PUGET SOUND ENERGY

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Clean Air Agency

June 22, 2017

BY HAND DELIVERY

Ms. Carole Cenci, P.E.
Compliance Manager
Puget Sound Clean Air Agency
1904 3rd Avenue, Suite 105
Seattle, WA 98101-3317

Re: NOV No. 3-008343

Dear Ms.Cenci:

Puget Sound Energy ("PSE") is pleased to submit the enclosed modeling analysis to accompany the Notice of Construction application submitted on May 22, 2017 for our proposed Tacoma LNG facility. The facility will serve PSE's existing customers by providing a dependable and cost-effective natural gas source during times of peak demand. The LNG produced at the facility will also provide a cleaner fuel alternative for regional businesses, including TOTE, a local shipping company operating cargo ships between Tacoma and Alaska. This innovative step will help them comply with new, stricter federal low-sulfur emission requirements.

The proposed Tacoma LNG facility will be subject to a variety of local, state and federal requirements discussed in the application, including, but not limited to, the application of Best Available Control Technology. As a result, the facility will have low emissions and will be a minor source of regulated air pollutants.

With the submittal of this ambient air quality impact analysis, we believe that the NOC application is complete. We intend to submit under separate cover a single application document that includes both the May 22 submittal and today's submittal. This will be provided to enhance public review but is not relevant of the completeness of our application with today's submittal.

We note that the Tacoma LNG project has complied with the State Environmental Policy Act based on the Final Environmental Impact Statement issued by the City of Tacoma on November 9, 2015.

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Please do not hesitate to contact me if you have any questions regarding this application.

Sincerely,

Roger Garratt
Director, Strategic Initiatives

cc (by email):
Rick Hess (RickH@pscleanair.org)
Jim Hogan
Lorna Luebbe
Keith Faretra
Bill Steiner
Tom Wood

5.0 AMBIENT AIR QUALITY ANALYSIS

This section discusses the air dispersion modeling results and provides a comparison of the results to the NAAQS and Washington Ambient Air Quality Standards (WAAQS) for criteria pollutants and the ASILs for TAPs. Copies of the electronic modeling files and inputs are provided in Appendix F.

First, criteria pollutant model results are compared to the "Cause or Contribute Threshold Values" under WAC 173-400-113, Table 4a (shown in the table below) in order to demonstrate that allowable project emissions will not cause or contribute to a violation of any ambient air quality standard.

Table 13: Cause or Contribute Threshold Values

Pollutant	Annual Average		24-Hour Average	8-Hour Average	1-Hour Average
CO	-		-	0.5 mg/m³	2 mg/m³
SO_2	1.0 µg/m³		5 µg/m³	-	30 µg/m³
PM_{10}	1.0 µg/m³		5 µg/m³	-	-
$PM_{2.5}$	0.3 µg/m³		1.2 µg/m³	-	-
NO_2	1.0 µg/m³		-	-	-

µg/m³ = micrograms per cubic meter
mg/m³ = milligrams per cubic meter

Source: WAC 173-400-113, Table 4a.

Second, for those TAPs that will be emitted by the project in excess of the applicable SQERs, model results are compared to the ASIL to determine if the pollutant would have a significant impact on ambient air quality.

As discussed in the following sections, the modeled ambient concentrations expected from project emissions are less than the cause or contribute values. Furthermore, predicted ambient concentrations of each TAP emitted above the SQER are less than the ASIL.

5.1 Model Methodology and Assumptions

Air dispersion modeling is conducted in general accordance with the 40 CFR Part 51 Appendix W, Guideline on Air Quality Models (January 17, 2017). The AERMOD modeling system is used to estimate ambient pollutant concentrations beyond the project property boundary for a variety of averaging times (e.g., 1 hour, 24 hours, annual, etc.). To do this, AERMOD requires input from several pre-processors for meteorological parameters, building downwash parameters, and terrain effects. AERMOD incorporates the data from the pre-processors with emission estimates and physical emission point characteristics to predict ambient concentrations of each pollutant across a network of receptors. The following sections describe these inputs and modeling assumptions.

AERMOD was set up to evaluate all operating scenarios:

1) Liquefying (all five waste gas cases)
2) Vaporizing (flare in holding mode)
3) Liquefying (all five waste gas cases) and truck and/or ship loading (all three waste gas cases)
4) Vaporizing and truck and/or ship loading (all three waste gas cases)
5) Flare in holding mode, no other operations
6) Flare in holding mode and truck and/or ship loading (all three waste gas cases).

