PEMBINA MARINE TERMINALS INC.

PEMBINA PORTLAND PROPANE TERMINAL

PSC Work Session – March 17, 2015

INTRODUCTIONS

Pembina Representatives:

- Harry Andersen, Vice President, Legal and General Counsel
- Stu Taylor, Senior Vice President, NGL Facilities
- Eric Dyck, Vice President, Marine Terminals

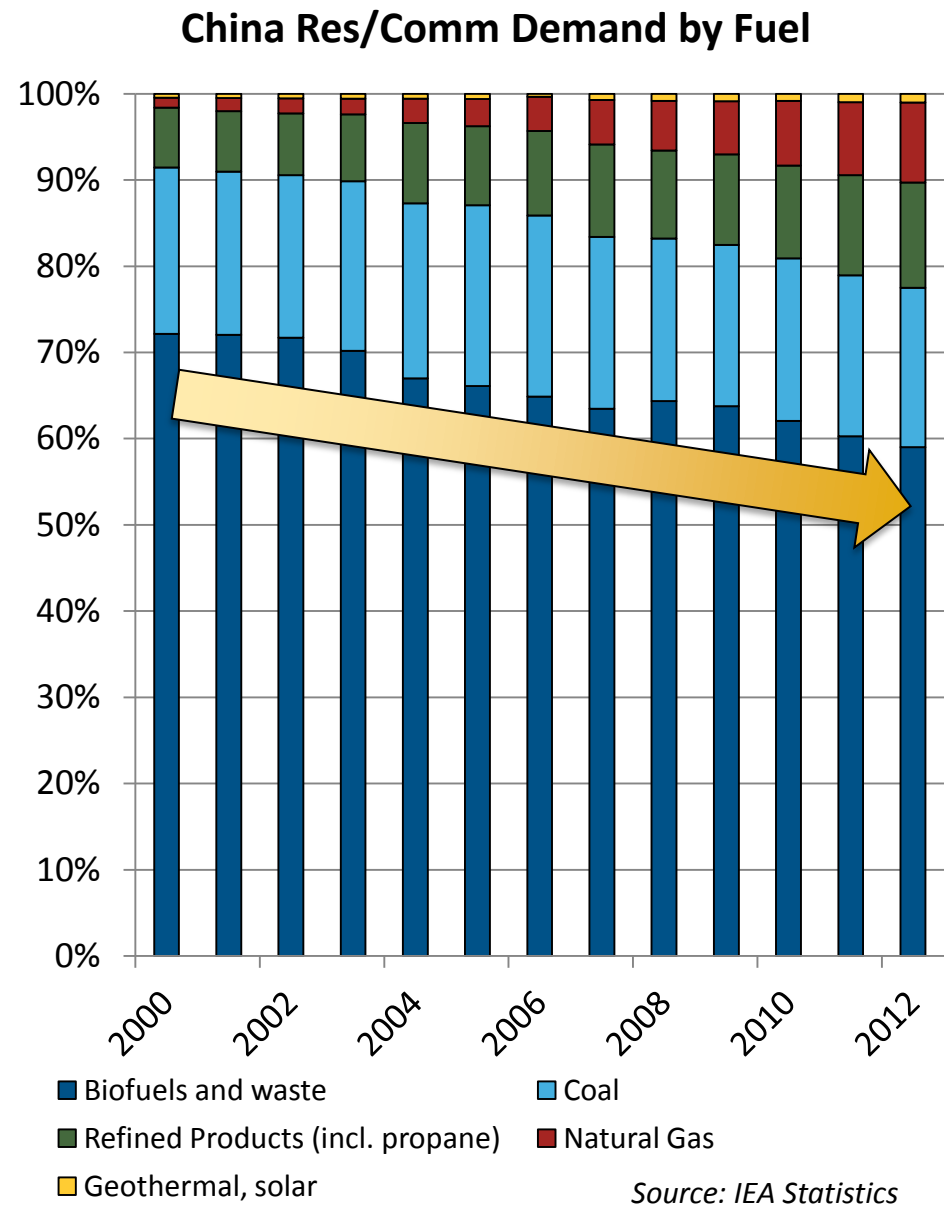
PRESENTATION OVERVIEW

- Introductions
- End Uses of Propane
- Facility Safety Features
- Quantitative Risk Assessment Process
- Conclusion
- Questions

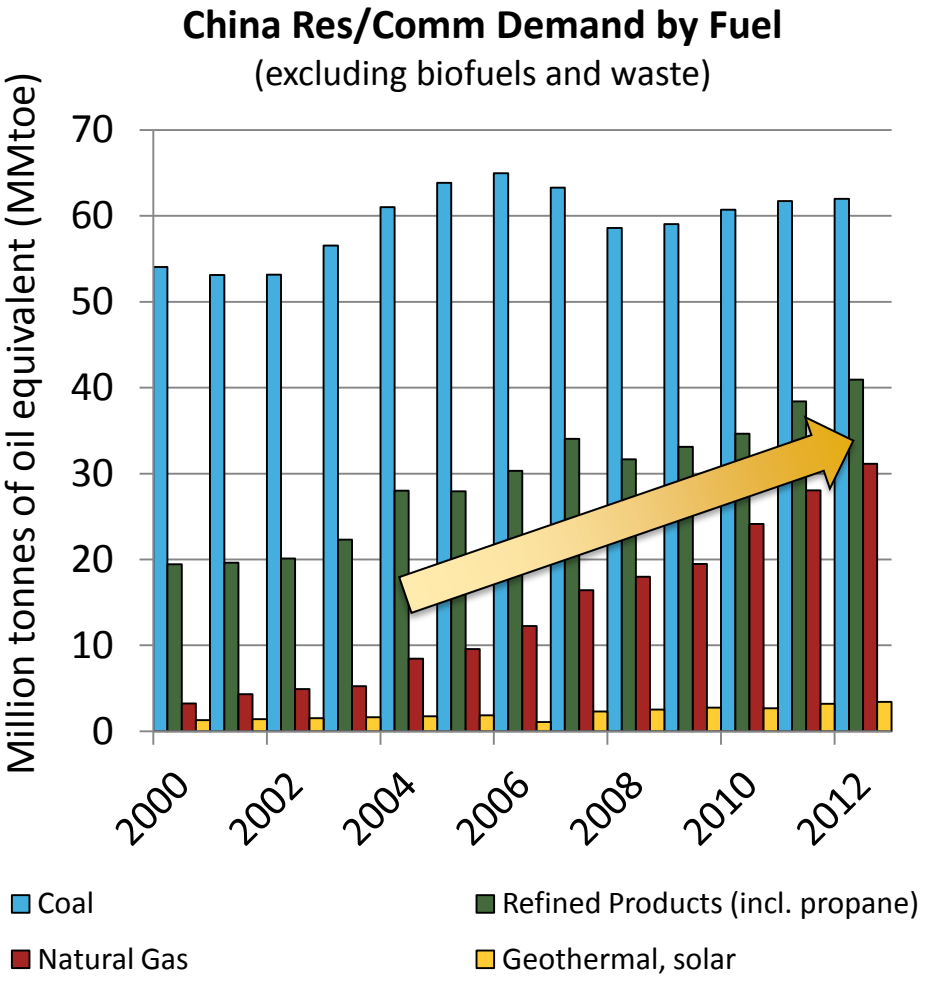
China has displaced burning solid biofuels in res/comm sector over time

