Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety, and Regulation

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Summary

Liquefied natural gas (LNG) is a hazardous fuel shipped in large tankers to U.S. ports from overseas. While LNG has historically made up a small part of U.S. natural gas supplies, rising price volatility, and the possibility of domestic shortages have significantly increased LNG demand. To meet this demand, energy companies have proposed new LNG import terminals throughout the coastal United States. Many of these terminals would be built onshore near populated areas.

The Federal Energy Regulatory Commission (FERC) grants federal approval for the siting of new onshore LNG facilities under the Natural Gas Act of 1938 and the Energy Policy Act of 2005 (P.L. 109-58). This approval process incorporates minimum safety standards for LNG established by the Department of Transportation. Although LNG has had a record of relative safety for the last 45 years, and no LNG tanker or land-based facility has been attacked by terrorists, proposals for new LNG terminal facilities have generated considerable public concern. Some community groups and governments officials fear that LNG terminals may expose nearby residents to unacceptable hazards. Ongoing public concern about LNG safety has focused congressional attention on the exclusivity of FERC's LNG siting authority, proposals for a regional LNG siting process, the lack of "remote" siting requirements in FERC regulations, state permitting requirements under the Clean Water Act and the Coastal Zone Management Act, terrorism attractiveness of LNG, the adequacy of Coast Guard security resources, and other issues.

LNG terminals directly affect the safety of communities in the states and congressional districts where they are sited, and may influence energy costs nationwide. Faced with an uncertain national need for greater LNG imports and persistent public concerns about LNG hazards, some in Congress have proposed changes to safety provisions in federal LNG siting regulation. Legislation proposed in the 110th Congress addressed Coast Guard LNG resources, FERC's exclusive siting authority, state concurrence of federal LNG siting decisions, and agency coordination under the Coastal Zone Management Act, among other proposals. Provisions in the Coast Guard Authorization Act of 2010 (H.R. 3619), passed by the House on October 23, 2009, would require additional waterway suitability notification requirements in LNG siting reviews by FERC (Sec. 1117). The Maritime Hazardous Cargo Security Act (S. 1385), introduced by Senator Lautenberg and three co-sponsors on June 25, 2009, would require a national study to identify measures to improve the security of maritime transportation of liquefied natural gas (Sec. 6).

If Congress concludes that new LNG terminals as currently regulated will pose an unacceptable risk to public safety, Congress may consider additional LNG safety-related legislation, or may exercise its oversight authority in other ways to influence LNG terminal siting approval. Alternatively, Congress may consider other changes in U.S. energy policy legislation to reduce the nation's demand for natural gas or increase supplies of North American natural gas and, thus, the need for new LNG infrastructure.

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Introduction

Liquefied natural gas (LNG) historically has played a minor role in U.S. energy markets, but in reaction to rising natural gas prices, price volatility, and the possibility of domestic shortages, demand for LNG imports has increased significantly in recent years. To meet anticipated growth in LNG demand, new onshore and offshore LNG import terminals have been constructed or approved in United States coastal regions. More have been proposed. Because LNG (like other fossil fuels) is a hazardous[1] liquid transported and stored in enormous quantities—often near populated areas—concerns exist about the federal government's role in addressing LNG safety in the terminal siting process. In addition, various energy policy proposals could impact the need for new LNG terminals by encouraging the development of alternative U.S. energy supplies and promoting conservation and efficiency.

This report provides an overview of recent industry development of new LNG import terminals. The report summarizes LNG hazards and the industry's safety record. It discusses federal laws and regulations related to LNG terminal siting with a focus on the authorities of key federal agencies and safety provisions in the permitting of onshore facilities. The report reviews controversial safety issues in recent LNG siting proceedings, such as safety zones, marine hazards, hazard modeling, and remote siting. The report outlines policy issues related to LNG terminal safety, including the Federal Energy Regulatory Commission's (FERC's) LNG siting authority, regional LNG siting, "remote" siting requirements in federal regulations, state permitting requirements, terrorism, and other issues.

Issues Facing Congress

LNG terminals directly affect the safety of communities in the states and congressional districts where they are sited, and may influence energy costs nationwide. Faced with an uncertain national need for greater LNG imports and persistent public concerns about LNG hazards, some in Congress have proposed changes to safety provisions in federal LNG siting regulation. Legislation proposed in the 110th Congress addressed Coast Guard LNG resources, FERC's exclusive siting authority, state concurrence of federal LNG siting decisions, and agency coordination under the Coastal Zone Management Act, among other proposals.[2] If Congress concludes that new LNG terminals as currently regulated will pose an unacceptable risk to public safety, Congress may consider additional LNG safety-related legislation, or may exercise its oversight authority in other ways to influence LNG terminal siting approval. Alternatively, Congress may consider other changes in U.S. energy policy legislation to reduce the nation's demand for natural gas or increase supplies of North American natural gas and, thus, the need for new LNG infrastructure.

[1] 49 C.F.R. § 172.101. *List of Hazardous Materials*. Office of Hazardous Materials Safety, U.S. Department of Transportation.

[2] LNG proposals in the 110th Congress are found in: H.R. 1564, H.R. 2024, H.R. 2830, H.R. 6720, S. 323, S. 1174, S. 1579, S. 2822, S. 3441.

Scope and Limitations

This report focuses broadly on industry and federal activities related to safety in LNG import terminal siting. For a more specific discussion of LNG security, see CRS Report RL32073, *Liquefied Natural Gas (LNG) Infrastructure Security: Issues for Congress*, by Paul W. Parfomak. This report also deals primarily with those parts of LNG terminals which transfer, store, and process LNG prior to injection to natural gas pipelines for transmission off site. For more discussion of general natural gas or pipeline hazards, see CRS Report RL33347, *Pipeline Safety and Security: Federal Programs*, by Paul W. Parfomak. Also, this report discusses mostly onshore facilities and near-shore shipping, since they pose the greatest public hazards. Offshore LNG terminal siting regulations are summarized in the **Appendix**.

Background

What Is LNG and Where Does It Come From?

When natural gas is cooled to temperatures below minus 260° F it condenses into liquefied natural gas, or LNG. As a liquid, natural gas occupies only 1/600th the volume of its gaseous state, so it is stored more effectively in a limited space and is more readily transported. A single tanker ship, for example, can carry huge quantities of LNG—enough to supply a single day's energy needs of over 10 million homes. When LNG is warmed it "regasifies" and can be used for the same purposes as conventional natural gas such as heating, cooking, and power generation.

In 2009, LNG imports to the United States originated in Trinidad (54%), Egypt (34%), Norway (8%), and Nigeria (4%).[3] In recent years, some LNG shipments have also come from Algeria, Qatar, Equatorial Guinea, Malaysia, Oman, Australia, and other countries.[4] Brunei, Indonesia, Libya, and the United Arab Emirates also export LNG, and may be U.S. suppliers in the future. In addition to importing LNG to the lower 48 states, the United States exports Alaskan LNG to Japan.

Expectations for U.S. LNG Import Growth

The United States has used LNG commercially since the 1940s. Initially, LNG facilities stored domestically produced natural gas to supplement pipeline supplies during times of high gas demand. In the 1970s, LNG imports began to supplement domestic production. Primarily because of low domestic gas prices, LNG imports stayed relatively small—accounting for only 1% of total U.S. gas consumption as late as 2002.[5] In countries with limited domestic gas supplies, however, LNG imports grew dramatically over the same period. Japan, for example, imported

[3] Energy Information Administration (EIA). *Natural Gas Monthly*. November 2009. p. 9. Data are published only for the first nine months of the year.

[4] Energy Information Administration (EIA). *U.S. Natural Gas Imports by Country*. Online database, November 30, 2009. http://tonto.eia.doe.gov/dnav/ng/ng_move_impc_s1_m.htm.

[5] Energy Information Administration (EIA). *Natural Gas Annual 2005*. Tables 1 and 9. November 16, 2006.

97% of its natural gas supply as LNG in 2002, more than 11 times as much LNG as the United States.[6] South Korea, France, Spain, and Taiwan also became heavy LNG importers.

Natural gas demand growth accelerated in the United States from the mid-1980s through 2000 due to environmental concerns about other energy sources, widespread building of natural gas-fired electricity generation, and low natural gas prices. Domestic gas supplies have not always kept up with growth in demand, however, so prices have become volatile. At the same time, international LNG costs have fallen since the 1970s because of increased supplies and more efficient production and transportation, making LNG more competitive with domestic natural gas.

In 2003 testimony before Congress, the Federal Reserve Chairman called for a sharp increase in LNG imports to help avert a potential barrier to U.S. economic growth. According to the Chairman's testimony: "... high gas prices projected in the American distant futures market have made us a potential very large importer.... Access to world natural gas supplies will require a major expansion of LNG terminal import capacity."[7] Likewise, FERC Commissioner Suedeen Kelly told industry representatives in 2006 that,"while LNG has made a marginal contribution to gas supply over the last 30 years, it is poised to make a major contribution in the future."[8] Because burning natural gas produces only half as much carbon dioxide as burning coal, and also less carbon dioxide than vehicular fuels like gasoline, some also anticipate natural gas demand to grow as the preferred fuel in the near-term for power plants and motor vehicles under a national policy of carbon control.[9] Recent increases in U.S. natural gas production from domestic shale deposits have complicated projections about LNG markets. Nonetheless, many analysts expect continued growth in the U.S. LNG imports over the long term.[10]

Proposed LNG Import Terminals in the United States

LNG tankers unload their cargo at dedicated marine terminals which store and regasify the LNG for distribution to domestic markets. Onshore terminals consist of docks, LNG handling equipment, storage tanks, and interconnections to regional gas transmission pipelines and electric power plants. Offshore terminals regasify and pump the LNG directly into offshore natural gas pipelines or may store LNG for later injection into offshore pipelines.

There are seven active onshore LNG import terminals in the United States: Everett, Massachusetts; Lake Charles, Louisiana; Cove Point, Maryland; Elba Island, Georgia; Peñuelas, Puerto Rico; Freeport, Texas; and Sabine Pass, Louisiana. There are two active offshore import terminals, one located in the Gulf of Mexico and a second near Boston, Massachusetts. (There is also one export terminal in Kenai, Alaska.) In addition to these active terminals, some 25 LNG terminal proposals have been approved by regulators across North America to serve the U.S. market **Figure 1**. A number of these proposals have been withdrawn, however, due to siting

[6] Energy Information Administration (EIA). "World LNG Imports by Origin, 2002." Washington, DC. October 2003.

[7] Greenspan, A., Chairman, U.S. Federal Reserve Board. "Natural Gas Supply and Demand Issues." Testimony before the House Energy and Commerce Committee. June 10, 2003.

