Fire Service Guidance for Participating in LNG Terminal Evaluation, Siting, and Operations

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1.0 OBJECTIVES AND SCOPE OF GUIDANCE

1.1 Introduction

The National Association of State Fire Marshals (NASFM), the Department of Transportation (DOT), and the Federal Energy Regulatory Commission (FERC) recognized the need for additional safety guidance for local fire officials that have Liquefied Natural Gas (LNG) facilities planned for or existing in their communities. To satisfy that need, this guidance was developed to assist them in understanding LNG hazards and the various federal processes that are in place to ensure LNG safety. The active participation of the local fire service is crucial to the success of the preliminary and final design, effective cost-sharing, planning and operational phases of LNG facilities. There are a number of ways that local first responders are intended to be integral to the process of LNG siting and operation and able to engage in analyzing as well as managing these risks.

This guidance is part two of a multi-phase set of guidance developed by NASFM. In the first phase of its LNG safety program, NASFM and its partners developed educational materials and a structure for how emergency responders can be better informed about the safety, transportation, storage and processing of LNG. Better education can lead to the fire service being a more valuable resource and a partner to industry during the permit approval phase, preliminary and final design phases and, if approved and constructed, during the operational phase of the LNG facility.

A recommended starting point to understand the fundamentals of LNG is the companion document to this guidance produced by NASFM "Liquefied Natural Gas: An Overview of the LNG Industry for Fire Marshals and Emergency Responders" (NASFM, 2005).1 This document was developed by NASFM under a cooperative agreement with DOT, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety (OPS). Its objective is to provide a broad overview of LNG, its properties, its hazards and risks, and the issues that fire safety officials may face as LNG infrastructure develops and expands to meet the country's future energy needs. References also include several useful sources of information on LNG for additional study. That guidance is supported by a companion training video, available from NASFM, which provides more in-depth information on LNG hazards and emergency response issues.

There are many available references concerning the LNG industry and its hazards, and some of the more significant ones are summarized in this guidance or listed in the appendices. It is recommended that fire departments that may have LNG operations introduced to their operating areas have a basic understanding of the properties of LNG, its hazards, the design of typical operations, and emergency response requirements. In addition they must understand the critical role they provide in the overall process of siting, assisting in the design of facilities, operating LNG terminals, and they must actively participate in the process.

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[1] "Liquefied Natural Gas: An Overview of the LNG Industry for Fire Marshals and Emergency Responders," National Association of State Fire Marshals, Washington, DC, 2005. http://www.safepipelines.org/cur_proj/liquid_gas/

1.2 Objectives of the Guidance

The principal objective of this document is to provide guidance to the fire service on how to get involved in the various processes involved in permitting an LNG import terminal. The intended audience for the guidance document is primarily the fire service, but it may also be useful to all first responders, industry and other LNG stakeholders during the siting, design, construction, and terminal operating stages.

This guidance is targeted in scope, with the express goal of helping the fire service to evaluate the general hazards, tactics and preplans that are associated with an LNG import terminal in their jurisdiction as well as to define their role and responsibilities. It describes the safety and security assessment processes that an applicant must undertake and recommends a step-wise plan for involvement including Federal and State regulatory reviews. In particular, Figure 5 in Section 3 is a key diagram illustrating the steps of the LNG import terminal siting process prescribed by FERC and how and when the fire service can become involved. It describes a five-step process to integrate fire service activities with the phases of the development and operation of an LNG import terminal. An accompanying checklist includes technical and administrative tasks recommended to be addressed during this process.

The guidance is not intended to replicate the scope of the already required FERC, US Coast Guard (USCG) and DOT assessments and regulations that determine and govern safety. Rather, it is intended to help the fire service better participate during these activities as a knowledgeable partner with industry and government. This task is consistent with NASFM's goal of helping the fire service better understand how to consider LNG safety while not influencing their decision on the merits of the LNG terminal seeking approval in their operating area.

1.3 Project Team

NASFM has assembled a team of experts on LNG, LNG safety and security, and fire service operations to develop guidance for fire departments where LNG import terminals are being considered. The guidance was prepared by the AcuTech Consulting Group, which was guided by a project advisory team whose members included:

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2.0 THE LNG INDUSTRY AND LNG HAZARDS

2.1 US LNG Industry History and Infrastructure Overview

U.S. interest in liquefied natural gas (LNG) has recently experienced a dramatic increase. This renewed interest in siting new LNG facilities should prompt more widespread involvement of the fire service as facilities and operations increase. The reasons for the resurgence and growth of the LNG industry are a combination of the increased demand for energy, the availability of natural gas reserves in locations around the world that provide new supplies, and advancements in LNG technology which lower the cost of the LNG value chain. Recent regulatory and policy changes have streamlined the permitting process and encouraged the construction of LNG facilities. As such, LNG has become an increasingly important part of the U.S. energy market.

The United States currently has four operational onshore import terminals at Elba Island, GA, Cove Point, MD, Everett, MA, and Lake Charles, LA. There is a fifth onshore import terminal in Puerto Rico and an offshore deepwater port located in Block 603 of the West Cameron Area, South Addition, at a distance of approximately 116 miles from the Louisiana coast. There is one operating LNG export terminal at Kenai, AK, which exports LNG to Japan. For a list of new facilities proposed and approved by various government agencies, visit the FERC website at www.ferc.gov and search for "Projects Near You."

Figure 1

U.S. LNG Import and Export Terminals

(Source: CLNG)

2.2 LNG Fixed Facilities

LNG facilities can be categorized as follows (see also Figure 2):

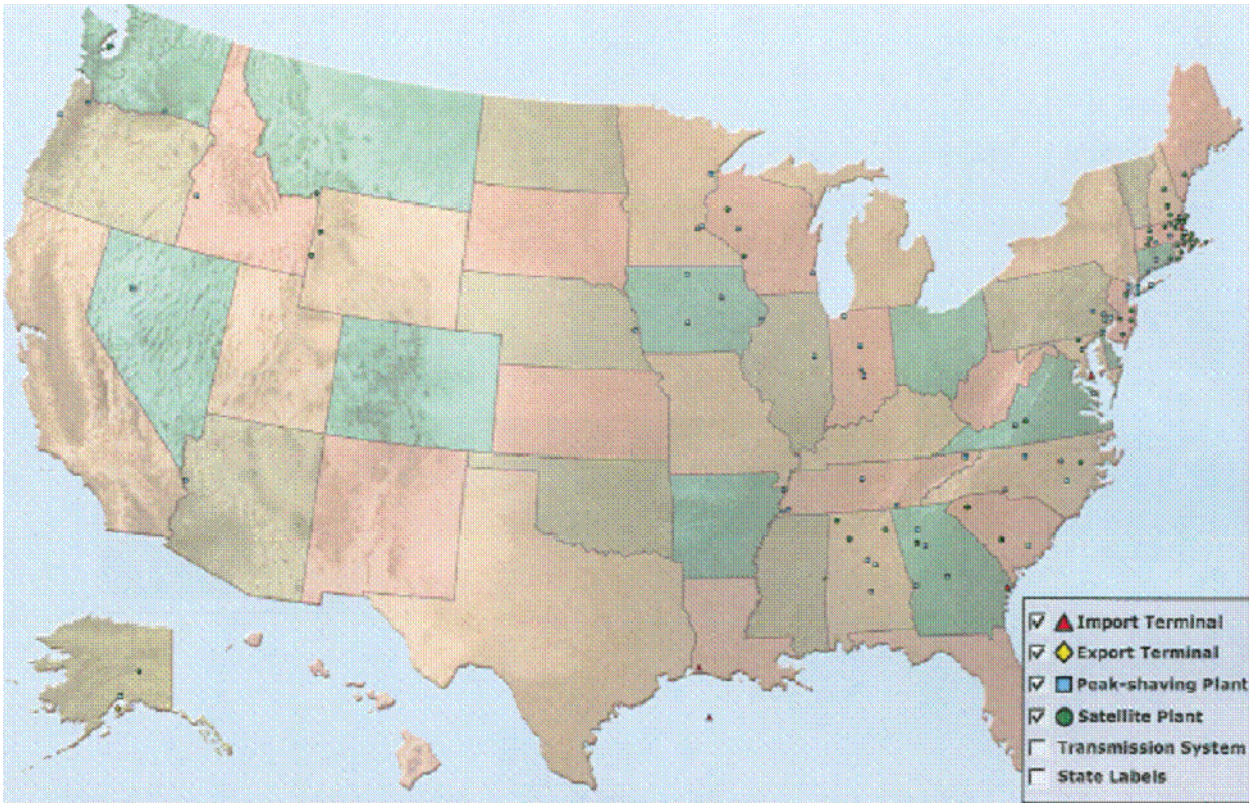
- Export Terminals/Liquefaction facilities – where LNG is liquefied, stored, and loaded onto carriers for shipment. There are presently over 19 export terminal/liquefaction facilities in the world including one in the U.S. (Kenai, AK).

- Import Terminals/Regasification facilities – LNG is received from carriers, stored, and, when needed, regasified for injection into the natural gas pipeline infrastructure. There are presently over 44 import terminal/regasification facilities in the world and 4 onshore in the mainland US (not including the Energy Bridge facility in the Gulf of Mexico offshore or the import facility in Puerto Rico).

