January 12, 2015

André Baugh, Chair
Planning and Sustainability Commission
City of Portland
1900 SW 4th Avenue, Suite 7100
Portland, OR 97201-5380

Re: Terminal 6 Environmental Overlay Zone Text and Map Amendment, Response to Questions from the Planning and Sustainability Commission Members

Dear Chair Baugh and Commissioners:

Over the last couple weeks, we received questions from members of the Planning and Sustainability Commission ("PSC") in anticipation of the hearing on the Terminal 6 Environmental Overlay Zone ("E-Zone") Text and Map Amendment. We anticipate that some questions may have been answered by the additional information Pembina provided in a separate package today but we thought it may also be helpful to provide written responses to your questions.
We look forward to the opportunity to discuss these questions and others with you during the hearing on January 13.

Our responses are framed below by general category of questions (which have been paraphrased and summarized). We understand that the Port of Portland has also provided written responses to some questions from the PSC, particularly questions related to jobs, economics, on-site habitat, and Port landlord considerations.

Site Selection and Outreach

Why did Pembina choose the Port of Portland and not B.C. as their export facility? Did the BC town turn it down, if so why?

Over the past two years, Pembina has investigated a number of potential locations for a west coast marine export facility north and south of the United States and Canada border. Factors for selecting the Port of Portland Terminal 6 as the site for a propane export terminal include Portland's readily available land (and land previously developed and zoned for heavy industrial use), an existing marine berth, deep-water access, rail access, Portland's local skilled labor force, and the geographic proximity to markets. Other locations did not offer all of these benefits. Pembina has not been "turned down" in other locations; the Portland site provides an ideal location and site for the proposed project.

Pembina Marine Terminals Inc.
4000, 585 – 8th Avenue S.W., Calgary, Alberta Canada T2P 1G1
Telephone: (403) 231-7500 Fax: (403) 237-0254

Have we contacted any towns in Canada which have Pembina facilities and researched if they're a good neighbor?

We encourage the City to contact local communities in which Pembina operates in Canada and the United States. Pembina actively works to develop long-term relationships based on mutual trust with communities within which it operates. Pembina believes in being a good neighbor and active member of the community. In more than 60 communities in North America, we have built a reputation as a neighbor of choice. We will do the same in Portland.

Links to articles and information about Pembina in some of the communities in which Pembina currently operates are included below:

http://www.pembina.com/our-responsibility/community-investment/

http://www.draytonvalleywesternreview.com/2014/06/30/pembina-pipelines-opens-new-facility-near-cynthia

http://www.draytonvalleywesternreview.com/2013/01/21/new-programming-helps-residents-step-into-winter

http://www.fortmcmurraytoday.com/2010/10/15/pipeline-companies-restore-gregoire-channel

http://www.fortsaskatchewanrecord.com/2012/10/11/gibbons-culture-centre-picks-up-more-sponsors

http://www.fortsaskatchewanrecord.com/2012/04/19/sturgeon-county-approves-industrial-developments

http://www.albertasurfacerights.com/articles/?id=191

Rail

What are the potential train routes that could be utilized for rail transport of propane to Terminal 6? Are there equity impacts depending on the route?

There are two potential United States carriers that may transport the propane to Portland: Union Pacific("UP") and Burlington Northern Santa Fe ("BNSF"). Pembina has not yet made a decision on which rail carrier to use.

BNSF has two potential routes into Portland:

- One route crosses into the United States from Vancouver, British Columbia and follows the I-5 corridor from Seattle to Vancouver, Washington. The train would then travel the three miles to Terminal 6 across the rail bridge on Hayden Island.

- The second route crosses into the United States at the Alberta/Montana border near Shelby, Montana. The train would travel west through Montana and Idaho to Spokane, Washington. From Spokane, the route goes to the Tri Cities area. The route travels on the west and north side of the Columbia River into Vancouver, Washington. The train would then travel the three miles to Terminal 6 across the rail bridge on Hayden Island.

Either BNSF route will have very little impact on Portland neighborhoods, traversing the far west side of the Kenton neighborhood for a very short distance after crossing the rail bridge from Vancouver, Washington, before entering the St John's neighborhood where Terminal 6 and the proposed project are located.

UP has a single route to Portland. The train would travel from Eastport, Idaho, through Spokane, Washington and to the Tri Cities area. The UP route travels on the east and south side of the Columbia River into Portland and through Portland to Terminal 6. This route will traverse Portland, entering the eastern extremity of the city from the Columbia River Gorge and follow north of NE Sandy Blvd until it crosses I-205. From that point, the route generally parallels (to the south side) NE and N Columbia Blvd to I-5 where it crosses to the north side of N Columbia Blvd and continues following N Columbia Blvd to N Hurst Ave where it turns north to enter Terminal 6 and the project site.

Pembina has not yet confirmed a rail transportation provider or route for this project. As part of our commitment to the safety of our employees and neighbors, we look closely at the safety records of potential carriers, the routes they travel, and the safety standards of the rail cars and tracks.

What is the safety record of propane transport by rail? Pembina stated that they have experienced no significant spills or explosions/fires. The City memo seems to imply that serious incidents involving propane have occurred. I'm interested in the industry-wide experience (as a way to estimate the likelihood of an incident and the potential human and environmental impacts).

We can only speak to our safety record. Pembina is known as a safe, reliable operator. We have been serving North America's energy industry safely for 60 years, we have been safely transporting propane across Canada and the United States for 40 years, and we have been shipping propane to Oregon, without incident, for 15 years. We have been recognized with numerous safety awards, from many major rail carriers.

We will use state-of-the-art equipment at all stages associated with the facility, from rail to storage and shipping. We lease our own fleet of 1200 rail cars specifically designed for liquid propane (DOT 112). The average age of our fleet is six years. The rail cars have emergency

pressure relief valves in order to relieve pressure in the event of an accident and include the additional following safety features:

- 11-gauge jacketed shell
- 0.618-inch thick, normalized steel shell

- 0.5-inch thick, full head shields and quipped with top-fitting protection
- 0.5-inch ceramic fiber insulation (thermal protection)

Propane Safety and Releases

My understanding is the propane after being chilled will not reach the ground and will evaporate before reaching the ground. Can we confirm this and correct if there need to be a change?

The staff report states that propane spilled on the ground will freeze organisms and vegetation. This is an oversimplification of a potential risk that does not consider the physical properties of propane and the behavior of liquid propane if it was exposed to outside air at the facility. Propane is liquid at -44F and therefore any unlikely spill or leak at temperatures above -44 F would result in a dissipating vapour. All the propane piping and storage is aboveground, meaning if there was a release, propane would be exposed to air and would convert to vapor and dissipate before coming in contact with the ground. Consequently, vegetation and wildlife mortality from freezing is extremely unlikely.

What is the radius of an explosion zone?

We do not have that information yet, but the work required to answer that question is already underway. Pembina has retained experts from DNV GL (DNV GL also performs work for Homeland Security) to conduct modeling studies for the facility to assist Pembina in the preparation of a site-specific Emergency Response Plan ("ERP"). The ERP will address potential emergency situations and will be reviewed by the US Coast Guard, Portland Fire and Rescue, and the Port of Portland.

It is important to note that a propane tank operating under normal circumstances will not explode or rupture. By design, all propane gas containers are manufactured to withstand extensive external damage; containment of liquid propane is factored into the engineering and construction. Safety devices and mechanisms are in place to prevent explosions, accidents, and propane tank ruptures or breaches. Just like any other hazardous material or activity, human error is a primary factor in contributing to any type of accident. The project design, relief systems, and operating procedures will contribute to incident prevention.

In addition, Pembina will have fire water systems to put water on tanks to cool them in rare instance of a fire.

What will happen in the case of an earthquake?

We are committed to the safety of our employees and our neighbors. Our facility will meet or exceed all current building design and construction standards, including the most recent seismic standards as required by the 2012 International Building Code and the 2014 Oregon Structural Specialty Code.