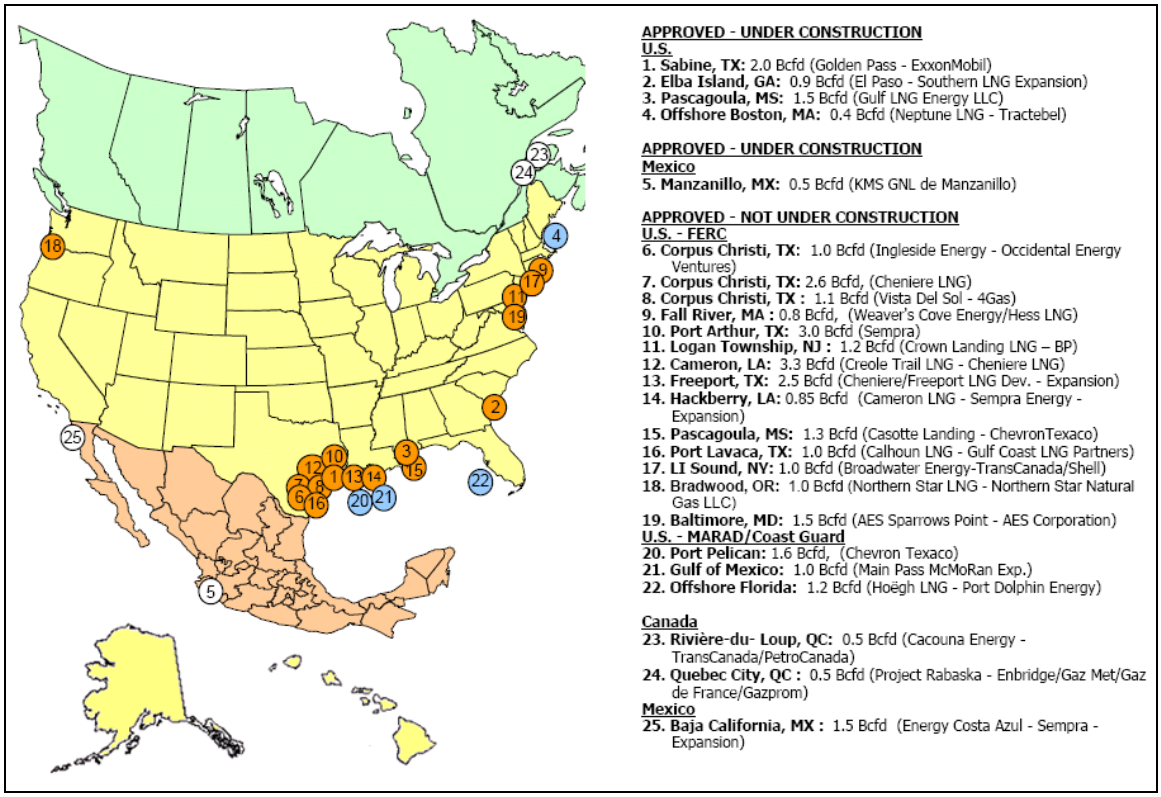
[8] *Inside F.E.R.C.* "Kelly-LNG Poised for 'Major Contribution' to Energy Supply, to Meet Industrial Demand." April 10, 2006.

[9] See, for example: John D. Podesta and Timothy E. Wirth. *Natural Gas: A Bridge Fuel for the 21st Century.* Center for American Progress. August 10, 2009. http://www.americanprogress.org/issues/2009/08/pdf/naturalgasmemo.pdf.

[10] Rita Tubb. "LNG Imports Projected to Rise." *Pipeline & Gas Journal*. May 1, 2009.

problems, financing problems, or other reasons. Developers have proposed another 8 U.S. terminals prior to filing formal siting applications.[11]

Figure 1. Approved LNG Terminals in North America.



Source: Federal Energy Regulatory Commission (FERC), "Approved North American LNG Import Terminals," updated October 27, 2009. http://ferc.gov/industries/lng/indus-act/terminals/lng-approved.pdf.

Potential Safety Hazards from LNG Terminals

The safety hazards associated with LNG terminals have been debated for decades. A 1944 accident at one of the nation's first LNG facilities killed 128 people and initiated public fears about LNG hazards which persist today.[12] Technology improvements and standards since the 1940s have made LNG facilities much safer, but serious hazards remain since LNG is inherently volatile and is usually shipped and stored in large quantities. A 2004 accident at Algeria's Skikda LNG terminal, which killed or injured over 100 workers, added to the ongoing controversy over LNG facility safety.[13]

[11] Federal Energy Regulatory Commission, "Proposed North American LNG Import Terminals," October 27, 2009. http://www.ferc.gov/industries/lng/indus-act/terminals/lng-proposed.pdf.

[12] Bureau of Mines (BOM). *Report on the Investigation of the Fire at the Liquefaction, Storage, and Regasification Plant of the East Ohio Gas Co., Cleveland, Ohio, October 20, 1944.* February 1946.

[13] Junnola, Jill, et al. "Fatal Explosion Rocks Algeria's Skikda LNG Complex." *Oil Daily*. January 21, 2004. p. 6.

Physical Hazards of LNG

Natural gas is combustible, so an uncontrolled release of LNG poses a hazard of fire or, in confined spaces, explosion. LNG also poses hazards because it is so cold. The likelihood and severity of catastrophic LNG events have been the subject of controversy. While questions remain about the credible impacts of specific LNG hazards, there appears to be consensus as to what the most serious hazards are.

Pool Fires

If LNG spills near an ignition source, evaporating gas will burn above the LNG pool.[14] The resulting "pool fire" would spread as the LNG pool expanded away from its source and continued evaporating. A pool fire is intense, burning far more hotly and rapidly than oil or gasoline fires.[15] It cannot be extinguished—all the LNG must be consumed before it goes out. Because an LNG pool fire is so hot, its thermal radiation may injure people and damage property a considerable distance from the fire itself. Many experts agree that a large pool fire, especially on water, is the most serious LNG hazard.[16]

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 ignite all at once, but the fire could still cause considerable damage.[17] 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.[18]

Other Safety Hazards

LNG spilled on water could (theoretically) regasify almost instantly in a "flameless explosion," although an Idaho National Engineering Laboratory report concluded that "transitions caused by mixing of LNG and water are not violent."[19] LNG vapor clouds are not toxic, but they could cause asphyxiation by displacing breathable air.[20] Such clouds may begin near the ground (or water) when they are still very cold, but rise in air as they warm, diminishing the threat to people. Due to its extremely low temperature, LNG could injure people or damage equipment through

[14] Methane, the main component of LNG, burns in gas-to-air ratios between 5% and 15%.

[15] Havens, J. "Ready to Blow?" *Bulletin of the Atomic Scientists*. July/August 2003. p. 17.

[16] Havens. 2003. p. 17.

[17] West, H.H. and Mannan, M.S. "LNG Safety Practices and Regulations." Prepared for the American Institute of Chemical Engineering Conference on Natural Gas Utilization and LNG Transportation. Houston, TX. April 2001. p. 2.

[18] Quillen, D. ChevronTexaco Corp. "LNG Safety Myths and Legends." Presentation to the Natural Gas Technology Conference. Houston, TX. May 14-15, 2002. p. 18.

[19] Siu, Nathan, et al. *Qualitative Risk Assessment for an LNG Refueling Station and Review of Relevant Safety Issues*. Idaho National Engineering Laboratory. INEEL/EXT-97-00827 rev2. Idaho Falls, ID. February 1998. p. 71.

[20] Siu. 1998. p. 62.

direct contact.[21] Such contact would likely be limited, however, as a major spill would likely result in a more serious fire. The environmental damage associated with an LNG spill would be confined to fire and freezing impacts near the spill since LNG dissipates completely and leaves no residue.[22]

Terrorism Hazards

LNG tankers and land-based facilities could be vulnerable to terrorism. Tankers might be physically attacked in a variety of ways to release their cargo—or commandeered for use as weapons against coastal targets. LNG terminal facilities might also be physically attacked with explosives or through other means. Some LNG facilities may also be indirectly disrupted by "cyber-attacks" or attacks on regional electricity grids and communications networks which could in turn affect dependent LNG control and safety systems.[23] The potential attractiveness of LNG infrastructure to terrorists as a target is discussed later in this report.

Safety Record of LNG

The LNG tanker industry claims a record of relative safety over the last 50 years; since international LNG shipping began in 1959, tankers have carried over 45,000 LNG cargoes and traveled over 128 million miles without a serious accident at sea or in port.[24] LNG tankers have experienced groundings and collisions during this period, but none has resulted in a major spill.[25] The LNG marine safety record is partly due to the double-hulled design of LNG tankers. This design makes them more robust and less prone to accidental spills than old single-hulled oil and fuel tankers like the *Exxon Valdez*, which caused a major Alaskan oil spill after grounding in 1989.[26] LNG tankers also carry radar, global positioning systems, automatic distress systems and beacons to signal if they are in trouble. Cargo safety systems include instruments that can shut operations if they deviate from normal as well as gas and fire detection systems.[27]

The safety record of onshore LNG terminals is more mixed. There are more than 40 LNG terminals (and more than 150 other LNG storage facilities) worldwide. Since 1944, there have been approximately 13 serious accidents at these facilities directly related to LNG. Two of these accidents caused single fatalities of facility workers—one in Algeria in 1977, and another at Cove Point, Maryland, in 1979. On January 19, 2004, a fire at the LNG processing facility in Skikda, Algeria killed an estimated 27 workers, injured 74 others, destroyed a processing plant, and

[21] Siu. 1998. p. 63.

[22] Quillen. 2002. p. 28.

[23] Skolnik, Sam. "Local Sites Potential Targets for Cyberterror." *Seattle Post-Intelligencer*. Seattle, WA. September 2, 2002.

[24] Center for LNG. "LNG Carrier Safety: A Long Record of Safe Operation." Internet page., December 14, 2009. http://www.lngfacts.org/About-LNG/Carrier-Safety.asp; Groupe International des Importateurs de Gaz Naturel Liquéfié, "LNG Ships," Paris, France, 2009, p. 1, http://www.giignl.org/fileadmin/user_upload/pdf/LNG_Safety/3%20-%20LNG%20Ships%208.28.09%20Final%20HQ.pdf.

[25] Foss, 2007; CH-IV International. *Safety History of International LNG Operations*. TD-02109. Millersville, MD. December. pp. 13-18.

[26] Society of International Gas Tanker & Terminal Operators Ltd. (SIGTTO). "Safe Havens for Disabled Gas Carriers." Third Edition. London. February 2003. pp. 1-2.

[27] Petroplus International, N.V. "Energy for Wales: LNG Frequently Asked Questions." Internet home page. Amsterdam, Netherlands. August 4, 2003.

damaged a marine berth. (It did not, however, damage a second processing plant or three large LNG storage tanks also located at the terminal, nor did the accident injure the rest of the 12,000 workers at the complex.) [28] It was considered the worst petrochemical plant fire in Algeria in over 40 years.[29] According to press reports, the accident resulted from poor maintenance rather than a facility design flaw.[30] Another three accidents at worldwide LNG plants since 1944 have also caused fatalities, but these were construction or maintenance accidents in which LNG was not present.

