PUGET SOUND ENERGY

Puget Sound Energy
P.O. Box 97034
Bellevue, WA 98009-9734
PSE.com

June 30, 2017

BY U.S. MAIL AND EMAIL

Mr. Ralph Munoz
Reviewing Engineer
Puget Sound Clean Air Agency
1904 3rd Avenue, Suite 105
Seattle, WA 98101-3317

Re: Tacoma LNG June 21, 2017 Information Request Letter

Dear Ralph:

Puget Sound Energy ("PSE") received your June 21, 2017 letter requesting additional information about the Tacoma LNG facility and is pleased to submit the enclosed material in partial response to your requests.

First, let me thank you for meeting with us on Wednesday to discuss our Notice of Construction application for the proposed Tacoma LNG facility. As we discussed in our meeting, our project will provide the means for key elements of the local transportation sector to move to cleaner fuels and thereby greatly reduce emissions of a variety of air pollutants including particulates, nitrogen oxides, sulfur dioxide and greenhouse gases. The facility will also serve PSE's existing customers by providing a dependable and cost-effective natural gas source during times of peak demand. We see this project as an important supplement to the work that your agency is doing to improve air quality in the Puget Sound region. I have included with this letter a copy of the slides that we shared with you that quantify some of the project benefits.

In relation to the information request letter, we wanted to get back to you as quickly as possible after our meeting with a response to your questions. Most of the items you identified are answered in this letter; a few items will take a bit longer to provide. Each of your questions is provided below along with either our response or an indication as to when we will provide this information to you.

Question 1: Provide a list of all onsite equipment.

Table 1 below is a list of all onsite equipment.

Table 1. Equipment List

LNG storage tank
Propane, isopentane & ethylene storage tanks
Valves and flanges associated with LNG transfer to and from LNG storage tank
Gas pretreatment system
Gas liquefaction system
LNG vaporization system
Boil off/flash gas recovery system
Facility cooling water system
Enclosed Ground Flare (pilot and burners)
Heavy hydrocarbon and fuel gas collection and storage system
Control building
Storage building
Compressor building
Power distribution center
Valves and flanges associated with pipeline from Tacoma LNG to TOTE terminal
TOTE terminal
Ship fueling (bunkering) arm(s) at Tote terminal
Truck loading racks

Question 2: Identify significant differences between the FEIS and the NOC application.

In completing the SEPA process, PSE conservatively outlined a facility design anticipated to reflect the highest impact configuration. Since the FEIS was issued by the City of Tacoma on November 9, 2015, PSE has worked to refine the design in ways that reduce the overall facility impacts. In Table 2 below we summarize the primary changes between the FEIS and the NOC application.

Table 2.

Change from FEIS to NOC Application	Explanation
Production capacity	Daily LNG production capacity has been reduced from 500,000 gallons in the FEIS to 250,000 gallons for the NOC to reflect current facility design.
Incoming natural gas composition variability	Additional design features were added to address possible variations in levels of ethane and propane in natural gas.

Refrigerant losses	The FEIS assessed 77 tons/year of refrigerant losses (VOC) as a component of normal operation. PSE revised the design to employ a sealed refrigerant system from which no fugitive emissions will occur.
Flare	The facility's flare configuration changed from two flares in the FEIS to a single ground flare, as it was determined that the second emergency flare is not needed. In addition, the ground flare design has been improved to include features such as low NOx burners.

You also requested in relation to this question that we provide you with the potential to emit ("PTE") for any exempt units. The exempt units at the facility are identified in Table 5 of the NOC Application. Table 3 below identifies each of those exempt units and provides PTE data.

Table 3: Exempt Equipment

Exempt Equipment	Potential to Emit
LNG Storage Tank	No emissions. Self-contained, low internal VOC vapor pressure.
Water/Propylene Glycol Pretreatment Heater	**See Attachment A-1**
Regeneration Pretreatment Heater	**See Attachment A-2**
Emergency Generator	**See Attachment A-3**
Propane Storage Vessel	No emissions. Self-contained pressurized tank.
Iso-Pentane Storage Vessel	No emissions. Self-contained pressurized tank.
Ethylene Storage Vessel	No emissions. Self-contained pressurized tank.
Heavies Storage Vessel	No emissions. Self-contained pressurized tank.
Facility Cooling Water System	No emissions. Closed loop system.
Power Distribution Center	No emissions.

