

Appendix D
Air Data

Existing Air Quality Conditions

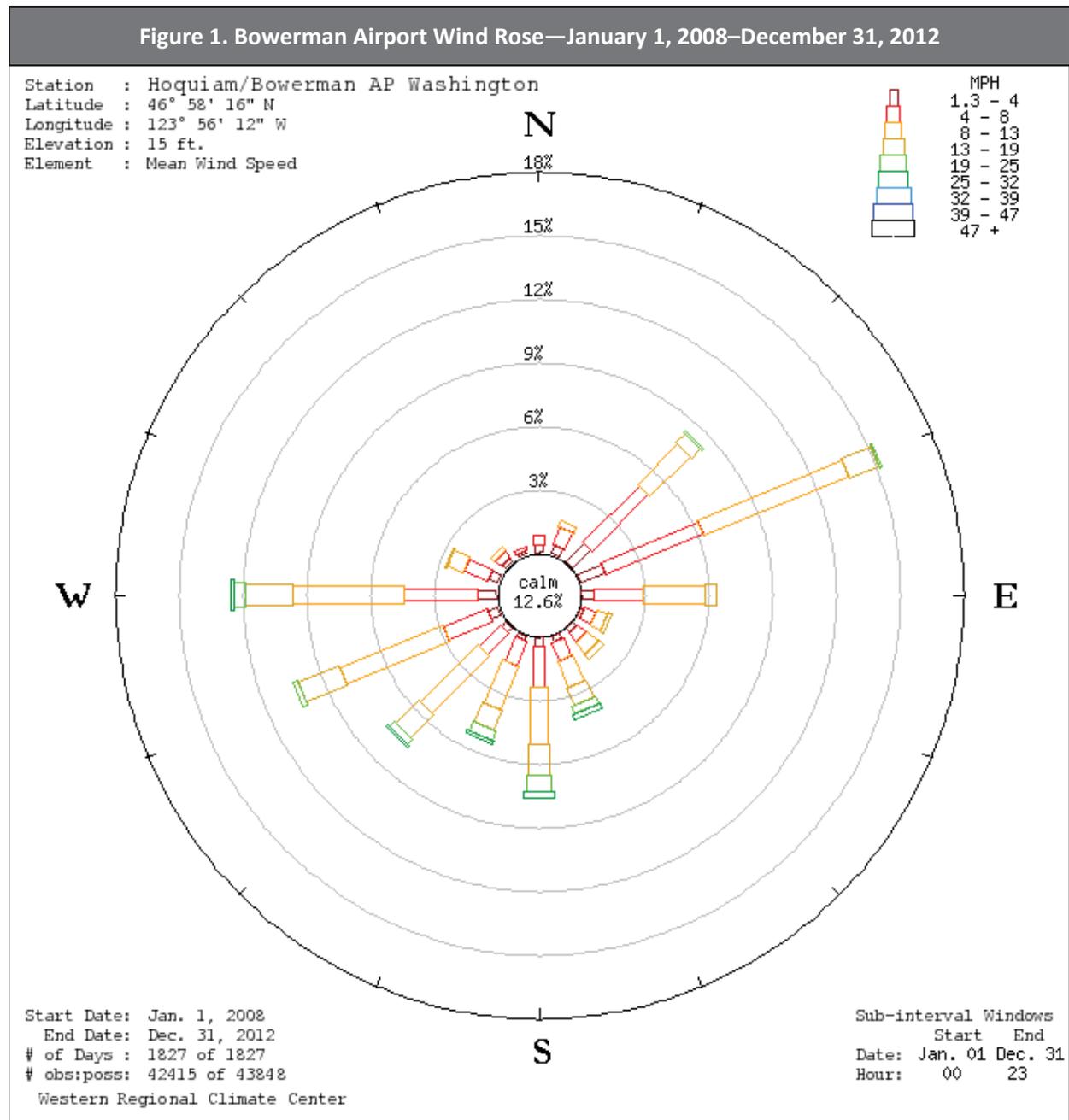
Wind Frequency, Speed, and Direction

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).