- Peak shaving and other facilities – peak shaving facilities store and vaporize LNG, operating on an intermittent basis to meet short term peak gas demands. There are currently 103 peak shaving and satellite plants in 31 states.

Figure 2

U.S. LNG Facilities Connected to Natural Gas Pipeline Systems



(Source: FERC)

2.3 LNG Hazards Summary

To avoid duplication with other NASFM, DOE, FERC, and DOT LNG guidance, this document will describe LNG hazards briefly below and list in Appendix A other resources on these topics.

LNG's principal hazards result from its:

(1) cryogenic temperature

(2) flammability, and

(3) vapor dispersion characteristics

LNG is a cryogenic liquid and is stored and transported at approximately -260ºF (-160ºC) because cooling natural gas to this temperature turns it into a liquid and reduces its volume by a ration of 600:1 at which point its transport and storage is more economical. Contact with a cryogenic liquid can cause freeze burns and eye damage.

LNG is flammable in its vapor state between approximately 5 percent and 15 percent concentration of gas in air. LNG is less flammable than other fuels such as propane and gasoline and requires a higher ignition temperature (1004ºF). If a flammable vapor-air mixture from an LNG spill is ignited, it may result in a flash fire, which is a short-duration fire that burns the vapors already mixed with air in flammable concentrations. The flame front will burn back through the vapor cloud to the spill site, provided the vapor concentration along this path is high enough to continue burning. An unconfined methane-air mixture will burn slowly, tending to ignite combustible materials within the vapor cloud, whereas a confined methane-air mixture will produce fast flame speeds that tend to produce flash burns rather than self-sustaining combustion.

As a liquid, LNG will neither burn nor explode. Methane, the primary component of LNG, is colorless, odorless, and tasteless, and is classified as a simple asphyxiant for human exposure. LNG vaporizes rapidly when exposed to ambient heat sources such as water, producing 620 to 630 standard cubic feet of natural gas for each cubic foot of liquid.

When spilled onto water, LNG will initially produce a cold vapor cloud that is denser than air and will stay close to the water or ground. As this cloud mixes with air, it will warm up and cause dispersion into the atmosphere. If not ignited, the flammable vapor cloud could drift downwind until the effects of dispersion dilute the vapors below a flammable concentration. The downwind distance that flammable vapors might reach is a function of the volume of LNG spilled, the rate of the spill, and the prevailing weather conditions. Also, in order to disperse to significant downwind distances, a vapor cloud must avoid ignition. An event of sufficient magnitude to rupture an LNG cargo tank is likely to provide ignition sources. If a flammable cloud is ignited by the initiating event or by other ignition sources (e.g., on the ship, on other nearby vessels, or on shore), the flame will burn back to the vapor source, and the flammable cloud would not travel a significant distance over land.

Although LNG vapors can explode if ignited within a confined space, such as a building or structure, there is no evidence suggesting that LNG vapor is explosive when ignited in unconfined open areas.

LNG is less hazardous than liquefied petroleum gas (LPG) and liquefied ethylene, which have (1) higher specific gravities, (2) a greater tendency to form explosive vapor clouds, (3) lower minimum ignition energies (MIEs), and (4) higher fundamental burning velocities. LNG is not toxic, and it rapidly evaporates; therefore, long-term environmental impacts from a release are negligible if there is no ignition of natural gas vapors.

2.4 Fire Hazards

The hazards of three types of fires — pool fires, jet fires, and flash fires — are presented by LNG:

- Pool Fire – When a flammable liquid is released from a storage tank or pipeline, a liquid pool may form. As the pool forms, some of the liquid will evaporate and, if flammable vapor finds an ignition source, the flame can travel back to the spill, resulting in a pool fire, which involves burning of vapor above the liquid pool as it evaporates from the pool

and mixes with air. Dikes around storage tanks are designed to contain the pool and the fire can burn in a contained area until the fuel is consumed.

- Jet Fire – If compressed or liquefied gases are released from storage tanks or pipelines, the materials discharging through the hole will form a gas or liquid jet that entrains and mixes with the ambient air. In its gaseous form, if the flammable gas encounters an ignition source and is at concentrations that put it in its flammable range, a jet fire may occur. For LNG stored at low pressure as a liquid, as it is in an LNG carrier, this type of fire is unlikely. Jet fires could occur during unloading or transfer operations when pressures are increased by pumping. Such fires could cause severe damage but will generally affect only the local area.

- Flash Fire – When a volatile, flammable material is released to the atmosphere, a vapor cloud forms and disperses (mixes with air). If this vapor cloud is ignited before the cloud is diluted below its lower flammability level (LFL), a flash fire may occur. The combustion normally occurs within only portions of the vapor cloud (where mixed with air in flammable concentrations), rather than the entire cloud. A flash fire may burn back to the release point, resulting in a pool or jet fire but is unlikely to explode when unconfined.

2.5 Explosions

As discussed in the previous section, a flash fire can occur if an LNG vapor cloud is released into the atmosphere and ignited. If ignited in open (unconfined) areas, pure methane is not known to generate damaging overpressures (explode). However, if some confinement of the vapor cloud is present, methane can produce damaging overpressures. Confinement can be provided by spaces within the ship or nearby structures, such as a building onshore or another ship. Areas congested with equipment and structures can also facilitate damaging overpressures if a vapor cloud is ignited within such an area. For example if a vapor cloud infiltrates a chemical process plant in an area with various vessels, structures, and piping and the cloud ignites, the portion of the cloud within that congested area may explode.

2.6 LNG Accidental and Intentional Release Scenarios

Predefining accidental and intentional release scenarios help emergency planners prepare by considering how something might go wrong and what the appropriate response might be. When developing the release scenarios, process equipment and operations are first grouped based on the following factors:

- Type of material being processed (flammable)
- Material phase (gas, liquid, or two phase)
- Process conditions (temperature and pressure)
- Type, size, and location of equipment
- Location of the release (on land or on water)

LNG poses a flammable hazard. It is transported, offloaded and stored as a liquid until it is converted back to a gas for transfer into the natural gas pipeline network. Using these factors and different operating conditions for a typical LNG ship and typical LNG terminal, the following accidental release scenarios could reasonably be developed:

1. LNG Shipping:
    - Collision of an LNG vessel with another ship;
    - Grounding of an LNG Vessel;
    - LNG vessel allision with terminal or other fixed structure.
2. LNG Terminal:
    - Failure of an LNG unloading arm;
    - Failure of an unloading header and transfer pipeline;
    - Failure of a storage tank;
    - Failure of a storage tank outflow line;
    - Failure of an LNG vaporizer inlet line;
    - Failure of a natural gas line.

The release scenarios above have been divided between LNG shipping and the facility itself. This was done for the following reasons:

- A LNG spill on water from a ship would float and would spread and vaporize more rapidly than an equal sized pool on land;
- LNG terminals are designed with features that minimize the potential for leaks and spills to occur and also include dikes, berms, and other impoundment systems to contain a liquid spill if one were to occur. A spill of LNG from a ship could result in an unconfined pool;
- LNG terminals are equipped with LNG detection and shutdown systems to limit the release duration. If both hulls and the LNG storage tank of an LNG ship were punctured, there is the potential for a loss of the entire inventory of the tank above the puncture since there would be no means to stop the release, even if detected.

These release scenarios will result in the potential fire hazards discussed above in Section 2.4: pool fire, jet fire and vapor cloud fire. These scenarios are the most appropriate to planning emergency response for LNG siting and operations.

2.7 LNG Safety Record and Public Risk Assessment

In the modern LNG era (1970 to present day), all segments of the LNG chain have an exceptional record of no public fatalities and injuries. The history of safe response to LNG

emergencies in the U.S. has also been more favorable than that of other fossil fuels. In fact, there have been no firefighter fatalities from responding to LNG incidents in the U.S.'[2]

The most common public concerns regarding the buildup of the U.S. LNG infrastructure are those involving marine transport and new import terminals. Both of these segments of the LNG chain have been shown to have relatively low public and worker societal risk levels due to the multiple levels of safeguards including robust ship and terminal design.

From 1941-2006, there have been few major incidents. All significant maritime incidents that have occurred with LNG shipping have occurred in international waters. None of these shipping incidents resulted in a catastrophic loss of cargo. In the past 40 years, there have been more than 50,000 LNG ship voyages without a significant accident or cargo security incident.

There have been only a few incidents involving LNG in operating LNG facilities that resulted in one or more fatalities: Skikda, Algeria, 2004 (export terminal); Bontang, Indonesia, 1983 (export terminal); Cove Point Maryland, 1979 (import terminal); Arzew, Algeria, 1977 (export terminal); and Cleveland, Ohio, 1944 (peak shaving facility).

There were two other incidents in LNG terminals (Portland 1968 and Staten Island 1973), both peak shaving facilities) that involved fatalities, but these are classified as construction accidents since LNG was not involved in the incidents. For a general discussion of these incidents, please refer to the NASFM Overview document.

2.8 Managing LNG Risks

The safety of LNG both in the U.S. and world-wide is a result of industry standards, strong regulations, and an industry commitment to risk management. Regardless of the type of LNG facility, there are multiple layers of protection implemented to minimize the likelihood of a LNG release. If a release occurs, these multiple layers of protection also serve to mitigate the consequences.

