March 17th PSC Hearing/Presentation - Testimony to be provided by Pembina

Presenting: Harry Andersen, Eric Dyck, Stu Taylor

Harry:

Slide 1: Cover Page

Slide 2: Introductions

Thank you to the PSC for this opportunity to once again speak to you and to provide this update on the work we've completed to date on our proposed project. My name is Harry Andersen and I am Pembina's Vice President of Legal and General Counsel. With me today are Stu Taylor, Senior Vice President of Natural Gas Liquids and Natural Gas Facilities and Eric Dyck, Vice President of our Marine Terminal division.

We're here to discuss a short piece of pipe – about 160 feet – to connect storage tanks to the marine loading berth. Pembina and the Port of Portland are asking the PSC to recommend an amendment to the City's Environmental Overlay Zone – or Ezone. The amendment would allow for the use of above ground pipe in the transportation of liquid propane from our storage facility to a ship for export. As it's currently worded, the zoning code allows for the transportation of a hazardous product through the zone by means of rail or truck, but not a pipe. Piping is a safe and efficient method of transportation.

Slide 3: Presentation Overview

When we last met in this forum, Pembina presented information about the project, the product and its origins. We discussed our record as a very safe operator and our public commitments to the community to act as a responsible, good neighbor.

Today, we'd like to provide you with some context on the propane market and the product's end-uses overseas. We will also explain the integrated safety features of the facility and the risk assessment work that's just been completed.

We commissioned a report from a global third party energy analytics firm to describe the end-uses of propane throughout Asia. Stu will summarize that report. It shows how propane is replacing coal, wood and other less-refined energy sources. Propane is being used as a bridge fuel to transition these heavily populated, developing areas of the world to less carbon-intensive fuels that are cleaner, safer and readily available by way of facilities such as ours.

Eric will then discuss the report that has been widely eagerly anticipated – the Quantitative Risk Assessment – or QRA. You have received a draft of that report today. The work to develop the QRA report is very intensive. It required detailed engineering design and review of the extensive geotechnical work that Pembina conducted to date. Presenting figures any sooner would've been deemed incomplete by the US EPA and our regulators.

I will now turn the presentation over to Stu.

Bentek (3rd Party) Report on Propane: Stu

At the January 13 Hearing there were a number of questions regarding market demand and end-uses of North American propane. In response, Pembina commissioned Bentek Energy, a unit of Platts (McGraw Hill Financial) a leading global energy market analytics company, to examine these topics.

I'm only going to talk to a few slides from the report, which confirms that the United States has moved from a major propane importer to a significant propane exporter.

Slide 4: Bentek Slide

Propane is a clean fuel alternative and transition fuel. As shown on the slide 4, which is data from China, showing when natural gas and refined products are available they will replace solid bio fuels, like wood and coal, especially in housing and rural farm usage. Because of its versatility and mobility, propane can benefit the lives of millions of people in Asia by improving their indoor and outdoor environments. When combusted, propane generates 33-percent less carbon dioxide than coal or wood. It also is accessible to remote areas not served by a natural gas distribution system and it is safe for indoor use.

Slide 5: Indoor

Solid biofuels pose serious health risks, and contribute to global warming; the World Health Organization estimates 4.3 million deaths in 2012, many of them in Asia, were caused by indoor air pollution.

Slide 6: LPG production

Relying on data from the International Energy Agency (IEA), Bentek indicates a wide variation in end-uses of propane among Asia Pacific importers. Most of these countries have demand that greatly exceeds their own domestic supplies.

In total, the five Asian markets investigated in this study used approximately 2.2 million barrels per day of propane and butane in 2012 - an increase of 23% over the 2005 levels. The fastest growing markets were Indonesia and India between 2005 and 2012.

In terms of demand use, residential/commercial was the largest sector across all five countries, representing 67% of total LPG consumption in 2012. The next largest sector was industrial at 14%, followed by transportation at 8%.

Slide 7: US supply and demand

As you know, propane is also making a difference here at home. It is included in Oregon's Clean Fuels program and is already making a positive contribution. Portland school buses use propane instead of diesel, which has cut carbon emissions and costs. If propane is considered a Clean Fuel in Oregon why would it not be considered a Clean Fuel in the Asia Pacific region?

Propane is already used and produced throughout Asia, but not enough to supply current or projected needs, as Asia attempts to reduce greenhouse gas and particulate emissions. The United States has exported propane since at least 1981. Since 2008, propane exports have risen sharply to more than

487,000 barrels per day last year. The United States is now one of the top propane exporters in the world. There are five operating propane export terminals in the United States today, with a capacity to load around 522,000 barrels per day. This capacity is concentrated in Texas, which also is the U.S. trading hub for propane.