LNG Hazard Models

Since the terror attacks of September 11, 2001, a number of technical studies have been commissioned to reevaluate the safety hazards of LNG terminals and associated shipping. The most widely cited of these studies are listed in **Table 1.** These studies have caused controversy because some reach differing conclusions about the potential public hazard of LNG terminal accidents or terror attacks. Consequently, some fear that LNG hazards may be misrepresented by government agencies, or that certain LNG hazards may simply not be understood well enough to support a terminal siting approval.[31]

Hazard analyses for LNG terminals and shipping depend heavily upon computer models to approximate the effects of hypothetical accidents. Federal siting standards specifically require computer modeling of thermal radiation and flammable vapor cloud exclusion zones (49 C.F.R. §§ 193.2057, 2059).[32] Such models are necessary because there have been no major LNG incidents of the type envisioned in LNG safety research and because historical LNG experiments have been limited in scale and scope. But LNG hazards models simulate complex physical phenomena and are inherently uncertain, relying on calculations and input assumptions about which fair-minded analysts may legitimately disagree. Even small differences in an LNG hazard model have led to significantly different conclusions. Referring to previous LNG safety zone studies, for example, FERC noted in 2003 that "distances have been estimated to range from 1,400 feet to more than 4,000 feet for [hazardous] thermal radiation."[33]

[28] Junnola, J., et al. January 21, 2004. p. 6.

[29] Hunter, C. "Algerian LNG Plant Explosion Sets Back Industry Development." *World Markets Analysis*. January 21, 2004. p. 1.

[30] Antosh, N. "Vast Site Devastated." *Houston Chronicle*. January 21, 2004. p. B1.

[31] See, for example: Jerry Havens, *Comments Submitted by Jerry Havens on Sparrows Point Final Environmental Impact Statement*, Federal Energy Regulatory Commission, Docket CP07-62-000, January 12, 2009.

[32] Gas Research Institute (GRI). "LNGFIRE: A Thermal Radiation Model for LNG Fires" Version 3. GRI-89/0176. Washington, DC. June 29, 1990; "LNG Vapor Dispersion Prediction with the DEGADIS: Dense Gas Dispersion Model." GRI-89/00242; "Evaluation of Mitigation Methods for Accidental LNG Releases. Vol. 5: Using FEM3A for LNG Accident Consequence Analyses." GRI 96/0396.5. Washington, DC.

[33] FERC. November 2003. p. 4-133.

Table 1. Recent LNG Hazard Studies

Author	Sponsor	Subject
Lloyd's Register of Shipping[a]	Distrigas (Tractebel)	Focused models of possible terror attacks on LNG ships serving Everett
Quest Consultants Inc.[b]	DOE (lead), FERC, DOT	Models catastrophic breach of an LNG ship tank
James Fay (MIT)[c]	Fair Play for Harpswell	Models fire and vapor hazards of proposed Harpswell LNG terminal
Tobin & Associates[d]	City of Vallejo	Reviews general safety of proposed Mare Island LNG terminal
Lehr and Simecek-Beatty[e]	NOAA staff	Compares hypothetical LNG and fuel oil fires on water
Det Norske Veritas[f]	LNG Industry Companies	Models LNG maximum credible failures
ABSG Consulting[g]	FERC (lead), DOT, USCG	Reviews consequence assessment methods for LNG tanker incidents
Sandia National Laboratories[h]	DOE	Two reports examine effect of large-scale LNG spills on water (additional studies underway)

Source: Congressional Research Service.

a. Waryas, Edward. Lloyd's Register Americas, Inc. "Major Disaster Planning: Understanding and Managing Your Risk." Fourth National Harbor Safety Committee Conference. Galveston, TX. March 4, 2002. Summary excerpts are in this presentation.

b. Juckett, Don. U.S. Department of Energy (DOE). "Properties of LNG." LNG Workshop. Solomons, MD. February 12, 2002. A Quest study summary is in this presentation.

c. Fay, James A. "Public Safety Issues at the Proposed Harpswell LNG Terminal." FairPlay for Harpswell. Harpswell, ME. November 5, 2003.

d. Tobin & Assoc. "Liquefied Natural Gas in Vallejo: Heath and Safety Issues." Report by the LNG Safety Committee of the Disaster Council, Vallejo, CA. January 16, 2003.

e. Lehr, W. and Simecek-Beatty, D. "Comparison of Hypothetical LNG and Fuel Oil Fires on Water." *Journal of Hazardous Materials*. v. 107. 2004. pp. 3-9.

f. Pitblado, R.M., J. Baik, G. J. Hughes, C. Ferro, and S. J. Shaw., Det Norske Veritas. "Consequences of LNG Marine Incidents." Presented at the Center for Chemical Process Safety (CCPS) Conference. Orlando, FL. June 29-July 1, 2004. Available at http://www.dnv.com/press/dnvcompletesstudyonlngmarinereleases.asp.

g. ABSG Consulting. *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*. GEMS 1288209. Prepared for the Federal Energy Regulatory Commission under contract FERC04C40196. May 13, 2004.

h. Sandia National Laboratories (SNL). Breach and Safety Analysis of Spills Over Water from Large Liquefied Natural Gas Carriers. SAND2008-3153. Albuquerque, NM. May 2008; Sandia National Laboratories (SNL). Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water. SAND2004-6258. Albuquerque, NM. December 2004.

The LNG hazard studies in **Table 1** have been sponsored by a range of stakeholders and have been performed by individuals with various kinds of expertise. It is beyond the scope of this report to make detailed comparisons of the methodologies and findings of these studies and FERC analysis. Furthermore, each of the available studies (or its application) appears to have significant limitations, or has been questioned by critics. For example, the ABSG Consulting study released by FERC in May 2004, which reviewed existing LNG hazard models, concluded that

- No release models are available that take into account the true structure of an LNG carrier;
- No pool spread models are available that account for wave action or currents; and
- Relatively few experimental data are available for validation of models involving LNG spills on water, and there are no data available for spills as large as the spills considered in this study.[34]

The 2004 Sandia National Laboratories study similarly reported that "there are limitations in existing data and current modeling capabilities for analyzing LNG spills over water."[35] Nonetheless, the Sandia report concluded that "existing [analytic] tools ... can be used to identify and mitigate hazards to protect both public safety and property."[36]

Uncertainty related to LNG hazard modeling continues. A December 2006 study using yet another LNG computer model of a large LNG fire states that "current generation models that are being used to calculate the radiant heat ... from the fire are found to be overly conservative."[37] In February 2007, the Government Accountability Office (GAO) issued a report comparing six recent unclassified studies (including studies in **Table 1**) of the consequences of LNG spills. The GAO report concluded that[38]

> Because there have been no large-scale LNG spills or spill experiments, past studies have developed modeling assumptions based on small-scale spill data. While there is general agreement on the types of effects from an LNG spill, the results of these models have created what appears to be conflicting assessments of the specific consequences of an LNG spill, creating uncertainty for regulators and the public.

Following the GAO report, Members of Congress expressed renewed concern about the uncertainty associated with LNG hazard analysis.[39]

Hazards vs. Risks

In reviewing the various LNG hazard studies, it is important to be clear about the distinction between *hazards* and *risks*. Although theoretical models may try to quantify the effects of "worst-case" hazards, evaluating the risks associated with those hazards requires an estimate of the probability that they will occur. Some argue that a significant *hazard* that is nonetheless highly unlikely does not represent an unacceptable *risk* to the public. In this view, worst-case hazard studies alone do not provide a sufficient basis for evaluating public safety. Unfortunately, few LNG safety studies comprehensively and convincingly address the probability of catastrophic

[34] ABSG Consulting. May 13, 2004. p. iii.

[35] SNL. December 2004. p. 14.

[36] SNL. December 2004. p. 14.

[37] Raj, P.K. *Spectrum of Fires in an LNG Facility: Assessments, Models and Consideration in Evaluations*. Prepared for the U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Admin. by Technology & Management Systems, Inc. Burlington, MA. December 5, 2006. p. E-4.

[38] Government Accountability Office (GAO). *Maritime Security: Public Safety Consequences of a Terrorist Attack on a Tanker Carrying Liquefied Natural Gas Need Clarification*. GAO-07-316. February 2007. p. 22.

[39] See, for example Senator Barbara A. Mikulski, testimony before the House Transportation and Infrastructure Committee, Coast Guard and Maritime Transportation Subcommittee field hearing on the Safety and Security of Liquefied Natural Gas and the Impact on Port Operations. Baltimore, MD. April 23, 2007.

accidents or attacks actually occurring.[40] In part, this shortcoming arises from a lack of historical LNG incidents and detailed terrorist threat information on which to base such probabilities. Faced with this analytic uncertainty, decision makers are forced to draw the best information they can get and rely upon their own best judgment to reach conclusions about LNG safety.

LNG Terminal Safety in Perspective

Other Hazardous Materials

LNG terminals and tankers have a high profile because of extensive media coverage, although there are few of them relative to all the hazardous chemical plants and ships currently operating near U.S. cities. According to the U.S. Environmental Protection Agency (EPA), for example, more than 500 toxic chemical facilities operate in "urban" areas at which worst-case accidents could affect 100,000 or more people.[41] These include chlorine plants in city water systems and ammonia tanks in agricultural fertilizer production. There are also oil refineries and liquefied petroleum gas (e.g., propane, butane) terminals operating in U.S. ports that pose safety hazards similar to those of LNG. Based on the most recent data available from the U.S. Office of Hazardous Materials Safety, there are over 100,000 annual U.S. shipments of hazardous marine cargo such as ammonia, crude oil, liquefied petroleum gases, and other volatile chemicals.[42] Many of these cargoes pose a hazard similar to LNG and pass through the same harbors serving existing or proposed LNG terminals.

Civil and Criminal Liability

One reason LNG tanker and terminal operators seek to ensure public safety is to avoid civil and criminal liability from an LNG accident; there are no special provisions in U.S. law protecting the fossil fuel industry from such liability. As a result of the 1989 *Exxon Valdez* oil spill, for example, Exxon has been required to pay over $500 million in criminal and civil settlements.[43] In January 2003, the Justice Department announced over $100 million in civil and criminal penalties against Olympic Pipeline and Shell Pipeline resolving claims from a fatal pipeline fire in Bellingham, Washington in 1999.[44] In March 2003, emphasizing the environmental aspects of homeland security, the U.S. Attorney General reportedly announced a crackdown on companies failing to protect against possible terrorist attacks on storage tanks, transportation networks, industrial plants, and pipelines.[45] In 2002, federal safety regulators proposed a $220,000 fine against the

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[40] One attempt at such a study is: Clarke, R.A., et al. *LNG Facilities in Urban Areas.* Good Harbor Consulting, LLC. Prepared for the Rhode Island Office of Attorney General. GHC-RI-0505A. May 2005.

[41] Based on facilities submitting Risk Management Plans required under Section 112 of the Clean Air Act (42 U.S.C. § 7412) and classified in the December 1, 2003, update of the EPA National Database using EPA's software RMP*Review (v2.1). EPA states that an entire population is highly unlikely to be affected by any single chemical release, even in the worst case. In an actual release, effects on a population would depend on wind direction and many other factors. In addition, these worst-case scenarios do not account for emergency response measures facility operators or others might take to mitigate harm.

[42] Office of Hazardous Materials Safety, Department of Transportation. *Hazardous Materials Shipments*. Washington, DC. October 1998. Table 2. p. 2.