The specific layers of protection for both LNG terminals and LNG vessels are detailed in the safety and security risk assessment sections of this document. In general, there are five primary layers of protection that are implemented to ensure the safe production, transportation, storage, and regasification of LNG:

- Operational Integrity and Regulatory Adherence – The first and most important safety requirement for the industry is to safely process, store and transport LNG. The exemplary safety record of the industry is due primarily to strict adherence to FERC, DOT and USCG regulations requiring that agencies audit facilities regularly to guarantee such adherence to safety regulations.

- Primary Containment – A function of operational integrity, a primary safety requirement for the industry, is to effectively contain LNG. This is accomplished by employing suitable materials for storage tanks and other equipment, and by appropriate engineering design throughout the value chain.

[2] Mike Hildebrand and Greg Noll, Storage Tank Emergencies Guidelines and Procedures (Maryland: Red Hat Publishing 2001).

- Secondary Containment – This third layer of protection ensures that if leaks or spills occur, in the unlikely event that operational integrity is compromised, the LNG will be contained and isolated.

- Safeguard Systems – In the fourth layer of protection, the goal is to minimize the release of LNG and mitigate the effects of a release. For this level of safety protection, LNG operations use systems such as gas, liquid and fire detection to rapidly identify any breach in containment along with remote and automatic fair safe shut off and control systems to minimize leaks and spills in the case of failures.

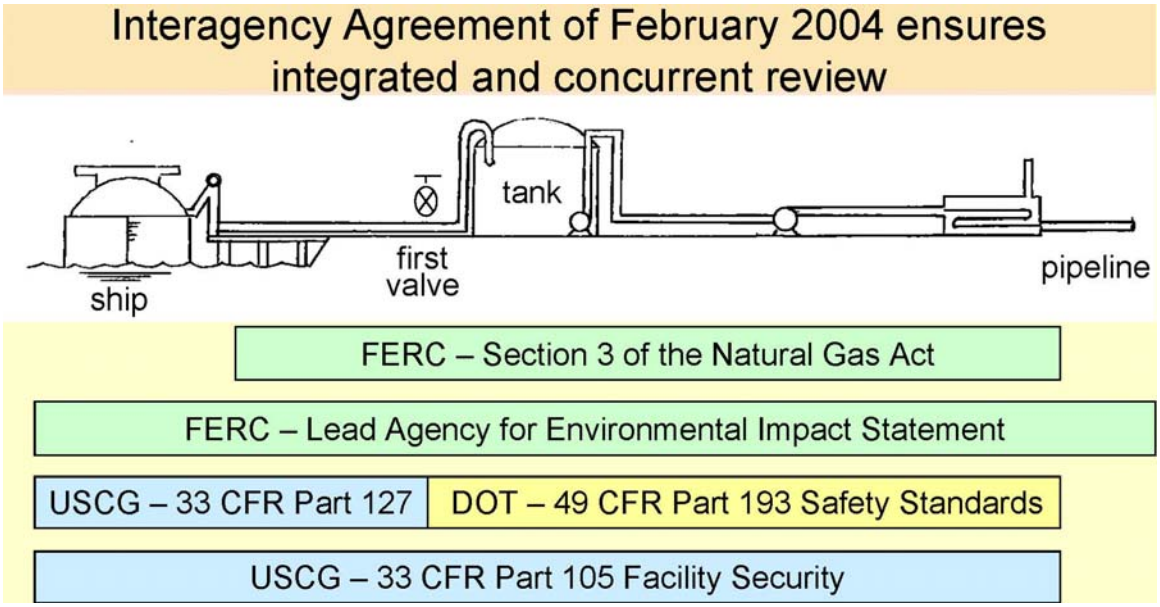
- Separation Distance - Federal regulations have always required that LNG facilities be sited at a safe distance from adjacent industrial, communities and other public areas. These safety exclusion zones are based on LNG vapor dispersion calculations, thermal radiation contours and other considerations as specified in regulations. The regulations are based on worst case scenarios far exceeding any incident at an LNG regasification terminal in the past 40 years. Also, the USCG Captains of the Port require detailed plans including safety/security zones around LNG ships while underway in U.S. waters and while moored to reduce the risk of collision with other vessels.

3.0 LNG IMPORT TERMINAL SITING SAFETY AND SECURITY PROCESSES

While the risk of an LNG incident is low, public concern regarding the siting and operation of LNG terminals and facilities can be significant. In addition, since the terrorist attacks in the U.S. in 2001, security of LNG ships, terminals and facilities has been of heightened interest to the public. Public concern coupled with the increase in interest in siting new terminals overlaid with a complex permitting process makes the understanding of the overall process and the early involvement of the fire service essential. Figure 3 illustrates the coordinated review and regulatory oversight led by FERC for onshore LNG facilities.

Figure 3

FERC Coordination of LNG Siting Review Process*



*(*Local regulatory participation and approval occurs throughout the various concurrent review processes Source: FERC, 2007)*

Although significant progress has been made to streamline the LNG permitting process, it remains complex and lengthy. As many as 100 permits and approvals may be required from federal, state, and local government agencies for a new onshore LNG terminal. These agencies rigorously examine the benefits of the proposed project, and take into account facility design, location, safety, and security as well as environmental concerns to arrive at the best, most informed decisions. Without significant delays, it may take up to seven years to bring a new onshore terminal on-line, from initial design to the first delivery of LNG imports, including up to three years for obtaining necessary permits and approvals. During this time, the fire service should be engaged early in the process (as early as the design stage) to ensure that the resulting decisions are made with full consideration of fire department needs and capabilities.

3.1 Federal, State and Local Decision Makers

The sections below discuss in general the federal decision process and where the public and the fire service can and should participate.

Numerous federal agencies oversee the nation's LNG infrastructure, working with the states and local authorities. Jurisdiction among federal agencies with LNG oversight responsibilities is sometimes a point of contention, and Memoranda of Understanding are established to delineate respective agency roles. Agencies involved in LNG include:

- The Federal Energy Regulatory Commission (FERC): FERC asserts approval authority over the place of entry and exit, siting, construction, and operation of new terminals as well as modifications or expansions of existing LNG terminals (see 18 CFR 153). FERC requirements include detailed site engineering and design information, evidence that an

LNG facility will safely receive or deliver LNG (including the existence of an emergency response plan), and delineation of a facility's proposed location and geologic risk, if any. Facilities to be located at the Canadian or Mexican border for import or export of natural gas also require a Presidential Permit. FERC staff members inspect new LNG import terminals to monitor the condition of the physical plant and review changes from the originally approved facility design or operations. FERC has jurisdiction over all existing LNG import terminals and 12 peak-shaving plants involved in interstate gas trade.

- The U.S. Coast Guard (USCG): The USCG is responsible for assuring the safety and security of marine operations in U.S. coastal waters under provisions of the Ports and Waterways Safety Act of 1972 (P.L. 92-340) and also the Maritime Transportation Security Act (MTSA). The latter was signed into law in November 2002, amending the Deepwater Port Act of 1974 (DWPA) to allow for offshore natural gas facilities. The USCG oversees the development of the Waterway Suitability Assessment, which is concerned with the safety and security of the shipping operation, and all equipment located in or adjacent to navigable waters on the pier including marine transfer areas and onshore terminal security. The USCG also regulates the design, construction, and operation of LNG ships and the duties of LNG ship officers and crews by inspective the operational and security compliance of facilities annually. Additionally, the USCG enforces security requirements for the LNG terminal and for the ships that call on it.

- The Department of Transportation Pipelines and Hazardous Materials Safety Administration Office of Pipeline Safety (DOT/PHMSA/OPS): DOT/PHMSA/OPS regulates the siting and safety of LNG pipeline facilities, including LNG peak-shaving plants, under the Pipeline Safety Act of 1994 (P.L. 102-508) as amended. Implementing regulations for the Act, including provisions on facility siting, are found in 49 CFR 191 – 199. Standards for operation, maintenance, fire protection, and security at such facilities are chiefly found in 49 CFR 193 and incorporate National Fire Protection Association (NFPA) standards. DOT/PHMSA/OPS also performs construction and operational safety inspections.

- The Department of Energy (DOE): DOE's Office of Fossil Energy coordinates across federal agencies that have regulatory and policy authority for LNG. The Natural Gas Act of 1938 requires that anyone seeking to import or export natural gas across U.S. borders must be authorized by DOE. DOE monitors LNG shipments to ensure the integrity of American energy supplies via a certification process. In addition, the Office of Fossil Energy and the National Energy Technology Laboratory fund LNG technology research and work to eliminate or minimize potential impediments to LNG facility siting and operations.

The regulation of LNG facilities by states varies from comprehensive to fragmented and depends on the location of the LNG facility (i.e., onshore/marine, offshore, inland). Many states are striving to address the evolving interest in LNG. Some state agencies, such as state public utility commissions, govern commerce and trade. Other state regulatory agencies (for example, state departments of environmental protection), together with the U.S. EPA, grant permits for specific activities to minimize environmental impacts. The California Energy Commission provides the leadership for an LNG Interagency Permitting Working Group to ensure close communication

among, and support for, agencies potentially involved in the permitting process of any LNG facility in that state.

