

LNG

DANGERS AND POSSIBLE DISASTERS

PUBLIC SAFETY ISSUES AT THE PROPOSED PLEASANT POINT LNG TERMINAL - by James Fay

Quoddy Bay L.L.C. has proposed to construct and operate a liquefied natural gas (LNG) import terminal on the Sipayik tribal land at Pleasant Point, near Eastport, ME. To reach this terminal, ocean-going LNG tankers must move through Canadian waters between Campobello and Deer islands (Canada) as well as U.S. and Canadian waters between Eastport and Deer Island. A tanker spill at any location along this route would have serious consequences for persons and property on the shore adjacent to the stricken vessel, whether that be on Campobello or Deer I. or Eastport and the Sipayik Reservation.

Natural gas, a hydrocarbon fuel, is usually piped directly from a gas well to the end consumer, never being stored locally in large amounts. When cooled to liquid form, however, as much as 50,000 tons can be stored in insulated tanks on land or aboard ship. In this form it is especially hazardous if it escapes by accident from its container, spilling onto ground or water and turning very rapidly into gaseous form, whereupon it will mix with air and then burn if ignited. By its very nature, an LNG import terminal is a hazardous industrial facility which could experience accidental fires that might harm surrounding populations and property.

Thermal Danger Zones

The thermal radiation danger zones for the largest credible spills are shown in Figure 1. All of these extend beyond the site boundaries, especially so for the tanker and secondary tank spill with fire. But even the FERC spills with fire from transfer piping and primary containment send damaging radiation beyond the site boundaries. Altogether, about 20 square miles of U.S. shore land in the Pleasant Point area and 3 square miles on Deer Island are at risk for damage to humans from on-site spills at the proposed LNG terminal.

Tanker Danger Zones

Spills from a fully loaded LNG tanker can occur not only at the unloading dock, as shown in Figure 1, but also at any point along the ship channel while approaching the terminal. Figure 2 shows the proposed path to be followed by an LNG tanker heading for the terminal. Thermal radiation danger zones for spills at four locations along the path are shown. At any location, about 2 square miles on the U.S. shoreline and an equal amount on the Canada shoreline (Campobello and Deer Islands) lie within the thermal danger zone.

Flammable Vapor Danger Zones

The dashed circle in Figure 1 depicts the flammability danger zone for a spill, without fire, from the tanker while located at the terminal pier. For any such spill, the flammable vapor plume or cloud would extend from the tanker in the downwind direction, encompassing an area of about a square mile. Winds from the northwest, and clockwise to the southeast, would send the vapor plume to U.S. land area from Eastport to the Passamaquoddy shoreline, while winds from the southwest, and clockwise to the northwest, would send the vapor over land areas of Deer Island. The Figure 1 does not include spills without fire from the secondary containment of the land storage tank. Because such a spill would be more than ten times the tanker spill in volume, the corresponding flammability distance would be considerably greater than the dashed circle shown in Figure 1.