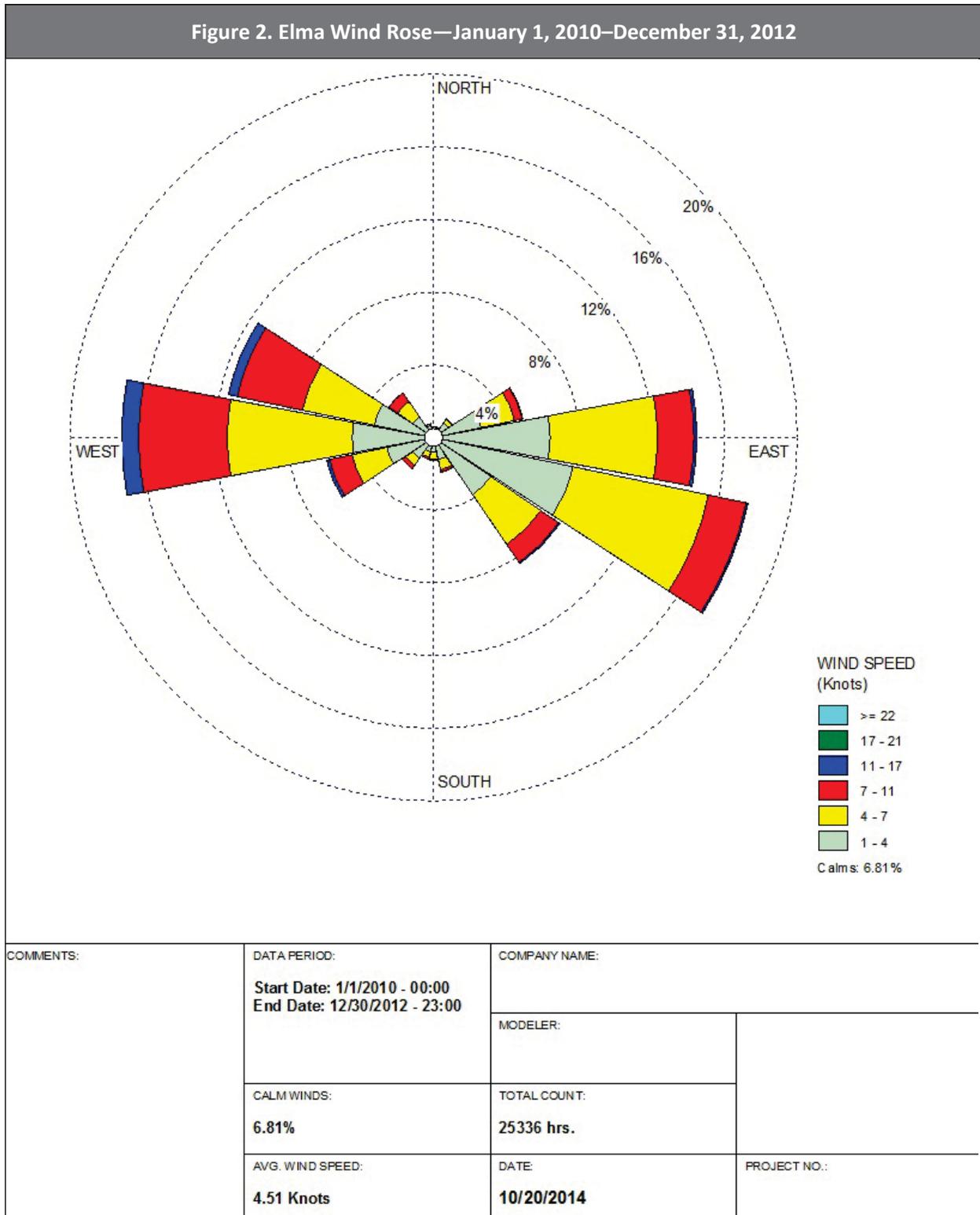
In the summer months, average wind speed is 8.5 miles per hour (mph); the winter months have stronger winds with an average wind speed of 10.7 mph. December and January have the highest average wind speed at 11 mph (Desert Research Institute Western Regional Climate Center 2013b). Annual average wind 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