State and local government agencies are also involved in zoning, construction, operation, and maintenance of LNG terminals. Local fire and police departments have jurisdiction on the basis of protecting the safety and security of the surrounding area.

Safety and security systems rely on personnel who are well trained on operational and maintenance procedures. Organizations such as the Society of International Gas Tanker and Terminal Operators, Gas Processors Association, and National Fire Protection Association (NFPA) have guidelines and provide training based on industry best practices. NFPA, for example, has developed fire safety codes and standards drawing on the technical expertise of diverse professionals, and on technical standards developed by organizations such as the American Society of Mechanical Engineers and the American Society of Civil Engineers.

Below is a list of other entities which may be involved in the process of siting and regulating LNG facilities:

- Additional Federal Agencies:
    - U.S. Environmental Protection Agency
    - U.S. Minerals Management Service
    - U.S. Fish and Wildlife Service
    - U.S. Dept. of Labor/Occupational Safety & Health Administration
    - U.S. Army Corps of Engineers
    - U.S. Maritime Administration
    - National Oceanic and Atmospheric Administration
    - U.S. Department of Homeland Security
    - U.S. Department of Justice
    - Federal Bureau of Investigation
- State and Local Agencies
    - State departments of environmental protection
    - Local governments
    - Fire departments
    - Law Enforcement
    - Critical Infrastructure Protection agencies

- Non-Governmental Standards Organizations
    - National Fire Protection Association
    - American Society of Mechanical Engineers
    - American Society of Civil Engineers
    - American Petroleum Institute
    - American Concrete Institute
    - American Society for Testing and Materials

3.2 FERC Review Process

The FERC LNG Program assures the safe operation and system reliability of proposed and operating jurisdictional LNG facilities throughout the United States. FERC coordinates closely with the USCG and DOT to assure a complete and seamless review of LNG operations from the point of entry into U.S. waters.

The project timeline for any LNG project proceeding before the Commission may be segmented into three distinct phases:

- Pre-filing technical consultation, which might include interagency coordination, scoping of issues, alternative siting analysis, and public outreach
- Pre-decision review
- Post-decision inspection and monitoring

More information on the FERC process and public involvement can be found at *www.ferc.gov.* A particularly useful document is available at *http://www.ferc.gov/for-citizens/citizen-guides/citz-guide-lng.pdf.*

3.2.1 Pre-Filing Technical Consultation

Prior to a company filing an LNG-related application, company representatives meet with FERC staff to explain the proposal and solicit advice. These meetings provide applicants the opportunity for FERC staff to offer suggestions related to the environmental, engineering and safety features of the proposals of prospective applicants. LNG project applicants are also required to develop and implement a Public Participation Plan that identifies specific tools and actions to facilitate stakeholder communication and dissemination of public information.

In this manner, FERC staff learns about future projects that may be filed at the Commission and can help direct companies in application preparation. This assistance is provided as part of the formal Pre-Filing Process. The process requires applicants to engage stakeholders in early discussions and resolution of issues that must be addressed for each project. The fire service is an important stakeholder and should be included early in the process. It is recommended that the fire service contact the applicant at this stage and begin building a positive working relationship early.

3.2.2 Pre-Decision Review

Prior to any Commission decision regarding an application for a new LNG terminal, FERC staff prepares an Environmental Impact Statement (EIS) to fulfill the requirements of the National Environmental Policy Act (NEPA). NEPA requires that federal agencies consider impacts to the environment of all proposals for major federal actions and, when appropriate, consider alternatives to those proposals. The purpose of the document is to inform the public, other permitting agencies and FERC Commissioners about the potential environmental impacts of proposed projects and their alternatives.

Applicants initiate the environmental review process through filing of an application which must include an Environmental Report (ER) with the 13 Resource Reports listed below:

- Resource Report 1-General Project Description
- Resource Report 2- Water Use and Quality
- Resource Report 3-Fish, Wildlife, and Vegetation
- Resource Report 4-Cultural Resources
- Resource Report 5-Socioeconomics
- Resource Report 6-Geological Resources
- Resource Report 7-Soils
- Resource Report 8-Land Use, Recreation and Aesthetics
- Resource Report 9-Air and Noise Quality
- Resource Report 10-Alternatives
- Resource Report 11-Reliability and Safety
- Resource Report 12-PCB Contamination
- Resource Report 13-Engineering and Design Material

The NEPA process includes open consultation with relevant agencies and the public. Although most applicants notify and meet with the public in advance, the formal NEPA process begins after an application is filed. In October, 2006 FERC adopted a final rule requiring potential developers of new liquefied natural gas (LNG) facilities to initiate a pre-filing process at least six months prior to filing a formal application with the Commission. The rule establishes mandatory pre-filing procedures for all applicants seeking to site, construct and operate new LNG terminals and related facilities, such as pipelines, that would transport the revaporized LNG to markets across the U.S. Prior to the October, 2006, ruling the pre-filing process was voluntary.

As the lead federal agency, FERC staff also coordinates closely with the U.S. Army Corps of Engineers, the U.S. EPA, and the States in fulfilling the requirements of the Clean Water Act, the

Rivers and Harbors Act, the Clean Air Act, and the Coastal Zone Management Act. FERC coordinates with the USCG to ensure the waterways management/navigation safety issues under the Ports and Waterways Safety Act and the maritime security issues under the Maritime Transportation Security Act are addressed.

The NEPA documents for new LNG facilities (and major expansions of existing sites) include a thorough study of potential impacts to public safety. To protect the public from potential incidents at an LNG facility, FERC staff determines if the proposal meets the siting requirements of the DOT regulations in 49 CFR 193 and National Fire Protection Association Standard (NFPA) 59A. The siting analysis includes:

- Verification of LNG dike and impoundment volumes
- Equipment spacing
- Design spills
- Exclusion zone calculations

Thermal radiation and flammable vapor exclusion zones are required within the facility property or on adjacent property whose activities are controlled by the operator or government agency. FERC engineering staff independently calculates and verifies the hazard modeling and presents the results in the EIS.

FERC staff also determines areas of hazard with respect to LNG spills from ships during the analysis of an LNG terminal. Staff uses results from the following two reports to calculate thermal radiation and flammable vapor dispersion distances:

- Department of Energy Report: *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water* (December 2004).
- Methodology described in FERC's study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers* (June 18, 2004).

Results from the analysis are estimates of an average, most probable "worst case" scenario that provides guidance in developing the safety and security requirements for LNG vessel transport, as well as in establishing potential impact areas for emergency response and evacuation planning. The results of this analysis, included in the draft EIS should be a focus of attention for the fire service.

FERC staff must also address any waterway issues such as vessel traffic congestion and security concerns.

Another significant component of this analysis is the Cryogenic Design Review, which runs parallel to the environmental review and assures the safe design of the proposed facilities and system reliability. During this phase, FERC engineers (and consultants) perform a detailed review of the proposed LNG facility design. FERC engineers evaluate:

- Design features

- Tank foundations
- Piping and instrumentation
- Seismic design
- Pressure relief and venting
- Spill containment
- Hazard detection & control systems
- Fire fighting water systems
- Emergency shutdown
- Security & emergency plans

The completed Cryogenic Design and Inspection Manual summarizes the design, process and equipment proposed at the LNG facility and includes the FERC staffs' conclusions and recommendations concerning the proposed project. Ultimately, these recommendations appear as conditions in any FERC Order approving the project. The fire service should be aware of the FERC findings and recommendations related to the Cryogenic Technical Review.

3.3 USCG Review Process

The USCG released guidance for conducting a Waterway Suitability Assessment (WSA) on June 14, 2005, in a Navigation and Vessel Inspection Circular (NVIC). The guidance in NVIC 05-05 is an important new development in the area of safety and homeland security for the transportation of LNG. The purpose of the guidance is to assist applicants in the analysis of safety and security of the port, terminal, and vessels and the surrounding public and infrastructure for the transportation of LNG. This information will be used by the USCG for assessment of the proposed marine operations and fulfilling its obligations to the FERC to provide input to the EIS. A WSA is now required before the applicant may secure a Letter of Recommendation (LOR) from the USCG to transport LNG via ship through state and federal waters to an onshore LNG terminal.

3.3.1 Waterway Suitability Assessment

While there are increased demands for LNG and concerns for safety and security of the various existing and proposed projects, LNG terminal projects must follow a comprehensive permitting process, led by the Federal Energy Regulatory Commission (FERC) for onshore terminals by the Maritime Administration (MARAD) and by the U.S. Coast Guard for offshore projects. This level of strict control results in a careful analysis of the risks. An element of the approval process needing improvement was guidance on the assessment of the safety and security aspects of the transportation of LNG by carriers to onshore terminals. The U.S. Coast Guard recently published guidance (NVIC 05-05)[3] requiring a Waterway Suitability Assessment (WSA). The

[3] NVIC 05-05 Waterway Suitability Assessment , USCG, 2005, http://www.uscg.mil/hq/gm/nvic/NVIC%2005-05.doc.pdf

latter is developed in conjunction with federal and state agencies and port stakeholders, as part of the approval process for securing a Letter of Recommendation (LOR) from the U.S. Coast Guard in order to transport LNG via ship through state and federal waters to an onshore LNG terminal.

