Nearly two years ago, an explosion and massive gas leak at a liquid natural gas (LNG) facility in Plymouth, Washington, thirty miles south of the Tri-Cities, injured five workers and forced hundreds of people to evacuate their homes. To this day, state and federal oversight agencies have not published the findings of their investigations into the accident, and the facts about what happened are almost completely unknown to the public.

Sightline's research into the Plymouth LNG explosion reveals that the LNG industry is creating a false safety record, and current regulations allow the industry to do so. Though the accident released a dangerous LNG vapor cloud into residential areas, it didn't meet the definition of "a threat to public safety," and federal rules did not classify it as an LNG spill. Furthermore, facility owner Williams Pipeline Company (Williams) is still withholding key details about the accident.

Incomplete accounting of accidents slows safety improvements in the LNG industry and conceals critical information that could help keep first responders safe. It also makes it very difficult for local governments and the public to make informed decisions about where to permit proposed LNG facilities. Oregon and Washington are considering three LNG terminal proposals, and the events at Plymouth should inform both states' analyses of those proposals.

## What happened at Plymouth LNG?

LNG is simply natural gas that has been refrigerated to -260 degrees Fahrenheit. At this temperature, natural gas becomes liquid and condenses to 1/600th of the space it occupied as a gas. Cryogenic refrigeration allows plant operators to store large quantities of natural gas in tanks that could not otherwise hold such a large volume. If liquid natural gas is not kept extremely cold, it turns back to a gas. When a utility needs to use the LNG it has stored, workers simply pipe LNG out of the refrigerated storage tank and return its temperature to normal.

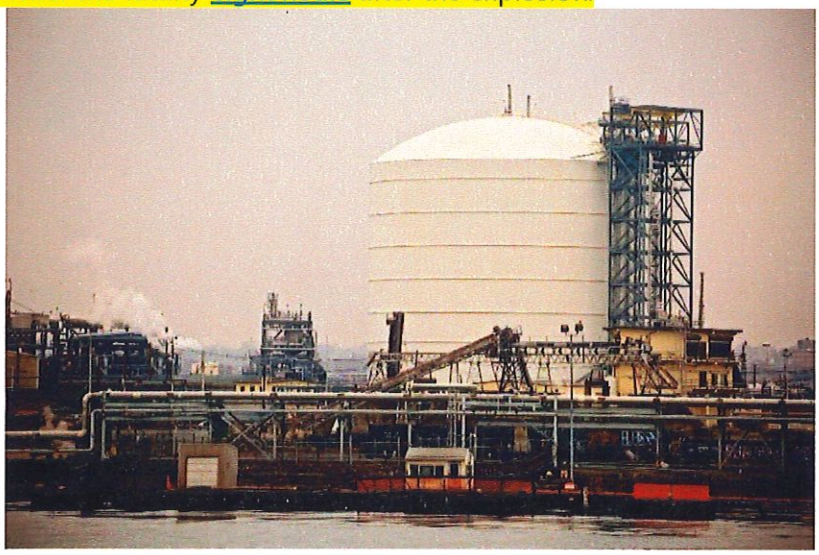
Plymouth is the largest LNG storage facility in the Pacific Northwest, boasting two 14.6 million gallon storage tanks. Shortly after 8:00 a.m. on March 31, 2014, gas processing equipment at Plymouth LNG exploded into a towering, mushroom-shaped cloud. Nearby residents saw flames shoot into the air, and people living three to six miles from the plant could feel the explosion. The blast sent 250 pounds of debris and shrapnel flying as far as 300 yards, damaging buildings and equipment and puncturing one of the large LNG storage tanks.

Shrapnel injured four of the fourteen employees on duty, and a fifth worker was hospitalized for burns. Debris from the blast also damaged the main rail line on the north side of the Columbia River, which delayed more than 40 trains before BNSF Railway completed repairs on Tuesday afternoon. (Sightline has previously calculated that on a typical day, several notoriously combustible oil trains traverse the route that passes by the Plymouth LNG facility.)

In the hours that followed, 14.3 million cubic feet of gas spewed from a large gash in the storage tank and other damaged equipment on site. Video and photos show vaporized LNG escaping from a puncture low on the tank. Williams says the damaged tank was only one-third full.

Fumes from the facility sickened residents and emergency responders and endangered the public. The leak formed a dangerous cloud of gas vapors, which an east wind pushed toward the town of Plymouth. Vapor clouds become more dangerous as they drift away from the site of the leak and mix with oxygen: at a 5 to 15 percent concentration, a vapor cloud that meets a spark or flame can catch fire and burn all the way back to the source. To protect public safety, state officials evacuated Plymouth LNG employees as well as residents within two miles of the facility. They shut down traffic on the nearby Columbia River, parts of Highway 14, and the rail lines near the plant, which helped reduce ignition sources for the escaping gas.