Question 3: Describe how PSE plans on controlling and minimizing odor from the H2S and other potentially odorous compounds from the enclosed ground flare in the event that device goes offline or needs maintenance.

As you correctly identified, the enclosed ground flare is used to combust H2S and any other potentially malodorous compounds. The flare is extremely effective at destroying these compounds such that odor will not be a problem from the facility. If the flare goes out of service, either due to upset or for maintenance, the systems feeding the flare shut down and residual gases within are maintained under pressure. Once the flare is put back into service, the systems would continue operating normally. We should note that the flare is not a type of equipment prone to issues. The plant as a whole is provided with two separate utility lines to ensure electric power supply redundancy and if both lines were to fail there is still adequate emergency generation onsite to power all equipment other than the liquefaction compressor. As we discussed, because of the nature of our processes and systems, we do not anticipate startup, shutdown or maintenance related emissions from the flare or elsewhere at the site.

Question 4: Please provide LDAR plan for review.

As we discussed, the Leak Detection and Repair ("LDAR") plan will be developed after the final equipment design is complete. At that time we will submit the plan to you for review and approval. In the interim, we have outlined the details of how the LDAR plan will be structured in Appendix D of the application.

Question 5: Provide additional support for BACT analysis.

PSE will provide this to you under separate cover as this task will take approximately 10 to 14 days to complete.

Question 6: Include BACT analysis for SO2 for ground flare.

PSE will include this in the response to Question 5.

Question 7: Provide documentation for sulfur inlet concentrations.

Table B-2 of the NOC Application presents sulfur content values for natural gas and for five different flared waste gas cases. You requested that we provide documentation of the sulfur inlet concentrations for each case. By inlet concentrations, we assume that you mean the inlet to the combustion device in which the gas is flared.

The "natural gas" column in Table B-2 of the NOC Application identifies the worst case sulfur content for the natural gas drawn from the Williams pipeline. This value (166 ppmw) is derived from the natural gas tariff with a slight variability factor added to it. The Williams pipeline typically supplies natural gas that has far less sulfur in it than the tariff allows. However, at times the amount of sulfur can trend high due to causes such as upstream maintenance activities. To be conservative, PSE assessed historic values and calculated a pipeline gas sulfur value that assumes the gas is continuously at the highest levels documented in the pipeline historically. Prolonged gas supply at the assumed sulfur level has not occurred so this is a very conservative emissions estimate. You had also asked for a copy of the tariff which can be found at:

http://www.northwest.williams.com/NWP_Portal/extLoc.action?Loc=FilesNorthwesttariff&File=tariff.pdf

In relation to the flared waste gas cases, each case represents an aggregate of the various gas streams that will occur during that case, and each stream's expected sulfur content. We will do our best to provide supporting information for those scenarios next week.

Question 8: Provide explanation of derivation of component count including explanation of which components are associated with which piece of equipment identified in process flow diagram (Figure 3 of NOC Application).

As part of the Facility's detailed engineering design process, CBI determined the number of components that will be required for each process, storage and loading area (shown on the revised Block Flow Diagram) based on site layout and operational needs. The number of components are provided in Table 3 and Figure 3 of the NOC Application Supporting Information Report for each area.

Question 9: Explain how nitrogen in the fuel was accounted for in the emissions calculations.

As noted in section 2.1.1 of the NOC Application, pipeline natural gas contains nitrogen. Every combustion device has the potential to form NOx from a combination of "fuel NOx" and "thermal NOx." Thermal NOx is caused by the oxidation of elemental nitrogen (N_2), and is controlled by the molar concentrations of nitrogen and oxygen and the temperature of combustion. Fuel NO_X results from the oxidation of already-oxidized nitrogen compounds that are contained in some fuels. Natural gas that the Facility will receive from the Williams NW Pipeline contains N_2, not fuel nitrogen.