With the design and mitigation requirements of these codes, the probabilistic hazard level for the facility considers earthquakes from the Magnitude 9 Cascadia Subduction Zone (which would originate near the Oregon coast) and the Magnitude 7 Portland Hills Fault Zone (which would originate less than 5 km away). The facility will be designed to withstand these levels of earthquakes. This means that post earthquake, the structures still support gravity load, damage that does occur will not prevent egress for occupants, and the tanks will retain containment capability.

What will happen in the case of a flood?

A small portion of the site is mapped within the 100-year floodplain. All propane storage and related equipment will be located outside of this area. The most recent topographical survey completed for the site indicates that none of the upland site is below the 31' base elevation, which marks the 100-year floodplain.

In addition, in the event of a flood, the equipment will be shut down, trains will not be brought to site, and ships will not be brought up the river. In the event a ship is at the dock when such an event occurs, it will be released and routed to the ocean when possible.

How high and voluminous will the flame be from the fire stack if there was an emergency to burn off all the propane? Would it be dangerous for close by residents and Forest Park?

In the event of an emergency, the flare stack will be used for safe, controlled combustion and release of the propane. In an emergency situation, the flame could reach 100 feet above the flare stack. The current design height of the flare stack is 228 feet – the flare stack height is designed to maintain the ground heat level such that there is no harm to people at the site boundaries. Consequently, there will be no harm to adjacent neighbors or communities if the flare does reach maximum emergency conditions. Please note the nearest residential community is approximately 1.4 miles from the flare stack.

Please confirm that the regulations Bureau of Development Services ("BDS") and the Fire Marshall will be using for the facility are equal or better than the regulations Pembina provided (which are the Canadian standards).

Pembina previously provided a five page list of codes and standards that will be used to design the facility (see attached). They are a list of applicable U.S. standards and references to other internationally accepted standards which would be used in the design of the project. These codes

and standards are not Canadian standards, however many of these standards form the basis for the Canadian design requirements for this type of facility.

Have BDS or the Fire Marshall contacted Canadian officials that site these propane facilities and discussed best practices?

Pembina has provided the Bureau of Development Services, the Bureau of Planning and Sustainability, and Fire and Rescue with facility details of other similar operating facilities in the United States. This included contact information for the relevant local area first responders. Pembina encourages the City of Portland staff to contact these facilities and agencies directly (see attached).

Have our officials been offered the opportunity to visit an existing exporting facility by Pembina?

Pembina does not have any other export facilities although we do have facilities in Canada and the United States that handle and store propane.

Pembina would encourage the City to contact one of the currently operating export facilities in the United States directly to obtain a site visit. As mentioned above, information on these facilities has been provided to City staff.

Will the hydrocarbon vapors developing during the loading operation be returned to a vapor recovery system involving the tanks?

Yes, the vapors that develop during the ship loading operation will be captured. They will be returned via the above-ground piping to the refrigerated storage tanks. Vapors will be cooled and converted back to liquid for storage in the tanks.

In Longview "Haven Energy" will invest in state-of-the-art safety features at the terminal, including the first full-containment propane and butane storage tanks to be constructed in the U.S. Will this facility be state-of-the-art for safety features like Longview? Will it be equal or above to the "gold standard"?

As part of our company's commitment to safety, we will use refrigerated storage tanks built of steel, with double-walled tanks (i.e. a tank within a tank) and will monitor the space between the tank walls for any leaks. A leak from the inner tank would be detected and contained in the outer tank. The facility will have emergency shutdown valves isolating individual parts of the terminal, as well as pressure relief and flare valves to route the propane to a flare stack, for a safe, controlled combustion and release. The flare stack will only operate during an emergency or during maintenance activities.

In the event of a power outage and the refrigeration compression was without power; the propane would slowly heat up, converting to a gas (similar to water boiling off as steam) and similarly, be routed to the emergency flare stack for a safe, controlled combustion and release.

This tank design is an industry proven and safe design for storage of propane.

My understanding is that the Coast Guard is proposing a security zone of 500 yards in all directions. There would be two to three ships per week at the 37,000 barrels capacity, but the facility has a capacity of 75,000 barrels. If at full capacity, would this mean that the harbor would be closed 24/7 365?

- *Have we evaluated the impact to the recreational boating community?*
- *Economic impact to associated business on the island that depend on that business?*
- *Describe what conversation we are having with the coast guard on these issues?*
- *Have we proposed an escort process through provided by the port during peak boating season?*

Pembina will have 2-3 ships per month, not two to three times a week. Further the average capacity of the facility will be 37,500 barrels or 1.6 million gallons per day.
The US Coast Guard (USCG) has not yet determined a safety and security zone for this facility and the associated ships. That will be determined only after a detailed Waterway Suitability Assessment (WSA) is completed. Pembina has initiated the studies that will be considered by the USCG in the WSA. Some of the studies include characterization of the Port, the proposed facility, and the ship route within United States waters; a risk assessment for maritime safety and security; identification of risk management strategies and resource needs for safety; and security, response and risk mitigation measures that may be employed.

It is expected that the WSA process with the USCG will be completed by the end of 2015 or early 2016. Pembina has had a preliminary meeting with the USCG and will be submitting our Letter of Intent and Preliminary WSA to the USCG to initiate the process by the end of January. Local agencies such as the City can participate in the WSA process coordinated by the USCG.

The USCG will determine from their review if a safety and security zone is required, its size, the conditions under which it occurs, and whether and how other boat traffic can enter the safety and security zone.

In the event the USCG recommends a security zone that extends across the Oregon Slough for the entire time the ship is at berth, access to the Oregon Slough would be limited only up to six days per month. The boat traffic would still have access to the Columbia River by accessing it upstream or downstream of Hayden Island. Consequently, it is not anticipated that any safety or security zone will result in economic impacts.

Impact on Grassland Habitat

Is grassland habitat restoration or enhancement something that BPS and BES have discussed with Pembina by way of mitigation and community benefits?

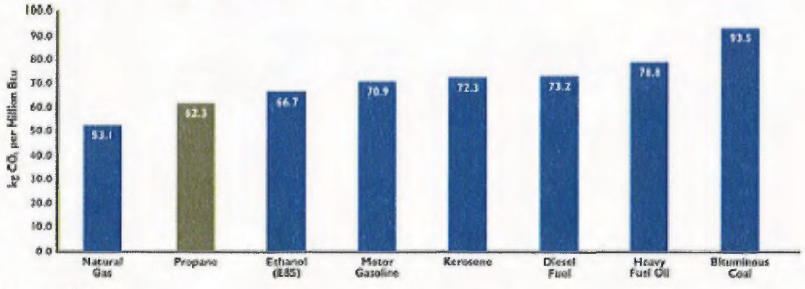
The City has identified grassland habitat on the eastern portion of the Pembina site. Pembina is in discussion with the City's Bureau of Environmental Services to undertake voluntary grassland habitat mitigation for any impacts of unprotected grassland. Although the discussions are preliminary, it is anticipated the mitigation will take the form of a grassland habitat enhancement project at another location in the general area.

Propane and Carbon Dioxide

What are the advantages of propane over other fuels in terms of greenhouse gas emissions? In my briefing, Pembina noted that propane had a higher energy output per unit of CO2 emissions. I would like to see (1)a more detailed science-based discussion of this point, and (2) a presentation of any existing field-based evidence that propane use actually reduces CO2 emissions in practice (i.e. relative to other fuels).

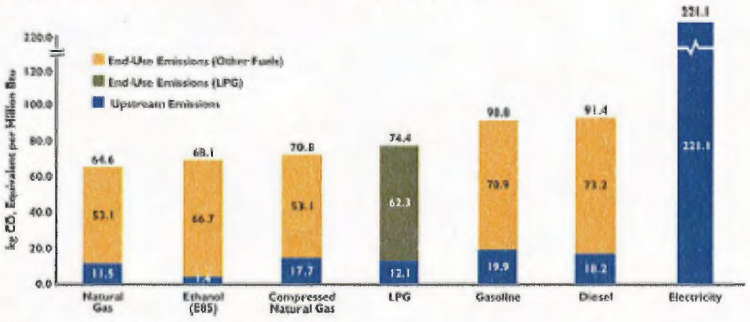
The environmental profile of propane makes it a more attractive product than many other energy sources. Propane is not a direct greenhouse gas ("GHG") because when it is emitted directly to the atmosphere, it does not release carbon dioxide or methane. When used as a fuel, propane does emit carbon dioxide, but when compared to conventional fuel supplies, propane generates fewer GHG emissions in almost every application. At the point of use, propane has a lower carbon content than gasoline, diesel, heavy fuel oil or ethanol.