PLATTS McGRAW HILL FINANCIAL

BENTEK Energy a unit of PLATTS



Source: IEA Statistics

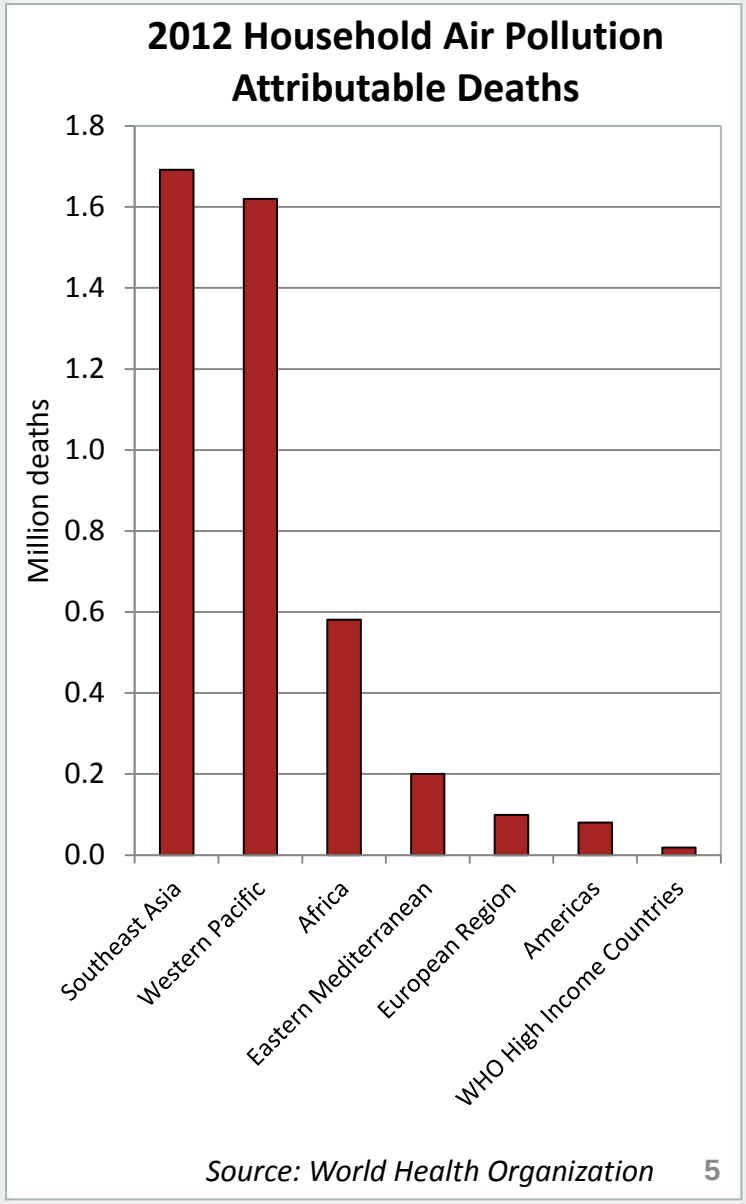


Solid biofuel is being displaced by refined products (including propane) and natural gas in the res/comm sector in China

