Public Safety Issues at the Proposed Pleasant Point LNG Terminal

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1 Introduction

Quoddy Bay L.L.C.[1] 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.

To build and operate an LNG terminal at the Pleasant Point site, Quoddy Bay must obtain permission from the Federal Energy Regulatory Commission (FERC)[2], an independent agency that regulates interstate commerce in natural gas and electricity. Although primarily an economic regulator, FERC has asserted jurisdiction over the safety aspects of the LNG facilities it permits. FERC requires facility owners to meet certain technical standards in site selection and equipment design and operation before it awards the right to import LNG and to connect the facility to an interstate natural gas transmission line. FERC's jurisdiction does not extend to safety aspects of marine tankers; they are regulated by the U.S. Coast Guard.[3]

FERC's objective in safety regulation is to limit, but not necessarily prevent, harm to persons and property outside the confines of the terminal site, should there be an accidental release of LNG at the site. The principal harmful effects are two: vapor plumes or clouds that can be ignited outside the site boundaries and harmful thermal radiation from on-site fires that extends across the site borders. But FERC's safety rules do not consider all credible spills on the site or any from the LNG tankers while in transit to the terminal or being unloaded.

This report explains the safety requirements that will likely be applied by federal regulators to the proposed LNG terminal in Pleasant Point. It delineates the geographic extent of harmful effects that could be expected from LNG spills at the site, including those that are excluded from FERC and U.S. Coast Guard safety regulations.

2 FERC site selection criteria

FERC rules[4] require the LNG terminal owner to install extensive technological features that will limit the harmful consequences of an accidental spill of LNG to within the property line enclosing the terminal. The harmful effects are twofold: combustible mixtures of vapor and air, such as might be driven by the wind blowing over an evaporating pool of spilled LNG, and thermal radiation from a fire burning above a liquid spill on the site. The types of spills to be considered are also twofold: a

[1] Quoddy Bay L.L.C. is owned by Smith Cogeneration (www.smithcogeneration.com).

[2] Federal Energy Regulatory Commission (www.ferc.gov).

[3] The safety of the natural gas pipeline connecting the terminal to the interstate transmission line is regulated by the Office of Pipeline Safety of the U.S. Department of Transportation, but the FERC permit for the LNG terminal confers on the terminal owner the right to seek seizure of private land to construct the connecting pipeline, if necessary.

[4] Code of Federal Regulations, 49 CFR 193.

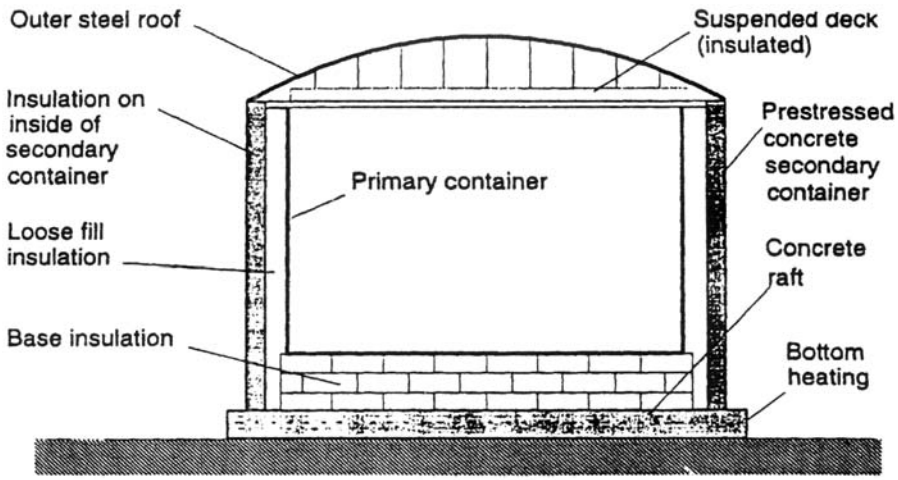

Figure 1: The primary and secondary containment tanks for a ”full containment” storage tank of the type to be used at the proposed Harpswell LNG terminal.

spill from transfer piping connecting the storage tanks and the regasification or unloading facilities, and the failure of the primary storage tank enclosure.

Limiting these effects at a terminal requires the construction of impounding areas surrounding potential spill sources so as to collect the spilled liquid and slow its vaporization or burning rate. If the spills are sufficiently small, harmful effects will not extend beyond the site line. For transfer line spills, the LNG is collected in a central impounding area. For storage tank spills, the inner storage container is surrounded by a secondary containment tank of slightly larger size, as shown in Figure 2, which can contain all the LNG that might spill from the inner primary container.