[43] Exxon Shipping Co. et al. v. Baker et al. 554 U.S. (2008) (Supreme Court of the United States of America). June 25, 2008. p. 4.

[44] *Energy Daily*. "Shell, Olympic Socked for Pipeline Accident." January 22, 2003.

[45] Heilprin, John. "Ashcroft Promises Increased Enforcement of Environmental Laws for Homeland Security." (continued...)

Distrigas LNG terminal in Everett, Massachusetts, reportedly for security training violations.[46] Notwithstanding these actions, some observers are skeptical that government scrutiny will ensure LNG infrastructure safety.

Even if no federal or state regulations are violated, LNG companies could still face civil liability for personal injury or wrongful death in the event of an accident. In the Bellingham case, the pipeline owner and associated defendants reportedly agreed to pay a $75 million settlement to the families of two children killed in the accident.[47] In 2002, El Paso Corporation settled wrongful death and personal injury lawsuits stemming from a natural gas pipeline explosion near Carlsbad, New Mexico, which killed 12 campers.[48] Although the terms of those settlements were not disclosed, two additional lawsuits sought a total of $171 million in damages. The impact of these lawsuits on the company's business is unclear, however; El Paso's June 2003 quarterly financial report stated that "our costs and legal exposure ... will be fully covered by insurance."[49]

Regulation of Onshore LNG Siting

The Department of Transportation (DOT) and FERC are the federal agencies primarily responsible for the regulation of onshore LNG facilities. Although federal statutes do not explicitly designate the relative jurisdiction of DOT and FERC, the agencies have clarified their roles through interagency agreement. These roles and their relation to other authorities are summarized below.

Department of Transportation

The DOT sets safety standards for onshore LNG facilities. The DOT's authority originally stemmed from the Natural Gas Pipeline Safety Act of 1968 (P.L. 90-481) and the Hazardous Liquids Pipeline Safety Act of 1979 (P.L. 96-129). These acts were subsequently combined and recodified as the Pipeline Safety Act of 1994 (P.L. 102-508). The acts were further amended by the Pipeline Safety Improvement Act of 2002 (P.L. 107-355) and the Pipeline Safety Improvement Act of 2006 (P.L. 109-468). Under the resulting statutory scheme, DOT is charged with issuing minimum safety standards for the siting, design, construction, and operation of LNG facilities. It does not approve or deny specific siting proposals, because that authority is vested with FERC, as discussed below.

The Pipeline Safety Act, as amended, includes the following provisions concerning LNG facility siting (49 U.S.C. § 60103):

(...continued)

Associated Press. *Washington Dateline*. Washington, DC. March 11, 2003.

[46] "Massachusetts LNG Company Faces RSPA Fines for Security Violations." Bulk Transporter. June 28, 2002; Pipeline and Hazardous Materials Safety Admin. "Summary of Enforcement Actions: Distrigas of Massachusetts Corp." Web page. May 8, 2008. http://primis.phmsa.dot.gov/comm/reports/enforce/Actions_opid_3411.html#_TP_1_tab_1

[47] Business Editors. "Olympic Pipe Line, Others Pay Out Record $75 Million in Pipeline Explosion Wrongful Death Settlement." *Business Wire.* April 10, 2002.

[48] National Transportation Safety Board (NTSB). *Pipeline Accident Report* PAR-03-01. February 11, 2003.

[49] El Paso Corp. *Quarterly Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934.* Form 10-Q. For the period ending June 30, 2002. Houston, TX.

> The Secretary of Transportation shall prescribe minimum safety standards for deciding on the location of a new liquefied natural gas pipeline facility. In prescribing a standard, the Secretary shall consider the—
>
> (1) kind and use of the facility;
>
> (2) existing and projected population and demographic characteristics of the location;
>
> (3) existing and proposed land use near the location;
>
> (4) natural physical aspects of the location;
>
> (5) medical, law enforcement, and fire prevention capabilities near the location that can cope with a risk caused by the facility; and
>
> (6) need to encourage remote siting.

General safety-related regulations may also impact siting decisions and affect the operation of existing facilities. The Secretary is authorized to order corrective action if operating an LNG facility could be hazardous to life, property, or the environment (49 U.S.C. §§ 60112, 60117). DOT's implementing regulations for the Pipeline Safety Act, as amended, are in 49 C.F.R.§§ 190-199. Safety standards, including those on siting, for LNG facilities are in 49 C.F.R. § 193 and are overseen by the Department's Office of Pipeline Safety (OPS) within the Pipeline and Hazardous Materials Safety Administration (PHMSA).

The siting provisions in 49 C.F.R. § 193 incorporate by reference standard 59A from the National Fire Protection Association (NFPA).[50] NFPA 59A requires thermal exclusion zones and flammable vapor-gas dispersion zones around LNG terminals (§§ 193.2057, 193.2059). The DOT regulations also adopt many of NFPA's design and construction guidelines including requirements for LNG facilities to withstand fire, wind, hydraulic forces, and erosion from LNG spills (§§ 193.2067, 193.2155, 193.2301). Other provisions address operations (§§ 193.2501-2521), maintenance (§§ 193.2601-2639), employee qualification (§§ 193.2701-2719), and security (§§ 193.2901-2917).

Federal Energy Regulatory Commission (FERC)

Under the Natural Gas Act of 1938 (NGA), FERC grants federal approval for the siting of new onshore LNG facilities.[51] Section 7 of the NGA authorizes FERC to issue certificates of "public convenience and necessity" for "the construction or extension of any facilities ... for the transportation in interstate commerce of natural gas" (15 U.S.C. § 717f). Section 7 does not expressly mention LNG facilities, however, so recent agency policy has FERC exercising LNG siting regulation under its Section 3 authority, which authorizes FERC to approve the import and

[50] National Fire Protection Association (NFPA). *Standard for the Production, Storage, and Handling of Liquefied Natural Gas*, 2001 Edition. NFPA 59A. Quincy, MA. 2001.

[51] Natural Gas Act (NGA) of June 21, 1938, ch. 556, 52 Stat. 812 (codified as amended at 15 U.S.C. §§ 717 et seq.); the Department of Energy Organization Act of 1977 (P.L. 95-91) transferred to the NGA authority to approve siting, construction and operation of onshore LNG facilities to the Secretary of Energy (§ 301b). The Secretary, in turn, delegated this authority to FERC.

export of natural gas (15 U.S.C. § 717b).[52] Specifically, FERC asserts approval authority over the place of entry and exit, siting, construction, and operation of new LNG terminals as well as modifications or extensions of existing LNG terminals.[53]

The Energy Policy Act of 2005 (P.L. 109-58) amends Section 3 of the NGA to give FERC explicit and "exclusive" authority to approve onshore LNG terminal siting applications (§ 311c). The 2005 act requires FERC to promulgate regulations for pre-filing of LNG import terminal siting applications and directs FERC to consult with designated state agencies regarding safety in considering such applications. It permits states to conduct safety inspections of LNG terminals in conformance with federal regulations, although it retains enforcement authority at the federal level. The 2005 act also requires LNG terminal operators to develop emergency response plans, including cost-sharing plans to reimburse state and local governments for safety and security expenditures (§ 311(d)). The 2005 act designates FERC as the "lead agency for the purposes of coordinating all applicable Federal authorizations" and for complying with federal environmental requirements, discussed below (§ 313a). It also establishes FERC's authority to set schedules for federal authorizations and establishes provisions for judicial review of FERC's siting decisions in the U.S. Court of Appeals, among other administrative provisions (§ 313(b)).

FERC implements its authority over onshore LNG terminals through the agency's regulations at 18 C.F.R. § 153. These regulations detail the application process and requirements under Section 3 of the NGA. The process begins with a pre-filing, which must be submitted to FERC at least six months prior to the filing of a formal application. The pre-filing procedures and review processes are set forth at 18 C.F.R. § 157.21. Once the pre-filing stage is completed, a formal application may be filed. FERC's formal application requirements include detailed site engineering and design information, evidence that a facility will safely receive or deliver LNG, and delineation of a facility's proposed location (18 C.F.R. § 153.8). Additional data are required if an LNG facility will be in an area with geological risk (18 C.F.R. § 153.8). The regulations also require LNG facility builders to notify landowners who would be affected by the proposed facility (18 C.F.R. § 157.6d). Facilities to be constructed at the Canadian or Mexican borders for import or export of natural gas also require a Presidential Permit.[54] According to FERC officials, applications under their Section 3-based regulations are also sufficient for Presidential Permit purposes (18 C.F.R. §§ 153.15-153.17).[55]

Under the National Environmental Policy Act of 1969 (P.L. 91-190), FERC must prepare an environmental impact statement during its review of an LNG terminal siting application (18 C.F.R. § 380.6). Applicants must prepare certain environmental reports to aid FERC in its preparation of the environmental impact statement (18 C.F.R. § 380.3(c)(2)(i)). These reports require analysis of, among other things, the socioeconomic impact of the LNG facility, geophysical characteristics of the site, safeguards against seismic risk, facility effects on air and

[52] In 1997, FERC reaffirmed its Section 3 authority despite changes to the Natural Gas Act in the Energy Policy Act of 1992 (P.L. 102-486). For details *see* 97 FERC ¶ 61,231 (2001). Also note that FERC's regulatory power regarding LNG importation under section 3 has been held to allow FERC to impose requirements equivalent to any in section 7, so long as FERC finds them necessary or appropriate to the public interest. Distrigas Corp. v. FPC, 495 F.2d 1057, 1066 (D.C. Cir. 1974).

[53] *See* 18 C.F.R. § 153; *see also* Foley, R., Federal Energy Regulatory Commission (FERC), Office of Energy Projects. "Liquefied Natural Gas Imports." Slide presentation. January 2003. p. 10.

[54] Executive Order No. 10,485 requires that FERC obtain a favorable recommendation from the Secretaries of State and Defense prior to issuing a Presidential Permit.

[55] FERC Office of Energy Projects, Personal communication, December 10, 2003.

noise quality, public safety issues in the event of accidents or malfunctions, and facility compliance with reliability standards and relevant safety standards (18 C.F.R. § 380.12). Once these environmental reports are received, the EPA may become involved in the approval process. The EPA often assists in the review of the environmental reports and the issuance of the environmental impact statements.[56]

In an effort to speed the review process for natural gas infrastructure projects (including LNG projects), FERC has approved rules to expand eligibility for "blanket certificates." Blanket certificates are granted by FERC to companies that have previously been granted certificates for construction for public convenience and necessity under Section 7 of the NGA. A company that possesses a blanket certificate may improve or upgrade existing facilities or construct certain new facilities without further case-by-case authorization from FERC. Regulations governing acceptable actions under blanket certificate authority can be found at 18 C.F.R. §§ 157.201-157.218.