Figure 2.1. End-Use CO_2 Emissions for Various Fuels



Source: EIA 2007
End-use emissions estimates based on chemical composition of the fuel with 100 percent combustion.

Figure 2.2. Total Greenhouse Gas Emissions for Various Fuels



Sources: EPA 2009, GREET 1.8c
End-use emissions estimates based on chemical composition of the fuel with 100 percent combustion.
Actual life-cycle emissions vary by application; in many cases, electricity provides more useful energy on a per-Btu basis.

Table 2.2. CO_2 Released per Btu

Fuel Type	kg CO_2 per million Btu
Natural Gas	53.06
Propane	62.30
Ethanol (E85)	66.70
Motor Gasoline	70.88
Kerosene	72.31
Diesel Fuel	73.15
Heavy Fuel Oil	78.80
Bituminous Coal	93.46

Estimates based on chemical composition of the fuel with 100 percent combustion, and based on average speciation of transportation fuels, except kerosene, heavy fuel oil, and bituminous coal, which are based on average speciation for stationary combustion use.

Source: EIA 2007

Source: *Propane Reduces Greenhouse Gas Emissions: A Comparative Analysis 2009*, Propane Education & Research Council and Energetics Incorporated. Available at http://www.energetics.com/resourcecenter/products/studies/samples/Pages/prop-greenhouse-report.aspx (last visited January 8, 2015).

Does Pembina have economic evidence that propane is actually displacing higher emission fossil fuels rather than just adding to overall fuel use?

Based on Pembina's preliminary marketing discussions with a number of potential buyers in the Asia-Pacific market and knowledge of the propane use in the market, we fully expect the propane that will be used as fuel to displace higher emission fossil fuels. .

My understanding from the US Energy Information Administration 12.7 gallons of propane produces when 139 pounds of CO2 when burned. Would 37,000 barrels of propane (e.g., 600,000 gallons of propane) burn 47,244,094 pounds of CO2?

As discussed above, Pembina's facility will have the capacity to handle on average 1.6 million gallons of propane per day or 37,500 barrels (there are 42 US gallons in one barrel). The US Energy Information Administration references that propane when burned generates 12.7 pounds

of CO2 emissions per gallon of propane. See http://www.eia.gov/environment/emissions/co2_vol_mass.cfm.

This is roughly 20,320,000 pounds of CO2 (or 9,216 metric tonnes). If all of the propane shipped to the Asia-Pacific market from Pembina's facility is burned as fuel, the total CO2 emissions would be approximately 3,387,200 metric tonnes annually. However, it is important to note that not all of the propane will be burned. Pembina estimates that 50 to 65 percent of the propane will be used to manufacture plastics and in this use, the propane is not burned and therefore does not release greenhouse gas emissions. If the other 50 percent of propane was burned as fuel, the CO2 emissions would be approximately 1,693,600 metric tonnes, and this is expected to represent an overall net reduction of emissions as the propane replaces more carbon intensive fuels.

Can staff develop top ten actions which offset CO2 emissions and relative cost per ton of CO2?

Pembina's facility will have limited direct greenhouse gas emissions. The facility will operate as a closed loop system. Minimal greenhouse gas emissions will be generated from small amounts of natural gas used to heat the office and hot water and the short monthly tests of the diesel-powered emergency backup equipment.

The majority of the equipment on site will be powered by electricity and there will be indirect greenhouse gas emissions associated with the electricity generation. However, Pembina is currently investigating options to purchase some form of green energy or carbon credits to offset the facility's energy consumption.

Regards,

Eric Dyck
Vice President, Marine Terminals

Pembina Propane Export Terminal

Design Code Summary

LOCAL OR NATIONAL REGULATIONS AND NORMS

NATIONAL ELECTRICAL CODE
ALL ENVIRONMENTAL RULES AND REGULATIONS
– OREGON STATE DEPARTMENT OF ENVIRONMENTAL QUALITY
– US EPA REGION 10
– SOUTHWEST CLEAN AIR AGENCY
– US ARMY CORP OF ENGINEERS
– US DEPARTMENT OF FISH AND WILDLIFE
– FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
– NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NATIONAL MARINE FISHERIES SERVICE)
– OREGON STATE DEPARTMENT OF FISH AND WILDLIFE
– OREGON STATE DEPARTMENT OF TRANSPORTATION
– CITY OF PORTLAND BUREAU OF DEVELOPMENT SERVICES, BUREAU OF ENVIRONMENTAL SERVICES, FIRE AND RESCUE, BUREAU OF PLANNING AND SUSTAINABILITY, WATER BUREAU, BUREAU OF TRANSPORATION
ALL LABOR RULES AND REGULATIONS
– SEE OTHER SAFETY REGULATIONS
CIVIL, STRUCTURAL & ARCHITECTURAL REGULATIONS
– ASCE 7, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES
– FEMA-P-750, NEHRP RECOMMENDED SEISMIC PROVISIONS FOR NEW BUILDINGS AND OTHER STRUCTURES
– ANSI/AISC 360-05: SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS (ALLOWABLE STRESS DESIGN)
– IBC 2012, INTERNATIONAL BUILDING CODE AND OREGON STATE AMENDMENTS (2014 OREGON STRUCTURAL SPECIALTY CODE)
– LOCAL BUILDING CODES, WHERE APPLICABLE
SAFETY REGULATIONS
– 18 CFR PART 380, CONSERVATION OF POWER AND WATER RESOURCES: REGULATIONS IMPLEMENTATING THE NATIONAL ENVIRONMENTAL POLICY ACT
– 33 CFR PART 127 – WATERFRONT FACILITIES HANDLING LIQUID NATURAL GAS AND LIQUEFIED HAZARDOUS GAS
– 29 CFR PART 1910.106, OSHA FLAMMABLE AND COMBUSTIBLE LIQUIDS
– 29 CFR PART 1910.165, OSHA EMPLOYEE ALARM SYSTEMS
– 29 CFR PART 1910.119, OSHA PROCESS SAFETY MANAGEMENT REGULATION
– 30 CFR PART 18.65, FIRE RESISTANCE OF CONVEYOR BELTING
– 33 CFR PART 160.101, PORTS AND WATERWAYS SAFETY: CONTROL OF VESSEL AND FACILITY OPERATIONS
– 33 CFR PART 165.20, REGULATED NAVIGATION AREAS AND LIMITED ACCESS AREAS: SAFETY
– 33 CFR PART 165.30, REGULATED NAVIGATION AREAS AND LIMITED ACCESS AREAS:

SECURITY
– 33 CFR PART 102, NATIONAL MARITIME TRANSPORTATION SECURITY
– 33 CFR PART 105, MARITIME SECURITY: FACILITIES
– 33 CFR PART 127, WATERFRONT FACILITIES HANDLING LIQUEFIED NATURAL GAS AND LIQUEFIED HAZARDOUS GAS
– 49 CFR PART 191, TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE, ANNUAL REPORTS, INCIDENT REPORTS, AND SAFETY-RELATED CONDITION REPORTS
– 49 CFR PART 192, TRANSPORTATION OF NATURAL GAS AND OTHER GAS BY PIPELINE: FEDERAL SAFETY STANDARDS
– PHMSA 49 U.S.C CHAPTER 601, SAFETY
– NSC 2117.1, SAFETY REQUIREMENTS FOR CONFINED SPACES
– OCIMF, GUIDE ON MARINE TERMINAL FIRE PROTECTION AND EMERGENCY EVACUATION
– ASME B20.1, SAFETY STANDARD FOR CONVEYORS AND RELATED EQUIPMENT
– OREGON INDUSTRIAL SAFETY AND HEALTH ACT
– OREGON STATE DEPARTMENT OF HEALTH