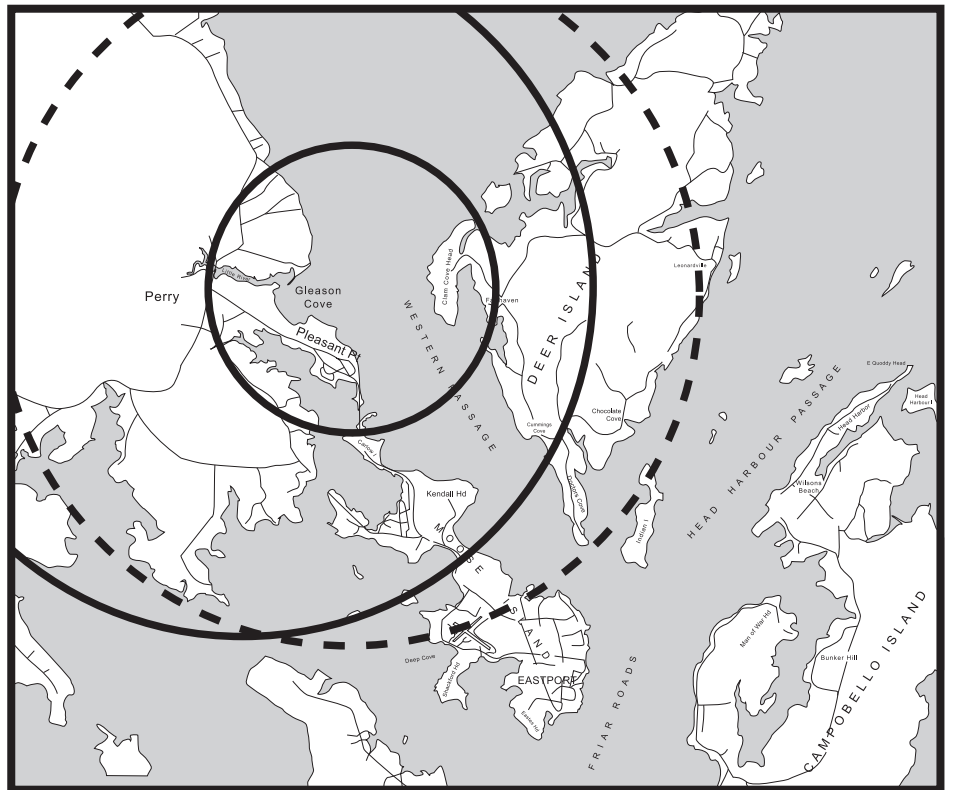


Figure 1: The thermal radiation and flammable vapor danger zones for spills. Solid circles are distances to radiation intensities of 1.6 kW/m² for a spill with fire; larger for loss of secondary containment of land storage tank, smaller for spill from one hold of LNG tanker. Dashed circle is flammable vapor distance for a tanker spill.



Figure 2: The path of a tanker approaching the proposed LNG terminal and the radiation danger zones for a spill at four locations along this path.

CRS Report for Congress

Liquefied natural gas (LNG) is a hazardous fuel frequently shipped in massive tankers from overseas to U.S. ports. Because LNG infrastructure is highly visible and easily identified, it can be vulnerable to terrorist attack. Since September 11, 2001, the U.S. LNG industry and federal agencies have put new measures in place to protect LNG infrastructure and respond to the possibility of terrorism. Nonetheless, public concerns about LNG risks continue to raise questions about LNG security. Faced with growth in demand and public concerns, Congress is examining the adequacy of federal LNG security initiatives.

LNG infrastructure consists primarily of tankers, import terminals, and inland storage plants. There are six active U.S. terminals and proposals for over 20 others. Potentially catastrophic events could arise from a serious accident or attack on such facilities, such as pool or vapor cloud fires.

The Coast Guard has lead responsibility for LNG shipping and marine terminal security. The Office of Pipeline Safety (OPS) and the Transportation Security Administration (TSA) both have security authority for LNG storage plants within gas utilities, as well as some security authority for LNG marine terminals. The Federal Energy Regulatory Commission (FERC) approves the siting, with some security oversight, of on-shore LNG marine terminals and certain utility LNG plants.

Overview of U.S. LNG Infrastructure

The physical infrastructure of LNG consists of interconnected transportation and storage facilities, each with distinct physical characteristics affecting operational risks and security needs. This overview focuses on the three major elements of this infrastructure: tanker ships, marine terminals, and storage facilities.

LNG Tanker Ships

LNG is transported to the United States in very large, specially designed tanker ships. There are currently 142 tankers in service around the world, with a combined cargo capacity of over 16 million cubic meters of LNG. Two LNG tankers are owned by Marathon Oil, a U.S. company; the rest are foreign-owned.



LNG Marine Terminals

LNG tankers unload their cargo at dedicated marine terminals which store and regasify the LNG for distribution to domestic markets. These terminals consist of docks, LNG handling equipment, storage tanks, and interconnections to regional gas transmission pipelines. There are six active U.S. LNG terminals:

LNG Peak Shaving Plants

Many gas distribution utilities rely on “peak shaving” LNG plants to supplement pipeline gas supplies during periods of peak demand during winter cold snaps. The LNG is stored in large refrigerated tanks integrated with the local gas pipeline network. LNG tanks are generally surrounded by containment impoundments which limit the spread of an LNG spill and the potential size of a resulting vapor cloud. LNG peak shaving plants are often located near the populations they serve, although many are in remote areas away from people.