FERC also has created a Liquefied Natural Gas Compliance Branch to monitor the safety of operational LNG facilities on an ongoing basis.[57] This branch is responsible for the continued safety inspections and oversight of operating LNG facilities, and it reviews final facility design and engineering compliance with FERC orders. The staff comprises LNG engineers, civil and mechanical engineers, and other experts. The branch coordinates FERC's LNG Engineering Branch, the U.S. Coast Guard (USCG), and DOT to address safety and security at LNG facilities.[58]

FERC-DOT Jurisdictional Issues

Jurisdiction between the two federal agencies with LNG oversight responsibilities historically has been a point of contention.[59] In practice, FERC requires compliance with DOT's siting and safety regulations as a starting point, but can regulate more strictly if it chooses. This working arrangement is not explicitly established under the relevant federal law. Neither do the statutes and regulations clearly define the roles of the agencies vis-a-vis one another. The Pipeline Safety Act, for example, states:

> In a proceeding under section 3 or 7 of the Natural Gas Act (15 U.S.C. § 717b or 717f), each applicant ... shall certify that it will design, install, inspect, test, construct, operate, replace, and maintain a gas pipeline facility under ... section 60108 of this title. The certification is binding on the Secretary of Energy and the Commission... (49 U.S.C. § 60104(d)(2)).[60]

Despite this provision, which might appear to give DOT full control of gas safety regulation (including LNG siting authority), the authors of the House committee report for the revised Pipeline Safety Act indicated their intention to preserve FERC jurisdiction over LNG.[61]

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[56] In July of 2006 EPA issued a "Liquefied Natural Gas Regulatory Roadmap" in an effort to assist LNG project applicants (both onshore and offshore) in dealing with environmental regulatory requirements. http://www.epa.gov/opei/lng/lngroadmap.pdf

[57] Press Release, Federal Energy Regulatory Commission, "Commission Establishes LNG Compliance Branch," May 2, 2006.

[58] *Id.*

[59] S.Rept. No. 96-182. 1979. p. 4.

[60] 49 U.S.C. § 61018 specifies DOT's requirements for pipeline facility inspection and maintenance.

[61] *See* H.Rept. No. 1390, 1968, *reprinted in* 1968 U.S.C.C.A.N. 3223, 3251. Note, FERC was known as the Federal (continued...)

Accordingly, FERC has held that the Pipeline Safety Act does not remove its jurisdiction under the NGA to regulate LNG safety.[62] In 1985, FERC and DOT executed a Memorandum of Understanding expressly acknowledging "DOT's exclusive authority to promulgate Federal safety standards for LNG facilities" but recognizing FERC's ability to issue more stringent safety requirements for LNG facilities when warranted. This agreement appears to have resolved any jurisdictional conflict between the agencies at that time.[63] In February 2004, FERC streamlined the LNG siting approval process through an agreement with the USCG and DOT to coordinate review of LNG terminal safety and security. The agreement "stipulates that the agencies identify issues early and quickly resolve them."[64]

U.S. Coast Guard

The USCG has authority to review, approve, and verify plans for marine traffic around proposed onshore LNG marine terminals as part of the overall siting approval process led by FERC. The USCG is responsible for issuing a Letter of Recommendation regarding the suitability of waterways for LNG vessels serving proposed terminals. The agency is also responsible for ensuring that full consideration is given in siting application reviews to the safety and security of the port, the LNG terminal, and the vessels transporting LNG. The USCG acts as a cooperating agency in the evaluation of LNG terminal siting applications. The Coast Guard provides guidance to applicants seeking permits for onshore LNG terminals in "Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas Marine Traffic" (NVIC 05-05) issued on June 14, 2005.[65] Provisions in the Coast Guard Authorization Act of 2010 (H.R. 3619) would require additional waterway suitability notification requirements in LNG siting reviews by FERC (Sec. 1117).

National Fire Protection Association (NFPA)

As noted above, LNG terminal safety regulations incorporate standards set by the 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."[66] The NFPA LNG Standards Committee includes volunteer experts with diverse representation from industry and government, including FERC, DOT, USCG, and state agencies. The NFPA standards for LNG safety were initially adopted in 1967, with 10 subsequent revisions, most recently in 2009.[67] According to the Society of International Gas Tanker and Terminal Operators (SIGTTO),

(...continued)

Power Commission (FPC) at the time.

[62] Chatanooga Gas Co., 51 FPC 1278, 1279 (1974).

[63] See "Notice of Agreement Regarding Liquefied Natural Gas," 31 FERC ¶ 61,232 (1985).

[64] Federal Energy Regulatory Commission (FERC). Press release R-04-3. February 11, 2004.

[65] Available at http://www.uscg.mil/hq/g-m/nvic/NVIC%2005-05.doc.pdf.

[66] National Fire Protection Assoc. (NFPA). *About NFPA.* Web page. Quincy, MA. 2009.

[67] National Fire Protection Association (NFPA). *Standard for the Production, Storage, and Handling of Liquefied Natural Gas*, 2009 Edition. NFPA 59A. Quincy, MA. 2009.

although the NFPA standards originated in the United States, they were the first internationally recognized LNG standards and are widely used throughout the world today.[68]

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. Under the Pipeline Safety Act, a state also may regulate *intra*state pipeline facilities if the state submits a certification under section 60105(a) or makes an agreement with the DOT under section 60106. Under these provisions, a state "may adopt additional or more stringent safety standards" for LNG facilities so long as they are compatible with DOT regulations (49 U.S.C. 60104(c)). Of course, if a particular LNG facility would otherwise not fall under FERC and DOT jurisdiction, states may regulate without going through the certification or agreement process. Regulation of *inter*state facilities remains the primary responsibility of federal agencies. The Office of Pipeline Safety may, however, delegate authority to *intra*state pipeline safety offices, allowing state offices to act as "agents" administering *inter*state pipeline safety programs (excluding enforcement) for those sections of *inter*state facilities within their boundaries.[69] All 50 states, the District of Columbia, and Puerto Rico are participants in the natural gas pipeline safety program.

State regulation of LNG facility safety and siting runs the gamut from piecemeal to comprehensive. For example, Arizona sets out specific requirements for LNG storage facilities, including "peak shaving" plants used by regional gas utilities, consistent with DOT regulations for construction maintenance and safety standards (Ariz. Admin. Code R14-5-202, R14-5-203, 126-01-001). Colorado and Georgia have comprehensive administrative systems for enforcing the federal standards (see 4 Co. Admin. Code 723-11; Ga. Admin. Code 515-9-3-03).

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 impact the planning and development of LNG facilities. This is discussed in more detail later in this report.

Federal-State Jurisdictional Conflicts

Federal and state government agencies have had jurisdictional disagreements specifically related to the siting of new LNG terminals. In February 2004, for example, the California Public Utilities Commission (CPUC) disputed FERC's jurisdiction over the siting of a proposed LNG terminal at Long Beach because, in the CPUC's opinion, the terminal would not be involved in interstate sales or transportation and therefore would not come under the Natural Gas Act.[70] In March 2004, FERC rejected the CPUC's arguments and asserted exclusive regulatory authority for all LNG import terminal siting and construction.[71] In April 2004, the CPUC voted to assert jurisdiction

[68] Society of International Gas Tanker and Terminal Operators (SIGTTO). Personal communication. London, England. December 19, 2003.

[69] 49 U.S.C. § 601. States may recover up to 50% of their costs for these programs from the federal government.

[70] FERC. "Notice of Intervention and Protest of the Public Utilities Commission of the State of California." Docket No. CP04-58-000. February 23, 2004. p. 6.

[71] Lorenzetti, M. "LNG Rules." *Oil & Gas Journal*. April 5, 2004. p. 32.

over the Long Beach terminal and filed a request for FERC to reconsider its March ruling.[72] In June 2004, FERC reasserted its March ruling, prompting a federal court appeal by California regulators. The Energy Policy Act of 2005 effectively codified FERC's jurisdictional rulings, however, leading the CPUC to drop its lawsuit challenging FERC's LNG siting authority in September 2005. Notwithstanding the CPUC case, other state challenges to FERC jurisdiction remain a possibility.

Key Policy Issues

Proposals for new LNG terminal facilities have generated considerable public concern in many communities. Some community groups and government officials fear that LNG terminals may expose nearby residents to unacceptable hazards, and that these hazards may not be appropriately considered in the federal siting approval process. Ongoing public concern about LNG terminal safety has focused congressional attention on the exclusivity of FERC's LNG siting authority, proposals for a regional LNG siting process, the lack of "remote" siting requirements in FERC regulations, state permitting requirements under the Clean Water Act (CWA) and the Coastal Zone Management Act (CZMA), terrorism attractiveness of LNG, the adequacy of Coast Guard security resources, and other issues.

"Exclusive" Federal Siting Authority

As stated earlier in this report, the Energy Policy Act of 2005 (P.L. 109-58) gives FERC the "exclusive" authority to approve onshore LNG terminal siting applications (§ 311(c)). Supporters of this provision argue that it is necessary to prevent federal-state jurisdictional disputes over LNG siting authority, and that it reduces the possibility that state agencies might prevent or unduly delay the development of LNG infrastructure considered essential to the nation's energy supply. They further argue that states retain considerable influence over LNG siting approval through their federally delegated permitting authorities under the Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.), the Clean Air Act (42 U.S.C. 7401 et seq.), and the Federal Water Pollution Control Act (33 U.S.C. 251 et seq.). They maintain that states have a role in siting reviews under provisions in P.L. 109-58 requiring FERC to consult with governor-designated state agencies regarding state and local safety considerations prior to issuing LNG terminal permits (§ 311(d)).

A number of lawmakers at the federal and state levels have suggested that Congress should consider amending or repealing FERC's exclusive authority under P.L. 109-58. Critics of this authority argue that it vests too much power in the federal government at the expense of state agencies, which may have a better understanding of local siting issues and may bear most of the risks or burdens associated with a new LNG facility. They do not believe that FERC adequately seeks state input in its LNG siting reviews, nor adequately addresses state concerns in its siting decisions.[73] Critics question why governors lack the authority to veto onshore LNG terminal proposals as they can offshore terminal proposals under the Deepwater Port Act (33 U.S.C. § 1503(c)(8)). Some in Congress have proposed granting governors similar veto authority over

[72] *Gas Daily*. "PUC Seeks Rehearing of FERC's Order on Long Beach LNG Project." April 27, 2004. p. 7.

[73] O'Neill, L. "Senators Drum Up Measure Giving States Authority Over LNG Siting." *Natural Gas Week*. April 14, 2008.

onshore LNG terminal proposals, or other legislation to increase state authority in terminal siting reviews. Several legislative proposals in the 110th Congress would have required state concurrence of federal siting approval decisions for onshore LNG terminals or would have repealed provisions in the Energy Policy Act of 2005 granting FERC exclusive authority to approve LNG terminal siting applications.[74]

Regional Siting Approach

In areas such as the Northeast, where a number of onshore LNG terminal proposals have been particularly controversial, some policy makers have sought to establish a regional approach for identifying suitable sites for such terminals. They argue that FERC's consideration of LNG terminals on a proposal-by-proposal basis does not adequately take into account the regional needs for LNG, public safety concerns, and environmental impacts.[75] They also argue that the proposal-by-proposal approach does not adequately account for the relative merits of multiple LNG and natural gas pipeline facilities proposed in the same region.[76] They assert a regional LNG siting process would be more efficient than FERC's current process because it would focus attention on sites and projects with the highest chances of success rather than having numerous communities and state and local agencies react to individual plans, many of which are unlikely to be approved.[77] One legislative proposal in the 110th Congress would have established a national commission for the placement of natural gas infrastructure, such as LNG terminals, taking regional energy and environmental considerations into account.[78]

FERC officials reportedly have stated in the past that while they are not opposed to regional siting in principle, the commission cannot adopt such a regional approach because it has no land-use authority or responsibility and must let the energy market determine which terminals ultimately are constructed.[79] FERC officials also have reportedly expressed skepticism about the effectiveness of regional siting processes, for example, in finding storage locations for low-level radioactive waste.[80] More recently, however, the acting chairman of FERC reportedly called for more assessment of alternatives to LNG terminals in LNG siting decisions "including full examination of regional gas infrastructure."[81] Whether this statement indicates a future shift in FERC's approach towards LNG siting reviews remains to be determined. As oversight of federal LNG siting activities continues in the 111th Congress, legislators may be asked to consider whether incorporating regional approaches in the LNG siting process could alleviate state concerns about FERC's current process while supporting the nation's needs for new LNG infrastructure.