DESIGN CODES AND STANDARDS (TYPICAL CODES)

- *AISC MANUAL OF STEEL CONSTRUCTION*
- *AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)*
- *AMERICAN CONCRETE INSTITUTE (ACI)*
- *AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)*
- *AMERICAN PETROLEUM INSTITUTE (API)*
- *AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION*
- *AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)*
- *AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)*
- *AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR- CONDITIONING ENGINEERS (ASHRAE)*
- *AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)*
- *AMERICAN WATER WORKS ASSOCIATION (AWWA)*
- *AMERICAN WELDING SOCIETY (AWS)*
- *BRITISH STANDARDS INSTITUTE (BSI: 6349-1:2000, MARITIME STRUCTURES)*
- *ELECTRONIC AND TELECOMMUNICATIONS INDUSTRIES ALLIANCES (EIA/TIA)*
- *ENVIRONMENTAL MANAGEMENT SYSTEMS ISO 14000/14001:2004*
- *FLUID CONTROLS INSTITUTE*
- *EUROPEAN TELECOMMUNICATIONS STANDARDS INSTIUTUION (ETSI)*
- *HEAT EXCHANGE INSTITUTE (HEI)*
- *HYDRAULIC INSTITUTE STANDARDS*
- *ILLUMINATION ENGINEERING SOCIETY (IES)*
- *INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)*
- *INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)*
- *INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)*
- *INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) 9000/9001/2002, 5167*
- *INTERNATIONAL PETROLEUM INDUSTRY ENVIRONMENTAL CONSERVATION*

ASSOCIATION (IPIECA)

- *INTERNATIONAL SHIP AND PORT FACILITY SECURITY (ISPS)*
- *INTERNATIONAL SOCIETY OF AUTOMATION (ISA)*
- *UNITED STATES MILITARY STANDARDS (MIL)*
- *INTERNATIONAL SOCIETY OF AUTOMATION (ISA)*
- *JOINT INDUSTRY CONFERENCE (JIC)*
- *MECHANICAL POWER TRANSMISSION ASSOCIATION*
- *INTERNATIONAL TELECOMMUNICATIONS UNION*
- *INTERNET ENGINEERING TASK FORCE*
- *NATIONAL ASSOCIATION OF COROSSION ENGINEERS (NACE)*
- *NATIONAL ELECTRIC CODE (NEC)*
- *NATIONAL ELECTRICAL MANUFACTURER ASSOCIATION (NEMA)*
- *NATIONAL ELECTRICAL SAFETY CODE (NESC)*
- *NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)*
- *NATIONAL FLUID POWER ASSOCIATION (NFPA)*
- *OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA 18000, 18001/2007)*
- *OIL INSURANCE ASSOCIATION*
- *PERMANENT INTERNATIONAL ASSOCIATION OF NAVIGATION CONGRESSES (PIANC)*
- *PRESTRESSED CONCRETE INSTITUTE (PCI)*
- *SCIENTIFIC APPARATUS MANUFACTURERS ASSOCIATION (SAMA)*
- *SOCIETY FOR PROTECTIVE COATINGS (SSPC)*
- *TUBULAR EXCHANGER MANUFACTURER ASSOCIATION (TEMA)*
- *UNDERWRITERS LABORATORIES (UL)*
- *UNIFORM PLUMBING CODE (UPC)*
- *USA UNIFORM BUILDING*
- *USA ENVIRONMENTAL PROTECTION AGENCY (EPA)*
- *WORLD BANK GROUP ENVIRONMENTAL, HEALTH, AND SAFETY*

Albrich, Elaine

From: Gail Feltham <GFeltham@pembina.com>
Sent: Wednesday, December 10, 2014 3:31 PM
To: 'charles.auch@portlandoregon.gov'
Cc: Albrich, Elaine; Nick Kangles; Chris Hayes; Cleveland, Leandra L.; 'Miranda, Donette P.'
Subject: Information for the Fire Bureau
Attachments: Figure 3_Pembina_Opt9-Civil-20141112-wof.pdf; InfoLPGFacilities.pdf; Submittal_Fire_20141210.pdf

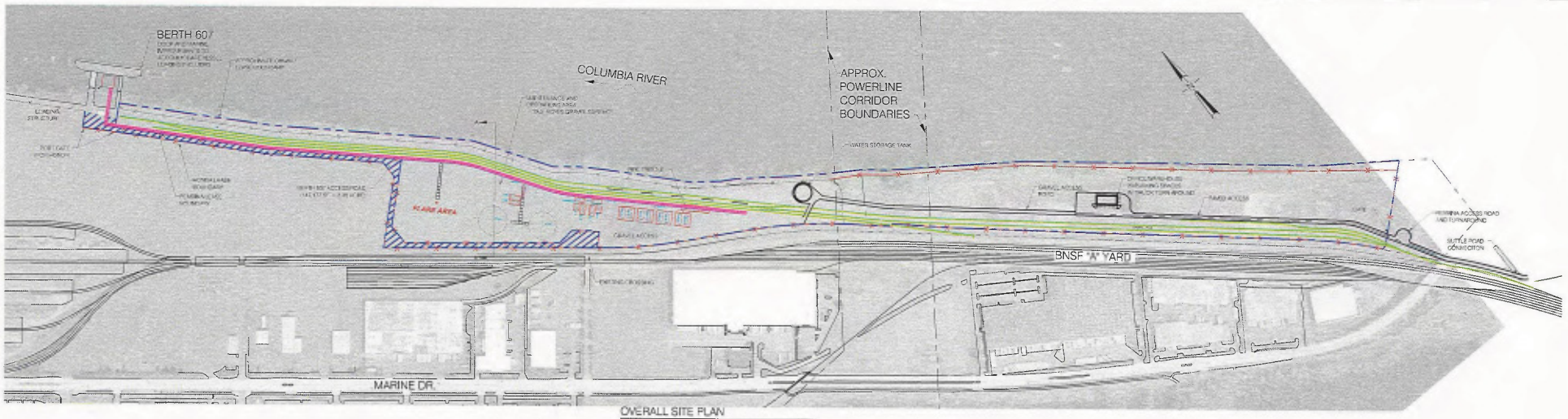
Good afternoon Charles,

Please find attached information for the Fire Bureau. If possible, we would like to meet with the Fire Bureau next Tuesday or Wednesday when a few of the necessary Pembina personnel will be in Portland for other meetings.

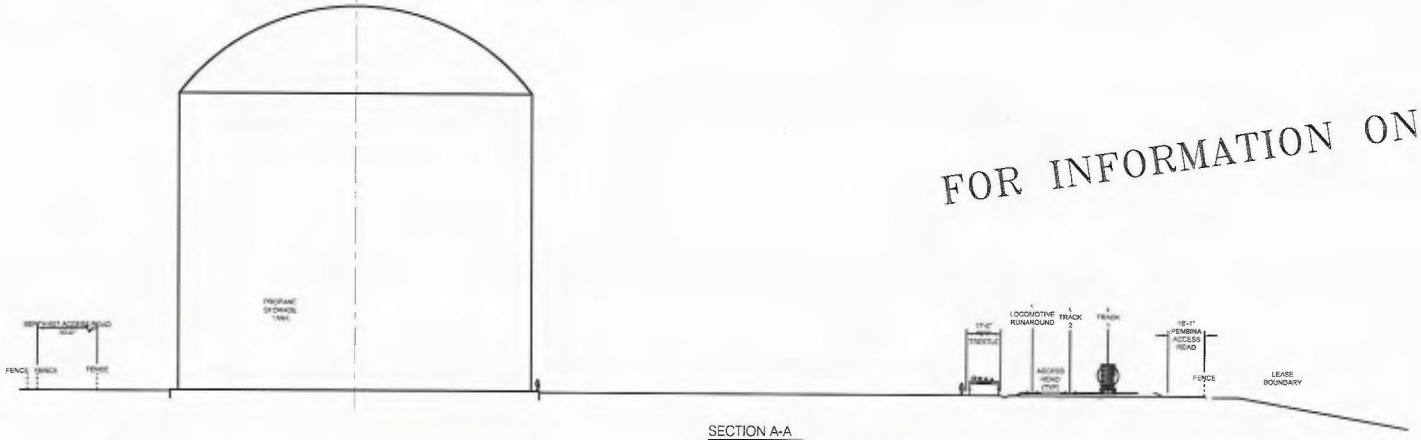
Regards,

Gail

Gail Feltham - Permitting, Marine Terminals
Pembina Pipeline Corporation | (Room 32-106) 3800, 525 - 8th Avenue S.W. Calgary, AB T2P 1G1
Tel: **(403) 231-6718** | Cell: **(403) 819-2514** | Fax: **(403) 237-0254** | gfeltham@pembina.com



OVERALL SITE PLAN
SCALE: 1" = 300'



SECTION A-A
SCALE: 1"=30'

FOR INFORMATION ONLY

NO	DATE	BY	REVISIONS	CKD	APP'D
NO	DATE	BY	REVISIONS	CKD	APP'D

PORTLAND, OREGON

HDR Engineering, Inc.