For perspective, the existing propane export terminal in Ferndale, Washington, has the capacity to load 30,000 barrels of propane per day. Pembina's proposed terminal would have a capacity of 37,500 barrels per day, or roughly 5 percent of the existing propane capacity in the United States.

The report clearly demonstrates how propane is being used as a bridge fuel to transition developing countries. Our relatively small export terminal in Portland will help meet the need in Asia and contribute to a cleaner environment in areas of the world that have no other practical or affordable energy choices.

I will now pass the testimony over to my colleague Eric Dyck who will speak to the projects safety features and the Quantitative Risk Assessment.

Eric: Safety and the QRA

Slide 8: Propane Terminal Overview

I know there is keen interest in the QRA report and I will summarize it right away. But let me set the context first. A quantitative risk assessment is just what it says. It's a study first of the possible consequences of bad things that could happen. Then it looks at the frequency of such things happening over history at this type of facility and equipment. Then it adds the safety features being built in to reduce the risk. The study can then answer very clearly that reasonable question that everyone near the facility has: what is the worst that could happen here?

Pembina believes the end result is reassuring. Even in the highly unlikely event of very bad things happening, the people who live closest to the facility would not be harmed.

I'll show you the slides that demonstrate this. First I want to go over the features we are building in to keep the facility safe.

From the time propane arrives at our site and when it is loaded on a ship, it will never see the light of day. This is what we mean by a closed-loop system. The propane from railcars will be unloaded into receiving tanks, refrigerated and placed into larger storage tanks and piped to Berth 607 for loading onto ships designed to carry liquid propane. Every piece of equipment and all piping will be above ground.

All the equipment at the Portland facility will be new and much of it sized and designed specifically for this site.

Slide 9: Subsurface Conditions

The site geotechnical structure has 20 feet of dredge sand fill overlying alluvial sands and silts and underlying gravel deposits. All structures will be supported on piles driven to the underlying gravels which occur at a depth of about 150 feet. The gravel is dense and not susceptible to liquefaction, seismic strength loss, or settlement. It is common practice in Portland area to provide seismic foundation support of heavy infrastructure in similar gravel deposits, such as the New Tilikum Crossing -TriMet Bridge.

Slide 10: Seismic Considerations

Just below the storage tanks and the piping that runs to the shipping berth, we will build an underground support wall – some 120-feet wide, 100-feet deep and 3,000-feet long.

The wall will prevent soil from sloughing into the river, meaning our facility will withstand a 9.0 seismic event in Portland.

The storage tanks and piping are designed to remain in place during a major earthquake. The tanks will sit atop 160-foot deep, 24-36-inch in diameter pilings to provide a solid mass, which exceeds Oregon's updated seismic building code standards. In fact the facility will be built to the equivalent of an "essential facility" level as defined in the Oregon Revised Statutes; this includes such facilities as hospitals, fire stations and emergency centres.

Slide 11: Site Specific Safety Features

The entire site will be under 24/7 surveillance by numerous "fire eyes" – that's an infrared detection system that senses heat and flame both day and night.

Gas detectors at ground level will also sense any fugitive vapors or gas. Each detection system connects to an automatic shut-off of the facility.

On-site control room operators will be on duty 24/7. When they see a problem or have a concern, they have the authority and obligation to shut down the facility. It won't restart until that operator is satisfied the facility is safe to operate.

The facility's 30-40 employees will be hired during the construction phase of the project. That ensures they are intimately familiar with the facility. They will know and understand everything that went into the terminal's construction and how it works. That gives a sense of pride and ownership for their facility.

The large storage tanks will be double-walled. They are, in effect, a tank within a tank. The 3-inch (or so) space between the inner and outer tank will be insulated to keep the propane at -44 degrees F. This space will also be monitored by our operators to safeguard against any leaks. There have been no failures of such a double walled tank within a tank system.

Slide 12: Site specific safety features

All operational parts of the facility will be connected to the emergency flare system. The flare will only be used for a control burn of any propane during an emergency or during equipment maintenance.

The apparatus to unload propane from railcars and load it onto ships will be equipped with quick-acting de-couplers. These would isolate the railcars or ships in the event of a problem.

Slide 13: Site specific safety features (rail)

The railcars themselves are specifically designed to carry liquid propane. We only use US DOT 112 railcars. The rail unloading rack will have an emergency water deluge system to keep rail cars cool in the event of an emergency or fire. Loaded rail cars will always be connected to the engine and can be removed off site in the event of a problem.

The security of our staff and infrastructure is of vital importance to Pembina. The site will be fully fenced and staffed 24/7/365. It is also located within the Port of Portland's Terminal 6 complex, a highly secure area governed by Homeland Security.