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[74] S. 1174, S. 3441, S. 2822, and H.R. 2042

[75] *Foster Natural Gas Report*, "Weaver's Cove Offshore Berth Project Must Be Reviewed From Scratch And By Taking A Regional Approach, Some Parties Insist," July 18, 2008, p. 11.

[76] See, for example: Sickinger, T. "Governor Ups Ante Against LNG Sites." *The Oregonian*. February 15, 2008. p. A1.

[77] *Bangor Daily News*. "Regional Energy." December 8, 2006. p. A10.

[78] H.R. 6720.

[79] *Foster Natural Gas Report*. "Northeast States Need LNG, Especially New England; No Evidence of Regional Planning." December 15, 2006. p. 5.

[80] Howe, P.J. "LNG Supplies, Solutions Lacking." *The Boston Globe*. September 26, 2006. p. C4.

[81] *Foster Natural Gas Report*, "Under FERC's New Acting Chairman, Renewable Energy And Efficiency May Command An Unprecedented Level Of Support," February 17, 2009, p. 12.

"Remote" Siting of LNG Terminals

The LNG safety provisions in the federal pipeline safety law require the Secretary of Transportation to "consider the ... need to encourage remote siting" of new LNG facilities (49 U.S.C. § 60103). Federal regulations contain no clear definition of what constitutes "remote" siting, relying instead on safety exclusion zones to satisfy the remoteness requirements under the Pipeline Safety Act. This regulatory alternative was criticized by the General Accounting Office (GAO) in 1979 testimony to Congress supporting remote siting in the Pipeline Safety Act:

> We believe remote siting is the primary factor in safety. Because of the inevitable uncertainties inherent in large-scale use of new technologies and the vulnerability of the facilities to natural phenomena and sabotage, the public can be best protected by placing these facilities away from densely populated areas.[82]

In 2003, Representative Edward Markey, an original sponsor of the Pipeline Safety Act, reportedly expressed concern that DOT regulations did not go far enough in complying with the congressional intent of the remote siting provisions.[83]

Industry and government officials maintain that exclusion zones do provide adequate public safety based on the current state of knowledge about LNG. They argue that LNG terminals are no longer a new technology and face far fewer operational uncertainties than in 1979. In particular, some experts believe that hazard models in the 1970s were too conservative. They believe that more recent models have led to a better understanding of the physical properties of LNG and, consequently, a better basis for design decisions affecting public safety.[84] They point out that LNG terminals like those in Everett, Massachusetts (1971); Barcelona, Spain (1969); Fezzano, Italy (1969); and Pyongtaek, Korea (1986) have been operating for decades near populated areas without a serious accident affecting the public. Of the 28 existing LNG terminals in Japan, a seismically active country, most are near major cities such as Tokyo and Osaka.[85] While the Algerian terminal accident was serious, experts point out that it did not lead to the catastrophic failure of the main LNG storage tanks and did not cause injuries to the general public. Nonetheless, some policy makers reportedly have called for amendments to federal energy law prohibiting new LNG terminals in urban and densely populated areas.[86]

Other Statutes that May Influence LNG Terminal Siting

The Energy Policy Act of 2005 (§ 311(c)) explicitly preserves states' authorities in LNG siting decisions under the Federal Water Pollution Control Act, the Coastal Zone Management Act of 1972, and other federal laws. Under the Federal Water Pollution Control Act, often referred to as the Clean Water Act (CWA), states have the authority to develop and enforce their own water

[82] Peach, J.D. General Accounting Office (GAO), Director, Energy and Minerals Division. Testimony to the Senate Committee on Commerce, Science and Transportation. Washington, DC. April 25, 1979. p. 10. The General Accounting Office is now known as the Government Accountability Office.

[83] Raines, B. "Congress Wanted LNG Plants at 'Remote' Sites." *Mobile Register*. Mobile, AL. November 16, 2003.

[84] Tobin, L.T. Remarks at a meeting of the City of Vallejo Seismic Safety Commission. Meeting minutes. Vallejo, CA. September 11, 2003. p. 5; see also: *Federal Register*. Vol. 62, No. 37. February 25, 1997. pp. 8402-8403.

[85] California Energy Commission (CEC). "Asia Pacific Countries Liquefied Natural Gas (LNG)." January 2008. http://www.energy.ca.gov/lng/worldwide/asia_pacific.html

[86] *Energy Washington Week*. January 10, 2007.

quality standards.[87] Any federal permit applicant for a project that may discharge pollutants into navigable waters must provide the permitting agency with a certification from the state in which the discharge originates or will originate that the discharge is in compliance with the applicable provisions of the CWA, including the state's water quality standards.[88] States potentially could use their certification authority under the Clean Water Act to influence the siting of an LNG project by attaching conditions to the required water quality certificate or by denying certification. This certification authority has become an important tool used by states to protect the integrity of their waters. It is worth noting that the Energy Policy Act of 2005 created one potential avenue of relief for potential developers by providing for expedited review in a federal court of any order or action, or alleged inaction, by a federal or state agency acting under the authority of federal law.[89] Previously, parties seeking to challenge a state's decision regarding a water quality certificate had to do so in state court.[90]

States have been delegated authority under the Coastal Zone Management Act (CZMA, 16 U.S.C. § 1451 et seq.) which also could influence permitting of LNG terminals. Under the CZMA, applicants for federal permits to conduct activity affecting the coastal zone of a state must be certified by that state that the proposed activity is consistent with the state's federally approved coastal program.[91] A state wishing to forestall the licensing of an LNG terminal in its coastal waters could deny the certification required by the CZMA.[92] However, unlike the state-issued water quality certificates required for federal permitting by the Clean Water Act, the CZMA provides an alternative to applicants who are unable to obtain state certification. Under the CZMA, applicants may appeal the state's decision to the Department of Commerce, which may find that the activity is consistent with the objectives of the CZMA, or is otherwise necessary in the interest of national security, and thus override the state's denial of certification.[93] One analyst has suggested that there is a specific set of circumstances in which a state could create a regulatory stalemate pursuant to its CZMA authority by rejecting an application as incomplete (rather than rejecting it as improper or by failing to act). Under these circumstances the statute does not grant the Secretary of Commerce authority to review the decision. Battles between state regulatory agencies and applicants for LNG terminals have played out in this manner on at least two occasions.[94]

The discussion above suggests that authorities under the CWA and CZMA, at a minimum, give states the opportunity to have their concerns addressed when applicants seek federal approval for new LNG terminals. One legal commentator has stated that

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[87] 33 U.S.C. § 1251(a),(b).

[88] *Id.* at § 1341(a).

[89] EPAct of 2005, P.L. 109-58 at §§ 717r(d)(1)-(2).

[90] For further discussion of the water quality certification process and its impact on LNG siting, see Dweck, J., Wochner, D., and Brooks, M. "Liquefied Natural Gas (LNG) Litigation after the Energy Policy Act of 2005: State Powers in LNG Terminal Siting." *Energy Law Journal*, Vol. 27, No. 45 (2006). p. 482-85.

[91] 16 U.S.C. § 1456(c)(3)(A).

[92] The state must actively state its objection to the applicant's certification; a state's failure to act is presumed to be concurrence with project certification. *Id.*

[93] 16 U.S.C. § 1456(c)(3)(A).

[94] For further discussion, see Ewing, K.A. and E. Petersen. "Significant Environmental Challenges to the Development of LNG Terminals in the United States." *Texas Journal of Oil, Gas and Energy Law*. November 2006. pp. 21-23; Dweck et al., p. 487-90.

> ultimately, while the EPAct of 2005 might have streamlined the federal [LNG siting] review process in some respects and changed the rules under which the review takes place, it has not dramatically changed the balance of power between the federal government and states.[95]

The courts addressed the potential tension between the CZMA and exclusive federal authority over LNG terminal siting in a dispute over a proposed LNG terminal in the Baltimore, MD, area. In AES Sparrows Point LNG, LLC v. Smith,[96] the U.S. District Court for the District of Maryland held that a recent amendment to the Baltimore County Zoning Regulations prohibiting the siting of an LNG facility in a particular "critical area" of the Chesapeake Bay was a part of the state's Coastal Zone Management Plan and thus not preempted by the Natural Gas Act as amended by the Energy Policy Act of 2005. The plaintiffs had claimed that the statutes explicitly gave LNG siting authority to the federal government, and thus the states could not interfere with FERC authority to rule on the plaintiff's LNG facility permit application.[97] However, on appeal the U.S. Court of Appeals for the 4th Circuit reversed the lower court's decision.[98] The appellate court ruled that the Baltimore County zoning regulation in question was not part of the state's Coastal Zone Management Plan because the regulation was never submitted to NOAA for approval.[99] The Supreme Court declined to review this decision in October of 2008.

Another statute that may have an emerging role in the LNG siting process is the Wild and Scenic Rivers Act of 1968 (WSRA).[100] The WSRA was enacted with the intention of preserving certain sections of rivers in the United States "in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes."[101] Under the WSRA, rivers may be designated as additions to the National Wild and Scenic Rivers system, or as potential additions to the system.[102] Designation of rivers prevents certain future development, including, potentially, projects licensed by FERC.

The WSRA explicitly prohibits FERC from licensing the construction of projects under the Federal Power Act "on or directly affecting any river which is designated ... as a component of the national wild and scenic rivers system."[103] However, projects and developments would be permitted above or below the section of the river designated under WSRA, if that development would not diminish the values present at the time of designation.[104] With regard to rivers that are designated as potential additions to the system, FERC similarly is prohibited from construction of projects along that river and other agencies are prohibited from assisting in such projects for

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[95] Dweck et al. 2006, p. 475.

[96] 539 F.Supp.2d 788 (D. Md 2007).

[97] The same court had previously overturned a Baltimore County zoning ordinance that prohibited siting of LNG facilities within a certain distance of residential and commercial facilities on those same grounds. See AES Sparrows Point LNG, LLC v. Smith, 470 F.Supp.2d 586 (D.Md. 2007).

[98] AES Sparrows Point LNG, LLC v. Smith, 5237 F.3d 120 (4th Cir. 2008).

[99] Id. at 126-27.