LNG Risks and Vulnerabilities

The risks associated with LNG infrastructure in the United States have been debated for decades. A prominent accident at one of the nation’s first commercial LNG facilities in 1944 initiated public fears and misperceptions

about LNG hazards which persist today. In this accident, the “Cleveland Disaster,” an LNG spill from an improperly designed storage tank caused a fire that killed 128 people. While this accident continues to serve as a reminder of the hazards of LNG, technology improvements since the 1940’s have made LNG facilities much safer. Serious risks remain, however, since LNG is inherently volatile and is usually stored in large quantities. Because LNG infrastructure is highly visible and easily identified, it is vulnerable to terrorist attack.

Physical Hazards of LNG

Natural gas is combustible, so an uncontrolled release of LNG poses a serious hazard of explosion or fire. LNG also poses hazards because it is so cold. Experts have identified several potentially catastrophic events that could arise from an LNG release. The likelihood and severity of these

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events have been the subject of considerable research and testing. While open questions remain about the impacts of specific hazards in an actual accident, there appears to be consensus as to what are the greatest LNG hazards.

- Pool fires. If LNG spills near an ignition source, the evaporating gas in a combustible gas-air concentration will burn above the LNG pool. The resulting “pool fire” would spread as the LNG pool expanded away from its source and continued evaporating. Such pool fires are intense, burning far more hotly and rapidly than oil or gasoline fires. They cannot be extinguished—all the LNG must be consumed before they go out. Because LNG pool fires are so hot, their thermal radiation may injure people and damage property a considerable distance from the fire itself. Many experts agree that a pool fire, especially on water due to thermal effects, is the most serious LNG hazard.

- Flammable vapor clouds. If LNG spills but does not immediately ignite, the evaporating natural gas will form a vapor cloud that may drift some distance from the spill site. If the cloud subsequently encounters an ignition source, those portions of the cloud with a combustible gas-air concentration will burn. Because only a fraction of such a cloud would have a combustible gas-air concentration, the cloud would not likely explode all at once, but the fire could still cause considerable damage. An LNG vapor cloud fire would gradually burn its way back to the LNG spill where the vapors originated and would continue to burn as a pool fire. If an LNG tank failed due to a collision or terror attack, experts believe the failure event itself would likely ignite the LNG pool before a large vapor cloud could form. Consequently, they conclude that large vapor cloud fires are less likely than instantaneous pool fires.

- Flameless explosion. If LNG spills on water, it could theoretically heat up and regasify almost instantly in a “flameless explosion” (also called a “rapid phase transition”). If there were a flameless explosion of LNG, experts believe the hazard zones around such an event “would not be as large as either vapor cloud or pool fire hazard zones.”

- Asphyxiation Hazard. In addition to these catastrophic hazards, an LNG spill poses hazards on a smaller scale. An LNG vapor cloud is not toxic, but could cause asphyxiation by displacing breathable air. Such clouds rise in air as they warm, however, diminishing the threat to people on the ground. Alternatively, extremely cold LNG could injure people or damage equipment through direct contact. The extent of such contact would likely be limited, however, as a major spill would likely result in a more serious fire.

LNG Security Risks

LNG tankers and land-based facilities are vulnerable to terrorism. Tankers may be physically attacked in a variety of ways to destroy their cargo—or commandeered for use as weapons against coastal targets. Land-based

Liquefied Natural Gas (LNG) Infrastructure Security: Background and Issues for Congress

LNG facilities may also be physically attacked with explosives or through other means. Alternatively, computer control systems may be “cyber-attacked,” or both physical and cyber attack may happen at the same time. Some LNG facilities may also be indirectly disrupted by other types of terror strikes, such as attacks on regional electricity grids or communications networks, which could in turn affect dependent LNG control and safety systems.