As a prudent operator, Pembina employs a "Safety First" culture; we plan for the worst and prepare our staff accordingly. We train our people in safe operating and emergency response procedures. They are observed on their job, tested and their competency is fully documented.

We will develop a site-specific Emergency Response Plan (ERP) for the facility. We test our ERP's annually, through simulated emergencies, to ensure we're prepared. We often make improvements to the plan as a direct result of these drills. Pembina invites local and state authorities to participate in these simulations.

Those are some of the highlights of the safety mitigation features included in the facility's initial design. We then look to the QRA to confirm the effectiveness of our design, and suggest how Pembina can make the facility safer through additional mitigation. We understand that people of course want to see the hazard zones, but our primary focus is on what we will do to make sure those hazards never occur.

Slide 14: QRA Oveview

Now having said all that let me first explain and then show you the hazard zones.

Designing a facility requires a lengthy, disciplined process. It's impossible to properly assess risk without the engineering design well underway.

In fact the definition of a Quantitative Risk Assessment – or QRA for short is this, "A formal and systematic approach of identifying potentially hazardous events, estimating the likelihood and consequence of those events, and expressing the results as risk to people (onsite and public), the environment or the business."

One of the most important pieces of data we needed was extensive geotechnical test results. We know how to build structures to meet strict seismic standards, but we need to identify the places on a site to build those structures, as already discussed.

We are now approximately 30-40% complete for our engineering detailed design. That is the minimal requirement to conduct an effective QRA.

Slide 15: What is Risk?

Pembina typically uses a QRA process for major projects. It is an industry standard procedure to examine risk. It starts with worst-case scenarios and no safety features, then adds in site-specific data such as weather conditions, incorporates all design safety features, and models how well the safety features mitigate the risks. Risk is consequence times frequency.

This is a critically important point. A submission to the PSC by Mr. Roxburgh, Mr. Ebersole, Mr. Helzer and the Northwest Citizen Science Initiative, using the ALOHA model, only examined theoretical and hypothetical consequences. There was no quantified frequency or resulting risk assessment in that submission. A comprehensive and credible risk model looks at both consequence and frequency – anything else is incomplete and not useful to decision makers.

Slide 16: DNV intro

Pembina hired an internationally recognized expert to conduct a QRA on our Portland propane export facility project. Det Norske Veritas, or DNV, was founded in 1860's and is considered a global leader in risk assessment, particularly regarding energy and marine infrastructure. DNV was not part of the facility's design or engineering prior to the QRA, nor will they be once it is complete. DNV is a independent third-party with only one role – to test our safety features against the scenarios.

Beyond some quantifiable data, the QRA reveals where we can optimize our safety features and shows us how we can make the facility even safer. The recommendations made by DNV will be embraced and incorporated into our final design.

DNV was tasked with conducting a QRA for the proposed facility and berth. Their reports will also support the U.S. Coast Guard's Water Suitability Assessment, Portland development permit, and our own emergency response planning.

We've been asked why a QRA was not commissioned for the rail route. We lease and maintain a fleet of up-to-date cars to transport liquid propane safely. We operate the largest private rail yard in Canada and have direct experience in moving propane. Pembina has safely moved 55 million gallons of propane to Oregon for the last 15 years.

Our Redwater facility logged zero work loss days in 2014. That's because we know how to handle propane safely. We apply that knowledge in choosing and working with rail carriers.

Pembina is in discussion to secure a rail carrier and definitive rail route for the project. Pembina is responsible for the safe loading and unloading of the product. We understand the class one rail carriers in the area are investing millions into their rail infrastructure and are committed to safety.

The QRA process included the technical workshop we hosted on March 10th with members of the community. Experts were on hand to answer all questions. The sole purpose of the QRA is to test our safety features against all identified scenarios, so we can make any adjustments required to maximize safety at the facility.

Pembina normally would engage mainly with experts such as local fire and emergency response personnel for the QRA work. In this case, we chose also to invite a number of representatives from the closest local communities: St. John's, Class Harbor Floating Homes and Hayden Island, to participate in the process.

Pembina agreed to publicize our risk assessment data. We made that commitment before we saw any data or any findings by DNV. We made that commitment because we share with everyone else in this community a strong desire to build and operate a facility that is safe for our employees and for our neighbors.

Slide 17: QRA Inputs

QRA inputs are:

- All equipment design and location
- Operational modes
- Onsite and offsite population and vulnerability
- Wind speeds and directions
- All ranges of weather conditions
- Product vapor cloud explosions and fire types, overpressure zones, BLEVE's
- All potential ignition sources
- Equipment isolation philosophies
- Safety designs and equipment
- Earthquake data (1 in 475 year return used)

Slide 18: QRA Outcomes

We use the outcomes of the risk assessment for four specific purposes. First, we use the risk assessment to confirm that our safety systems will work well and we make any necessary adjustments. Second, we revise the facility design as needed. Third, we make any changes required to our operating procedures. Finally, we use the risk assessment as the basis of our emergency response planning for the facility.