[100] P.L. 90-542, codified at 16 U.S.C. § 1271 et seq. For an examination of the purposes, language and legislative history of this act, and an analysis of its effect on water rights, see CRS Report RL30809, *The Wild and Scenic Rivers Act (WSRA) and Federal Water Rights*, by Cynthia Brougher.

[101] 16 U.S.C. § 1271.

[102] Rivers designated as "potential additions" are those that warrant further study before full extension of the protections of the WSRA. 16 U.S.C. § 1276.

[103] 16 U.S.C. § 1278(a).

[104] Id.

certain periods of time after the designation to allow for the study and consideration of the river's inclusion in the system.[105]

LNG industry representatives have opined that the WSRA may be used to block LNG facility siting.[106] These representatives cited a legislative proposal in the 110th Congress to designate segments of the Taunton River in Massachusetts as "scenic and recreational" under the WSRA.[107] The industry representatives argue that this provision, if enacted, would be an obstacle towards the construction of the proposed Weaver's Cove LNG Terminal in Massachusetts.[108] The Center for Liquefied Natural Gas described this provision as a "congressional hurdle" and said that it provided a case study of "the gauntlet of things that can be used to oppose a project."[109] As oversight of the federal LNG siting process continues, Congress may consider how federal authorities under the Energy Policy Act of 2005, the CWA, the CZMA, the WSRA, and other federal statutes fit together to achieve their various objectives.

Terror Attractiveness

Potential terrorist attacks on LNG terminals or tankers in the United States have been a key concern of policy makers because such attacks could cause catastrophic fires in ports and nearby populated areas. A 2007 report by the Government Accountability Office states that, "the ship-based supply chain for energy commodities," specifically including LNG, "remains threatened and vulnerable, and appropriate security throughout the chain is essential to ensure safe and efficient delivery."[110] Accordingly, the Coast Guard's FY2006 budget requested funding for "additional boat crews and screening personnel at key LNG hubs."[111] To date, no LNG tanker or land-based LNG facility in the world has been attacked by terrorists. However, similar natural gas and oil assets have been terror targets internationally. The Department of Homeland Security (DHS) included LNG tankers among a list of potential terrorist targets in a security alert late in 2003.[112] The DHS also reported that "in early 2001 there was some suspicion of possible associations between stowaways on Algerian flagged LNG tankers arriving in Boston and persons connected with the so-called 'Millennium Plot'" to bomb targets in the United States. Although these suspicions could not be proved, DHS stated that "the risks associated with LNG shipments are real, and they can never be entirely eliminated."[113] The 2004 report by Sandia National Laboratories concluded that potential terrorist attacks on LNG tankers could be considered "credible and possible."[114] Former Bush Administration counterterrorism advisor Richard Clarke

[105] 16 U.S.C. § 1278(b).

[106] Clarke, D., *LNG Sector Fears Use of NewLegislative Tactic to Oppose Facilities*, Energy Washington Week, July 30, 2008.

[107] Ibid.; H.R. 415.

[108] Ibid.

[109] Ibid.

[110] Government Accountability Office (GAO). "Maritime Security: Federal Efforts Needed to Address Challenges in Preventing and Responding to Terrorist Attacks on Energy Commodity Tankers," GAO-08-141, December 10, 2007, p.77.

[111] Department of Homeland Security (DHS). *Budget-in-Brief, Fiscal Year 2006*. https://www.dhs.gov/xlibrary/assets/Budget_BIB-FY2006.pdf.

[112] Office of Congressman Edward J. Markey. Personal communication with staff. January 5, 2004.

[113] Turner, Pamela J., Assistant Secretary for Legislative Affairs, Department of Homeland Security (DHS). Letter to U.S. Representative Edward Markey. April 15, 2004. p. 1.

[114] Sandia National Laboratories (SNL). *Guidance on Risk Analysis and Safety Implications of a Large Liquefied* (continued...)

has asserted that terrorists have both the desire and capability to attack LNG shipping with the intention of harming the general population.[115]

Although they acknowledge the security information put forth by federal agencies, some experts believe that concern about threats to LNG infrastructure is overstated.[116] In 2003, the head of one university research consortium reportedly remarked, "from all the information we have ... we don't see LNG as likely or credible terrorist targets."[117] Industry representatives argue that deliberately causing an LNG catastrophe to injure people might be possible in theory, but would be extremely difficult to accomplish. Likewise, FERC and other experts believe that LNG facilities are relatively secure compared with other hazardous chemical infrastructures that receive less public attention. In a December 2004 report, FERC stated that

> for a new LNG terminal proposal ... the perceived threat of a terrorist attack may be considered as highly probable to the local population. However, at the national level, potential terrorist targets are plentiful.... Many of these pose a similar or greater hazard to that of LNG.[118]

FERC also remarked, however, that "unlike accidental causes, historical experience provides little guidance in estimating the probability of a terrorist attack on an LNG vessel or onshore storage facility."[119] Former Director of Central Intelligence James Woolsey has stated his belief that a terrorist attack on an LNG tanker in U.S. waters would be unlikely because its potential impacts would not be great enough compared with other potential targets.[120] LNG terminal operators that have conducted proprietary assessments of potential terrorist attacks against LNG tankers have expressed similar views.[121] In its September 2006 evaluation of a proposed LNG terminal in Long Island Sound, the USCG stated that "there are currently no specific, credible threats against" the proposed LNG facility or tankers serving the facility.[122] The evaluation also noted, however, that the threat environment is dynamic and that some threats may be unknown.[123] Echoing this perspective, a 2008 report by the Institute for the Analysis of Global Security states

> Proponents are correct in that both safety and security measures currently in place make LNG terminals and ships extremely hard targets for terrorists. However, it would be

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Natural Gas (LNG) Spill Over Water. SAND2004-6258. Albuquerque, NM. December 2004. pp. 49-50.

[115] Clarke, Richard A. et al. *LNG Facilities in Urban Areas.* Good Harbor Consulting, LLC. Prepared for the Rhode Island Office of Attorney General. GHC-RI-0505A. May 2005.

[116] McLaughlin, J. "LNG Is Nowhere Near as Dangerous as People Are Making it Out to Be." *Lloyd's List.* February 8, 2005. p. 5.

[117] Behr, Peter. "Higher Gas Price Sets Stage for LNG." *Washington Post.* July 5, 2003. p. D10.

[118] Federal Energy Regulatory Commission (FERC). *Vista del Sol LNG Terminal Project, Draft Environmental Impact Statement*. FERC/EIS-0176D. December 2004. p. 4-162.

[119] FERC. FERC/EIS-0176D. December 2004. p. 4-162. Notwithstanding this assertion, in its subsequent draft review of the Long Beach LNG terminal proposal, the FERC states that "the historical probability of a successful terrorist event would be less than seven chances in a million per year.... " See FERC. October 7, 2005. p. ES-14.

[120] Woolsey, James. Remarks before the National Commission on Energy LNG Forum, Washington, DC, June 21, 2006.

[121] Grant, Richard, President, Distrigas. Testimony before the Senate Committee on Energy and Natural Resources, Subcommittee on Energy hearing on "The Future of Liquefied Natural Gas: Siting and Safety." February 15, 2005.

[122] U.S. Coast Guard. *U.S. Coast Guard Captain of the Port Long Island Sound Waterways Suitability Report for the Proposed Broadwater Liquefied Natural Gas Facility.* September 21, 2006. p. 146.

[123] Ibid.

> imprudent to believe that terrorists are either incapable or unwilling to attack such targets. It would be equally imprudent to assume that these targets are impenetrable. If anything, in today's environment, insiders will always remain a potential threat.[124]

Because the probability of a terrorist attack on LNG infrastructure cannot be known, policy makers and community leaders must, to some extent, rely on their own judgment to decide whether LNG security is adequately addressed in FERC siting application reviews. As oversight of the federal role in LNG terminal siting continues, Congress may explore policies to reduce this uncertainty by improving the gathering and sharing of terrorism intelligence related to LNG.

Public Costs of LNG Marine Security

The potential increase in security costs from growing U.S. LNG imports, and the potential diversion of Coast Guard and safety agency resources from other activities have been a persistent concern to policy makers.[125] According to Coast Guard officials, the service's LNG security expenditures are not all incremental, since they are part of the Coast Guard's general mission to protect the nation's waters and coasts. Nonetheless, Coast Guard staff have acknowledged that resources dedicated to securing maritime LNG might be otherwise deployed for boating safety, search and rescue, drug interdiction, or other security missions.

In a December 2007 report, the GAO recommended that the Coast Guard develop a national resource allocation plan to address growing LNG security requirements.[126] In subsequent testimony before Congress, Coast Guard Commandant Admiral Thad Allen expressed concern about the costs to the Coast Guard of securing dangerous cargoes such as LNG and called for a "national dialogue" on the issue.[127] During questioning, Admiral Allen acknowledged that the Coast Guard did not currently possess sufficient resources to secure future LNG deliveries to a proposed LNG terminal in Long Island Sound which has subsequently been authorized by FERC.[128]

State and local agencies also seek more funding to offset the costs of LNG security. Addressing these concerns, the Energy Policy Act of 2005 requires private and public sector cost-sharing for LNG tanker security (§ 311d). In compliance with the act and prior FERC policy, FERC officials require new LNG terminal operators to pay the costs of any additional security or safety needed for their facilities.[129] FERC has also recommended that LNG terminal operators provide private security staff to supplement Coast Guard and local government security forces.[130] A legislative

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[124] Cindy Hurst. *The Terrorist Threat to Liquefied Natural Gas: Fact or Fiction?* Institute for the Analysis of Global Security. Washington, DC. p. 3.

[125] See, for example, Representative Peter Defazio, remarks before the House Homeland Security Committee hearing on Securing Liquid Natural Gas Tankers to Protect the Homeland. March 21, 2007.

[126] Government Accountability Office. *Maritime Security: Federal Efforts Needed to Address Challenges in Responding to Terrorist Attacks on Energy Commodity Tankers*. GAO-08-141. December 10, 2007. p. 79.

[127] Admiral Thad Allen, Commandant, U.S. Coast Guard. Testimony before the House Committee on Appropriations, Subcommittee on Homeland Security hearing, "Coast Guard Budget: Impact on Maritime Safety, Security, and Environmental Protection." March 5, 2008.

[128] Admiral Thad Allen, March 5, 2008; Federal Energy Regulatory Commission. "Order Granting Authority Under Section 3 of the Natural Gas Act and Issuing Certificates." Docket No. CP06-54-0000. March 20, 2008.

[129] Baldor, L.C. "Federal Agency, R.I. Officials Meet over LNG Terminal." *Associated Press*. March 17, 2005.

[130] Federal Energy Regulatory Commission (FERC). "Response to Senator Jack Reed's 2/1/05 letter regarding the proposed Weaver's Cove LNG Project in Fall River, MA & the proposed KeySpan LNG Facility Upgrade Project in (continued...)

proposal in the 110th Congress would have prohibited LNG facility security plans based upon the provision of security by a state or local government lacking an LNG security arrangement with the facility operator, and would have required the Coast Guard to certify that it has adequate security resources in the sector where a terminal would be located before facility security plans for a new LNG terminal could be approved.[131] In the 111th Congress, the public provision of LNG security continues to be an issue. The Maritime Hazardous Cargo Security Act (S. 1385), introduced by Senator Lautenberg and three co-sponsors on June 25, 2009, would require a national study to identify measures to improve the security of maritime transportation of liquefied natural gas, among other provisions (Sec. 6).