Most of the public attention on LNG terminal siting has focused on the potential worst case consequences of LNG releases and fires which results in a limited analysis that does not lead to a complete risk assessment. A complete risk assessment examines the potential consequences as well as the likelihood of spill events. The WSA process involves examining all of the factors for assessing safety and security risks, including the measures taken by industry and government to manage these risks. By framing LNG in the context of risk instead of basing it solely on potential worst case consequences, an informed judgment on the risk to society can be made. The results can then be used to compare the risk of LNG operations to other industries and other societal risks posed to the public.

The WSA process includes consideration of both safety and security risk factors in a holistic manner. Participants in the WSA process include the applicant, USCG, the local fire service and law enforcement and port stakeholders such as port pilots with existing knowledge of the physical characteristics and existing traffic patterns on the waterway.

A primary objective of the WSA is to identify the federal, state, local and private sector resources needed to carry out the mitigation measures identified in the WSA. The fire service is an important participant in the WSA process and should use the opportunity to participate, voice its opinions on the vulnerabilities identified and the degree and type of risk management measures required. A full discussion of the Waterway Suitability Process is presented in Appendix C.

For guidance and clarification of the roles and activities of various participants in the WSA process, please refer to the USCG Navigation and Vessel Inspection Circular 05-05 which was issued on June 14, 2005, and is available at: http://www.uscg.mil/hq/g-m/nvic/.

The scope of a WSA is to:

- *Address* transportation of LNG from a carrier's entrance into U.S. territorial waters, through its transit to/from LNG terminal (receiving) facility, and including operations at the vessel/facility interface;
- *Address* navigational safety issues and port security issues introduced by proposed LNG operations;
- *Identify* relevant safety and security issues from a broad viewpoint of impact to the entire port, as well as provide a detailed review of specific points of concern along a carrier's proposed transit route;
- *Identify* effective mitigation methods to reduce safety and security-related potential risks to a generally acceptable level of risk.

While the WSA is a major step forward in assessing safety and security risks, in practice the process leaves the applicant with some challenging decisions that the guidance does not fully answer. The NVIC guidance was not meant to be prescriptive in its approach, but, rather is intended to provide a nationally consistent process that will produce port-specific results.

3.3.2 Role of the U.S. Coast Guard

The WSA planning processes come under the jurisdiction of the USCG. An applicant proposing a new LNG terminal or modification of an existing LNG terminal must submit a Letter of Intent (LOI) to the appropriate USCG Captain of the Port (COTP). The COTP must assess the suitability of the waterway for LNG marine traffic and then prepare a Letter of Recommendation (LOR) with the determination. A proposed LNG terminal project can not proceed without an LOR deeming the waterway suitable for LNG marine traffic.

With the issuance of NVIC 05-05, a WSA is now required prior to an LOR being issued. The WSA process is solely under the direction of the USCG COTP. According to the NVIC, the purpose of a WSA is "...to ensure that full consideration is given to safety and security of the port, the facility, and the vessels transporting LNG." The WSA identifies credible safety hazards and security threats to LNG transportation in that port and waterway and identifies appropriate risk mitigation measures.

The WSA process includes consideration of both navigational safety and maritime security. The navigational safety portion of the WSA is most likely well understood and includes issues previously considered for other forms of marine transportation. It is the maritime security part that is less familiar to the participants and as such poses the greatest challenge. Growing public concern for the security of LNG transits make this evaluation even more important.

The participants of the WSA process include the applicant, the USCG, the local fire service and law enforcement, critical infrastructure protection personnel, and port stakeholders such as port pilots with existing knowledge of the physical characteristics and existing traffic patterns on the waterway. For maritime safety, they consider the change in the port safety environment due to the introduction of the LNG ship transportation including the potential for groundings, collisions and allisions. The WSA includes information on the commercial traffic within the waterway, recreational vessel usage of the waterway, and the time of day when the waterway is at its peak usage. It also includes physical considerations such as bridges, natural or man-made hazards, underwater pipelines, as well as important or significant icons, such as parks, monuments, etc., along the transit to the terminal and nearby the berth at the LNG terminal.

For LNG terminal projects and related shipping, NVIC 05-05 calls for the involvement of a cross-section of the public officials responsible for the safe transit of LNG vessels bound for a U.S. port. The COTP may also involve existing or ad hoc committees (e.g., Area Maritime Security Committee (AMSC) comprising law enforcement, subject matter experts, critical infrastructure protection agencies, emergency responders, other industrial users of the port, etc. to participate in the process.

As part of the WSA, an analysis is prepared by the project applicant, drawing on internal and/or external security and safety expertise, to determine potential risks of safety hazards and security threats to the vessel, the public and property along the transit route and at the terminal berth. The analysis includes measures that should be employed to mitigate such risks and is conducted in consultation with key stakeholders at the port, often represented by such groups as the AMSC. Once the applicant has completed the WSA, it is submitted to the USCG COTP who may then convene another stakeholder team (often a subcommittee of the AMSC) to review and validate the analysis for completeness and accuracy. Subsequently, the COTP, using their input from the

local stakeholders, prepares a Waterway Suitability Report that is submitted to FERC for use in their permitting process and forms the basis for the USCG's LOR.

Once the LNG terminal becomes operational, a Vessel Transit Plan is usually developed that provides detailed information on the safety and security regime to be implemented when an LNG vessel calls on that port. The plan should be developed with an eye toward flexibility as it must be able to change to meet the specific operational requirements of each transit as well as changes in MARSEC threat levels. The various security plans need to mesh well with the emergency management plans along the vessel transit route and the emergency response plan at the terminal.

A primary objective of the WSA is to identify the federal, state, local and private sector resources needed to carry out the mitigation measures identified in the WSA. The WSA also requires the identification of the resources currently available and the mechanism by which funding will be provided for additional public or private resources needed for the safety and security of the LNG marine transit and unloading operations at the terminal.

The various stakeholders may have differing opinions on the vulnerabilities identified and the degree and type of risk management measures required. Part of the WSA's purpose is to raise and discuss these issues and reach agreement on the best, site-specific approach for managing the risks.

3.3.3 Benefits of Waterway Suitability Assessment (WSA) Process

For the fire service, a key outcome of the process is the improved understanding of the hazards of the intended operation, an opportunity to query the project team, USCG and other stakeholders on the planned operations, to interject comments and ask questions of the group, and the opportunity to identify resource needs for managing emergencies.

The results of the 2004 Department of Energy (DOE) funded study by Sandia National Laboratories on the risks of intentional and accidental spills of LNG on water provide the basis for analyzing the consequences within the WSA[4]. While this study was mostly a consequence analysis, it did recommend that a risk-based approach be used for the analysis of these situations. Consequence-based zones of concern are to be overlaid on carrier routes to assess potential consequences of an accidental or intentional release of LNG along the waterway.

The WSA process will have a positive impact on the various proposed projects and existing terminals since it addresses the need for conducting a comprehensive safety and security risk assessment in a systematic and participatory manner for new or modified facilities. Without the consistency of a standard WSA process, a strong potential exists for a wide variety of unanswered public concerns along with biased and unscientific studies being conducted without the benefit of full subject matter expert and stakeholder input.

The WSA guidance provides a robust process for reviewing safety and security issues specific to a proposal. Appropriate stakeholder involvement and technical expertise is involved, and the process tackles tough issues in the proper environment. The WSA considers infrastructure

[4] *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water*, Sandia, http://www.fossil.energy.gov/programs/oilgas/storage/lng/sandia_lng_1204.pdf

dependencies and impacts along the route of the carrier; and it systematically addresses risk measures against standardized attack modes and vulnerabilities to provide a better basis for USCG and FERC decision-making.

3.4 The Public's Role in the LNG Siting Process

Regulatory processes for LNG facility siting and expansion encourage open public consultation and comment, which are critical to successful project planning and development. Informed decision making increases certainty that safer and more secure projects with a high degree of environmental integrity are approved.

Opportunities for public participation exist at many stages of the permitting process. Generally, the public first receives notice of a facility project (either through a mailing from the applicant or through newspaper notices) when the company proposing the project begins to prepare environmental studies as required for the FERC application, or when a company seeks easement or purchase of land from private landowners or local governments. Once an application is filed, FERC publishes a notification of application in the Federal Register. The Federal Register is the federal government's daily publication of rules, proposed rules and notices of government organizations accessed through http://www.gpoaccess.gov/fr/index.html. FERC's records on a project are available through FERC's website and are accessed by using the applicant's docket number.

Public meetings are required under pre-filing FERC approval processes. Such meetings provide a public forum for questions and concerns about proposed projects. The public can also express views in writing directly to FERC. The Environmental Assessment (EA) and Environmental Impact Statement (EIS) processes allow for a public comment period. All comments received during this open comment period, announced in the Federal Register, are addressed in the final EA or EIS.

More information on the FERC process and public involvement can be found at www.ferc.gov. A particularly useful document, *A Guide to LNG: What All Citizens Should Know*, is available at www.ferc.gov/for-citizens/my-rights.asp. In addition, a diagram illustrating public input opportunities is available at http://www.ferc.gov/help/processes/flow/lng-1.asp.