1001 SW 5TH AVE, SUITE 1800, PORTLAND, OR 97204 (503) 423-3700

DESIGNED BY	WD
DRAWN BY	JAP
CHECKED BY	
DATE	11/03/2014
GRAPHICAL SCALE BAR	0 1/2" 1" 2"

TERMINAL 6
CONCEPT - No 9 - CIVIL SITE PLAN
RAILCAR TO MARINE TRANSFER FACILTY

SUBMITTED BY

TYPE	DRAWING NO:
CD	FIGURE-C1 -/-

Information on Operational Marine LPG Export Terminals

Company	Targa Midstream Services LP	Enterprise Products	Petrogas Energy	DCP Midstream Partners	Sunoco
Facility Name	Galena Park Marine Terminal	EPOLP Marine Loading Facility	Ferndale Terminal (LPG Marine Export)	Chesapeake Terminal	Marcus Hook
Facility Description[2,3] (from RMP and press releases)	The Galena Park Terminal is a facility which receives and delivers liquefied petroleum gases (both mixed and pure), olefins, and chemical feedstocks by ships, barges, trucks, rail, and pipelines. Import/ Export Marine Terminal for propane and butane and handles Very Large Gas Carriers and Medium Gas Carriers for propane. Expansions completed 2013 and 2014 for increased capacity of propane to an overall capacity of 6.5 million barrels per month of propane	Enterprise's Marine Loading Facility is used to offload and load various LPG streams. Off loaded products include propane and butanes. These LPG products are imported from ships and barges. The products are then pumped into pipelines for distribution. Loaded products at the marine facility include propane and butanes. The facility incorporates some processing such as dehydration prior to refrigeration of the propane and butane. Expansion announced January 2014 to increase capacity to load 16 million barrels per month of propane or butane (planned to be in service at the end of 2015)	The Terminal serves as a storage facility for Liquefied Petroleum Gas (propane and butane) receiving and sending these products via railcar, truck, pipeline and ship. Purchased from Chevron in 2014. Can import or export up to 30,000 barrels per day of LPG.	Chesapeake Terminal imports, exports and stores fully refrigerated liquid propane. The terminal also heats the propane to +40 deg F for shipment to its customers by truck and rail. Ethyl mercaptan is added to the LPG being distributed from the terminal. An expansion to store and export butane is underway and exports were expected to begin late 2014.	The Marcus Hook Facility, located in Marcus Hook, Pennsylvania and Claymont, Delaware, is a terminal facility with LPG storage and transfer capabilities. It also handles crude oil. It has processing, storage, dock facilities, truck racks, pipeline access and rail access.
Address[2]	12510 American Petroleum Road	15602 JacintoPort Blvd, Site C	4100 Unick Road	2901 South Military Highway	100 Green Street
City, State[2]	Galena Park, Texas	Jacinto City[4], Texas	Ferndale, Washington	Chesapeake, Virginia	Marcus Hook, Pennsylvannia (the facility is also located in Delaware)
County[2]	Harris County	Harris County	Whatcom County	Chesapeake City	Delaware County
Most recent RMP[1]	2009	2012	2008 (by Chevron)	2010	2013
Link to most recent RMP[2]	http://www.rtknet.org/db/rmp/rmp.php?reptype=a&database=rmp&facility_name=galena&combined_name=&parent=targa&all_naics=&execsum=&city=&county=&state=TX&zip=&chemical_id=&detail=4&datatype=T	http://www.rtknet.org/db/rmp/rmp.php?reptype=f&database=rmp&facility_name=epolp&parent=&combined_name=enterprise&city=&county=&state=TX&zip=&district=&execsum=&all_naics=&chemical_id=98&detail=4&datatype=T&sortp=F	http://www.rtknet.org/db/rmp/rmp.php?reptype=a&database=rmp&facility_name=&combined_name=&parent=&all_naics=&execsum=&city=ferndale&county=&state=WA&zip=&chemical_id=&detail=4&datatype=T	http://data.rtknet.org/rmp/rmp.php?database=rmp&detail=3&datype=T&facility_id=100000168301	http://www.rtknet.org/db/rmp/rmp.php?city=marcus+hook&state=PA&parent=sunoco&datype=T&reptype=a&database=rmp&detail=4&submit=GO
Flammable Storage[2]	222,713,000 lbs (2,100,000 lbs butane; 6,700,000 lbs propane)	1,570,000 lbs	162,500,000 lbs (2,500,000 lbs of propane; 160,000,000 of butane)	98,413, 262 lbs (almost all propane; 22,020 lbs mercaptan)	379,829,000 lbs (various flammable products including propane)
Local Response Agency (Contact #)[2]	Channel Industries Mutual Aid Org (281-476-5040)	North Channel LEPC (703-455-5372)	Whatcom County Fire District No. 7 (360-384-0303)	Chesapeake Fire Department (757-543-1573)	Borough of Marcus Hook (610-485-1341) Delaware County LEPC (610-565-8700) Lower Chichester Township (610-485-1472) New Castle County LEPC (302-573-2856)

Footnotes:

1 An RMP is a Risk Management Plan that is required for operational facilities with a capacity to store hazardous products over certain thresholds. The RMPs are published on-line through the Right to Know Network (www. rtknet.org)

2 This information is pulled from the most recently available RMP for the facility on the Right to Know Network. Some of the information may be out of date and may not fully reflect the facility's current capacities.

3 Relevant information is pulled from recent relevant press releases

4 The most recent RMP references Houston as the city. Jacinto City is part of the Houston-Sugar Land-Baytown metropolitan area and is bordered by the Cities of Houston and Galena Park.