Under Scenario 1, the liquefaction process is operating and natural gas is pretreated, chilled, and sent to the LNG storage tank. Under Scenario 2, the LNG is vaporized and the flare is in holding mode. Scenario 2 (vaporizing) is not expected to occur more than 10 days per year whereas Scenario 1 (liquefying) could occur all hours of the year when not vaporizing. In addition, blow down and purge gas from the truck and ship loading operation may be flared during all of the other operations (liquefying, vaporizing, or maintenance shutdown). As discussed in Section 2.2.2, several waste gas stream compositions are considered for each burner in the flare assembly (five cases for liquefying and three cases for truck and ship loading). Each waste gas stream is modeled for each operating scenario to determine which combination produces the highest predicted ambient concentration.

We conservatively assume that the units will be operating at maximum capacity for all short-term averaging periods (1-hour, 3-hour, 8-hour, and 24-hour averaging periods).

5.1.1 Emission Source Representation

CB&I provided architectural drawings to show the dimensions and location of the emission points and buildings. Exhaust parameters are obtained from manufacturer-provided data.

The vaporizer is modeled as a point source as follows:

- Stack Height: 60 feet
- Stack Inner Diameter: 42 inches
- Plume Exit Temperature: 680°F
- Exhaust Flow Rate: 42,022 actual cubic feet per minute (acfm).

The emission rates for the vaporizer are discussed in Section 2.2.1 and calculations are provided in Table B-3 of Appendix B.

The flare burner assembly will be contained inside a 9-foot-diameter structure that will be 85 feet tall. The flow rate of the flare will vary by waste gas characteristics and operating scenario (see Table 14 below). The flare is modeled as a point source as follows:

- Stack Height: 85 feet
- Stack Inner Diameter: 9 feet
- Plume Exit Temperature: 1,600°F.

Table 14: Exhaust Gas Flow Rates for Each Flare Operating Scenario

Operating Scenario Number	Scenario Description	Modeling Source ID	Exhaust Gas Flow Rate (acfm)
1	Liquefying Case 1	LW1	21,534
1	Liquefying Case 2	SW2	5,326
1	Liquefying Case 3	LW3	65,793
1	Liquefying Case 4	LW4	69,404
1	Liquefying Case 5	LW5	70,842
3	Liquefying Case 1, Truck and Ship Loading A1	LWSC1A1	29,847
3	Liquefying Case 2, Truck and Ship Loading A1	SWSC2A1	13,639
3	Liquefying Case 3, Truck and Ship Loading A1	LWSC3A1	74,106
3	Liquefying Case 4, Truck and Ship Loading A1	LWSC4A1	77,718
3	Liquefying Case 5, Truck and Ship Loading A1	LWSC5A1	79,155
3	Liquefying Case 1, Truck or Ship Loading A2	LWSC1A2	25,844
3	Liquefying Case 2, Truck or Ship Loading A2	SWSC2A2	9,636
3	Liquefying Case 3, Truck or Ship Loading A2	LWSC3A2	70,104
3	Liquefying Case 4, Truck or Ship Loading A2	LWSC4A2	73,715
3	Liquefying Case 5, Truck or Ship Loading A2	LWSC5A2	75,152
3	Liquefying Case 1, Blow Down and Purge B	LWSC1B	23,526
3	Liquefying Case 2, Blow Down and Purge B	SWSC2B	7,318
3	Liquefying Case 3, Blow Down and Purge B	LWSC3B	67,785
3	Liquefying Case 4, Blow Down and Purge B	LWSC4B	71,396
3	Liquefying Case 5, Blow Down and Purge B	LWSC5B	72,834
2, 5	Flare Holding	FLAREH	1,808
6	Flare Holding, Truck and Ship Loading A1	SWSCHA1	10,121
6	Flare Holding, Truck or Ship Loading A2	SWSCHA2	6,118
6	Flare Holding, Blow Down and Purge B	SWSCHB	3,800

acfm = actual cubic feet per minute

The emission rates for each flare burner and waste gas case are discussed in Section 2.2.2 and calculations are provided in Table B-4 to B-12 of Appendix B. The emission rates for the combined operation of the burners for the scenarios described above are provided in Table 15, Table 16, and Table 17 below.