Recent LNG Security Initiatives

The terror attacks of September 11 focused attention on the vulnerability of LNG infrastructure to different threats, such as systematic attacks on LNG facilities by foreign terrorists. Consequently, both government and industry have taken new initiatives to secure LNG infrastructure in response to new threats.

1. Coast Guard Maritime Security Activities

Shortly after September 11, 2001, the Coast Guard began to systematically prioritize protection of ships and facilities, including those handling LNG, based on vulnerability assessments and the potential consequences of security incidents.

The most heavily secured LNG shipments are those bound for the Everett terminal because they pass through Boston harbor. The Coast Guard has had numerous security provisions in place for these shipments, including:

- Inspection of security and tanker loading at the port of origin in Trinidad.
- Occasional on-board escort to Boston by Coast Guard “sea marshals.”
- 96-hour advanced notice of arrival of an LNG tanker.
- Advance notification of local police, fire, and emergency agencies, as well as the Federal Aviation Administration and the U.S. Navy.
- Boarding of the LNG tanker for inspection prior to entering Boston harbor.
- Harbor escort by armed patrol boats, cutters, or auxiliary vessels.
- Enforcement of a security zone closed to other vessels two miles ahead and one mile to each side of the LNG tanker.
- Suspension of overflights by commercial aircraft at Logan airport.
- Additional security measures that cannot be disclosed publicly.

2. Federal Pipeline Safety and Security Agencies

The Office of Pipeline Safety (OPS) within the Department of Transportation has statutory authority to regulate the safety and security of LNG peak-shaving plants. These regulations govern security procedures, protective enclosures, communications, monitoring, lighting, power sources, and warning signs.

The agency oversees pipelines and land-based LNG as the “national transportation security manager.”

3. Federal Energy Regulatory Commission (FERC) Oversight

The FERC is responsible for permitting new land-based LNG facilities, and for ensuring the safe operation of these facilities through subsequent inspections. The initial permitting process requires approval of safety and security provisions in facility design, such as hazard detectors, security cameras, and vapor cloud exclusion zones.

4. National Fire Protection Association (NFPA)

The NFPA is an international nonprofit organization which advocates fire prevention and serves as an authority on public safety practices. According to NFPA, its 300 safety codes and standards “influence every building, process, service, design, and installation in the United States.” The NFPA LNG Standards Committee includes volunteer experts with diverse representation from industry and government, including FERC, DOT, USCG, and state agencies.

5. State Regulatory Roles

While the federal government is primarily responsible for LNG terminal safety and siting regulation, state and local laws, such as environmental, health and safety codes, can affect LNG facilities as well.

Apart from state regulation aimed specifically at LNG facilities, generally applicable state and local laws, such as zoning laws and permit requirements for water, electricity, construction, and waste disposal, also may serve to impact the planning and development of LNG facilities.

6. Industry Initiatives for Land-Based LNG Security

After the September 11 attacks, gas infrastructure operators, many with LNG facilities, immediately increased security against the newly perceived terrorist threat.

Key Policy Issues in LNG Security

Government and industry have taken significant steps to secure the nation’s LNG infrastructure. But continued progress in implementing and sustaining LNG security faces several challenges. Agency officials are concerned about the public costs of LNG security, and the growth in those costs as LNG imports increase. [This has caused] concern about the public cost and sustaina-

bility of securing LNG shipments. Overall cost data for LNG security are unavailable, but estimates have been made for Everett shipments. The Coast Guard Program Office estimates that it currently costs the Coast Guard approximately \$40,000 to \$50,000 to “shepherd” an LNG tanker through a delivery to the Everett terminal, depending on the duration of the delivery, the nature of the security escort, and other factors. State and local authorities also incur costs for overtime police, fire and security personnel overseeing LNG tanker deliveries. The state of Massachusetts and the cities of Boston and Chelsea estimated they spent a combined \$37,500 to safeguard the first LNG shipment to Everett after September 11, 2001. Based on these figures, the public cost of security for an LNG tanker shipment to Everett is on the order of \$80,000, excluding costs incurred by the terminal owner.