Indoor air pollution from solid biofuels is a serious health hazard

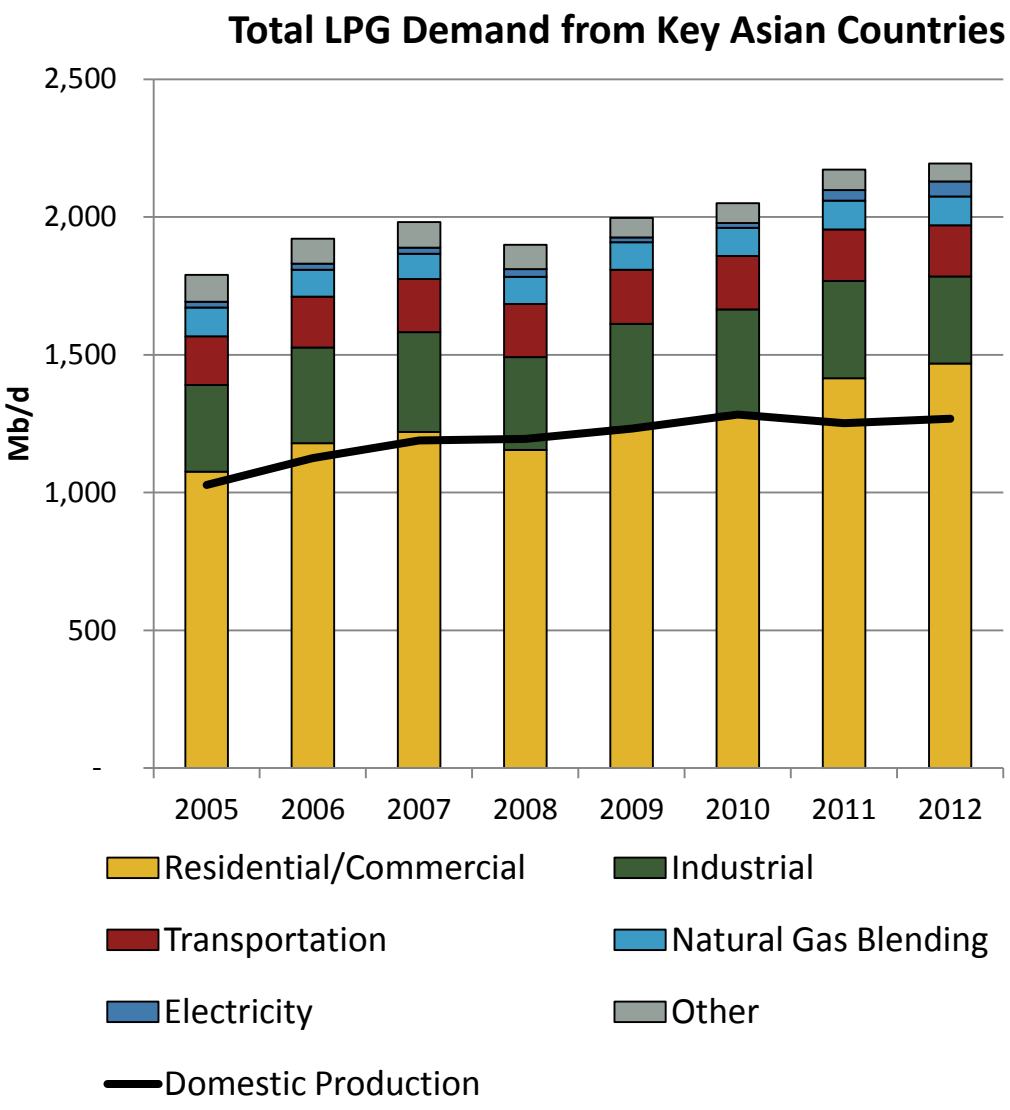
- Household air pollution created from burning solid fuels (wood, grasses, dung) creates health hazards in developing countries
- These fuels produce high levels of smoke and pollution inside the home, which can lead to respiratory conditions, lung cancer, heart disease, stroke and cataracts
- WHO attributes **4.3 million deaths** in 2012 to household air pollution, with most in occurring in Southeast Asia