3.5 First Responder's Role in the FERC Regulatory Review Process

The focus of the natural gas industry, the public, and federal, state, and local governmental agencies on new LNG facilities and expansions to existing LNG facilities has raised awareness about relevant siting and operational issues. Such dialogue is needed to assure that the use of LNG will be safe and secure and will maintain the integrity of the human and natural environment. Citizens and communities are likely to seek the opinions of public safety officials about the risks of LNG during the siting review process. The fire service can be influential in the decision process and should be well-informed and involved early in the process.

Figure 4 is an illustration of the how and when the fire service should become involved in the LNG terminal siting process. The phases (or Steps) shown in the large shaded areas are intended to convey the importance of an on-going involvement along with the need to be aware of and involved with all of the other responsible parties throughout the process.

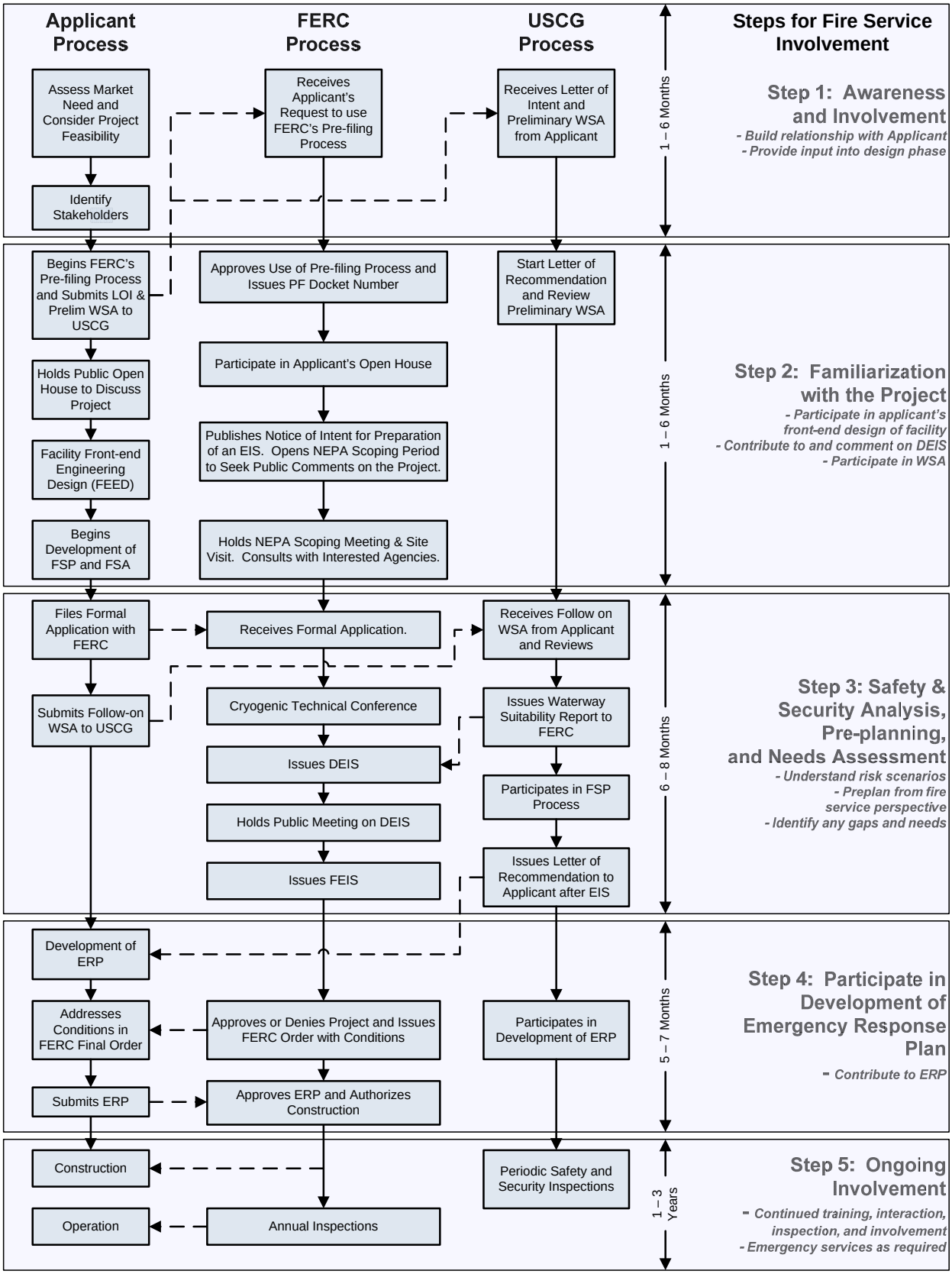
It is beneficial and efficient for the fire service to be involved from the pre-filing stage all the way through to the construction and operation phase as decisions early in the process regarding design and operation will affect decisions made later in the process regarding the Emergency Response Plan. Each step involving the fire service is iterative and builds on knowledge, understanding and relationships developed early in the process.

Use both Figure 4 and the detailed checklists to get an overall idea of the time and resources needed to participate as a full partner in the LNG terminal siting process. You will need to plan ahead for your involvement and maintain contact with the applicant throughout. Use of the diagram in Figure 4 and the checklists should result in a compendium of technical information about the site, a better understanding of waterway and vessel transport issues, and a complete Emergency Response Plan which contains the cost-sharing plan.

It is strongly recommended at a very early stage in the process that an experienced ranking person within the fire service be assigned to coordinate the necessary fire service involvement throughout the process. If this person leaves or is reassigned, then a management of change system needs to be in place so the new person may be able to properly serve the needs of the community in the LNG terminal siting and operations. In certain jurisdictions, it may be necessary to form an ad-hoc committee led by the coordinator from the fire service.

Figure 4

Fire Service Involvement in LNG Siting Process



Section 3.5.1 below has a more complete explanation of the expectations during each part of the approval and siting process, how and when the fire service should be involved, as well a general description of how long each part of the process might take. Specific suggestions for activities and tasks for the fire service to consider are outlined in greater detail in the checklist section that was developed to accompany Figure 4.

3.5.1 Opportunities for Fire Service Involvement

The first responder has a critical role to play in the development and ongoing operations of LNG facilities. The recommended approach is a strong working relationship with the proposed or current operating facility. A step-by-step process on how and when to get involved and who to seek out to get involved is discussed below:

Step 1 - Awareness and Involvement

In this Step, the fire service should spend time building a strong working relationship with the Applicant and becoming familiar with both the proposed project and the FERC review process. As soon as you become aware that an LNG operation is planned in your jurisdiction, you should make contact with the Applicant to get to know them and provide them with the opportunity to get to know you. In an initial meeting, all experts and company officials should be introduced, their background and expertise explained and the fire service should discuss jurisdictional issues. Consider developing a Memorandum of Understanding outlining periodic reviews or training required by the facility or fire service to enable continuity if personnel changes occur.

Both parties should agree on how and when to continue their interactions and how information should be shared. It is important for the fire service to impress on the Applicant that early involvement of the fire service in the planning, research and design phase will benefit the Applicant and save time and effort.

At this point in the process, it would be timely to provide training to fire service personnel to familiarize them with the hazards of LNG and likely accident scenarios.

Step 1 occurs as the Applicant is designing the facility, conducting site surveys, beginning surveys and studies and requesting the use of FERC's pre-filing process. At this point, the Applicant will also submit a Letter of Intent and preliminary Waterway Suitability Assessment to the USCG.

The FERC process at this stage includes facilitating the identification of issues and study needs, initiating the preparation of the preliminary NEPA document and reviewing draft resource reports (these draft resource report are related to the project description, the impact of the project on environmental, cultural and geological resources, and the potential implications of the project on land use, air quality and noise and aesthetic issues). Consider assigning a coordinator and, if necessary, from an ad hoc team at this point.

The pre-filing process will require a minimum of 6 months before an application is actually filed with FERC.

Detailed suggestions for administrative and technical tasks appropriate for the fire service in Step 1 are found in the checklist section in Step 1.

Step 2 - Familiarization with Project

In this Step, the fire service should research and understand the technical aspects of what the applicant proposes to build, how it will operate and how it will affect and be affected by the surrounding community. During this stage, the Applicant will be developing the front-end engineering design (FEED) of the facility. The Applicant will benefit from the involvement of the fire service at this early stage as the fire service has unique knowledge about the community that could be important. In addition, as the Applicant designs the facility, input from the fire service regarding equipment spacing, spill containment, and impoundment volumes is critical.

Discussions between the fire service and the Applicant should be held now regarding access routes to the facility, water supply and how security measures might impact the ability of the fire service to effectively respond to the facility in an emergency.

This step in the fire service's involvement includes participating in community activities such as the applicant's open house for stakeholders and participating in the early stages of the NEPA process.

Other activities that take place around this time include the FERC publication of the Notice of Intent for preparing an EIS and the beginning of the NEPA scoping period. Concurrently, the USCG will have started developing its Letter of Recommendation and reviewing the preliminary WSA.

Now is the time to become familiar with the WSA process by reviewing NVIC 05-05 and the information in Appendix B. The applicant should have conducted a Facility Security Assessment (FSA) and should be developing their draft Facility Security Plan (FSP). The FSA and FSP will enable the applicant to incorporate the security measures needed to address security-related risks. As mentioned before, the FSA and the Emergency Response Plan need to mesh well together so the facility may properly address all the risks.

