34.45 | 0.07 | 65.27 | 2.16 | 2.03 |
| Off-site passenger vehicles | 3.64 | 1.59 | 0.01 | 0.24 | 0.09 | 0.07 |
| Total Emissions | 63.00 | 62.81 | 0.15 | 68.67 | 4.18 | 3.67 |

Operations

Tables 5 through 7 illustrate estimated emissions of criteria air pollutants and toxic air pollutants under the proposed action.

Table 5. Estimated Emissions of Criteria Air Pollutants and Toxic Air Pollutants (pounds per year) Emitted On Site under the Proposed Action

| Pollutant | Stationary Sources ^a | | | | | | Total | |
|--------------------------------|---------------------------------|----------------------------|---------------|--|----------------------|------------------------|------------|----------|
| | Fugitive Emissions ^b | Storage Tanks ^c | Tank Cleaning | Marine Vapor Control System ^d | Rail (Mobile Source) | Vessel (Mobile Source) | Stationary | Combined |
| Criteria Air Pollutants | | | | | | | | |
| NO _x | – | – | – | 4,934 | 13,658 | 10,256 | 4,934 | 28,848 |
| PM10 | – | – | – | 499 | 508 | 184 | 499 | 1,191 |
| PM2.5 | – | – | – | 499 | 493 | 170 | 499 | 1,162 |
| VOC | 652 | 22,188 | 31,694 | 29,464 | 803 | 384 | 83,997 | 85,183 |
| CO | – | – | – | 26,849 | 2,033 | 812 | 26,849 | 29,694 |
| SO ₂ | – | – | – | 33 | 7 | 295 | 33 | 335 |
| Toxic Air Pollutants | | | | | | | | |
| Benzene | 2.6 | 50.4 | 23.2 | 42.8 | 16.1 | 7.7 | 119.0 | 143 |
| Formaldehyde | – | – | – | 4.1 | 120.4 | 57.6 | 4.1 | 182 |
| Hydrogen sulfide | <0.1 | 25.0 | 19.0 | 35.0 | – | – | 79 | 79 |
| Toluene | 6.5 | 71.4 | 15.8 | 29.2 | 12.0 | 5.8 | 122.9 | 141 |
| Sulfuric acid mist | – | – | – | 1.0 | – | – | 1 | 1 |
| n-hexane | 2.6 | 70.3 | 15.8 | 29.2 | 1.3 | 0.6 | 117.9 | 120 |
| Cyclohexane | 4.6 | 90.4 | 42.2 | 77.7 | – | – | 215 | 215 |

^a Trinity Consultants 2015.

^b Emissions are from losses during filling and draining.

^c Leaks from valves and flanges.

^d Vessel loading emissions are primarily from the marine vapor control system. The marine vapor control system has a John Zink performance guarantee destruction efficiency of 98% minimum reduction in the total hydrocarbon vapor emissions routed through the marine vapor control system.

NO_x = nitrogen oxides; PM10 = particulate matter with a diameter of 10 micrometers or less; PM2.5 = particulate matter with a diameter of 2.5 micrometers or less;

VOC = volatile organic compound; CO = carbon monoxide; SO₂ = sulfur dioxide

Table 6. Annual Operational Emissions of Criteria Air Pollutants Emitted within Gray Harbor County under the Proposed Action (tons per year) Compared to 2011 Gray Harbor County Emissions