Indian woman tending wood-burning stove

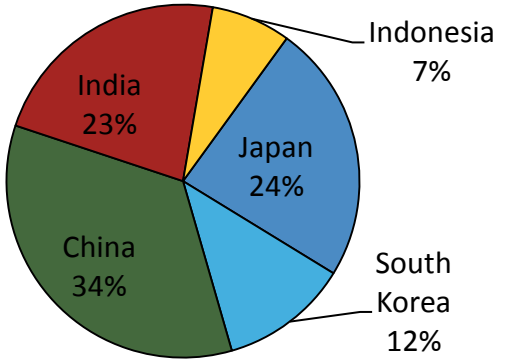


Source: World Health Organization

Local LPG production insufficient to meet demand

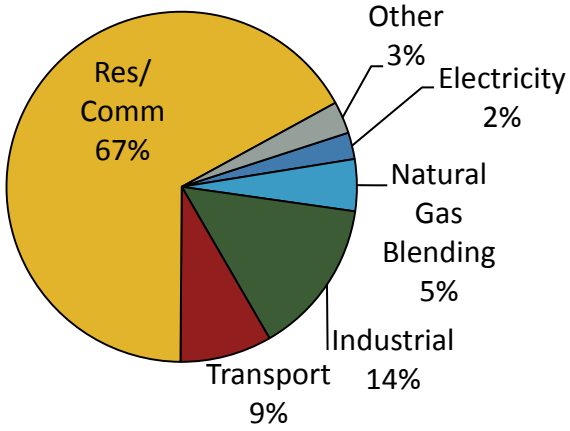


2012 Total LPG Demand by Country



China and Japan represent nearly 60% of total LPG demand for these five nations

2012 Total LPG Demand by Source



Residential/commercial demand represented 67% of total demand in 2012

Increased propane production creates marine export opportunity for Portland

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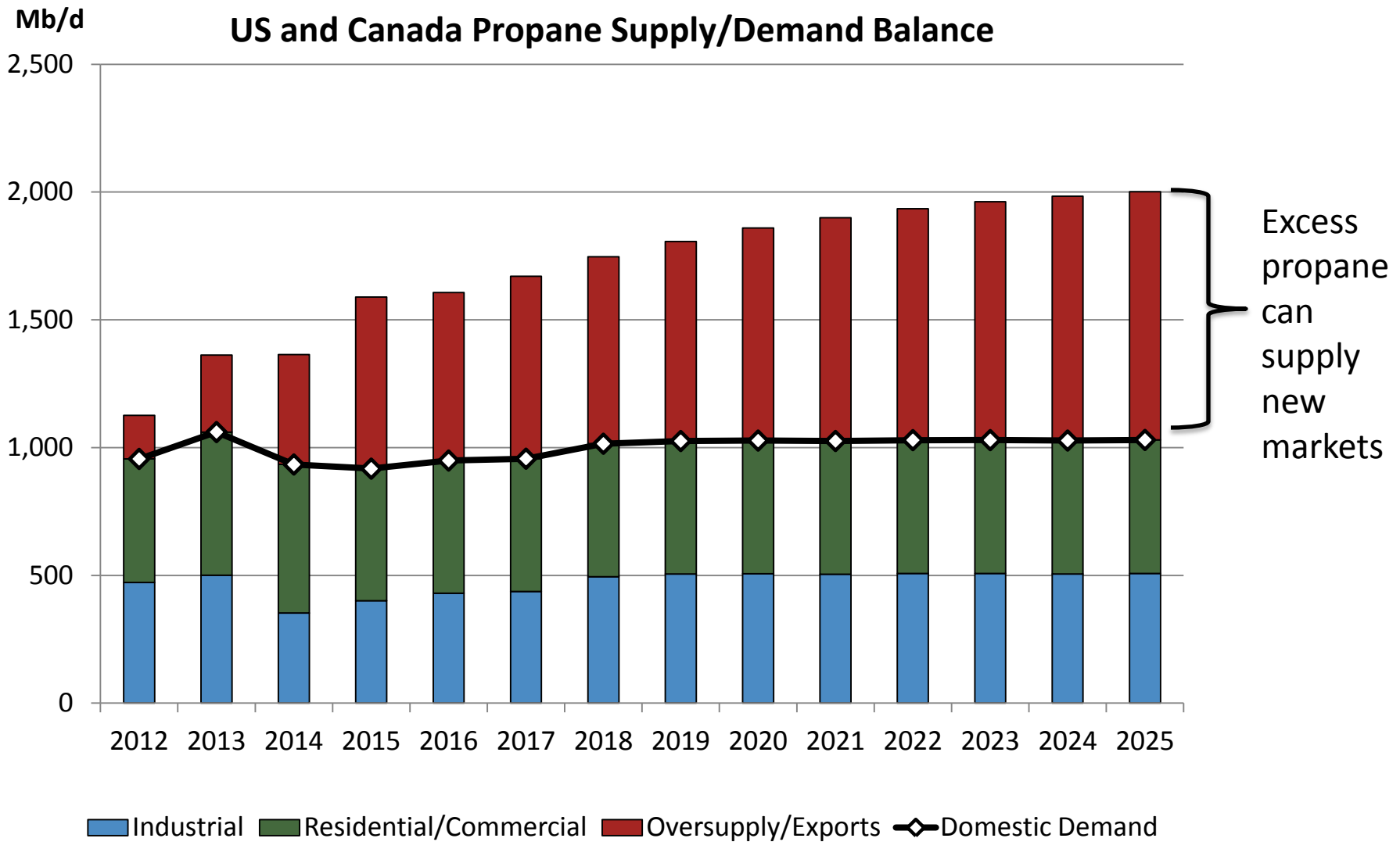
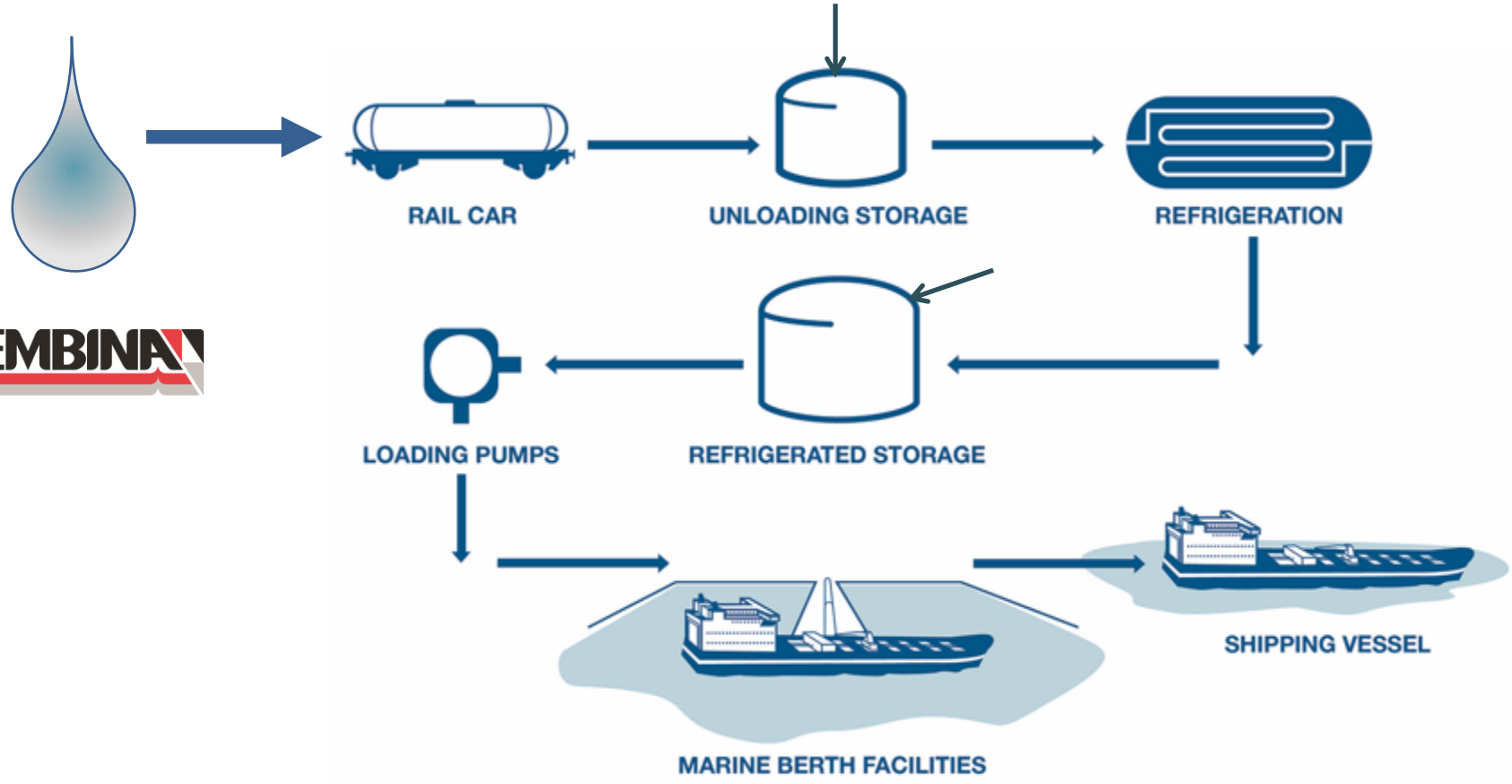
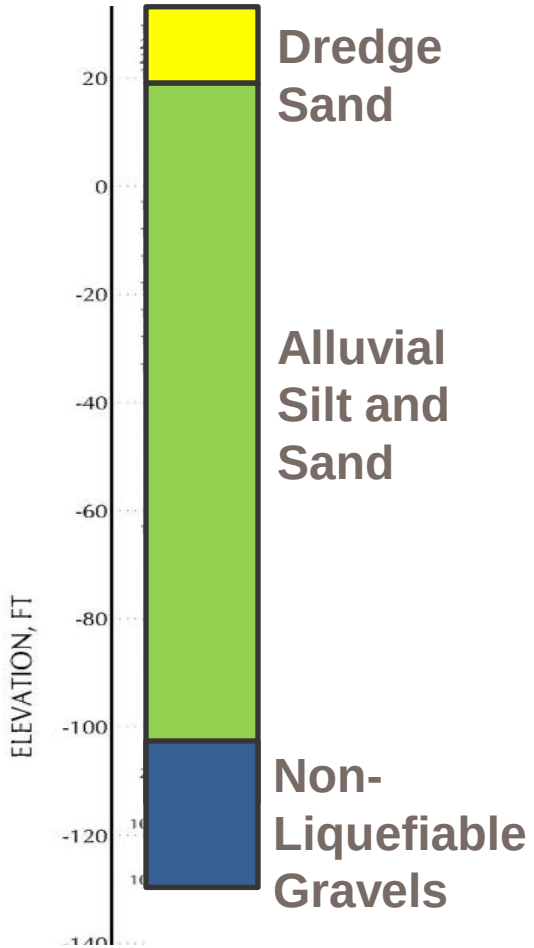


