

Email from J. Lewis, UTC with “PSE LNG Draft
Overview.docx” attachment
(4/10/2019)

From: [Lewis, Jason \(UTC\)](#)
To: [White, Kendra \(UTC\)](#)
Subject: PSE LNG Draft Overview
Date: Wednesday, April 10, 2019 11:55:00 AM
Attachments: [PSE LNG Draft Overview.docx](#)

As discussed the other day, attached is a DRAFT overview of the PSE LNG document that I use for briefings. Some of the information in the document represents “thoughts” or potential discussion ideas but they are marked as such.

BRIEFING MEMORANDUM

Puget Sound Energy, Tacoma Liquefied Natural Gas (LNG) Facility

July 18, 2018

Re: Overview and Status of the PSE Tacoma LNG facility

Federal Oversight of LNG Projects

Federal oversight of LNG facilities is provided by three federal agencies. The primary agencies include:

- The Federal Energy Regulatory Commission (FERC),
- The U.S. Coast Guard (USCG) within the U.S. Department of Homeland Security (DHS), and
- The Pipeline and Hazardous Materials Safety Administration (PHMSA) within the U.S. Department of Transportation (DOT).

FERC reviews the safety and reliability of facilities which import or export LNG based on Federal LNG safety regulations

LNG facilities connected to pipelines in the United States are subject to safety reviews by PHMSA or designated State agencies¹ based on the same Federal LNG safety regulations

Under Section 3 of the Natural Gas Act of 1938, FERC is responsible for authorizing the siting and construction of onshore and near-shore LNG import or export facilities.

Under Section 7 of the Natural Gas Act of 1938, FERC also issues certificates of public convenience and necessity for LNG facilities engaged in interstate natural gas transportation by pipeline.

The Coast Guard has authority over the safety of LNG vessels and the marine transfer area.

PHMSA has authority to establish and enforce safety standards for onshore LNG facilities.

Title 49, Part 193 of the Code of Federal Regulations (CFR) refer to the siting authority of PHMSA or its state delegate in the areas of:

- Thermal Radiation Exclusion Zone Analysis
- Vapor Dispersion Exclusion Zone Analysis
- Wind Analysis Hazards

Project Background

¹ The Commission is the designated state agency for inter and intrastate pipelines.

The Washington Utilities and Transportation Commission (Commission) has three distinct roles as it relates to the Puget Sound Energy (PSE) Tacoma LNG facility. The first deals with the corporate structure of the LNG facility and the methodology for allocating costs between regulated and non-regulated services for PSE.² The second focuses on PSE’s request for an exemption from Title 49 C.F.R. § 193.2167 to Construct a Buried Liquefied Natural Gas Transfer System.³ The third role, the Commission, in its capacity as an Interstate Agent, conducts inspections, reviews documents and ensures compliance with federal standards.

In August 2015, Puget Sound Energy filed a proposal (UG-151663) with the Commission to develop a liquefied natural gas facility at the Port of Tacoma. The initial proposal requested to have part of the facility treated as a piece of PSE’s regulated utility business. In response, the parties involved in the filing entered into mediation in May 2016, in order to resolve disputed matters regarding the corporate structure and impact on regulated customers.

Concurrently, on October 5, 2015, PSE filed (PG-151949) with the Commission a request for exemption from Title 49 C.F.R. § 193.2167 – adopted by reference in Washington Administrative Code (WAC) 480-93-999 – which prohibits covered impounding systems. PSE proposed to construct a buried LNG transfer pipeline to deliver LNG product from PSE’s Tacoma, Washington facility for use as transportation fuel.

DOCKET UG-151663, Regulated and Non-Regulated Service

On October 31, 2016 the UTC approved an all-party settlement agreement with conditions to protect Puget Sound Energy customers. The approval allows PSE’s parent company, Puget Energy, to create a wholly-owned subsidiary, named Puget LNG, LLC. Puget LNG will be a limited liability company, the sole purpose of which will be owning, developing, and financing the Tacoma LNG facility.