Slide 19: Societal Risk Criteria

I also need to explain how risk is quantified by the professionals who specialize in this area. If you think about it, we face and accept risk in every activity we undertake every day, from riding a bike to skiing that perfect powder run. There are global standards for acceptable levels of risk.

- The maximum tolerable risk for workers on an industrial site is one fatality in 1,000 years.
- For the public around that facility, it's one fatality in 10,000 years.
- Broadly acceptable risk is 1 fatality in 1 million years.

The difference between workers and the public is that workers have control over the facility. They can activate the safety equipment.

With this as a background, I'll get in to the QRA results.

Sldie 20: QRA Results: worst-case consequences slide

The analysis starts with the worst case scenario as designated by the EPA - the consequence of a major event if there's no safety mitigation in place at all. So this assumes the tanks are all full and something happens that releases all the inventory at once with a vapor cloud and detonation. Such a thing happening would cause thermal heat radiation or heat impacts and 1 psi overpressure.

In the EPA worst case scenario, if the refrigerated storage tank instantaneously disappears, the overpressure extends almost 4 miles from the site. EPA is a hypothetical scenario, made impossible given the safety feature of the site. A rail car rupture would have a smaller radius – it would extend 0.4 miles from the site. And a pressure propane storage vessel rupturing would have a radius 0.6 miles from the facility.

Now remember, that's worst case with no safety mitigations. That's the consequences part of our equation: risk = consequences times frequency.

When we add the likely frequency of each event to the assessment, the results are well within the global standards of maximum tolerable risk. In fact, the risk of a serious event doesn't extend very far beyond the site itself.

Slide 21: First map slide

Here's what this looks like on the maps.

These circles are called risk contours. They show how far potentially fatal heat radiation or heat impact would extend from the site from a serious or catastrophic event. The inner red circle, for example, shows how far the 1 in 1,000 year risk would extend which is the maximum for workers on site. The outer most circle here shows the potential reach of the 1 in 100 million years catastrophic failure.

Slide 22: Second map slide

This is the same image zoomed in more tightly. As you can see, even in those truly worst case scenarios the risk of fatalities – as dreadful as they would be – does not reach any residential areas.

Slide 23: Third map

This contour map shows another type of impact. This is how far the 1 psi overpressure would reach from an incident. That 1 psi measure is a threshold mandated by the EPA.

Slide 24: Fourth map

Again, this is the zoomed in view. You can see that the inner circle – the 1 in 1,000 year risk, is fully contained within the plant site. Even the most severe event does not extend far beyond our site fence.

These maps are only four of a long series contained in the report, but they all show very similar results. There is also a great deal of additional detailed information in the report.

I know this information is technical. But this effort is what will ultimately keep all of us safe once we incorporate the analysis and these learnings into the facility design.

The key finding here is that the risks of accidents at this facility will be largely contained to the site. Even so, those are our Pembina employees. So to us, any substantive risk that those individuals won't go home safely to their families after every shift is totally unacceptable. We are highly motivated to keep our people safe, and by extension all the people of Portland.

Now I will pass this back to Harry to wrap up.

Harry

Slide 25: Conclusion

In summary, we want to thank the Commissioners for their time today. Pembina wants to be a good neighbor and part of this community. We've heard your questions and have been working hard to address them in an open and transparent way.

Pembina is following through on the commitments we made in January:

- to coordinate a Community Advisory Committee
- to purchase renewable green energy to offset power used at the site
- to explore opportunities for shoreline and habitat enhancement projects.

This Project has significant economic benefits. It will be the single largest private investment in Portland's history with a capital investment of approximately $500 million. The Project will be funded entirely by Pembina.

Pembina has not sought any public subsidy or tax abatement for our project. Instead, we expect to pay approximately $12 million annually in local property taxes, as well as state and local income taxes. The City of Portland is projected to receive $3 million yearly in new property tax revenues.

Approximately $250 million of project costs will be locally sourced equipment, material and labor. The facility will also spend approximately $25 to $30 million per year in operating costs.

Pembina has signed a Letter of Understanding with the Columbia Pacific Building Trades Council as a way for Pembina to tap into Portland's extensive pool of skilled workers and who share our company's commitment to workplace safety.

The QRA report prepared by DNV shows this project is safe.

We look forward to being a member of the Portland community.

Our company's reputation as a respected, reliable and trusted operator was earned over 60 years – a legacy we don't take lightly, but endeavor to build upon in Portland.

We thank you and look forward to your recommendations on April 7th.