Table 15: Short-Term Emission Rates for Each Flare Operating Scenario

Operating Scenario Number	Scenario Description	Modeling Source ID	NO_x (lb/hr)	CO (lb/hr)	SO_2 (lb/hr)	$PM_{10}/PM_{2.5}$ (lb/hr)
1	Liquefying Case 1	LW1	0.27	0.82	0.27	0.080
1	Liquefying Case 2	SW2	0.19	0.54	0.04	0.023
1	Liquefying Case 3	LW3	0.82	2.6	1.96	0.26
1	Liquefying Case 4	LW4	0.85	2.7	2.04	0.27
1	Liquefying Case 5	LW5	0.89	2.8	0.69	0.28
3	Liquefying Case 1, Truck and Ship Loading A1	LWSC1A1	0.52	1.6	0.27	0.11
3	Liquefying Case 2, Truck and Ship Loading A1	SWSC2A1	0.45	1.3	0.044	0.055
3	Liquefying Case 3, Truck and Ship Loading A1	LWSC3A1	1.1	3.3	2.0	0.29
3	Liquefying Case 4, Truck and Ship Loading A1	LWSC4A1	1.1	3.4	2.0	0.30
3	Liquefying Case 5, Truck and Ship Loading A1	LWSC5A1	1.1	3.5	0.69	0.31
3	Liquefying Case 1, Truck or Ship Loading A2	LWSC1A2	0.40	1.2	0.27	0.096
3	Liquefying Case 2, Truck or Ship Loading A2	SWSC2A2	0.32	0.92	0.04	0.039
3	Liquefying Case 3, Truck or Ship Loading A2	LWSC3A2	0.95	3.0	2.0	0.28
3	Liquefying Case 4, Truck or Ship Loading A2	LWSC4A2	0.98	3.1	2.0	0.29
3	Liquefying Case 5, Truck or Ship Loading A2	LWSC5A2	1.0	3.2	0.69	0.30
3	Liquefying Case 1, Blow Down and Purge B	LWSC1B	0.33	0.98	0.27	0.087
3	Liquefying Case 2, Blow Down and Purge B	SWSC2B	0.25	0.71	0.044	0.030
3	Liquefying Case 3, Blow Down and Purge B	LWSC3B	0.88	2.8	2.0	0.27
3	Liquefying Case 4, Blow Down and Purge B	LWSC4B	0.91	2.8	2.0	0.28
3	Liquefying Case 5, Blow Down and Purge B	LWSC5B	0.94	3.0	0.69	0.29
2, 5	Flare Holding	FLAREH	0.058	0.17	0.002	0.008
6	Flare Holding, Truck and Ship Loading A1	SWSCHA1	0.31	0.93	0.0016	0.039
6	Flare Holding, Truck or Ship Loading A2	SWSCHA2	0.19	0.55	0.0016	0.024
6	Flare Holding, Blow Down and Purge B	SWSCHB	0.11	0.34	0.0016	0.015

lb/hr = pounds per hour

Table 16: Criteria Pollutant Annual Emission Rates for Each Flare Operating Scenario

Operating Scenario Number	Scenario Description	Modeling Source ID	NO_x (tpy)	SO_2 (tpy)	$PM_{10}/PM_{2.5}$ (tpy)
1	Liquefying Case 1	LW1	1.2	1.2	0.35
1	Liquefying Case 2	SW2	0.85	0.19	0.10
1	Liquefying Case 3	LW3	3.6	8.6	1.1