Puget LNG will sell LNG as transportation fuel for ships. Puget Sound Energy’s co-ownership interest is to provide its core natural gas customers with capacity that can be called upon when demand for natural gas is at its highest levels during the year, usually during the winter months.

Under the settlement agreement, PSE and Puget LNG will operate the Tacoma LNG facility under a Joint Ownership Agreement that the companies are required to file with the commission if the project goes forward.

OWNERSHIP INTERESTS

| Component Ownership Share | PSE | Puget LNG |
|---------------------------|-----|-----------|
| Liquefaction | 10% | 90% |
| Storage | 79% | 21% |

² DOCKET UG-151663, *In the Matter of the Petition of PUGET SOUND ENERGY for (i) Approval of a Special Contract for Liquefied Natural Gas Fuel Service with Totem Ocean Trailer Express, Inc. and (ii) a Declaratory Order Approving the Methodology for Allocating Costs Between Regulated and Non-regulated Liquefied Natural Gas Services*

³ DOCKET PG-151949, *In the Matter of PUGET SOUND ENERGY’S Request for Exemption from Title 49 C.F.R. § 193.2167 to Construct a Buried Liquefied Natural Gas Transfer System*

| | | |
|---------------|------|------|
| Bunkering | 0% | 100% |
| Truck Loading | 5% | 95% |
| Vaporization | 100% | 0% |
| Common | 43% | 57% |

DEVELOPMENT COSTS

| Component Ownership Share | PSE | Puget LNG | Projected Capital Expenditures (No AFUDC) | Projected Capital Expenditures Allocated to PSE | Projected Capital Expenditures Allocated to Puget LNG |
|---------------------------|------------|------------|-------------------------------------------|-------------------------------------------------|-------------------------------------------------------|
| Liquefaction | 10% | 90% | \$88,546,234 | \$8,854,623 | \$79,691,611 |
| Storage | 79% | 21% | \$96,237,245 | \$76,027,424 | \$20,209,821 |
| Bunkering | 0% | 100% | \$29,671,922 | \$0 | \$29,671,922 |
| Truck Loading | 5% | 95% | \$6,229,252 | \$311,463 | \$5,917,789 |
| Vaporization | 100% | 0% | \$17,135,822 | \$17,135,822 | \$0 |
| Common | 43% | 57% | \$72,884,330 | \$31,340,262 | \$41,544,068 |
| TOTAL | N/A | N/A | \$310,704,805 | \$133,669,593 | \$177,035,212 |

DOCKET PG-151949, Waiver of Title 49 Code of Federal Regulations (49 CFR) 193.2167

On April 28, 2016, the Commission granted PSE's request for Exemption from Title 49 C.F.R. § 193.2167 to Construct a Buried Liquefied Natural Gas Transfer System, subject to conditions. The conditions recommended by Commission staff and detailed in the Order are as follows:

- a. The enclosed drainage channel must be made of steel 48 inches in diameter and one-inch thick, and bored at least 11 feet below grade to provide a conservative level of clearance beneath the roadway, rail road tracks, and existing underground utilities.
- b. The LNG transfer system must be composed of two vacuum-jacketed LNG lines and one vacuum-jacketed vapor return line installed on a movable pipe rack that will be inserted into the buried enclosed drainage channel.
- c. The moving pipe rack must be inserted into the completed enclosed drainage channel and sealed.
- d. During operation and LNG transfer, the vacuum jacketing of the liquid and vent lines must be constantly monitored for loss of vacuum.
- e. The enclosed drainage channel must be filled with nitrogen gas and constantly purged with a monitor for hydrocarbons at the nitrogen vent.
- f. The bottom of the enclosed drainage channel must be instrumented with cryogenic temperature monitors that will detect any liquid release and will also act as a secondary containment vessel.
- g. The entire pipeline must be continuously monitored from the Tacoma LNG Facility Control Room, which will be staffed 24 hours a day, year round.
- h. The casing must be cathodically protected.