| Criteria Air Pollutant | Sources | Source Categories ^a | | | | | Total Emissions |
|------------------------|---------------------|----------------------------------|---------------------|---------------------|----------------|---------------|-----------------|
| | | Facility Operations ^b | Rail ^{c,d} | Vessel ^d | On-Road Mobile | Other Sources | |
| NO _x | Proposed Action | 2.5 | 28.8 | 44.0 | 0.1 | - | 75.4 |
| | Grays Harbor County | 643.7 | 41.4 | 297.9 | 2,224.3 | 484.2 | 3,691.5 |
| PM10 | Proposed Action | 0.2 | 1.1 | 0.7 | <0.01 | - | 2.0 |
| | Grays Harbor County | 410.2 | 1.0 | 9.9 | 82.5 | 1,681.4 | 2,185.0 |
| PM2.5 | Proposed Action | 0.2 | 1.0 | 0.6 | 0.0 | - | 1.8 |
| | Grays Harbor County | 375.0 | 0.9 | 9.5 | 66.0 | 722.8 | 1,174.2 |
| VOC | Proposed Action | 14.7 | 1.7 | 2.0 | 0.0 | - | 18.4 |
| | Grays Harbor County | 140.7 | 1.6 | 7.8 | 1,138.6 | 19,451.3 | 20,740.1 |
| CO | Proposed Action | 13.4 | 4.3 | 3.1 | 0.2 | - | 21.0 |
| | Grays Harbor County | 730.8 | 4.1 | 55.8 | 13,786.3 | 12,562.9 | 27,139.9 |
| SO _x | Proposed Action | 0.02 | <0.01 | 1.0 | <0.01 | - | 1.0 |
| | Grays Harbor County | 227.7 | 0.3 | 14.7 | 7.1 | 21.5 | 271.2 |

Sources: Grays Harbor County emissions: Washington State Department of Ecology 2014d; proposed action facility operations emissions: Trinity Consultants 2015.

^a Source categories based on Washington State Department of Ecology 2014d.

^b The proposed action onsite emissions include only those from stationary sources. The county emissions represent those from all industrial point sources.

^c Based on estimate that 68% of the fuel consumption from rail transit along the PS&P occurs within Grays Harbor County.

^d Rail and vessel emissions for the proposed action include emissions from on-site rail and vessel operations.

CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; VOC = volatile organic compound; PM10 = particulate matter with a diameter of 10 micrometers or less; PM2.5 = particulate matter with a diameter of 2.5 micrometers or less

Table 7. Estimated Increased Emissions of Criteria Air Pollutants and Toxic Air Pollutants (pounds per year) from Off-site Rail and Vessel Transport Related to the Proposed Action

| Pollutant | Rail | | Vessel | |
|--------------------------------|-------------|-------------|---------------|-------------|
| | 2017 | 2037 | 2017 | 2037 |
| Criteria Air Pollutants | | | | |
| NO _x | 63,237 | 63,633 | 78,031 | 27,613 |
| PM10 | 2,353 | 1,555 | 1,205 | 1,205 |
| PM2.5 | 2,282 | 1,555 | 1,109 | 1,109 |
| VOC | 3,717 | 4,136 | 3,626 | 3,626 |
| CO | 9,412 | 9,412 | 5,302 | 5,302 |
| SO ₂ | 33 | 33 | 1,776 | 1,776 |
| Toxic Air Pollutants | | | | |
| Benzene | 74 | 83 | 73 | 73 |
| Formaldehyde | 558 | 620 | 544 | 544 |
| n-hexane | 6 | 7 | 6 | 6 |
| Toluene | 56 | 62 | 54 | 54 |

NO_x = nitrogen oxides; PM10 = particulate matter with a diameter of 10 micrometers or less; PM2.5 = particulate matter with a diameter of 2.5 micrometers or less;
 VOC = volatile organic compound; CO = carbon monoxide; SO₂ = sulfur dioxide

Greenhouse Gas Emissions

Table 8 illustrates the annual average greenhouse gas (GHG) emissions from operation of the proposed action compared to statewide GHG emissions.

Table 8. Annual Average GHG Emissions (MT/yr CO₂e) from Operation of the Proposed Action Compared to Statewide 2011 GHG Emissions

| Source Type | Washington State^a | Proposed Action | Increase (%) |
|-------------------------|-------------------------------------|------------------------|---------------------|
| Rail transit | 1,000,000 | 25,543 ^b | 2.554 |
| Vessel transit | 3,300,000 | 783 ^c | 0.024 |
| Industrial sources only | 3,700,000 | 4,052 ^d | 0.109 |
| Total | 91,700,000 | 30,378 | 0.033 |

^a Washington State Department of Ecology 2014e.

^b Rail transport throughout the state; includes on-site rail emissions.

^c Includes emissions from vessels hoteling at the Terminal 1 dock (i.e., on-site vessel emissions).

^d On-site stationary sources: Trinity Consultants 2015.

MT/yr CO₂e = metric tons per year of carbon dioxide equivalent

References

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