Operating Scenario Number	Scenario Description	Modeling Source ID	NO_x (tpy)	SO_2 (tpy)	PM_{10}/ $PM_{2.5}$ (tpy)
1	Liquefying Case 4	LW4	3.7	8.9	1.2
1	Liquefying Case 5	LW5	3.9	3.0	1.2
3	Liquefying Case 1, Truck and Ship Loading A1	LWSC1A1	1.2	1.2	0.35
3	Liquefying Case 2, Truck and Ship Loading A1	SWSC2A1	0.86	0.19	0.10
3	Liquefying Case 3, Truck and Ship Loading A1	LWSC3A1	3.6	8.6	1.1
3	Liquefying Case 4, Truck and Ship Loading A1	LWSC4A1	3.7	8.9	1.2
3	Liquefying Case 5, Truck and Ship Loading A1	LWSC5A1	3.9	3.0	1.2
3	Liquefying Case 1, Truck or Ship Loading A2	LWSC1A2	1.2	1.2	0.35
3	Liquefying Case 2, Truck or Ship Loading A2	SWSC2A2	0.86	0.19	0.10
3	Liquefying Case 3, Truck or Ship Loading A2	LWSC3A2	3.6	8.6	1.1
3	Liquefying Case 4, Truck or Ship Loading A2	LWSC4A2	3.7	8.9	1.2
3	Liquefying Case 5, Truck or Ship Loading A2	LWSC5A2	3.9	3.0	1.2
3	Liquefying Case 1, Blow Down and Purge B	LWSC1B	1.2	1.2	0.35
3	Liquefying Case 2, Blow Down and Purge B	SWSC2B	0.85	0.19	0.10
3	Liquefying Case 3, Blow Down and Purge B	LWSC3B	3.6	8.6	1.1
3	Liquefying Case 4, Blow Down and Purge B	LWSC4B	3.7	8.9	1.2
3	Liquefying Case 5, Blow Down and Purge B	LWSC5B	3.9	3.0	1.2
2, 5	Flare Holding	FLAREH	0.25	0.0071	0.034
6	Flare Holding, Truck and Ship Loading A1	SWSCHA1	0.27	0.0071	0.036
6	Flare Holding, Truck or Ship Loading A2	SWSCHA2	0.26	0.0071	0.035
6	Flare Holding, Blow Down and Purge B	SWSCHB	0.26	0.0071	0.035

tpy = tons per year

Table 17: Toxic Air Pollutant Annual Emission Rates for Each Flare Operating Scenario

Operating Scenario Number	Scenario Description	Modeling Source ID	Cadmium (tpy)	7,12-Dimethylbenz (a)anthracene (tpy)	Formaldehyde (tpy)	Arsenic (tpy)
1	Liquefying Case 1	LW1	4.8E-05	7.0E-07	3.3E-03	8.7E-06
1	Liquefying Case 2	SW2	1.2E-05	1.7E-07	8.0E-04	2.1E-06
1	Liquefying Case 3	LW3	1.6E-04	2.4E-06	1.1E-02	3.0E-05
1	Liquefying Case 4	LW4	1.7E-04	2.4E-06	1.1E-02	3.1E-05
1	Liquefying Case 5	LW5	1.8E-04	2.6E-06	1.2E-02	3.2E-05
3	Liquefying Case 1, Truck and Ship Loading A1	LWSC1A1	4.8E-05	7.0E-07	3.3E-03	8.8E-06

Operating Scenario Number	Scenario Description	Modeling Source ID	Cadmium (tpy)	7,12-Dimethylbenz (a)anthracene (tpy)	Formaldehyde (tpy)	Arsenic (tpy)
3	Liquefying Case 2, Truck and Ship Loading A1	SWSC2A1	1.2E-05	1.7E-07	8.2E-04	2.2E-06
3	Liquefying Case 3, Truck and Ship Loading A1	LWSC3A1	1.6E-04	2.4E-06	1.1E-02	3.0E-05
3	Liquefying Case 4, Truck and Ship Loading A1	LWSC4A1	1.7E-04	2.5E-06	1.1E-02	3.1E-05
3	Liquefying Case 5, Truck and Ship Loading A1	LWSC5A1	1.8E-04	2.6E-06	1.2E-02	3.2E-05
3	Liquefying Case 1, Truck or Ship Loading A2	LWSC1A2	4.8E-05	7.0E-07	3.3E-03	8.8E-06
3	Liquefying Case 2, Truck or Ship Loading A2	SWSC2A2	1.2E-05	1.7E-07	8.1E-04	2.2E-06
3	Liquefying Case 3, Truck or Ship Loading A2	LWSC3A2	1.6E-04	2.4E-06	1.1E-02	3.0E-05
3	Liquefying Case 4, Truck or Ship Loading A2	LWSC4A2	1.7E-04	2.5E-06	1.1E-02	3.1E-05
3	Liquefying Case 5, Truck or Ship Loading A2	LWSC5A2	1.8E-04	2.6E-06	1.2E-02	3.2E-05
3	Liquefying Case 1, Blow Down and Purge B	LWSC1B	4.8E-05	7.0E-07	3.3E-03	8.7E-06
3	Liquefying Case 2, Blow Down and Purge B	SWSC2B	1.2E-05	1.7E-07	8.1E-04	2.1E-06
3	Liquefying Case 3, Blow Down and Purge B	LWSC3B	1.6E-04	2.4E-06	1.1E-02	3.0E-05
3	Liquefying Case 4, Blow Down and Purge B	LWSC4B	1.7E-04	2.4E-06	1.1E-02	3.1E-05
3	Liquefying Case 5, Blow Down and Purge B	LWSC5B	1.8E-04	2.6E-06	1.2E-02	3.2E-05
2, 5	Flare Holding	FLAREH	5.0E-06	7.2E-08	3.4E-04	9.0E-07
6	Flare Holding, Truck and Ship Loading A1	SWSCHA1	5.2E-06	7.6E-08	3.5E-04	9.5E-07
6	Flare Holding, Truck or Ship Loading A2	SWSCHA2	5.1E-06	7.4E-08	3.5E-04	9.2E-07
6	Flare Holding, Blow Down and Purge B	SWSCHB	5.0E-06	7.3E-08	3.4E-04	9.1E-07