- i. Commission Staff securing an independent geotechnical engineering consultant to assist in ensuring that PSE's design of this pipeline meets federal code requirements as it relates to forces applied by a seismic event.

Seismic

As noted, the Commission required PSE to pay for an independent analysis of its seismic study because it did not believe the Basin Effect⁴ was adequately captured. The company hired by PSE for the original seismic study was GeoEngineers. In its initial report it includes the seismic design for the PSE LNG facility, TOTE LNG fueling system, and approximately 800 feet underground LNG transfer system (pipeline) between these two facilities.

The review and recommendations to the seismic evaluation was performed by Shannon & Wilson, Inc. The NFPA-59A (2001) "Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)" requires that the piping system being designed for operating basis earthquake (OBE) ground motion (NFPA-59A, 2001, Section 6.1.2). The NFPA-59A (2001) OBE ground motion is represented by a ground motion response spectrum in which the spectral acceleration at any period is equal to two-thirds of the spectral acceleration of the Maximum Considered Earthquake (MCE) ground motion, but need not exceed the motion represented by a 5 percent damped acceleration response spectrum having a 10 percent probability of exceedance within a 50-year period (i.e., 475-year return period ground motion) (NFPA-59A, 2001,

The City of Tacoma required the PSE proposal to meet NFPA-59A (2013) requirements, which is an updated version of the NFPA-59A (2001). The review of the original seismic plan could not verify that the Tacoma basin effects were included.

GeoEngineers confirmed that they would revise their recommended seismic design ground motions to include basin amplification effects and update their seismic analyses and subsequently revised their ground motions to include basin effects.

PSE submitted GeoEngineers' January 10, 2017, addendum letter with these revisions to the Commission. Shannon & Wilson, Inc. found that in "review of the PSE submittal of Geo Engineers' March 21, 2016, report and GeoEngineers' January 10, 2017, addendum, it is our opinion that the design ground motions have by-in-large been developed in accordance with the requirements of the various design codes. In our opinion, the combined March 2016 and January 2017 PSE submittals achieve a PHMSA form 18 "Satisfactory" status."

Role of the Commission

LNG facilities that are under the purview of 49 CFR Part 193 are subject to the regulatory authority and enforcement provisions of PHMSA and by an Interstate Agent Agreement with the Commission. In its capacity as an Interstate Agent, the Commission conducts inspections, reviews documents and ensures compliance with federal standards. The inspection and

⁴ Basin effects are the effects of the two- or three-dimensional (2D or 3D) sedimentary basin geometry of the sedimentary on the seismic waves within a basin that cannot be modeled in a one-dimensional (1D) site response analysis.

enforcement of PSE proposed LNG facility design, construction and operation are broken up into individual inspection modules , as referenced in PHMSA Form 18 Evaluation of LNG Facility Siting, Design, Construction, and Equipment.

The key elements include:

- a. Receive and Review of Design Documents
 - i. After the Commission receives the design documents for the project from PSE, we will reach out to Tacoma to discuss key safety elements that are being reviewed. PHMSA and PSE may be consulted during this process as well.
- b. Construction Process Coordination
 - i. Assuming the project moves forwards, the Commission will coordinate with Tacoma on its inspection schedule, findings and concerns during the construction process.
- c. Ongoing Communication on Life of Facility
 - i. If completed, the Commission will have the responsibility for continued inspections of the facility.

Exclusion Zones

There has been public concerns regarding the risks associated with ignition, explosion, vapor clouds and impacts to the storage tank. Tacoma and PSE have responded to those concerns with their statement regarding the modeling required by federal code,

“2-D and 3-D PHAST quantitative modeling has been completed for the Project in accordance with federal regulation. The modeling results have been reviewed by the LNG engineering consultant for the City, who determined that the modeling was done according the federal requirements and the guidelines of 59A of the National Fire Protection Association. The modeling shows that exclusions zones that extend significantly beyond the facility site are not warranted.”