The potential for harmful effects to humans from a given spill decreases with distance from the spill site. The harmful effect of ignitable natural gas vapor is measured by the flammability distance, a distance down wind from the spill site at which the vapor has been so diluted by mixing with air that it cannot be ignited. Any ignition at a closer distance can propagate a flame, but that flame will not propagate beyond the flammability distance. If the latter distance lies within the site boundary, no flame can extend beyond that boundary.

Thermal radiation from on-site LNG fires fed by an evaporating pool of spilled LNG can cause first, second or third degree burns to the skin of humans exposed to the radiation, depending upon the intensity of radiation. For a given fire, this intensity decreases with distance from the fire. The least intense thermal radiation that FERC rules allow humans outside the site boundary to be exposed to is 5 kilowatts per square meter, an amount that produces second degree burns after only thirty seconds exposure.[5]

The FERC requirements for the proposed Quoddy Bay terminal can be estimated from the Final Environmental Impact Statement for the Hackberry LNG project in Louisiana.[6] This project, consisting of three storage tanks and two unloading piers, employs the technology likely to be used at the Pleasant Point facility. Values from this report of the flammability and thermal radiation dis-

[5]More intense and thereby more damaging exposure is permitted depending upon land use characteristics at the site boundary.

[6]Final Environmental Impact Statement, Hackberry LNG Project, Cameron LNG, LLC. FERC/EIS-0156. Office of Energy Projects, Federal Energy Regulatory Commission, Washington, DC 20426. August 2003.

Table 1: Flammability and radiation distances for FERC-defined spills

Spill source	Size (ton)	Flammability (ft)	5 kW/m^2 Radiation (ft)
Transfer piping	840	770	320
Storage tank (primary)	74,000		929

tances for a transfer line spill, and the thermal radiation distance for a primary containment spill, are listed in Table 1, together with the amounts of the respective spill volumes. It would appear that for these FERC-defined spills neither radiation nor flammability will exceed the FERC limits beyond the site boundary.

3 Risks that FERC ignores

There are several important public safety risks that are not considered in the FERC regulations discussed above.

1. First of all, FERC allows damaging thermal radiation beyond the site boundary as long as its level is below 5 kilowatts per square meter. However, it is not until the thermal radiation intensity falls below 1.6 kilowatts per square meter that there is no damage to exposed humans. A safe radiation distance for fires would be that for which the thermal radiation level does not exceed 1.6 kilowatts per square meter. Distances at which the radiation exceeds this value would lie within a *thermal radiation danger zone.*

2. Secondly, FERC's regulations ignore the greatest risks of all, that foreign or domestic terrorists could destroy the storage tank primary and secondary containment systems, or the LNG tanker cargo hold, allowing LNG to spill unhindered onto ground or water, where it would most likely burn. Because the lateral extent of such spills would be so much greater than those considered in the FERC regulations, it is to be expected that their harmful effects would exist very far beyond the site boundaries.

To show how public safety can be adversely affected by credible spills that have been overlooked by FERC, we have extended Table 1 to include the effects listed above.[7] This expanded assessment is listed in Table 2. Two additional spills are considered, those from the secondary storage tank containment system and a single hold of a marine tanker (last two rows of Table 2). For these and the previous spills of Table 1, the safe radiation distance defining the outer boundary of the thermal radiation danger zone, mentioned in item 1 above, has been calculated for all spills (last column of Table 2). Also, the flammability distance for the FERC primary containment failure accident is shown in the flammability column.

[7]The methods used for this assessment are identical to those contained in "Consequence assessment methods for incidents involving releases from liquefied natural gas carriers", Report 131-04 GEMS 1288209, ABS Consulting, Inc., May 13, 2004, (available on FERC web site at www.ferc.gov/industries/gas/indus-act.asp) and its Attachment 1 of June 29, 2004, as listed on the FERC site at http://ferris.ferc.gov/idmws/search/fercgensearch.asp under docket AD04-6.