These activities will take a minimum of 6 months and may occur before the application is filed.

Detailed suggestions for administrative and technical tasks appropriate in Step 2 are found in the checklist section in Step 2.

Step 3 - Safety/Security Analysis, Pre-planning and Needs Assessment

This Step occurs around the time that a formal application is filed with FERC and the WSA and EIS/EA processes are underway. The FERC engineering review will be taking place at this time as well as the marine safety review, coordinated with the USCG. Both of these technical reviews are of importance to the fire service and require attendance and participation in all conferences and consultations. The expertise of the fire service will be critical for the Applicant in understanding the details of the challenges posed by the

LNG facility and the kinds of scenarios for which the fire service needs to prepare. The fire service should use this Step to begin understanding their needs for manpower, equipment and training. A thorough understanding of the technical safety and security issues analyzed during this Step will enable the fire service to participate better in documentation of the ERP in Step 4.

Activities undertaken at this point can take up to 6 or 8 months to complete.

Detailed suggestions for administrative and technical tasks appropriate in Step 3 are found in the checklist section in Step 3.

Step 4 - Emergency Response Plan Development

This step occurs at the time FERC issues the final EIS and their Order authorizing the project if it is approved. The Applicant must provide an ERP for the facility and transit route for FERC approval prior to any facility construction activities. In addition, the cost-sharing plan, which outlines mechanisms for funding all project-specific security/emergency management costs that may be imposed on state and local agencies, must be completed at this time. This is a critical part of the fire service's involvement and is the culmination of all of the previous administrative and technical review and participation that the fire service is recommended to have undertaken in the first three steps.

During this time period, the USCG will also issue its Letter of Recommendation to the Applicant at any time after the final EIS is issued. In this step, meetings with appropriate stakeholders to discuss the process and specifics for completing the ERP should begin. Stakeholders will likely be interested in hearing from the fire service about its plans for emergency response, how it plans to notify local businesses and residents, the plans for evacuation, evacuation routes and shelter for displaced residents. Having a solid communication plan with a backup plan in place is one key to a successful ERP.

The ERP must be prepared prior to starting the construction phase of the LNG project—a phase that could last up to 3 years.

Activities during this phase are expected to take between 5 and 7 months and require the fire service's full involvement.

Detailed suggestions for administrative and technical tasks appropriate in Step 4 are found in the checklist section in Step 4. In addition, Appendix C contains draft guidance developed by FERC for what constitutes a complete ERP for an LNG terminal. Appendix A (Informational Resources) lists other documents and guidelines that will be helpful to the fire service in understanding how to prepare for different types of incidents.

Step 5 - Ongoing Involvement

Step 5 occurs during and after the facility's construction and continues during the facility's construction and operation. It is important for the fire service to maintain ongoing positive relationships with the facility owners and operators that consist of regular communication regarding personnel, changes in the facility or ongoing needs for

training, drills and exercises. Continued fire prevention, testing and coordination are essential.

Adjustments should be made to the ERP to reflect modifications at the facility or lessons learned from training or real emergencies. Continued planning, training, drills and exercises are important as is establishing a protocol for regular re-evaluation of manpower availability and equipment needs. Maintain updated communications contacts and ensure that the fire service has the ability to routinely tour the facility and the ships.

Activities during this time period include the construction of the facility, which may take up to 3 years, initialization of operations and ongoing operations into the future.

Detailed suggestions for administrative and technical tasks appropriate in Step 5 are found in the checklist section in Step 5.

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Five Phase Process[1]

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Step 1: Awareness and Involvement with Applicant

Administrative tasks:

- ☐ Identify LNG operations planned or operating in your area of responsibility.
  - ☐ Ensure you are connected with communications on LNG projects. If a new facility is proposed or sited in your community, you may learn about it through the mail or through newspaper notices. Property owners within a half-mile of the proposed site will be notified by certified or first-class mail once the pre-filing process results in the filing of an application.
  - ☐ Attend any pre-filing process public meetings scheduled by the company wishing to site the facility.
  - ☐ Familiarize yourself with the FERC on-line resources that will enable you to participate in the formal public comment periods and access records and documents that are submitted to the docket. The docket information and a guide to using the electronic resources are located at www.ferc.gov.
  - ☐ Review public information on the owner's website or other sources.
- ☐ Contact the proposed owner/operator of the site as soon as the pre-filing process begins.
  - ☐ Initiate a meeting with the applicant, specifically requesting to meet with safety, security, and technical staff on the project.
  - ☐ Solicit names, titles and credentials of technical staff for the project and for the fire service.
  - ☐ Identify a single point of contact for the applicant; offer a single point of contact for the fire service.
  - ☐ Identify applicant's marine-based safety specialist, if there is one who is different from other safety and security specialists.

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- ☐ Discuss and understand jurisdictional issues related to the scope of the project.
  - Does the proposed site or ship transit, including the pier, reside in multiple fire service jurisdictions? If so, there is a need to coordinate with the applicant and those other state and local jurisdictions.
  - Does fire service jurisdiction include EMS or not? If so, these issues need to be explored with the applicant.
  - How will the fire service be included in discussions about security?
- ☐ Decide how to share information regarding the project - especially information that may be business confidential or sensitive security information.
  - Provide instructions to fire service personnel who might not be familiar with how to handle sensitive and proprietary information. Specifically, provide guidance on proper handling of Sensitive Security Information (SSI) per USCG (www.uscg.mil/hq/g-m/mp/pdf/GuideSSI.pdf) or Critical Energy Infrastructure Information (CEII) documents per FERC (http://www.ferc.gov/legal/ceii-foia.asp).
- ☐ Consider developing a Memorandum of Understanding outlining periodic reviews or training required by the facility or fire service to enable continuity if personnel changes occur for the contacts involved in the ongoing industry-fire service relationship.
- ☐ Learn how to contact the appropriate federal, state and local decision makers and other stakeholders in the review and siting process. (See Appendix A of the NASFM LNG guidance for contact information).
- ☐ Contact municipal elected officials to ensure they are aware of the project. Advise them of the fire departments involvement as well as the staff and time commitment that will be needed.
- ☐ Contact county and state fire officials. Make them aware of the project and invite them to participate throughout the project.
- ☐ Obtain the necessary budget approval for the time and resources that will be required to manage the siting process.

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Technical Tasks:

- Conduct preliminary training for the fire service to become familiar with the hazards of LNG, general operational and processing practices of US LNG facilities, the history of LNG safety and incidents and likely emergency response scenarios.
- Contact fire departments with similar facilities to solicit their experiences and suggestions to develop an understanding of preplanning, tactics, fire suppression methods, and public protection guidelines.
- Obtain LNG and other MSDS information from the applicant and become aware of general hazards of the materials being stored and processed.

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Step 2: Familiarization with the Project

Among other activities, the applicant will be developing the front-end-engineering design (FEED) of the facility at this time. Input and coordination with the fire service at this stage would have the greatest and most efficient impact.

Administrative tasks:

- ☐ Review project information in the FERC public docket accessible through www.ferc.gov.
- ☐ Review the proposed site plan location to understand the design and layout of the proposed facility.
  - There should be a siting analysis created to comply with the Department of Transportation's regulations in 49 CFR 193 and National Fire Protection Association Standard 59A. This siting analysis should contain verification of LNG dike and impoundment volumes, equipment spacing, design spills, and exclusion zone calculations.
- ☐ Request from the applicant a review of the facility's design basis, project plans and operating parameters.
- ☐ Participate in the applicant's Open House held to discuss the project with stakeholders.
- ☐ Consider whether to submit comments to FERC during the NEPA scoping period.
- ☐ Propose initial and on-going training for the host department and mutual aid departments.
- ☐ Identify resource needs and gaps and begin the development of the cost-sharing plan, including Memorandum of Understanding, to facilitate the availability of such resources.

Technical tasks:

- ☐ Identify and evaluate such siting and design issues as:
  - access routes to the terminal;
  - staging locations for apparatus;

- exposures;
- occupancies requiring special attention during emergencies;
- proximity to other hazardous activities (manufacturing facilities, rail lines for hazardous materials transport, etc.);
- special circumstances such as high angle or confined space rescue issues and identify the ability of the host department to provide the service (equipment, training, etc.);
- location of containment systems, fixed suppression and other safety systems provided by the terminal;
- ingress and egress to the facility and the pier (to ensure that the width and length of fire apparatus will be accommodated and they have the ability to pass each other, especially on the pier);
- ability of the pier to carry the weight of apparatus, including multiple pieces of equipment;
- water supply and location including water supply to the pier;
- ability to gain access to ship.

☐ Understand LNG ship designs and cargo sizes that will be unloaded at this terminal as well as the cargo unloading system.

☐ Understand the vessel fire and vapor detection systems along with the firefighting systems.

☐ Understand security issues and their implications for fire safety (must not block access to site with permanent barriers, etc.).

☐ Determine the applicant's fire safety strategy.

☐ Identify types of extinguishing agents and quantities needed to handle LNG incidents and identify sufficient number of applicators.

☐ Outline manpower requirements and ability of the host department to provide such resources.

☐ Understand what kind of shipboard incidents may occur and whether shipboard firefighting and specialized equipment is available or must be acquired.