Source: Bentek *Market Call: North American NGLs 1Q2015*

PEMBINA PROPANE TERMINAL



SUBSURFACE CONDITIONS AND FOUNDATION SUPPORT SUMMARY



- Site is mantled with about 20 ft 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 ft. The gravel is dense and not susceptible to liquefaction, seismic strength loss, or settlement
- It is common practice in the Portland area to provide seismic foundation support of heavy infrastructure in similar gravel deposits, e.g. New Tilikum Crossing, TriMet Bridge

SEISMIC CONSIDERATIONS

- Build a 120-foot wide, 100-foot deep, 3,000-foot long underground wall
- The wall will withstand a 9.0 seismic event in Portland
- Storage tanks and piping are designed to remain in place during seismic event
- Storage tanks will sit atop 160 foot deep 24-36 inch in diameter pilings
- Design will exceed Oregon's updated seismic building code standards
- Facility is designed to be built to an "essential facility" level as defined in the Oregon Revised Statutes

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SITE SPECIFIC SAFETY FEATURES

- 24/7 surveillance by specifically placed “fire eyes”
- Gas detection at ground level to sense gas
- Detection system connects to automatic shut-off
- Facility staffed 24/7, staff will have authority and obligation to shut down facility
- Double-walled, large storage tanks
- No failure of double-walled, tank within a tank system

SITE SPECIFIC SAFETY FEATURES

- All equipment connected to flare system
- Apparatus to unload propane from railcars and load onto ships, equipped with quick-acting de-couplers
- Over-pressure automatic relief valves
- Automatic shutoff and isolation valves

SITE SPECIFIC SAFETY FEATURES

- DOT 112 railcars designed for propane
- Emergency water deluge system
- Site engines always hooked to loaded cars
- Security in accordance with Marine Transportation Security Act and implementing regulations
- “Safety First” culture
- Site specific emergency response plan to be developed

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QUANTITATIVE RISK ASSESSMENT (QRA)

- QRA Defined:
  - *"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."*

- QRA Basics:
  - Identify all hazards
  - Analyze each hazard's consequences
  - Determine each hazard's known historical failure frequency
  - Combine consequence and frequency to form a risk assessment
  - Mitigate risk to meet or better broadly acceptable risk levels

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WHAT IS RISK?

Risk = Consequence x Frequency

- Risk is a measure of human injury, environmental damage, or economic loss in terms of both the incident likelihood and the magnitude of the loss or injury (Center for Chemical Process Safety, 2000).
  - An expectation of loss
  - Always an element of uncertainty
  - Always refers to future
  - Usually covers both severity and likelihood of a loss
  - Usually refers to unwanted consequences

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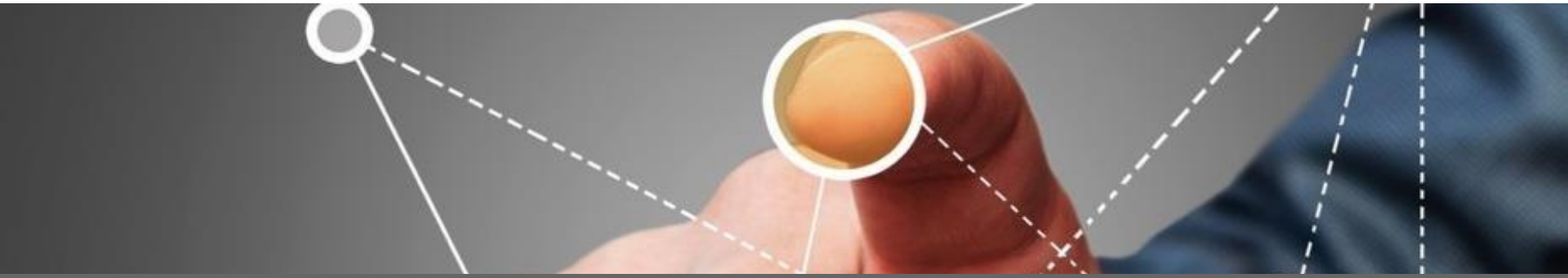
DNV – INDEPENDENT GLOBAL EXPERT



Developed over five decades, DNV GL's consequence and quantitative risk modelling software sets the standard for safety and risk management, enhancing business performance for our customers.