Ambient air drawn into and through the flare and most other combustion devices is approximately 78% N_2. The extremely small amount of N_2 that will sent to the flare from natural gas pretreatment and line purging will have no practical effect on the amount of N_2 passing though the flare or the flare's emissions. As you area aware, thermal NOx generation will be limited by low-NOx burners that are incorporated into the facility's design. A primary element of low-NOx technology is flame temperature control. PSE relied on NOx emission factors provided by the burner vendors in calculating NOx emissions associated with combustion of natural gas. See Table B-3 of the NOC Application. These factors account for the different possible means of generating NOx emissions.

Question 10: Describe the mercury removal system and how mercury not removed by the system is accounted for in the emissions.

Measurable amounts of mercury are not known to occur in the Williams Northwest Pipeline natural gas that the Tacoma LNG facility will receive and process. In fact, the tariff covering the natural gas delivered to the facility (see response to Question 7) states that "The gas shall be free from any detectable mercury." As a precaution in the event that mercury does unexpectedly occur, PSE has chosen to include a mercury removal system, so there is no chance of mercury emissions even in the very unlikely event that mercury is encountered in the gas stream. Again, PSE does not anticipate that under normal operations it will encounter mercury in the natural gas that would require removal and the removal system would prevent any emission of mercury, thus mercury is not accounted for in the emissions inventory.

The mercury removal system will consist of a 3-1/2 ft diameter 11 ft tall vertical pressure vessel containing mercury adsorbent material (spherical metal oxide) through which the natural gas is passed. Under normal operations the adsorbent will serve no purpose. In the highly unusual circumstance that any mercury is present in the natural gas, the mercury will be adsorbed onto the media. If the media ever requires disposal, it will be properly characterized and managed appropriately as waste consistent with all applicable laws and regulation.

Question 11: Which compounds are included in the "heavy hydrocarbons" and is storage of these hydrocarbons accounted for in the emission calculations?

The heavy hydrocarbons consist of a portion of the ethane, propane, butane, pentane, hexane, and C6+ hydrocarbons that are present in pipeline natural gas. A portion of these components is removed from the plant inlet feed gas to prevent freezing and plugging of the heat exchangers used in the liquefaction of natural gas. The tank in which they are stored is a pressurized vessel and thus expected to have no emissions under normal operations.

Question 12: Is the gas odorant injection process a source of fugitive emissions and where does this step occur in the process flow diagram?

The odorant injection process will not result in any fugitive emissions. The injection of gas odorant (i.e., methyl mercaptan) is heavily regulated by federal law (49 CFR 192). As such, every aspect of that process is under extreme scrutiny as the addition of odorant is critical to the safety of the gas supply system. No fugitive emissions are expected because the odorant storage and delivery systems are leaktight--a necessary precaution given the intentionally odiferous nature of methyl mercaptan. If any leak were to develop, it would be instantly identified and addressed.

The process flow diagram is revised to reflect the odorant injection step. Ship and truck loading arm/hose purge gases going to flare have also been added per your request during yesterday's meeting.

Question 13: Explain how the nitrogen used for purging various processes (e.g., truck loading, marine bunkering) is accounted for in emissions calculations.

Elemental nitrogen (N_2) is used to purge various processes such as the marine bunkering arm and truck loading hoses prior to disconnection so as to ensure the fugitive emissions do not occur. Any resulting nitrogen purges will then be routed to the enclosed ground flare. The elemental nitrogen in the purge line will not materially contribute to the formation of NOx. Thermal NOx formation involves elemental nitrogen, but the combustion process has an excess of available nitrogen in the combustion (ambient) air for the formation reaction to occur. Furthermore, the facility's proposed low-NOx burners are designed to limit thermal NOx formation. In short, the passage of elemental nitrogen through the flare will not affect NOx formation. Please also see related information in our response to Question 9.

Question 14: Provide dispersion modeling for toxic air pollutants potentially emitted above their respective SQERs.

This modeling was provided to you by letter dated June 22, 2017.

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

Sincerely,

Keith Faretra

Attachments

- Facility Block Diagram Revision C
- Attachments A-1, A-2, A-3
- June 28, 2017 Slide Presentation

cc (by email):

- Jim Hogan
- Lorna Luebbe
- Bill Steiner
- Tom Wood