tpy = tons per year

5.1.2 Building Downwash

Building downwash occurs when the aerodynamic turbulence induced by nearby buildings causes a pollutant emitted from an elevated source to be mixed rapidly toward the ground (downwash), resulting in higher ground-level pollutant concentrations. The software program Building Profile Input Program-Plume Rise Model Enhancements (BPIPPRM, version 04274) is used to determine if exhaust from emission units are affected by nearby building structures. The location of each building considered in the downwash analysis is provided on Figure 2 and the peak height of each building is provided in Table 18 below.

Table 18: Building Peak Height

Name	Peak Height (ft)	Model ID
Refrigerant Storage Vault	16	BLD_1
Control and Admin Building	24	BLD_2
Compressor Building	30	BLD_3
Power Distribution Center	25	BLD_4
LNG tank	144	BLD_5
Vaporizer	12	BLD_6
Existing Warehouse	16	BLD_7

μg/m^3 = micrograms per cubic meter
mg/m^3 = milligrams per cubic meter

Source: WAC 173-400-113, Table 4a.

The minimum stack height not subject to building downwash effects is called Good Engineering Practice Stack Height, or GEP. GEP stack height is defined as the height of the nearby structure(s) measured from the ground-level elevation at the base of the stack plus 1.5 times the lesser dimension, height, or projected width of the nearby structure(s). The use of a stack height greater than 65 meters (m) or GEP, whichever is greater, is prohibited by WAC 173-400-200. The proposed stacks are less than 65 meters. Therefore, a GEP analysis is not necessary.

5.1.3 Receptors

A receptor grid was extended from beyond the facility boundary. The grid spacing varied with distance from the facility, as listed below:

- 10-m spacing from the property boundary to 200 m
- 20-m spacing from 200 m to 400 m
- 50-m spacing from 400 m to 1,000 m.

Concentrations are modeled at the fenceline and waterway boundary using discrete receptors at 10-m intervals.

To model the effects of surrounding terrain on the plume, AERMOD requires the elevation of each receptor in the modeling domain. The AERMAP pre-processor (version 11103) is used to determine a hill height scale and the base elevation for each receptor using 1/3 arc second National Elevation

Dataset (NED) data downloaded from the Multi-Resolution Land Characteristics Consortium in GeoTIFF format.[6]

5.1.4 Meteorological Inputs

AERMET (version 16216) is the meteorological pre-processor that merges meteorological data from surface station, upper air station, and onsite station observations to estimate boundary-layer parameters and other atmospheric conditions used by AERMOD. AERMET processes three types of meteorological input data in three stages, and from this process it generates two input files for the AERMOD model. The following meteorological surface observation sites are available:

- National Weather Service (NWS) station at Sea-Tac International Airport approximately 12 miles northeast of the project site or McCord Air Force Base approximately 10 miles southwest of the project site.
- PSCAA's Tacoma Tideflats air quality monitoring station with wind speed and wind direction approximately 1 mile southeast of the project site.
- Ecology's Indian Hill meteorological station with wind speed, wind direction, lateral wind turbulence, and temperature approximately 2 miles north of the project site.