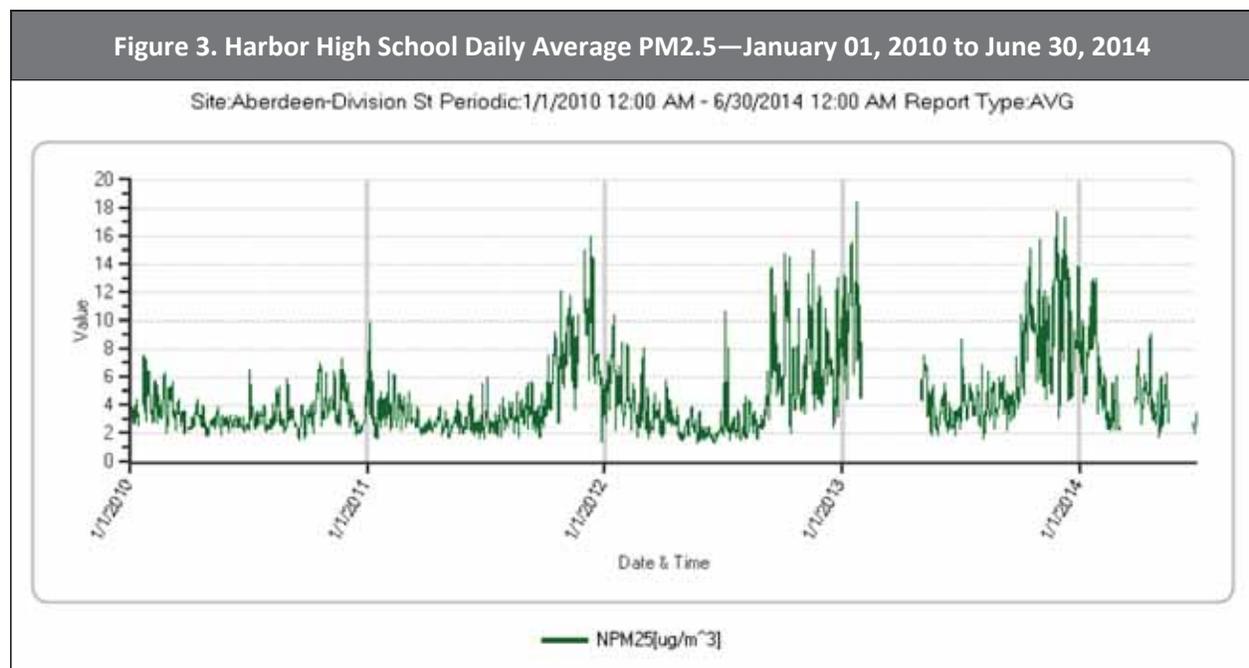
PM2.5 Monitoring in the Study Area

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.

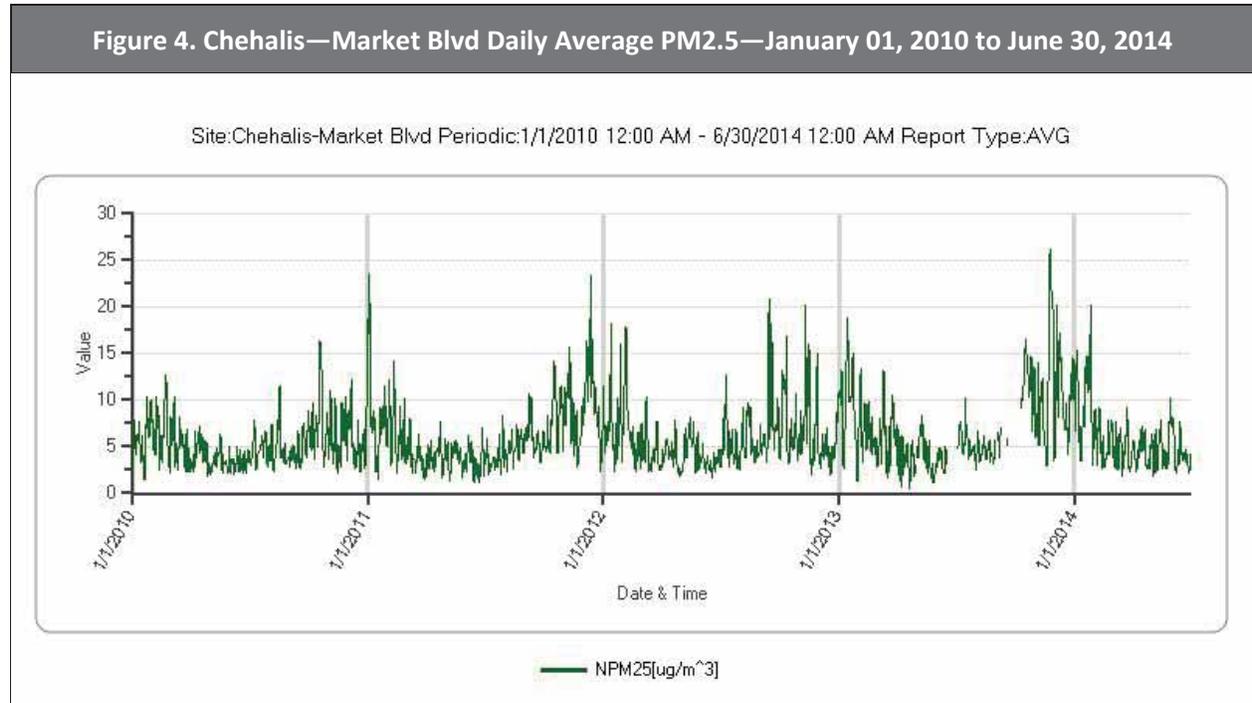
The Harbor High School monitoring site, approximately 1 mile from the project site, is representative of particulate matter levels near the project site and in Hoquiam and Aberdeen. Ecology has identified that the sources contributing to PM2.5 measured by this monitoring site are from home heating and 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.