“The LNG facility design would incorporate mitigation measures to ensure that thermal radiation and vapor dispersion does not extend beyond the land portions of the PSE and TOTE property lines.”

Staff Background Note:

As indicated in the evaluation process for the much larger export LNG facility proposed for Coos Bay Oregon, the existing regulatory process has a few fundamental flaws regardless of ones position on a project. LNG siting is deemed acceptable if the project can show that any consequences of an accident will not extend beyond its property line. In order to “calculate” the consequence and impact, the projects use a process called “designed spills” in order to determine exclusion distances. The Final PSE Tacoma LNG EIS has the “design spill” concept outlined and there are numerous mitigation measures in place due to the calculation. Unlike a

“worst case discharge of oil” which would assume all contents of the largest tank, the “design spill” only takes the largest transfer line to develop its model.

The modeling of the exclusionary zones and impact outside of the property lines is based on the location of the “design spill” collection points. This means that a mechanical failure in the loading arm of the bunkering operations would not necessarily be part of the model or exclusionary zone distance.

As stated in the FEIS, “The primary safety concern of an LNG terminal is a fire from the release of LNG caused by equipment failure or spill. The siting and design of the facility would incorporate containment features, such as sumps to which a release of LNG would be directed. If a release and subsequent ignition were to occur, the fire hazard would be localized.”

“The proposed Tacoma LNG facility is appropriately sited on a brownfield site in an existing industrial area zoned for industrial activities. To ensure public safety and comply with applicable regulations, vapor dispersion and thermal radiation analyses have been conducted for credible spill scenarios, using the methodologies and computational models prescribed by the Pipeline and Hazardous Materials Safety Administration (PHMSA) and approved on similar facilities. The modeling conclusively demonstrates that exclusion zones defined by federal regulation 49 CFR. § 193.2059 and, by reference, National Fire Protection Association (NFPA) 59A (2001), remain within the property lines of the proposed site. The EIS describes the modeling and includes mitigation measures to ensure that vapor dispersion and thermal radiation does not extend beyond the property lines of the Tacoma LNG project.”⁵

Concerns over exponential impact of hydrocarbons:

Natural gas, upon delivery and prior to conversion to LNG, must be conditioned. This entails the removal of any constituents other than pure methane. These constituents could include ethane, propane, butane, and other heavy-end hydrocarbons, as well as minor quantities of nitrogen, carbon dioxide, sulfur compounds, and water. In addition to the LNG spill impoundments Facility would include other impoundments for collection of spilled mixed-refrigerant, heavy hydrocarbons, water/propylene glycol (WPG), amine, and equipment lubrication system and transformer oil.

Mitigation Measures:

- a. The Tacoma LNG Facility would contain fire and hazardous gas detectors, fire extinguishing systems, and an extensive firewater system, as well as new pier and access trestles that would provide firetruck access to the loading platform.
- b. The intrusion detection system would monitor the perimeter for the facility and alarm when the perimeter is disturbed.

⁵ Puget Sound Energy Proposed Tacoma Liquefied Natural Gas Project Final Environmental Impact Statement

- c. Security cameras would be installed along the perimeter and other select locations for maximum viewing coverage.
- d. Closed-circuit television system components would be powered by an uninterruptible power system.
- e. The perimeter of the Tacoma LNG Facility and TOTE Marine Vessel LNG Fueling System sites would be enclosed by a chain-link security fence to ensure public safety, welfare, and site security.
- f. The Tacoma LNG Facility would be equipped with an Integrated Control and Safety System.
- g. LNG Spill Impoundment
- h. In the event of LNG spills, LNG would be directed to various spill containments consisting of below grade open top concrete sumps. LNG spills emanating on the loading platform at the end of the pier would be collected in a concrete curbed area under the loading arms or hoses and piping.
- i. Fire Protection System

Fire Suppression System

A fire suppression system would be installed at the facility. This system would include fire water, dry chemical extinguishers, and sprinklers within the control building. Water is not used to extinguish flame on an LNG pool. Fire on an LNG pool is typically extinguished by smothering the flame with a dry chemical extinguishing agent or left to burn itself out if it presents no risk to life or property.