Based on the distance, location, and surrounding topography, meteorology from the Tacoma Tideflats is preferred. The Indian Hill station was located on a hill above the Tacoma Tideflats (approximately 550 feet above sea level) specifically to capture conditions for sources with tall stacks and elevated plumes in the Tacoma Tideflats area. The wind profile of PSCAA's Tacoma Tideflats monitor will more closely represent conditions at the height of the stacks of the modeled sources for this project. Furthermore, winds are slower at the low elevation of the Tacoma Tideflats and there is some southeasterly drainage in that area, which is not captured by the Indian Hill or either NWS station.

All of the data necessary for AERMOD is not collected at the PSCAA's Tacoma Tideflats monitor. Therefore, these data are supplemented with hourly data from Sea-Tac International Airport in AERMET. In addition, missing data is substituted with data from Sea-Tac International Airport. The number of hours substituted in each year is provided in Table 19 below.

6 https://www.mrlc.gov/viewerjs/ (accessed March 24, 2017).

Table 19: Number of Missing Hours in Tacoma Tideflats Data

Year	Season	Wind Direction	Wind Speed
2012	Spring	0	0
	Summer	2,102	2,104
	Fall	305	305
	Winter	48	81
	Total	**2,455**	**2,490**
2013	Spring	1	1
	Summer	2	2
	Fall	1	1
	Winter	1	1
	Total	**5**	**5**
2014	Spring	21	21
	Summer	1	1
	Fall	7	7
	Winter	0	0
	Total	**29**	**29**
2015	Spring	45	46
	Summer	42	42
	Fall	95	94
	Winter	3	4
	Total	**185**	**186**
2016	Spring	0	0
	Summer	2	2
	Fall	0	0
	Winter	1	1
	Total	**3**	**3**

The surface data are combined with twice-daily upper air soundings from the Quillayute, Washington station. Site-specific surface characteristics of albedo, Bowen ratio, and surface roughness are used in Stage 3 processing in AERMET for calculating surface energy fluxes and other dispersion parameters. Surface characteristics are taken directly from AERSURFACE output, described in the next subsection.

Figure 5 shows the resultant wind rose constructed from processing 5 years (January 1, 2012 through December 31, 2016) of hourly surface data from PSCAA's Tacoma Tideflats and Sea-Tac International Airport in AERMET.

5.1.5 Surface Characteristics

A land cover analysis is conducted to properly define the following surface characteristics: surface albedo, Bowen ratio, and roughness length for the meteorological processing. AERSURFACE (version 13016) is used to generate surface characteristics for the 10-kilometer (km) area surrounding both meteorological sites (PSCAA's Tacoma Tideflats monitor and Sea-Tac International Airport). The analysis follows procedures and guidance in the AERSURFACE user guide (EPA 2013). AERSURFACE calculates average surface characteristics for each season using National Land Cover Data 1992 (NLCD92) downloaded from the Multi-Resolution Land Characteristics Consortium in GeoTIFF format.[7]

Sectors are defined using the default maximum of 12 sectors. The default study radius of 1 km for surface roughness and 10 km for Bowen ratio and albedo is used. The temporal resolution of land cover is set to "seasonal" using AERSURFACE default season/month assignments. The station does not experience continuous snow cover during winter months and, therefore, snow cover surface parameters are not used during the winter season. The project area is not considered an arid region.

Satellite imagery of the area shows that the land cover in Class 23 Commercial/Industrial/ Transportation is predominantly commercial and industrial buildings, not transportation (roads and other paved surfaces) in the area surrounding the PSCAA's Tacoma Tideflats monitor. The appropriate surface roughness length for transportation is much lower than the length that would be appropriate for a commercial and industrial area. Therefore, the AERSURFACE designation for an airport location (with the assumed surface roughness calculated based on 95 percent transportation and 5 percent commercial and industrial) is not appropriate for this site. However, the airport location flag is appropriate for the Sea-Tac International Airport site where most of the surrounding area is paved roads and surfaces.

Annual precipitation for "Tacoma 1" and "Seattle Tacoma Intl AP" for each modeled year was obtained from the Western Regional Climate Center database. The annual precipitation at both stations was within the top 30th percentile of the past 30 years of annual precipitation totals for 2012, 2014, 2015, and 2016. Therefore, in accordance with EPA guidance, surface moisture conditions are considered wet when compared to historical norms and Bowen ratio values for wet surface moisture is used for those 4 years. The annual precipitation at both stations was within the bottom 30th percentile of the past 30 years of annual precipitation totals for 2013 and Bowen ratio values for dry surface moisture is used for 2013.