Emergency responders—there were more than 100 on the scene—had to wait for the wind to dissipate the natural gas before they could safely enter the facility and address the leak. The wait was drawn out by LNG's extremely low temperature: the leak kept forming ice blockages over the hole in the tank. External temperatures would then melt the ice, and the leak would continue. Hazardous materials experts were finally able to enter the facility eight hours after the explosion.



LNG terminal by NorthEndWaterfront.com used under CC BY-NC 2.0

## A failure to report

Federal law requires operators of LNG plants or gas pipelines to report to the Pipeline and Hazardous Materials Safety Administration (PHMSA) any incident that causes an emergency shutdown, death, an overnight hospital stay, or property damage greater than $50,000. Companies must report to PHMSA within 30 days, and sometimes the safety agency asks for a supplemental report. Williams provided its

initial report in May 2014 and prepared the supplemental report in December 2015—twenty-one months after the incident.

Despite this generous time frame, Williams Pipeline Company summed up the complex accident in just one paragraph, revealing that it was caused by "incorrect operation" of equipment. LNG facilities shut down for maintenance a couple of days per year, and operators purge gases from the equipment that helps cool natural gas into a liquid state. Yet on the day preceding the accident, the operators did not properly purge the equipment, so when employees started up the system on March 31, a mixture of gas and air auto-ignited inside the system, causing a rapid increase in pressure. Overpressurization exploded a unit of processing equipment along with some piping inside the plant, and flying shrapnel damaged adjacent buildings and equipment.

Here's what the extraordinarily brief narrative does not say: According to a Benton County Fire Department captain, the shrapnel actually created two separate leaks in the LNG tank: one in the tank's outer wall and one in a small pipe that connects to the bottom of the storage tank. LNG leaked from the pipe for over 24 hours until crews stopped the leak by shutting off a valve the next afternoon. Yet Williams' report to federal officials only mentions the leak in the tank's wall. Sightline pointed out this omission to a PHMSA official, who was not aware of the second leak.

The Williams narrative also leaves out other key information, including the size and location of the hole in the tank, whether the interior of the double-walled tank was punctured, and which equipment was damaged. As it turns out, these omitted pieces of information are critical to whether or not the accident can be officially classified as an LNG leak.

## Most injuries are never recorded

According to federal rules, a person has to either die or stay overnight in a hospital for an injury sustained in an LNG accident to be considered significant. Since the four employees who were struck by flying debris were treated and released the same day, PHMSA doesn't count their injuries. The only person whose injury counts as "significant" is the employee who was hospitalized for burns, so only one injury is listed in PHMSA's official records.

No harms to the public will go on record either. Even though a resident who lived a quarter-mile from the plant reported smelling gas and said it was "making people sick," and responding officers became nauseous at the scene, these harms will never become part of the official record because no members of the public were killed or hospitalized overnight.

The permissive accounting standards for LNG accidents give the industry license to distort its safety record by downplaying serious accidents like the one at Plymouth LNG. For example, a full 18 months after the Plymouth explosion, the Environmental Impact Statement (EIS) for the proposed Tacoma LNG facility claimed that only two LNG accidents in US history have resulted in adverse effects on the public: a

1944 disaster in Cleveland that killed 128 people and an industry-changing explosion at Cove Point, Maryland, in 1979.

It's hard to imagine that the Plymouth accident was unknown to project backer Puget Sound Energy, which stored natural gas at Plymouth LNG at the time of the accident, or to the City of Tacoma, which prepared the Tacoma LNG EIS. Yet even Tacoma's accounting is more thorough than what's found in the safety analysis of Oregon LNG and Jordan Cove, two large LNG export proposals in Oregon for which the Federal Energy Regulatory Commission and the project backers claim that aside from the Cleveland accident, "the LNG industry has been free of safety-related incidents resulting in adverse effects on the public or the environment."

## Spill of LNG won't count as LNG spill

In addition to not being considered a threat to public safety, the Plymouth LNG spill is not even considered an LNG spill. The data retrieved from PHMSA's website states that even though 14,270 barrels (599,340 gallons) of LNG spilled, no LNG was lost. When Sightline contacted PHMSA about the apparent error in the report, an agency official responded that in fact no LNG was spilled at all. The official clarified that *evaporated* natural gas was spilled, not *liquid* natural gas.

Semantically, this is akin to saying that if you leave a glass of water outside and the water evaporates, then you have not lost any water, you've only lost water vapor. LNG becomes vaporized natural gas when it warms to a temperature above -260 degrees, so if the LNG has time to vaporize before it hits the ground, a company can say it didn't spill any LNG.

But what about the second leak, the one Williams didn't mention in its report to PHMSA? It's possible that this leak was LNG that did not evaporate—that it was still liquid as it leaked out of the pipe. A spokesperson for Williams stated in April 2014 that leaking LNG froze the ground before warming up and evaporating into the atmosphere. We still don't know whether investigative agencies will count the second leak as an LNG spill, or whether their reports will mention the second leak at all.