Information on Other Operational Large LPG Terminals with Storage

Company	Targa Midstream Services LP	Enterprise Products	Plains LPG Services LP	Enterprise Propane Terminals and Storage, LLC
Facility Name	Hattiesburg Terminal	Mont Belvieu Facility	Alto Terminal	Apex Terminal
Facility Description[2,3] (from RMP, company website and press releases)	The Hattiesburg Terminal is a propane marketing and storage terminal that receives propane product by pipeline, rail and truck. The propane is stored on site in underground storage caverns and above ground storage tanks and then delivered to market via pipeline, rail and transport trucks. This facility can store 269 million barrels per day.	This facility has processing including natural gas liquids fractionation, reaction, separation, and distillation as well as storage. It utilizes gas-fired turbines to generate electricity or run compressors, and to supply heat for process operations. Additionally, there are a number of gas-fried heaters to provide heat for various processes including distillation. The facility has three flares.	At the terminal, propane and butane are received via railcar and stored in pressure tanks or underground storage caverns. Propane and butane are loaded into transport trucks from the above ground tanks only.	The Apex terminal receives and stores ethyl mercaptan and liquefied propane, and loads propane onto trucks. The facility consists of one refrigerated propane storage tank, ten propane pressure storage tanks, a six-station truck loading rack, mercaptan storage and injection equipment, a propane refrigeration system and associated piping, valves and other miscellaneous equipment.
Address[2]	18 Chappel Road	10207 FM 1942	6050 Alden Nash Avenue	1521 East Williams Street
City, State[2]	Petal, Mississippi	Mont Belvieu, Texas	Alto, Michigan	Apex, North Carolina
County[2]	Forrest County	Chambers County	Kent County	Wake County
Most recent RMP[1]	2009	2010	2013	2011
Link to most recent RMP[2]	http://data.rtknet.org/rmp/rmp.php?facility_id=100000166036&database=rmp&detail=3&datype=T	http://www.rtknet.org/db/rmp/rmp.php?facility_name=Mont&parent=enterprise&sortp=F&datype=T&reptype=f&database=rmp&detail=4&submit=GO	http://www.rtknet.org/db/rmp/rmp.php?reptype=f&database=rmp&facility_name=alto&parent=&combined_name=plains&city=&county=&state=&zip=&district=&execsum=&all_naics=&chemical_id=&detail=4&datype=T&sortp=F	http://www.rtknet.org/db/rmp/rmp.php?reptype=f&database=rmp&facility_name=apex&parent=&combined_name=propane&city=&county=&state=&zip=&district=&execsum=&all_naics=&chemical_id=&detail=4&datype=T&sortp=F
Flammable Storage[2]	1, 100,012,000 lbs	49,281,000 lbs	212,886,300 lbs	84,021,000 lbs
Local Response Agency (Contact #)[2]	Mississippi Emergency Management (800-222-6362)	Police Department/ Mutual Aid Organization (281-576-2417)	Alto Fire Department (616-632-6255)	Apex Fire Department (919-362-4001)

Footnotes:

1 An RMP is a Risk Management Plan that is required for operational facilities with a capacity to store hazardous products over certain thresholds. The RMPs are published on-line through the Right to Know Network (www. rtknet.org)

2 This information is pulled from the most recently available RMP for the facility on the Right to Know Network. Some of the information may be out of date and may not fully reflect the facility's current capacities.

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4 The most recent RMP references Houston as the city. Jacinto City is part of the Houston-Sugar Land-Baytown metropolitan area and is bordered by the Cities of Houston and Galena Park.

Information on Pembina's Portland Propane Terminal

Provided to:

City of Portland DevTeam Liaison

City of Portland Fire Bureau

Provided by:

Pembina Marine Terminals, Inc.

525 8th Avenue SW, Suite 3800

Calgary AB T2P1G1

December 10, 2014

This information is based on the best information currently available for the Project given the early design phase and may be subject to change.

Propane Physical Characteristics and Handling Process

To better understand "what would happen" in the instance of a propane leak, spill or emergency situation, it is necessary to describe the physical characteristics of propane and how Pembina will handle the propane at the facility.

Physical Characteristics

Propane is derived from natural gas. When natural gas is produced it typically contains a variety of associated hydrocarbons, water and other associated impurities. Natural gas processing plants separate all of the various hydrocarbons and fluids from the pure natural gas, to produce what is known as "pipeline quality" dry natural gas. Among the natural gas liquids that are separated in this process is propane. Propane can be separated from the natural gas liquids by raising the temperature and separating the lighter ends (i.e., propane) from the heavier components. It is similar to boiling water and collecting the rising steam. This separation process will be completed at Pembina's Redwater facility in Canada, northeast of Edmonton, Alberta, before shipping the propane to the proposed facility in Portland.

Propane is colorless, odorless and flammable, and is a gas at atmospheric pressure. It freezes at -306 F and boils (evaporates) at -44 F. Propane when mixed with air is flammable at concentrations of 2.1 to 9.5 percent. It will auto-ignite at a temperature of 842 F. The vapor has a density of 1.6 (heavier than air). High concentrations of propane can displace oxygen in the air and cause effects such as dizziness, confusion and suffocation (as a result of oxygen deficiency). Contact with liquid propane or contact with vessels with liquid propane can cause frostbite (Reference from Center for Disease Control - http://www.cdc.gov/niosh/docs/81-123/pdfs/0524.pdf). In the presence of excess oxygen, propane burns to form water and carbon dioxide. However, if not enough oxygen is present for complete combustion, incomplete combustion occurs, allowing carbon monoxide and/or soot (carbon) to form as well. (Reference: http://en.wikipedia.org/wiki/Propane).

Propane is not a criteria air pollutant, hazardous air pollutant, or greenhouse gas under the federal or state air quality programs.

The propane at the Pembina facility, which will be of a commercial grade, will not contain an odorant (which is used in consumer propane to detect leaks). Odorant is not customarily added to commercial propane. Because one of the likely end uses of commercial propane is as a petrochemical feedstock, the odorant would negatively affect the production processes. Pembina will install sensors at the facility to detect potential leaks of propane with appropriately designed emergency handling equipment in the event a leak does occur.

Process

Pembina will only handle liquid propane of sales quality specification and so there will be no need for further processing of the propane at the facility. All processing will take place in Alberta, Canada prior to the liquid propane being loaded onto rail cars for transportation to the terminal.

Liquid propane will be loaded onto railcars in Canada. When the propane is transported by train, it is pressurized (like propane in a barbecue tank). It is a liquid, at approximately 10 times atmospheric pressure and 60 to 80 degrees F. When the propane reaches the facility, it will be offloaded from rail cars into the double-walled offload storage tanks (which will also be pressurized to keep the propane in liquid form). There will be eight offload tanks, each with a storage capacity of 125,000 gallons.

From the offload storage tanks, the liquid propane is refrigerated to -44 F, at which point it will be a few pounds above atmospheric pressure. At these conditions, propane would look similar to water in a cup. Once refrigerated, the liquid propane is moved through aboveground piping into two large aboveground refrigerated storage tanks that collectively store approximately 33.6 million gallons.

The liquid propane will be stored, on average, for 15 days before it is loaded onto ocean going ships. It will be pumped from the large storage tanks through aboveground piping to the ship's cargo hold. The advantage of transporting refrigerated propane is that the propane is at a pressure similar to atmospheric pressure, and the ships do not need to be designed with the same amount of steel as if propane were pressurized.

Liquid propane at the terminal is only transported through aboveground piping. When preparing for and loading ships, the aboveground piping will be cooled to transport the propane from the large storage tanks. At other times, the aboveground piping will be allowed to warm up, causing any residual propane left in the piping from the ship loading operation to go to a gas form, return to the refrigerated storage tanks and be cooled to liquid form to -44F and retained in the large storage tanks. Except for approximately six days per month when ships are at berth, the aboveground pipes will only contain trace amounts of propane vapor. This aboveground piping, however, will also be in a closed position when no loading is taking place with the use of valves and therefore will never be open to atmospheric conditions.

The facility will have overpressure relief valves on equipment to route propane to the flare stack for any required safe, controlled combustion and release. For example, in the event of a power failure, propane in the refrigerated storage tanks (either the large storage tanks or the offloading storage tanks) and refrigeration compression may warm up enough to increase the pressure in the tank. To relieve the pressure, propane is sent through aboveground piping to the flare to relieve the tank pressure. In addition, the flare will also be used during equipment maintenance; if equipment needs to be taken down for servicing, vapors within the equipment will be drawn down, and the remainder sent to flare prior to opening up the equipment.

Emergency Response Planning and Preparedness

Emergency Response Plans (ERPs) are one component of Pembina's Safety, Environment and Security Management System (SESMS) that is in place to manage potential risks associated with the company's activities and operations. A more complete discussion of Pembina's SESMS was provided in the original submittal to the City on November 19, 2014.

Pembina currently manages the same type of activities (rail unloading, storage, piping) and product handling (for propane) at its other facilities. Pembina's Redwater facility outside of Edmonton, Alberta, for example, processes natural gas liquids and separates and extracts the propane from other products. At the Redwater facility, there is rail loading and unloading, processing, piping, and storage of both natural gas liquids and propane. Similarly, at Pembina's propane facility in Lynchburg, Virginia, United States, there is rail unloading, propane storage, and truck loading activities.