5.1.6 Chemical Transformation of NO_x to NO_2

NO_x emissions from combustion contain some proportion of nitrogen oxide (NO) and NO_2. During ambient dispersion of NO_x emissions, the NO fraction reacts with ambient ozone to generate NO_2. The emission rate provided by the manufacturer is for total NO_x, while the NAAQS applies to the NO_2

7 https://www.mrlc.gov/viewerjs/ (accessed March 24, 2017).

portion only. NO_2 concentrations are calculated from the modeled NO_x emission rate using the Tier 2 method of 40 CFR Part 51 Appendix W, commonly referred to as the Ambient Ratio Method. Results are multiplied by the annual national default value of 0.75 and 1-hour national default value of 0.80.

5.2 Ambient Air Quality Analysis Results

Modeling results for criteria pollutants and TAPs are presented and discussed in the following sections.

5.2.1 Criteria Pollutant Modeling Results

The results of the criteria pollutant modeling are provided in Table 20. Aside from SO_2, maximum results for short-term averaging periods were predicted to occur when the facility is vaporizing LNG (no liquefying) and LNG is transferring to either ship or truck (but not both). For SO_2 short-term averaging periods and all annual averaging periods, worst-case concentrations were predicted when the facility is liquefying. The receptors with the highest predicted concentrations are on the facility fenceline with the exception of the SO_2 1-hour standard. The highest predicted concentration for the SO_2 1-hour standard is located within the 50-meter resolution grid, approximately 2,100 feet (650 meters) north of the facility fenceline. Model output files and plot files are provided on the DVD enclosed with Appendix D.

The modeled ambient concentrations are less than the cause or contribute threshold levels for all pollutants and averaging periods. Therefore, this project is not expected to cause or contribute to a violation of the NAAQS or WAAQS.

Table 20: Criteria Pollutant Modeling Results – Project-Related Increase

Criteria Pollutant	Averaging Period	NAAQS/ WAAQS (µg/m³)	Threshold Value[a] (µg/m³)	Modeled Concentration[b] (µg/m³)	Scenario
CO	8-hour	10,000	500	12	Vaporizing + Transfer Case A2
	1-hour	40,000	2,000	36	Vaporizing
SO_2	Annual	52	1	0.29	Liquefying Case 3
	24-hour	260	5	3.1	Liquefying Case 4
	3-hour	1,310	25	7.2	Liquefying Case 4
	1-hour	200	30	14	Liquefying Case 4
PM_{10}	Annual	--	1	0.039	Liquefying Case 5
	24-hour	150	5	1.1	Vaporizing + Transfer Case A2
$PM_{2.5}$	Annual	12	0.3	0.039	Liquefying Case 5
	24-hour	35	1.2	1.1	Vaporizing + Transfer Case A2
NO_2	Annual	100	1	0.091	Liquefying Case 5
	1-hour	188	10	9.7	Vaporizing

[a] Cause or contribute threshold value from WAC 173-400-113, Table 4a. The 1-hour NO_2 threshold value reflects the EPA's Interim 1-hour NO_2 Significant Impact Level.
[b] Highest first high value for all receptors.

5.2.2 Toxic Air Pollutant Modeling Results

The first-tier ambient concentration screening analysis is summarized in Table 21 below. This screening analysis is conducted on all TAPs with expected emission rates that exceed the SQER (as presented in Table 7). As shown in Table 21, the maximum modeled ambient concentrations for each TAP are less than their respective ASILs.

Table 21: Toxic Air Pollutant Modeling Results

Pollutant	CAS Number	Averaging Period	ASIL[a] (µg/m³)	Modeled Concentration (µg/m³)	Scenario
Arsenic	57-97-6	Year	0.000303	0.00000100	Liquefying Case 5
Cadmium	--	Year	0.000238	0.00000553	Liquefying Case 5
7,12-Dimethylbenz(a)anthracene	7440-43-9	Year	0.0000141	0.0000000800	Liquefying Case 5
Formaldehyde	50-00-0	Year	0.167	0.000377	Liquefying Case 5
Sulfur dioxide	7446-09-05	1-hour	660	13.7	Vaporizing

[a] WAC 173-460-150

APPENDIX F

Modeling Input and Output Files
(on DVD)