Other Issues

Conducting More Safety Research

Analysts have suggested for several years that Congress could call for additional LNG safety research to help reduce uncertainties about specific LNG terminal or shipping hazards.[132] Among the LNG terminal hazard reports issued by federal agencies, LNG developers, and community groups, there appears to be widespread agreement that additional "objective" LNG safety research would be beneficial. The ABSG report states, for example, that "additional research will need to be performed to develop more refined models, and additional large-scale spill tests would be useful for providing better data for validation of models."[133] The 2004 Sandia study similarly concluded that "obtaining experimental data for large LNG spills over water would provide needed validation and help reduce modeling uncertainty."[134] Physical testing (as opposed to computer simulations) of impacts, explosions, and thermal stresses on LNG tanker hulls could also fill important gaps in engineering knowledge about the potential effects of terrorist attacks.

In 2008, Congress appropriated $8 million to fund large-scale LNG fire experiments by the Department of Energy addressing some of the hazard modeling uncertainties identified in the 2007 GAO report.[135] In that report, the GAO stated that DOE's proposed research plan at that time would "address only 3 of the top 10 issues—and not the second-highest ranked issue—that our panel of experts identified as potentially affecting public safety."[136] In response to the GAO's concerns and those of congressional staff, the DOE and Sandia modified their test program to better align with the priorities put forward by the GAO.[137] The DOE's study could, nonetheless, still be subject to the same types of technical limitations and criticisms facing existing analysis, so

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Providence, RI under CP04-293 et al." March 3, 2005. p. 2.

[131] H.R. 2830.

[132] See, for example: Kytömaa, H. and Gavelli, F. "Studies of LNG Spills Over Water Point Up Need for Improvement." *The Oil and Gas Journal*. May 9, 2005. p. 61.

[133] ABSG Consulting. May 13, 2004. p. iv.

[134] SNL. December 2004. p. 18.

[135] Consolidated Appropriations Act, 2008 (P.L. 110-161), Division C—Energy and Water Development and Related Agencies Appropriations Act, 2008, Title III, Explanatory Statement, p. 570.

[136] GAO. 2007. pp. 22-23.

[137] Anay Luketa, Sandia National Laboratories. *DOE/Sandia National Laboratories Coordinated Approach for LNG Safety and Security Research*. Presentation to the Committee on Gas, NARUC Summer Committee Meetings. Portland, OR. July 22, 2008. Physical testing and model development by Sandia are scheduled to be completed in 2009.

while it may reduce key uncertainties, it may not eliminate them altogether. As of December 2009, Sandia had completed two large LNG pool fire experiments, although the test results are not yet available.

Developer Employee Disclosure

Some policy makers have been concerned that LNG terminal developers may engage in non-public community lobbying or other similar activities promoting individual LNG terminals. Concern arises that these activities may limit public information and awareness about proposed terminals and, therefore, may impede the federal LNG siting review process. Accordingly, legislation proposed in the 110th Congress would have required an applicant for siting approval for an LNG terminal to identify each of its employees and agents engaged in activities to persuade communities of the benefits of the terminal.[138] Supporters of such a policy view it as a means of ensuring public transparency in LNG terminal siting. Disclosure requirements of this type might trigger some First Amendment concerns, however. The Supreme Court has recognized that such government disclosure requirements may have a deterrent effect on the exercise of First Amendment rights.[139] In balancing First Amendment interests, for example, against the government's interest preserving the integrity of the legislative process, the Court has generally upheld the constitutionality of disclosure requirements related to "direct" lobbying of members of Congress.[140] It is unclear how the Court would rule on a disclosure law such as S. 323 related to "indirect" lobbying efforts targeting constituents or otherwise taking place at the local level.[141]

Reducing LNG Demand

Some policy makers argue that Congress should try to reduce the need for new LNG terminals by acting to curb growth in domestic LNG demand, or growth in natural gas demand overall. For example, Congress could change public and industrial incentives for conservation and efficiency, switching to other fuels, or developing renewable energy supplies. Conservation and renewable energy provisions in the American Recovery and Reinvestment Act of 2009 (P.L. 111-5), which was signed by President Obama on February 17, 2009, exemplify such policies. Switching to nuclear power or biomass, however, poses its own hazards to communities and the environment, and so may not be preferable to additional LNG infrastructure. Conservation and renewable energy sources are less hazardous, although they face significant technological and cost barriers to public adoption on the scale that would be required.

Another potential way to curb U.S. LNG demand is to encourage greater North American production of natural gas. Provisions in the Energy Policy Act of 2005 promote this objective, as do proposals to encourage construction of an Alaska gas pipeline and to expand natural gas production on the outer continental shelf. An Alaska gas pipeline would take years to build, however, and might not on its own be able to meet anticipated long-term growth in U.S. gas demand.[142] Increased production from natural gas wells in the lower 48 states since 2005, as well

[138] S. 323

[139] *Buckley v. Valeo*, 424 U.S. 1, 65 (1976).

[140] *United States v. Harriss*, 347 U.S. 612 (1954).

[141] For further discussion on this topic, see CRS Report RL33794, *Grassroots Lobbying: Constitutionality of Disclosure Requirements*, by Jack Maskell.

[142] For further analysis, see CRS Report R40963, *The Alaska Natural Gas Pipeline: Background, Status, and Issues for* (continued...)

as the recent U.S. economic recession, have reduced possible near-term pressure on natural gas supplies. It is unclear, however, if new domestic gas supplies may offer a sufficient long-term natural gas supply to meet rising gas demand in the future.

Conclusion

Proposals for new U.S. LNG import terminals pose safety challenges. LNG is inherently hazardous and its infrastructure is potentially attractive to terrorists. The 2004 LNG terminal fire in Algeria demonstrates that, despite technological improvements since the 1940s, LNG facilities can still experience serious accidents. Many lawmakers and the general public are concerned about these hazards.

The U.S. LNG industry is subject to more extensive siting and safety regulation than many other similarly hazardous facilities. Federal, state, and local governments have also put in place security measures intended to safeguard LNG against newly perceived terrorist threats. Some community groups and other stakeholders fear that federal siting requirements for LNG facilities are still not stringent enough, but the responsible federal agencies disagree.

The safety issues associated with LNG terminal siting are both important and familiar. Every major energy source poses some hazard to public safety. Similar public concerns have been raised around siting of other types of energy facilities such as nuclear power plants, oil import terminals, pipelines, and electric transmission lines. In evaluating new LNG terminal proposals, therefore, policy makers face a full range of facilities and safety hazards associated with U.S. energy supplies, not only LNG needs and hazards on their own.

Although LNG terminal regulations are extensive, and the global industry has decades of experience operating LNG facilities, many stakeholders question LNG terminal safety. Some of these questions might be resolved through additional research on key LNG topics. LNG siting decisions are already underway, however, so any additional research efforts intended to affect the siting process would probably have to be completed quickly. Revising LNG safety requirements after completion of a facility could be disruptive of energy supplies. Some cite the Shoreham nuclear power plant in the 1980s, which was closed after construction due to new public safety requirements, as an example of the need to resolve safety concerns before capital is invested.

Both industry and government analysts project continued growth in the demand for natural gas. Greater LNG imports represent one way to address this growth in demand, along with increased North American gas production, conservation, fuel-switching, and the development of renewable energy sources. One way or another the fundamental gas supply and demand balance must be maintained. If policy makers encourage LNG imports, then the need to foster the other energy options may be diminished—and vice versa. Thus decisions about LNG infrastructure could have consequences for a broader array of natural gas supply policies.

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Congress, by Paul W. Parfomak.

Appendix. Offshore LNG Terminal Regulation

Under the Deepwater Port Act of 1974 (P.L. 93-627) the Secretary of Transportation is directed to "authorize and regulate the location, ownership, construction, and operation of deepwater ports" (33 U.S.C. §§ 1501(a), 1503). The Secretary has delegated this authority to the Maritime Administration (MARAD) within the Department of Transportation, and to the Coast Guard (USCG), within the Department of Homeland Security.[143] Originally, P.L. 93-627 applied only to offshore oil ports and terminals and not LNG facilities. However, the Maritime Transportation Security Act of 2002 (P.L. 107-295) amended P.L. 93-627 to include natural gas facilities, including LNG terminals, developed offshore. As amended, "deepwater ports" are:

> any fixed or floating manmade structure other than a vessel ... located beyond State seaward boundaries ... intended for use as a port or terminal for the transportation, storage, or further handling of oil *or natural gas* for transportation to any State... (33 U.S.C. § 1502(9a))[144]

The Deepwater Port Act sets out a detailed process for offshore facility siting applications. The act also authorizes regulations addressing potential threats to the environment or human welfare posed by development of offshore LNG facilities (33 U.S.C. §§ 1504, 1508; 33 C.F.R. § 148). The act also requires regulations for the designation of safety zones around deepwater ports (33 U.S.C. § 1509(d)). Among the amendments to the act is a provision exempting LNG terminals from the limitation on the number of "deepwater ports" that can be located in a designated "application area," a provision applicable to oil terminals (33 U.S.C. §§ 1504(d)(4), (i)(4)). Additionally, a preexisting provision of the act allows the governor of a state adjacent to a proposed offshore LNG facility to have that facility license conform to state environmental protection, land and water use, or coastal zone management programs (33 U.S.C. § 1508(b)).

The USCG's regulations regarding LNG facilities are codified throughout 33 C.F.R., with major provisions in part 127. These regulations detail the requirements for siting applications, which include information about the proposed location, design, construction, and operation (33 C.F.R. § 148.109). NEPA analysis is often instrumental in siting and safety-related decisions at specific proposed facilities and is facilitated by the Minerals Management Service, the agency responsible for offshore minerals extraction and the Outer Continental Shelf leasing program.[145] Unlike requirements for onshore facilities, the Coast Guard does not appear to require generally applicable exclusion zones for offshore facilities, but relies instead on case-by-case designation of safety zones.[146] Additional USCG regulations include agency oversight of emergency procedures, security, fire protection, and design and construction standards (33 C.F.R. §§ 127.109, 127.701-127.711, 127.601-127.617, 127.1101-127.1113, 149.205).

[143] For a recent LNG siting application, MARAD performed financial analysis and USCG evaluated environmental impacts; the agencies cooperated on all other aspects of the review. ("First Offshore Terminal in U.S. is About to Secure Federal License." *Foster Natural Gas Report*. Bethesda, MD. November 20, 2003. p. 21.

[144] The statute defines natural gas to include "liquefied natural gas." 33 U.S.C. § 1502(14).

[145] Sierra B. Weaver, Note, "Local Management of Natural Resources: Should Local Governments Be Able to Keep Oil Out?," 26 *HARV. ENVTL. L. REV.* 231, 246 (2002).

[146] See 33 C.F.R. § 165, Regulated Navigation Areas and Limited Access Areas.

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