Pembina's corporate ERP and the site-specific ERPs for the Redwater and Lynchburg facilities contain emergency response measures and protocols, which given the overlapping nature of the activities and product handling, are similar to those types of measures and protocols that would be developed to respond to incidents that could occur at the proposed facility in Portland. Pembina continues to be a top performing company with respect to overall safety within its industry and has safety statistics that are near the top within the Canadian Energy Pipeline Association (CEPA) group of 12 companies. To date in 2014, Pembina has had no lost time injuries within its work force after 2.1 million man-hours. Pembina also is proud of the fact that it has not experienced a major explosion event at its facilities to date but continues to be prepared by way of its ERP's, training of staff and association with local emergency responders for any potential event.

In addition to Pembina's facility-specific ERPs, there are national resources for emergency responders and firefighters. The National Propane Gas Association created the *Propane Emergencies* program to provide a uniform curriculum to help America's emergency responders and firefighters develop the knowledge and skills necessary to safely and effectively manage a propane emergency in transportation or at fixed facilities. See www.propanesafety.com for more information (http://www.propanecouncil.org/safety-and-training/). There also is the Propane Emergencies program developed by the Propane Education and Research Council (PERC). This comprehensive training program is adopted by 27 state firefighter training agencies and propane marketers and is designed to help emergency responders develop the knowledge and skills necessary to safely and effectively manage a propane emergency in transportation or at fixed facilities. It is aimed to firefighters and members of the Hazardous Materials Response Teams, propane marketers, propane industry product and container specialists, and private or emergency response contractors and based upon commonly used practices, references to nationally recognized engineering practices, regulations and consensus standards, and training programs. See http://dev-staging.propanecouncil.org/marketer-resources/safety-and-training/propane-emergencies/scenarios/.

How will propane act if released?

Possible propane releases could occur from leaking valves or fittings, piping, valve or fitting failures, rail car derailment, during loading or unloading operations, or tank leaks. What happens in the case of a release depends on different factors including the volume of propane released, the temperature of the propane released, the outside temperature, and the presence of wind.

For small leaks, propane will evaporate and dissipate in the atmosphere due to wind and temperature effects. The propane is flammable only when within the narrow range of propane-air mix that contains 2.1 to 9.5 percent propane.

Propane vapor is heavier than air and can settle in low areas when there is little or no wind or warming of the earth. With time, pooled vapors will dissipate. The vapor will generally be non flammable within the vapor cloud as there will not be adequate oxygen to ignite. However, at the edges of the propane vapor cloud, there will be areas where there is the appropriate ratio of oxygen and propane which could the lead to ignition. In most instances, smaller propane leaks from pressured systems will quickly expand to a vapor, can mix more readily with air and not form a vapor cloud that would stay on the ground or take a long time to dissipate. Larger leaks could form a vapor cloud as could releases of refrigerated propane.

Potential risks from exposure to propane in the event of a release as a vapor cloud are described below. The health and safety risks described would be limited at the site to workers or emergency response personnel that would respond to this type of incident.

- If propane is at a high enough concentration in the air it displaces theoxygen which can have health effects. Air with less than 19.5% oxygen is considered oxygen-deficient causing effects like dizziness, and less than 10% oxygen can result in loss of consciousness (http://www.airproducts.com/~/media/Files/PDF/company/safetygram-17.pdf).

- Propane, when initially released, is extremely cold and could freeze skin tissue upon direct contact in close proximity to the release point.

- Air quality will not be negatively affected by the release except directly in the vapor cloud, and because the propane is not combusted it will not generate any GHG emissions.

- In the unlikely event of a release over the water, the area at the release point will become cold as the propane evaporates, however no impacts to water quality would be expected as a result of the release because the liquid will evaporate.

How is a release detected?

The facility will have sensors around the site and on equipment that will be monitored, activate alarms and will be used to identify any potential releases. These sensors are a proven technology and various designs have been in use for decades; the sensors are regularly tested for correct operation. Pressure and temperature sensors will be placed at strategic points within the facility and equipment. Fire and gas sensors will be placed inside buildings where equipment handling propane will be located, in areas

where there are many pipe connections, at the ship load berth and around the perimeters of the site. These sensors are connected to computer monitoring systems to alarm and warn staff of smaller concentrations of propane, or in event of fire detection or larger amounts of propane to automatically shut down equipment and / or the facility and isolate it by use of emergency shutdown valves. Propane may be routed to flare for safe combustion. During vessel loading and rail unloading operations, personnel will also be present to manage and visually monitor the operations. Various design features will be installed, such as emergency shutdown valves that would be activated automatically by sensors or manually by onsite personnel or by a control room operator in the event of a release to minimize the volume of propane that could be released.

What happens when there is a release?

In the unlikely event of a release, installed fire and gas sensors will alarm and activate emergency shutdown valves and other shutdown procedures. A Pembina employee may also manually activate shutdowns of the facility or equipment as required.

A Pembina employee would activate the facility's Emergency Response Plan (ERP). Response measures include (taken from Pembina's corporate ERP):

- Assess the situation to determine the problem, extent and action required
- Evacuate all unnecessary personnel from the site, and eliminate any possible sources of ignition
- Initiate air monitoring for oxygen deficiency or explosive gas mixture
- Shut in the equipment that is the source of the leak when safe to do so.
- Initiate leak control procedures and shut down and/or de-pressurize facilities, as required.
- Allow liquids to evaporate and disperse

Depending on the size of the release and weather conditions, additional steps may include establishing roadblocks, notifying adjacent neighbors, or implementing shelter-in-place and/or evacuations of potentially affected areas. These additional requirements would only be required in the event of a significant release from the facility.

What if the propane ignites?

The vapor cloud or plume will move in the direction of the wind. Because of the mixing of air with the dispersing propane, propane concentration decreases continuously both with downwind distance as well as in the crosswind direction. When the propane concentration in the air is between 2.1 and 9.5 percent by volume, this cloud or plume can be ignited at a distance downwind by an ignition source.

Ignition of a dispersing vapor cloud or plume may result in a flashback type of vapor fire. In extremely rare cases, and only when the physical conditions are conducive, with partial or full confinement of the propane-air mixture of proper concentration and its ignition, a vapor explosion can occur.

Because propane vapor at ambient pressure and temperature is heavier than air, it will tend to flow towards and accumulate in low-lying areas adjacent to the release location. If a building or other semi-

confined area exists adjacent to the release location where the vapor can accumulate, a potential explosion hazard will result.

There can be high enough energy as a result of a failure for example in the piping that the propane will ignite from the failure.

In the event of a fire, suppression of the fire by use of chemical suppressants or water is not effective. Instead, the key strategies are:

- to avoid or minimize propane release by isolating the affected equipment;
- limit the potential for other adjacent equipment to become affected by the fire through use of water (cool the adjacent equipment and exposures that contain propane that could also ignite with water); and
- manage the fire until the propane is consumed.

If propane ignites, a Pembina employee would immediately activate the ERP. Response measures include (taken from Pembina's corporate emergency response plan):

- Ensure safety of response personnel and area residents / public
- Activate emergency shut down valves and isolate affected area, if safe to do so
- Identify proximity to bullets and any flammable substances
- Discontinue any loading/unloading or processing work affected by, or impacted by, the emergency and initiate shut down procedures of plant operations
- Assess the emergency situation
- Following proper safety protocols, treat and evacuate any injured personnel
- Monitor the air for oxygen deficiency or explosive levels of gas mixture in affected and potentially affected areas of plume dispersion
- Isolate the area and restrict entry. Adjust and control perimeters as incident progresses.
- Evacuate non-essential personnel and residents from the potentially affected area
- Use water to cool equipment and adjacent exposures

What if there is an incident during propane loading of ship?