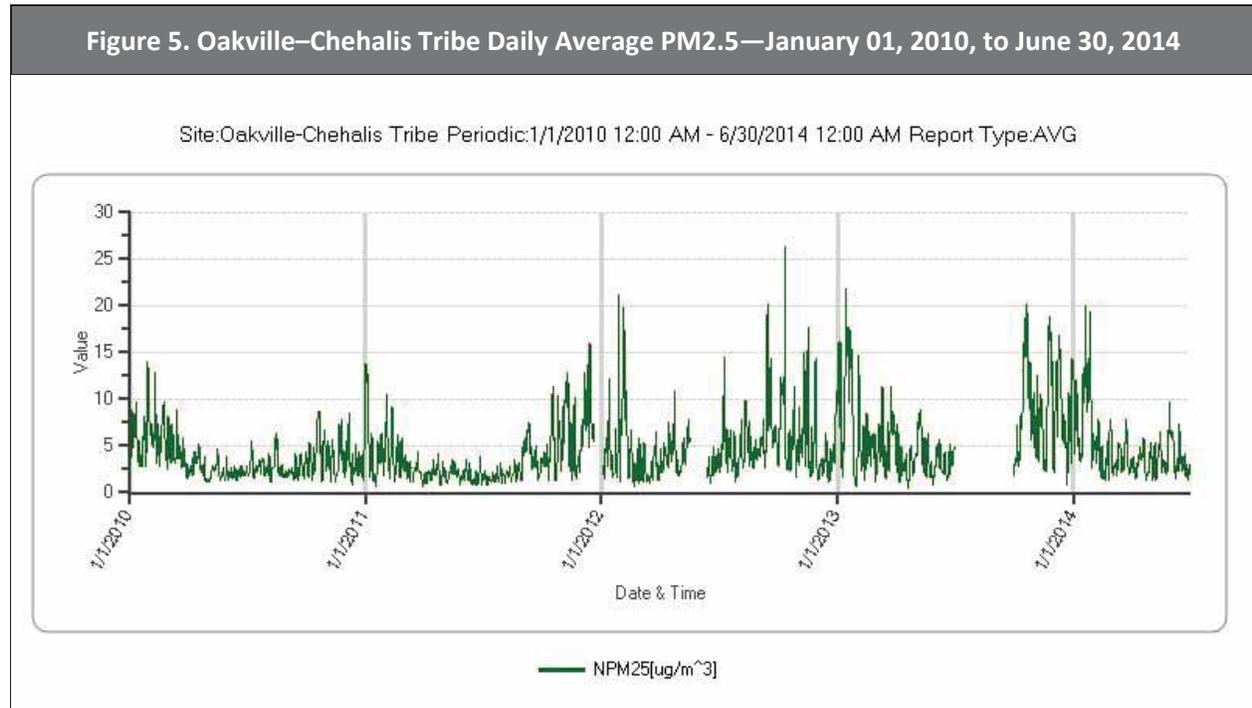
Figures 3 through 5 show how PM2.5 emissions peak in the fall and winter months and that the higher concentrations (above $20 \mu\text{g}/\text{m}^3$) are relatively infrequent.