- What proof does DNV have?
  - Use industry leading software
  - Phast and Safeti are the market leaders in the oil and gas, petrochemicals, chemicals and pharmaceutical industries
  - There are over 10,000 Phast users and over 2000 Safeti users globally
  - DNV GL sets the industry standard for carrying out quantitative risk assessments. E.g. our QRA software Safeti- NL is mandated by the Dutch Government
  - Phast and Safeti's dispersion model is one of only three approved for use in LNG siting applications by the U.S. Department of Transport's Pipeline and Hazardous Materials Safety Administration

QRA INPUTS

- 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, BLEVEs
- All potential ignition sources
- Equipment isolation philosophies
- Safety designs and equipment
- Earthquake data (1 in 475 year return used)

QRA OUTCOMES

- QRA outcomes are used to:
  - Confirm all currently designed safety and emergency relief systems are adequate and revise as necessary
  - Enhance facility and equipment design and placement as necessary
  - Optimize future operating procedures
  - Form the basis of site specific emergency response planning

SOCIETAL RISK CRITERIA

- Used a worldwide standard for acceptable societal risk
- Individual risk identified as:
  - Maximum tolerable risk for site workers – 1 in 1,000 years
  - Maximum tolerable risk for public – 1 in 10,000 years
  - Broadly acceptable risk is – 1 in 1,000,000 years

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WORST CASE CONSEQUENCE RESULTS

- DNV's consequence software predicts the same consequence result (distance to overpressure 1 psi) for each worst case scenario (according to EPA), **assuming no safety mitigation.**
  - The release of the largest quantity of a regulated substance from a vessel or line failure, and the release that results in the greatest distance to the endpoint for the regulated flammable substance.
  - The worst-case release modeling must assume that the entire inventory is released instantly to form a vapor cloud with the total quantity of the substance released contributing to a detonation. The rule requires the analysis to estimate the distance to a 1 psi overpressure.

Worst Case Scenario (designated by EPA)	Inventory	Distance to 1 psi Overpressure (mi)
Refrigerated storage tank disappears	23,100,000 gal (550,000 bbls)	3.9 mi
Rail car rupture	33,460 gal (797 bbls)	0.4 mi
Pressure propane storage vessel rupture	121,800 gal (2,900 bbls)	0.6 mi

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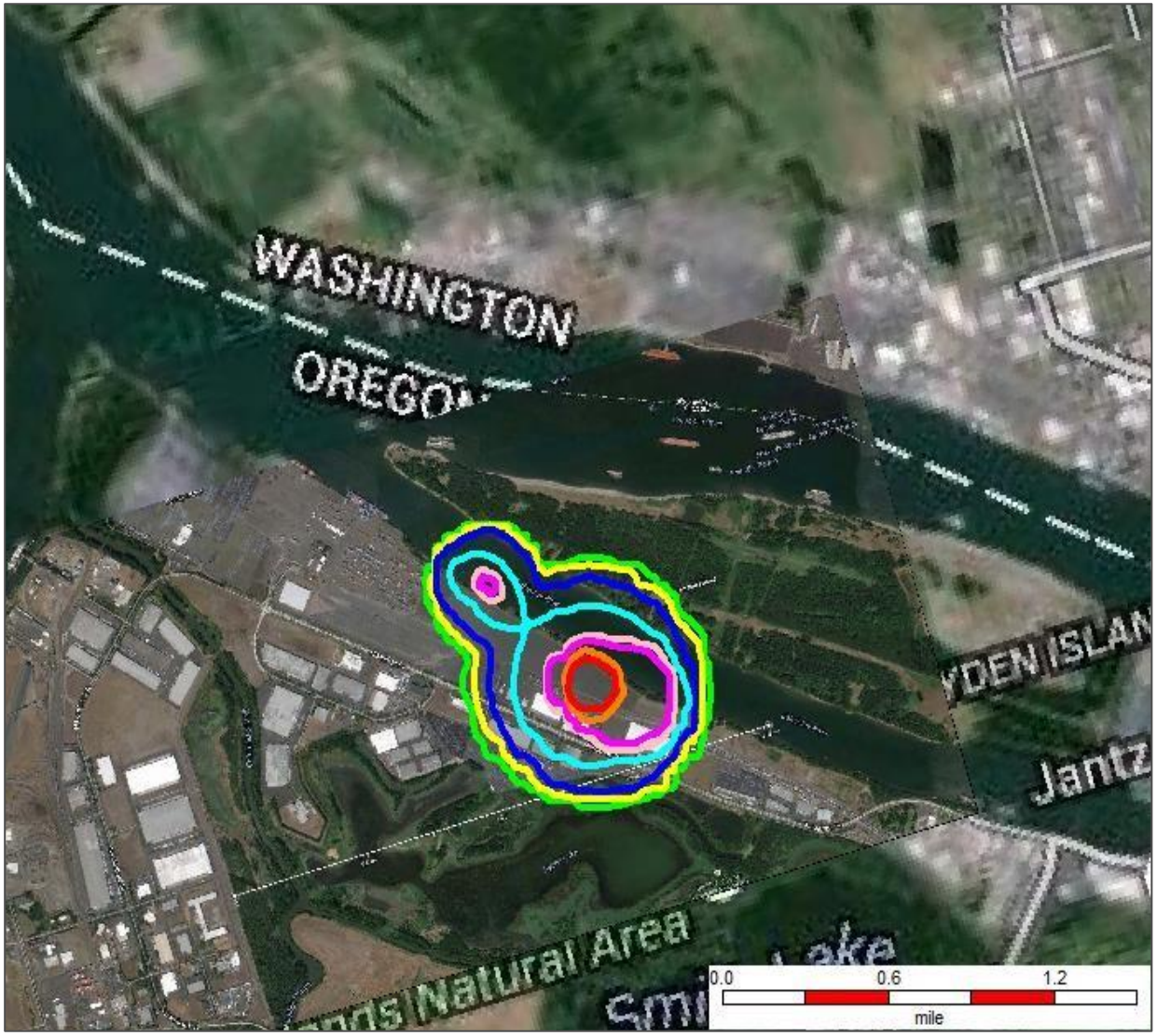
RISK IS CONTAINED AND DOES NOT IMPACT THE RESIDENTIAL COMMUNITIES