Neither PHMSA nor the Washington Utilities and Transportation Commission (UTC) has completed a report on the accident. PHMSA's report will be published by the end of the second quarter of 2016, more than two years after the incident. Meanwhile, the UTC does not have any anticipated date for publishing its investigation. Both reports will likely be published only after Williams completes repairs to Plymouth LNG in April 2016.

## Plymouth may still pose danger

As Williams Pipeline Company prepares to resume full service operations at Plymouth LNG, we still don't know what happened in March 2014, and we don't know something that's equally important: how Williams repaired the damage. According to public documents available from the Washington UTC, the tanks at Plymouth are double-walled steel tanks built in the late 1970s, around the time the industry

began to enhance the safety of LNG tanks by surrounding them with an exterior container made of concrete. Plymouth LNG does not have these "full-containment" tanks, leaving the exterior wall of both LNG storage tanks exposed.

The damaged tank at Plymouth could be set to spill more LNG in the future. The interior wall of an LNG tank is made of 9 percent nickel steel, which can withstand extremely cold temperatures without becoming brittle. The exterior wall, however, is not made of a steel grade that stands up to the cold temperatures of LNG over time; its purpose is to help contain spilled LNG, but exposure to the thermal stress of LNG temperatures can crack and warp the outer wall. Now that the exterior wall has been damaged by a large gash and exposed to cryogenic temperatures, it's important to know whether Williams simply patched the puncture or whether it completed more thorough fortifications on the damaged tank. It's also important to know how much, if any, damage was sustained by the interior tank wall. While the exterior wall is visible, the interior wall is hidden, so any faults that might develop after the repair will also be hidden. As metallurgical and mechanical engineering firm Hoffmann Engineering noted in a 2007 report to the American Gas Association on aging LNG facilities, a tank failure "could be an isolated occurrence or the beginning of a series of failures."

When companies don't have to provide these details, the information that the LNG industry reports about safety at its facilities becomes completely unreliable. As more companies propose LNG terminals in the Pacific Northwest, who will parse the industry's semantics to determine whether or not the industry is as safe as it claims to be? Under the current regulatory framework, towns and ports that lease land to LNG projects can't possibly learn from prior mistakes when deciding which safety features they should require to protect nearby citizens. And as long as safety reports take two years to publish or lack key details, the public will lack the facts needed to make informed decisions about where—and indeed whether—to build these terminals.

***Update 2/12/16:*** *Sightline accessed PHMSA's data on the Plymouth LNG accident on Jan 21, 2016. The database indicated that 14,270 barrels were spilled. We revisited the database on Feb. 11, 2016. The information had been changed to 0 barrels spilled. See comparison of the first and second data exports. We contacted PHMSA for clarification. The agency stated that their previous data was incorrectly listed as barrels, because barrels count only the "volume of liquid spilled to the ground." PHMSA confirmed that they consider the spill to have released 14,270 MCF of gas (14,270,000 cubic feet, or 181,964 gallons in liquid form). This quantity includes evaporated LNG that will not be counted as LNG. At this time PHMSA has no plans to add volume of gas released to the data on their public display, so the publicly available data will continue to read as 0 releases from the Plymouth accident, as though nothing came out of the tank at all.*

- Local administrative groups tend to not account for the overall impact of Natural Gas extraction and transportation:

Source: http://www.cityoftacoma.org/cms/One.aspx?portalId=169&pageId=113653

Question: Why does the (LNG Tacoma export terminal) EIS not account for greenhouse gas emissions during extraction, transmission, and processing of LNG?

Answer: Scoping is the first step in an EIS process and is intended to narrow the focus of the EIS to significant issues, eliminate insignificant impacts, and identify alternatives to the proposal. Any impacts associated with natural gas extraction, processing and transportation to the PSE natural gas system were considered too remote to the actual impacts of the project in and around the project site, and in the City of Tacoma generally, to legitimately be part of the scope of the EIS. Through the scoping process, and following consultation and comment from other agencies with expertise, the City of Tacoma determined that the greenhouse gas emissions evaluation would be limited to the Tacoma LNG facility and TOTE Marine Vessel LNG Fueling system.

❖ Social Cost of Carbon Approach

The social cost of carbon approach is:

- A dollar estimate of the future damages from climate impacts (eg: droughts) wrought by each ton of carbon dioxide released to the atmosphere
- Motivation: until there is a price on carbon, most of these climate impacts will be borne by the environment and the public, not paid by power generators

An important feature of this approach:

- States can put cleaner energy sources on a more level playing field with fossil fuels
- Experts say the social cost of carbon approach may have even greater impact on carbon emissions than a carbon tax alone, because social cost of carbon estimates are typically higher than carbon market prices.

Source: https://insideclimatenews.org/news/11082017/states-climate-change-policy-calculate-social-cost-carbon