Initial and ongoing training and familiarization would be provided to City of Tacoma fire department personnel to ensure they have a strong understanding of behavioral properties of LNG and to inform them of appropriate response tactics at the facility.

Mixed refrigerant components would be stored in tanks encased in a sand-filled containment area to prevent fire impingement from a plant or tank fire.

Related Issues of Note:

- PHMSA working on a potential revision to its policy and rules related to LNG and small scale applications to fuel transportation.⁶
- The International Maritime Organization (IMO) has set a global limit for sulphur in fuel oil used on board ships of 0.50% m/m (mass by mass) from 1 January 2020. This will significantly reduce the amount of sulphur oxide emanating from ships and should have major health and environmental benefits for the world, particularly for populations living close to ports and coasts.

⁶ PIPES ACT of 2016 mandated a review of small scale LNG siting

- The current global limit for sulphur content of ships' fuel oil is 3.50% m/m (mass by mass).
- The new global limit will be 0.50% m/m will apply on and after 1 January 2020.
- The date of 1 January 2020 was set in the regulations adopted in 2008. However, a provision was adopted, requiring IMO to review the availability of low sulphur fuel oil for use by ships, to help Member States determine whether the new lower global cap on sulphur emissions from international shipping shall come into effect on 1 January 2020 or be deferred until 1 January 2025.
- Technically feasible compliance strategies
 - In order to comply with the existing and future emission regulations and restrictions inside an ECA, the following options are available for vessels that are subject to the regulations in MAR POL Annex VI.
 - 1. Use of low sulphur diesel fuel
 - 2. Use of alternative fuels
 - 3. Use of abatement technologies, typically exhaust gas treatment system
 - The use of low sulphur diesel fuel will ensure compliance with SO_x emission requirements, but the compliance with the upcoming restriction in NO_x emissions in the ECAs will not be met with the existing engine technology unless exhaust after treatment is used. Engine manufacturers are developing on-engine technology that is designed to comply with the stricter requirements on NO_x emissions. It is expected that this will involve Exhaust Gas Recirculation (EGR) in order to reduce the NO_x emissions to the IMO Tier III /EPA Tier 4 levels.
 - Natural gas stored as LNG is the alternative fuel that is considered the most likely option in the short to medium future because of the available engine and system technology, class/statutory regulations, operational experience, fuel cost and availability of natural gas worldwide. There are other alternative fuels that might become relevant options, including LPG, DME /Methanol, synthetic fuels and biofuels.
 - The third option for a ship to comply with the regulatory limits on exhaust emissions from ships is the installation and use of exhaust gas treatment system. This option differs from the other options since the harmful substances are removed from the exhaust gas following the combustion process.
 - Many refiners are considering implementation of bottom-of-the-barrel upgraders to produce more low-sulfur distillates, including marine diesel.
 - The changes outlined by IMO will have repercussions for many refiners, particularly in the Asia Pacific region where much of the world's bunker

fuel is produced. Refiners will need to consider available investment options to remain profitable as the market for HSFO is eliminated.

- Desulfurization of atmospheric or vacuum residues remains the predominant technology available for producing 0.5 wt % LSFO from residues and is widely used throughout the Asia Pacific region. Proper integration of atmospheric or vacuum residue desulfurization into an existing refinery can offer additional processing benefits that can improve return on investment. Using this technology to produce LSFO with less than 0.1 wt % sulfur to comply with proposed regulations for ECA compliant fuels, however, will be difficult and impractical.
- Refiners seeking to exit the fuel oil market are considering several available bottom-of-the-barrel technology options.