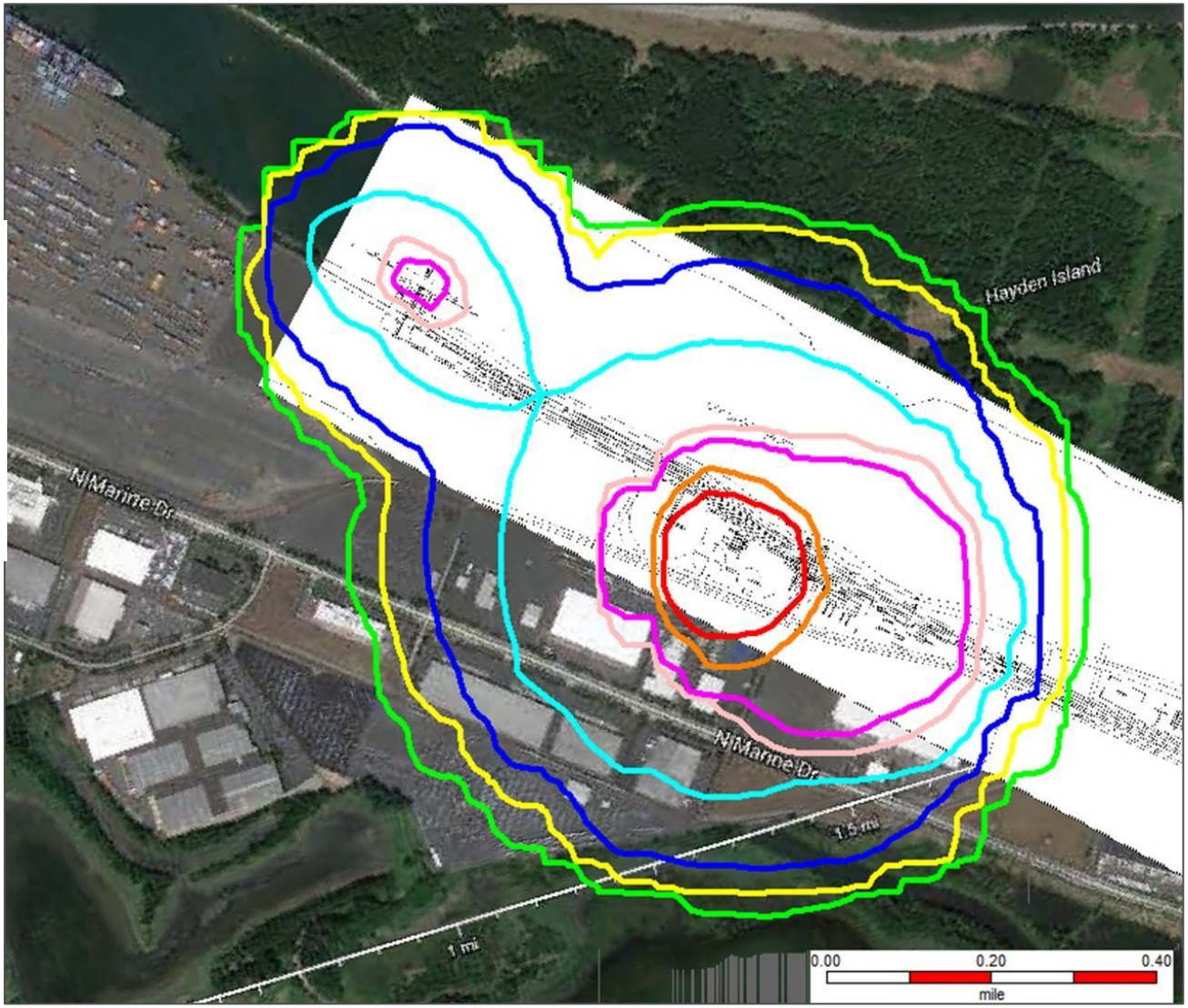
Thermal heat radiation frequency contours for 35 kW/m2



RISK IS CONTAINED AND DOES NOT IMPACT THE RESIDENTIAL COMMUNITIES

Thermal heat radiation frequency contours for 35 kW/m2

Risk Contours	Risk Tolerance
1 in 1,000 years	Max for workers
1 in 2,000 years	
1 in 10,000 years	Max for public
1 in 20,000 years	
1 in 100,000 years	
1 in 1,000,000 years	Broadly acceptable
1 in 10,000,000 years	
1 in 100,000,000 years	Miniscule



RISK IS CONTAINED AND DOES NOT IMPACT THE RESIDENTIAL COMMUNITY

Over-pressure frequency contours for 1 psi (EPA mandated threshold)