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					3.11	0.82	
Excavation	0.66	1.94	0.00	0.16	0.08	0.07	527
<i>Total earth moving activities</i>	<i>0.66</i>	<i>1.94</i>	<i>0.0042</i>	<i>0.16</i>	<i>3.20</i>	<i>0.89</i>	<i>527</i>
Pile driving	0.11	0.35	<0.01	0.03	0.01	0.01	89
Mechanical	1.19	4.44	<0.01	0.27	0.14	0.02	509
General construction	4.88	6.84	0.01	2.34	0.66	0.64	878
Off-site passenger vehicles	1.14	0.50	0.0026	0.07	0.0288	0.0222	224
Total Emissions	7.97	14.07	0.020	2.88	4.04	1.58	2,228
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					0.05	0.01	
Excavation	0.16	0.48	0.0010	0.04	0.02	0.02	132
<i>Total earth moving activities</i>	<i>0.16</i>	<i>0.48</i>	<i>0.0010</i>	<i>0.04</i>	<i>0.07</i>	<i>0.03</i>	<i>132</i>
Pile driving	0.17	0.60	0.0012	0.05	0.01	0.01	148
Mechanical	0.41	1.52	0.0014	0.09	0.05	0.01	174
General construction	1.22	1.71	0.0018	1.32	0.16	0.16	220
Off-site passenger vehicles	0.27	0.12	0.0006	0.0172	0.0067	0.0052	52
Total Emissions	2.23	4.43	0.006	1.52	0.30	0.22	727
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	22.23	76.68	0.07	4.91	2.60	0.68
General construction	63.13	61.20	0.10	9.28	4.30	4.12
Off-site passenger vehicles	33.20	14.51	0.07	2.16	0.84	0.65
Total Emissions	118.56	152.38	0.25	16.35	7.74	5.44

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					Vessel (Mobile Source)	Total	
	Fugitive Emissions ^b	Storage Tanks ^c	Tank Cleaning	Marine Vapor Combustion Unit ^d	Rail (Mobile Source)		Stationary	Combined
Criteria Air Pollutants								
NO _x	-	-	-	30,915	7,134	25,855	30,915	63,904
PM10	-	-	-	917	265	465	917	1,648
PM2.5	-	-	-	917	257	428	917	1,603
VOC	400	21,872	2,159	98,048	419	967	123,379	124,765
CO	-	-	-	168,033	1,062	2,046	168,033	171,141
SO ₂	-	-	-	8,472	4	744	8,472	9,220
Toxic Air Pollutants								
Benzene	3.9	57	3.3	316	8.4	19.3	380	408
Formaldehyde	-	-	-	32	62.9	145.1	32	240
Hydrogen sulfide	<0.1	49	8.9	174			232	232
Toluene	19	201	3.0	434	6.3	14.5	657	678
Sulfuric acid mist	-	-	-	610	-	-	610	610
n-hexane	4.2	79	7.3	834	0.7	1.6	925	927
Cyclohexane	3.3	99	8.0	420			530	530
Ethyl benzene	3.9	51	0.3	26			81	81
Ethanol	264	3,060	-	6,140			9,464	9,464

^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 combustion unit. 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 combustion unit.

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/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	16	38.4	78.5	0.1	-	132.5
	Grays Harbor County	644	41	298	2,224	484	3,692
PM10	Proposed action	0.46	1.4	1.2	<0.01	-	4.2
	Grays Harbor County	410	1	10	83	1,681	2,185
PM2.5	Proposed action	0.46	0.9	1.1	0.00	-	3.64
	Grays Harbor County	375	1	9	66	723	1,174
VOC	Proposed action	61.7	2.5	3.5	0.01	-	81.3
	Grays Harbor County	141	2	8	1,139	19,451	20,740
CO	Proposed action	84	5.7	5.5	0.2	-	95
	Grays Harbor County	731	4.1	56	13,786	12,563	27,140
SO _x	Proposed action	4.2	0.0	1.90	<0.01	-	10.57
	Grays Harbor County	227.7	0.29	14.65	7.07	21.46	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 on-site emissions include emissions from onsite rail and vessel operations. The county emissions represent those from all other 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	100,461	101,090	131,145	46,408
PM10	3,738	2,471	2,025	2,025
PM2.5	3,626	2,471	1,863	1,863
VOC	5,904	6,571	6,094	6,094
CO	14,952	14,952	8,911	8,911
SO ₂	53	53	2,986	2,986
Toxic Air Pollutants				
Benzene	118.09	131.42	121.88	121.88
Formaldehyde	885.64	985.63	914.10	914.10
n-hexane	9.45	10.51	9.75	9.75
Toluene	88.56	98.56	91.41	91.41
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; SO ₂ = 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	35,708 ^b	3.571
Vessels transit	3,300,000	1,417 ^c	0.043
Industrial sources only	3,700,000	6,634 ^d	0.179
Total	91,700,000	43,759	0.048

^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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- Washington State Department of Ecology. 2014e. Washington State Greenhouse Gas Emissions Inventory 2010–2011. December. Publication 14-02-024. Olympia, WA.