Conclusions

While rising LNG imports may offer economic benefits, they also pose risks. LNG is inherently hazardous and its infrastructure is potentially attractive to terrorists. Both lawmakers and the general public are concerned about these risks.

The material from this article is from the Congressional Research Service (CRS) reports *Liquefied Natural Gas (LNG) Infrastructure Security: Background and Issues for Congress* (order code: RL32073 September 9, 2003) by Paul W. Parfomak, Specialist in Science and Technology Resources, Science, and Industry Division and *Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety and Regulation* (order code: RL32205 January 28, 2004) by Paul W. Parfomak and Aaron M. Flynn, Legislative Attorney, American Law Division. These articles have been edited for content and space. For the complete articles please refer to our website:

www.savepassamaquoddybay.org



Save Passamaquoddy Bay - A 3-Nation Alliance

We Will Keep LNG from Passamaquoddy Bay

From our beginning, Save Passamaquoddy Bay has been true to our commitment to engage the community that encircles Passamaquoddy Bay through education and events to keep LNG out of our bay. Opposition against LNG has grown, dedication to the cause has intensified, and we are more determined than ever that LNG will not come to Passamaquoddy Bay.

Hundreds of Passamaquoddy Bay residents—from Pleasant Point, Perry, Robbinston, Calais, St. Stephen, Deer Island, St. Andrews, Campobello Island, Grand Manan Island, Blacks Harbor, Lubec, Trescott, Whiting, Edmunds, Dennysville, and Eastport have made their voices heard—with petitions, proclamations, protests, letters, editorials, visits to political leaders, public rallies, press conferences, votes and media releases and feature stories and our website (www.savepassamaquoddybay.org)

EVENTS

Perry

March 16th - Public Hearing, Perry Municipal Building, 7pm
March 23rd - LNG Economic Forum, Crohn Center, Otis Lane, South Meadow Rd., 7pm
March 28th - Vote on Article 40, Perry Municipal Building, all day

Eastport

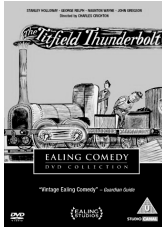
February 15th and March 15th, 3-Nation Alliance meetings, The Commons, 7pm

Hosting a series of three movie nights co-sponsored by the Northern Lights Film Society:
February 18th - First movie night, *Local Hero*, Shead High School, 7pm



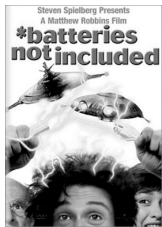
The delicate ecological balance of a small unspoiled Scottish village is threatened by the rich plans of a wealthy oilman. *Local Hero* is a tender, very funny movie about astronomy, a mermaid, a village that want to get rich, and an old man who doesn't. With Burt Lancaster, Peter Riegert.

March 4th - Second movie night, *The Titfield Thunderbolt*, Shead High School, 7pm



The *Titfield Thunderbolt* takes place in a tiny British village serviced by a branch railway line. When government plans to close the line down, the locals scheme with the town's wealthiest man for the villagers to run the rail line themselves. A fine, if whimsical, example of the common man triumphing over bureaucracy. Stanley Holloway and Sidney James

March 18th - Third movie night, *Batteries Not Included*, Shead High School, 7pm



When an unscrupulous real estate developer sends thugs into a deteriorating tenement to get rid of the last five residents, they need nothing short of a miracle to stay where they are. A delightful fantasy starring Jessica Tandy and Hume Cronyn. Produced by Steven Spielberg.

FOCUS ON PASSAMAQUODDY BAY

First day of Spring till the Full Moon, March 21 - 25 - actions, events and international attention on our efforts to Save Passamaquoddy Bay and Protect Our Homeland.



ASK QUESTIONS.

Oklahoma-based Quoddy Bay LLC, and Portland-based Savvy, Inc have announced four information sessions:

- February 21st at the Perry Fire Hall in Perry - 6:00 - 8:00
- February 22nd at the Recreation Center at Pleasant Point - 6:00 - 8:00
- February 23rd at the Recreation Center at Peter Dana Point - 5:30- 7:30
- February 24th at the Youth Center in Eastport - 6:00 - 8:00