Table 2: Flammability and radiation distances for all credible spills

Spill source	Size (ton)	Flammability (ft) Danger zone	1.6 kW/m^2 Radiation (ft) Danger zone
Transfer piping	840	770	1,230
Storage tank (primary)	74,000		1,490
Storage tank (secondary)	74,000		19,685
Tanker hold	5,250	19,360	7,870

3.1 Thermal danger zones

The thermal radiation danger zones for the largest credible spills listed in Table 2 are shown in Figure 2. 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.

3.2 Tanker danger zones

Spills from a fully loaded LNG tanker can occur not only at the unloading dock, as shown in Figure 2, but also at any point along the ship channel while approaching the terminal. Figure 3 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.

3.3 Flammable vapor danger zones

The blue circle in Figure 2 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 spills described in Tables 1 and 2 do 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 blue circle shown in Figure 2.

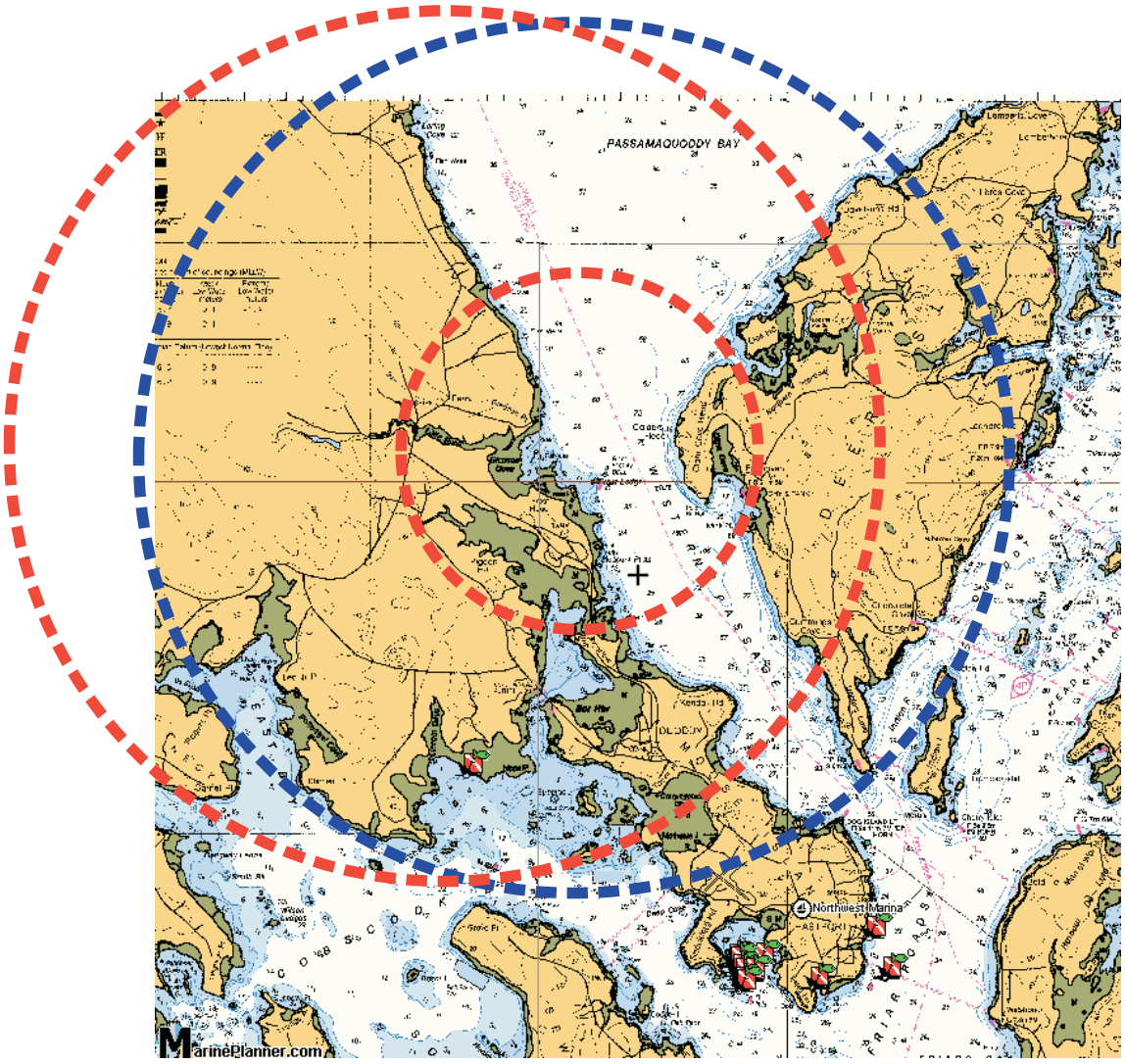

Figure 2: The thermal radiation and flammable vapor danger zones for spills listed in Table 2. Red circles are distances to radiation intensities of 1.6 kW/m^2 for a spill with fire; larger for loss of secondary containment of land storage tank, smaller for spill from one hold of LNG tanker. Blue circle is flammable vapor distance for a tanker spill.