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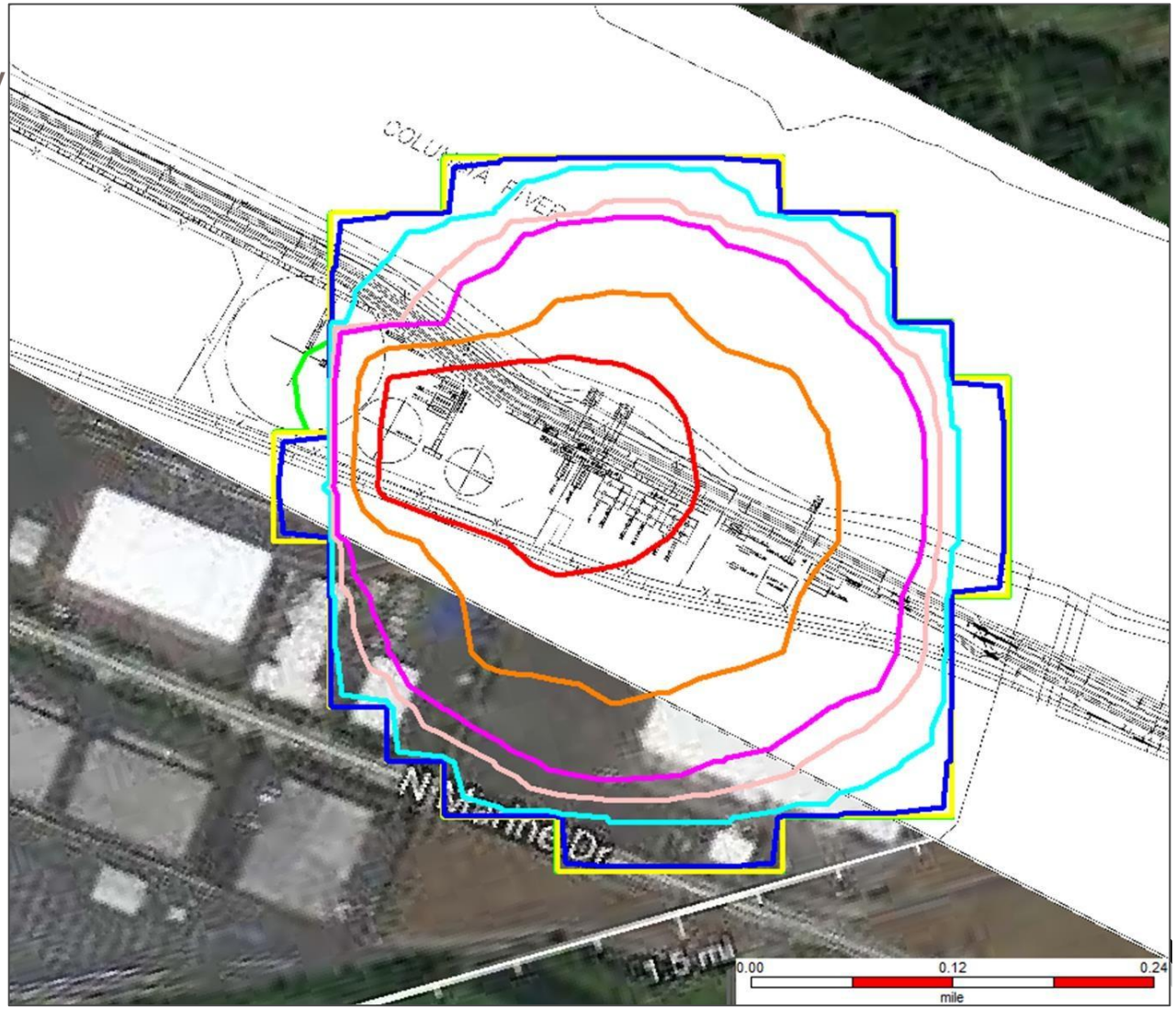


CONCLUSION

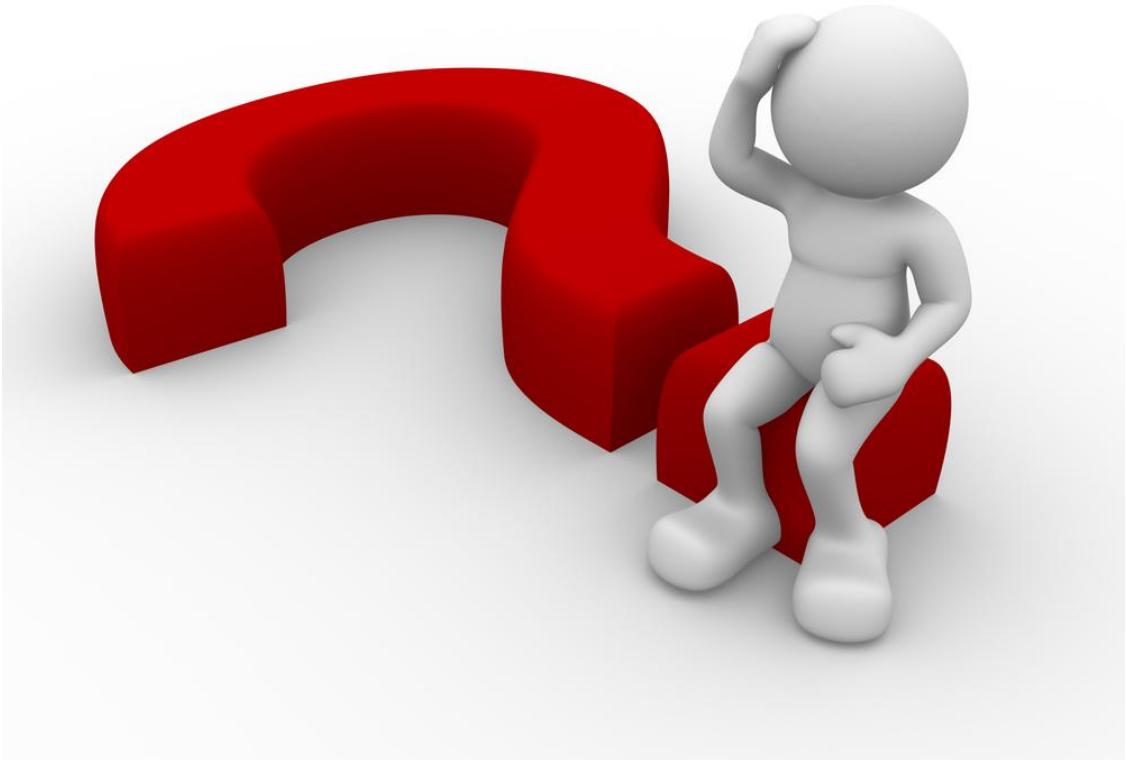
Pembina is following through on the commitments we made in January:

- 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.
- LOU with Columbia Pacific Building Trades Council

CONCLUSION

- This project is safe and the QRA report prepared by independent expert DNV, provided today validates the project is safe.
- We look forward to being a member of Portland.
- 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.

QUESTIONS



FORWARD-LOOKING STATEMENTS

FORWARD-LOOKING STATEMENTS & INFORMATION

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