The aboveground propane piping to the vessel will have emergency shutdown valves located on the berth, at the shoreline and at the storage tanks; these emergency shutdown valves will automatically activate in any perceived emergency situation when propane is being loaded to a vessel. Various aboveground pipe locations will have fire, gas and pressure detection equipment which will be tied into the monitoring and control system. The control system will automatically activate the emergency shutdown valves where required and shut down all pumps sending propane to the ship. Pembina staff will physically monitor propane loading operations both on the dock and in the control room, and will have the ability to initiate shut down of the propane loading operation by activating the onsite emergency shutdown valves and shutdown of all pumps sending propane to the ship. The ship's crew will also have the capability to shutdown the propane loading should an incident occur on the ship; activating the onsite emergency shutdown valves and shutdown of all pumps sending propane to the

ship. The load arms used to load propane on the ship are designed with quick close valves and emergency disconnects should the ship accidentally pull away from the dock.

There are more safety measures and protocols available to minimize the risk of release of propane from the aboveground piping contemplated by the proposed text amendment than if propane were being loaded onto a vessel directly from a railcar or truck, both of which are currently allowed in the e-zone. Simply, there is more control associated safety and automatic control system equipment on aboveground piping than equipment on railcars or trucks.

What is the risk of a large explosion from the facility?

Pembina is conducting modeling studies to assess the risk of different types of incidents associated with the facility and possible consequences. This modeling will then be used to inform detailed design of the facility, emergency response planning, and operating protocols and procedures for the facility and the vessels.

The closest residential community is the houseboat community on the south side of the Oregon Slough located on the downstream side of the rail bridge. The closest residence is approximately 1.2 miles from the rail offload tanks, approximately 1.4 miles from the large refrigerated storage tanks, and approximately 1.8 miles from Berth 607.

Safety or Security Zone

The U.S. Coast Guard (USCG) conducts a Waterway Suitability Assessment (WSA) for the Project. Pembina is currently conducting studies for the WSA, which include characterization of the Port, the proposed facility, and the ship route within United States waters; a risk assessment for maritime safety and security; identification of risk management strategies and resource needs for safety; and security, response and risk mitigation measures that may be employed. Based on the WSA, the USCG makes recommendations as to the suitability of the shipping route and facility for handling the shipsbased on the information noted above. Also considered are the characteristics of existing ship traffic, manmade obstructions on the ship route, and the characteristics of the area near the facility including water depths, sea conditions, natural hazards, underwater pipelines (which do not exist for this Project), and the relationship of the berthed ship to the navigation channel. The WSA process is expected to be completed by the end of 2015 or early 2016.

The USCG may also establish a security zone around a vessel in transit and during loading at a facility. The USCG has the authority to require a security zone around vessels carrying hazardous cargo on the Columbia River (33 CFR 165.1335). A security zone is 500 yards in all directions from the vessel and is applied at the discretion of the USCG (not automatically). Entry into a security zone is allowed only with permission and at the discretion of the USCG. In the event a security zone is established under these regulations, the USCG will issue a local broadcast notice to mariners. In addition, the USCG has established specific regulations for other similar facilities in other waterways. Common requirements in these regulations include the provision of advance notice of upcoming safety zones by the USCG to the

mariner community and most allow for access through the zone if permission is requested and granted by the relevant Captain of the Port or his designate. The location and size of the zones in these regulations reflect the unique issues at these facilities and waterways.

Some examples of security zones for vessels carrying similar types of cargos in other locations are described below.

- In the Port Houston-Galveston area, there are a variety of security zones established under the regulations primarily as locations. (33 CFR 165.814 Security Zones; Captain of the Port Houston-Galveston Zone).

- In the Portland, Maine area, a security zone for liquefied petroleum gas vessel transits is established as one mile ahead, one mile astern and 1000 yards on either side. In the Piscataqua River in New Hampshire, however the zone is established as a 500 yard radius while the vessel is moored (33 CFR 165.103 Safety and Security Zones; LPG Vessel Transits in Portland, Maine, Captain of the Port Zone, Portsmouth Harbor, Portsmouth, New Hampshire). Propane is a liquefied petroleum gas.

- In the Tampa Bay area, a floating safety zone is established 1000 yards fore and aft of a loaded liquefied petroleum gas vessel and the width of the channel in specific areas. Loaded liquefied propane gas vessels heading to the Receiving Facility in Rattlesnake have a 500 yard security zone in all directions. While the loaded vessel is maneuvering in the Rattlesnake slip and until it is safely moored at the facility, the floating safety zone extends 150 feet fore and aft of the loaded vessel and the width of the slip. Once it is safely moored there is no floating safety zone. (33 CFR 165.704 Safety Zone; Tampa Bay, Florida)

- In the Corpus Christi area, loaded incoming and outgoing liquefied propane gas vessels have a safety zone that is 500 yards in radius while transiting Corpus Christi Ship Channel, which is in effect until moored. (33 CFR 165.808 Corpus Christi Ship Channel, Corpus Christi, TX)

Importantly, security zones and other restrictions are common place on the Columbia and Willamette Rivers. Examples include restrictions around passenger vessels such as cruise ships, grain vessels and naval vessels and during specific activities such as the annual Rose Festival, firework shows and construction projects.

Depending on the outcome of the WSA and the USCG's recommendations for a security zone, recreational boaters and other boat traffic on the Oregon Slough may have limited access at certain times of the month while the ships are being loaded. However, only two to three ships will arrive per month at the facility and the ships are expected to be on the berth approximately up to two days each time. In total, limited access in the Oregon Slough in proximity of Berth 607 may only be up to six days per month. Again, the USCG provides advance notice of any security zones to the marine community.

A 500 yard security zone for a vessel at Berth 607 would extend across the width of the Oregon Slough and into the forested area of West Hayden Island on the north side of the vessel. On the south side of the vessel, it would not extend as far as North Marine Drive and to the west, it would not extend as far as the container terminal.

Seismic Considerations

On a regional scale, the site lies within the Willamette-Puget Sound lowland trough of the Cascadia convergent tectonic system (Blakely, et al. 2000). On a local scale, the site lies within the Portland Basin. The site is located in relative close proximity to the inferred traces of the Portland Hills Fault and the East Bank Fault indicated on published geologic mapping (Personius, et al. 2003).

Earthquake loadings for upland building structures shall be based on the 2012 International Building Code ("IBC") and 2014 Oregon Structural Specialty Code. The 2012 IBC develops the response spectra based on ground motions associated with the Maximum Considered Earthquake("MCER"). The ground motion associated with the probabilistic MCER represents a targeted risk level of 1 percent in 50 years probability of collapse in the direction of maximum horizontal response with 5 percent damping, and is based on modifications to the USGS 2,475-year hazard level PSHA results. The design-level response spectrum is obtained by taking two-thirds of the MCER level ground motions.

An extensive geotechnical and seismic hazard investigation is currently being completed at the site. These investigations will provide recommendations to address the seismic hazards in the area and suitably support the proposed structures at the design-level earthquakes discussed above. This investigation includes over 40 explorations with some to over 150 feet in depth. The seismic hazards being evaluated as part of the study include ground shaking, soil liquefaction, lateral spreading and seiches.

The geotechnical report will provide mitigation recommendations to address any seismic hazards at the site. Consistent with many Port of Portland and waterfront sites in the area, mitigation for liquefaction-induced hazards is anticipated to limit the risks to structures associated with the vertical and lateral movements. Without mitigation, the risks to structures could include excessive or damaging vertical settlements or soil movements exerting very large lateral forces on structures. For each of the structures, target acceptable horizontal and vertical settlements will be developed by the team to accommodate the required performance level during the design level earthquake(s). The associated seismically induced settlement and horizontal movement is commonly mitigated in the area with ground improvement and/or deep foundations. For example, a combination of stone columns and jet grouting ground improvements was completed within the last five years for the marine facility just downstream. Deep foundations such as driven pipe piles are currently being considered as an alternative to support the tank.

With the design and mitigation requirements, the probabilistic hazard level for the facility considers earthquakes from the Magnitude 9 Cascadia Subduction Zone (which would originate near the Oregon coast) and the Magnitude 7 Portland Hills Fault Zone (which would originate less than 5 km away). At a minimum, the facility must be designed to withstand these levels of earthquakes. This means that post

earthquake, the structures still support gravity load, damage that does occur doesn't prevent egress for occupants, and the tanks will retain containment capability.