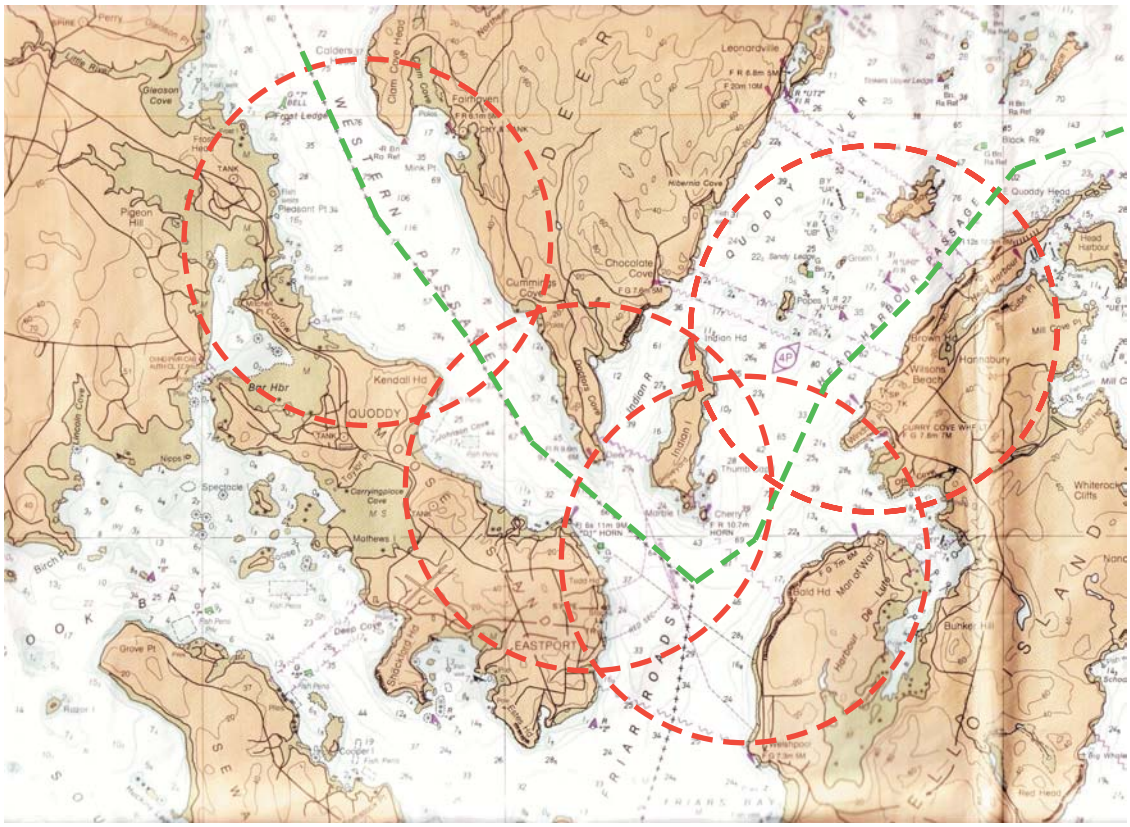

Figure 3: The path of a tanker approaching the proposed LNG terminal (green dashed line) and the radiation danger zones for a spill at four locations along this path.

4 Conclusions

1. **The federal safety requirements for the proposed Pleasant Point LNG terminal will not prevent harm to humans outside the site boundary for the spill scenarios that FERC considers.**

2. **For all credible spills, including terrorist attacks on the storage tank and LNG tanker, the danger zone for humans extends almost 4 miles from the terminal site, encompassing 20 square miles of land in the Pleasant Point area.**

3. **For a tanker spill anywhere along the route leading to the LNG terminal, the thermal radiation danger zone for humans extends 1.5 miles from the tanker route, encompassing up to 4 square miles of land along U.S. and Canada shores in Eastport, Campobello Island and Deer Island, depending upon the spill location along the tanker track.**