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Step 3: Safety/Security Analysis, Pre-Planning and Needs Assessment

The purpose of this Step is to research, plan and assess the technical hazards and needs that may be posed to the community by an LNG terminal. At the conclusion of this Step, the fire service should have the information needed to participate in the documentation of the ERP required by the FERC Order, the creation of the Emergency Manual as required by the USCG, and the cost-sharing plan.

Administrative tasks:

- Review the Draft Environmental Impact Statement (DEIS), particularly the Resource Report 11, Reliability and Safety, for discussion of hazards on site, etc., and provide comment to the public docket and/or the applicant directly. See www.ferc.gov for obtaining the docket. (See Section 3.4 of this guidance on how to obtain public documents.)
- Participate in public meetings regarding the DEIS.
- Discuss with the applicant the cost-sharing plan outlining how the applicant will contribute to implementation of additional safety and security investments for the community.
- Participate in USCG Waterway Suitability Assessment (WSA).

The WSA is conducted under guidance released by the US Coast Guard called NVIC 05-05 (click here to access the NVIC: http://www.uscg.mil/hq/g-m/nvic/index00.htm) and its scope includes addressing transportation of LNG from a carrier's entrance into US waters through its transit to/from an LNG terminal and including operations and the vessel/facility interface. The WSA addresses navigational safety issues and port security issues and identifies relevant safety and security issues from a broad perspective of impact to the entire port. Participants in the WSA process include the USCG, local fire service, subject matter experts, law enforcement, critical infrastructure protection agencies, key port stakeholders and port pilots with existing knowledge of the physical characteristics and existing traffic patterns on the waterway. The WSA must be completed before the Waterway Suitability Report may be sent to the FERC from the USCG and a Letter of Recommendation is issued.

Technical tasks:

- Contribute technical input to the WSA such as explaining resources available for emergency response, knowledge of significant local hazards and exposures to be aware of, training and capabilities available, and mutual aid agreements in place.
- Explain the WSA results to other local fire personnel, pubic officials, or the public in public meetings or various other forms of communication.

National Association of State Fire Marshals
Checklist for Fire Service Participation in LNG Terminal Siting and Operations
Five Phase Process[1]

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Step 4: Participation in Development of the Emergency Response Plan (ERP) for the LNG Facility and Related Community Issues

A key element of the safety of an LNG facility is the ERP. This document serves multiple roles as a planning document, a training guideline, a communication tool for employees and the public, and as a reference during actual emergencies. While the responsibility for the development of the LNG facility ERP resides with the facility, the plan must be prepared in consultation with the USCG and state and local agencies, and it must be approved by the Commission prior to the start of construction. An ERP should also be created for the construction phase.

Each LNG terminal operator must develop an Emergency Response Plan and cost-sharing plan with written procedures for responding to:

- *emergencies within the LNG terminal;*
- *emergencies that could affect the public adjacent to an LNG terminal;*
- *emergencies that could affect the public along the LNG vessel transit route.*

Administrative tasks:

- ☐ Participate in applicant meetings convened for ERP development.
- ☐ Understand the FERC Final Order and the contingencies contained within it.
- ☐ Understand the USCG Letter or Recommendation and any contingencies contained within it related to emergency planning.
- ☐ Evaluate the DEIS and the results of the WSA and determine the resources required for managing any residual risks.
- ☐ Review relevant information discussed in the Cryogenic Technical Conference.

Technical tasks:

- ☐ Develop site specific emergency pre-plans with the applicant for all credible scenarios identified in the DEIS and WSA.
- ☐ Develop and document planning for onsite incidents including prompt incident notification.

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Checklist for Fire Service Participation in LNG Terminal Siting and Operations
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- Develop a communications plan (including a backup plan) to ensure ongoing communication with first responders, facility personnel, local government, residents and the media (have a list of contacts and more than one way to reach them).
- Develop a plan for and document methods of notification for facilities/communities near the LNG facility in the unlikely event of an incident or evacuation emergency.
- Plan for and document evacuation/shelter-in-place plans for residents and local businesses.
- Plan for and document evacuation routes including alternatives.
- Plan for and document means to shelter displaced residents.

National Association of State Fire Marshals
Checklist for Fire Service Participation in LNG Terminal Siting and Operations
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Step 5: Ongoing Involvement in Operations of the Facility

Administrative tasks:

- Work with the applicant to establish a fire safety plan for the construction phase of the facility.
- Establish a protocol for scheduled periodic re-evaluation of manpower availability and equipment needs.
- Understand potential changes to the operations, physical plant, etc., and adjust planning, training, drills and exercises prior to initiating.
- Ensure the ability of fire service to routinely tour plant, ships, etc., to encourage familiarization.
- Establish regular, ongoing meetings to review changes to facility and personnel at both the facility and the fire service.
- Resolve any issues with operations including discussing resource and training required.

Technical tasks:

- Conduct initial training and drills for fire service and facility personnel.
- Establish regular, on-going training for host department and mutual aid departments.
- Conduct routine tabletop drills and live training exercises.

[1] **"Fire Service Guidance for Participating in LNG Terminal Evaluation, Siting, and Operations," National Association of State Fire Marshals, Washington, DC, February 2007**

3.6 Post Authorization Inspection and Monitoring

Once a project is authorized, the comprehensive design review and inspection process continues. This occurs in two main phases during construction and during operation. If a company receives FERC approval for a project and has met all pre-construction conditions required by a FERC Order, including the development and approval of an Emergency Response Plan, the Director of Office of Energy Projects will authorize construction to begin. Construction of an LNG facility can take up to 3 years.

Once in operation, each LNG facility under FERC jurisdiction is required to file semi-annual reports to summarize plant operations, maintenance activity and abnormal events for the previous six months. FERC staff conducts regular inspections (focusing on equipment, operation, safety and security) of each facility throughout its operational life. The fire service should establish contact with the facility management to be aware of these issues as well.

In addition to FERC inspections and monitoring, the DOT/PHMSA/OPS performs construction and operational safety inspections and the USCG inspects the operational and security compliance of facilities annually.

4.0 LNG EMERGENY RESPONSE PLANNING

A key element of the safety of an LNG facility is the Emergency Response Plan (ERP). This document is required by the Energy Policy Act of 2005 (P.L. 109-58, Section 311) which requires an Emergency Response Plan to be prepared in consultation with the USCG and state and local agencies and be approved by the Commission prior to any final approval to begin construction. The Plan must include a cost-sharing plan. This document serves multiple roles as a planning document, a training guideline, a communications tool for employees and the public, and as a reference during actual emergencies and as the outline of the details of the emergency response cost-sharing plan.

Appendix C consists of FERC's draft Guidance for LNG Terminal Operators Emergency Response Plan. The draft guidance presents the regulatory basis, what the contents of the plan should be, at a minimum, and provides several attachments outlining other relevant regulatory guidance. This draft FERC guidance is subject to change.

There are many other useful documents and guidelines that may be useful to the fire service when preparing to participate in the ERP development and documentation. A list and brief summary of these resources is provided in Appendix B under Emergency Response Planning-Other Resources.

The final ERP is focused on both the waterway as well as the facility hazards. By becoming directly involved in the emergency planning process, the fire service has an opportunity to further understand the hazards, to determine potential impacts to the community, to assess current capabilities to manage emergencies, to determine any gaps in resources and existing plans, and to complete the required resource emergency response cost-sharing plan in cooperation with the applicant.

5.0 LNG FACILITIES SAFETY AND SECURITY CONSIDERATIONS

As a facility in the US energy infrastructure, LNG facilities are one of numerous possible terrorist targets. However, LNG facilities are also one of the more highly protected. The higher levels of protection found at LNG facilities make planning and executing an attack more difficult. This has the effect of reducing the attractiveness of LNG as a target. LNG facilities and ships require a higher degree of planning, resources, knowledge, and risk to attack than softer targets. The risk of attack for LNG facilities must be placed in perspective relative to other more attractive and unprotected infrastructure/energy assets that the US is obligated to protect from the threat of terrorism.

Appendix D outlines some of the important safety and security considerations given to the shipping of LNG, the terminals where LNG is received and the carriers used to transport it. Appendix D also discusses steps taken to improve Homeland Security and how the Maritime Transportation Security Act relates to the shipping of LNG. The fire service should be aware of the security planning that has taken place and should be certain that security measures will not hamper their ability to respond in an emergency. The vessel security plan, area maritime security plan, facility security plan, vessel transit management plan, terminal emergency response plan, and emergency management plans along the transit route must all be compatible to ensure safe and secure operations along with the appropriate level of response to an incident.

6.0 CONCLUSIONS

The fire service has a crucial role in the entire lifecycle of the LNG terminal from concept, to engineering/design, to permits and regulatory analysis and compliance, and finally to construction and ongoing operations. In the end a constructive relationship with the local fire service will serve the interests of the applicant, federal, state and local government, and the public.

There are numerous opportunities to become involved but clearly involvement in the earliest stages ensures that design and operating concepts are introduced to the project making the overall residual risk lowest. This allows for improved fire prevention and emergency response, lowers overall community risks, and provides the earliest opportunity for effective cost-sharing plans and agreements.

This guidance is intended to make the myriad of activities and the technical topic more understandable so as to maximize the opportunities for the fire service to be involved and to make a positive difference in an efficient and effective way.

The fire service and other appropriate emergency response officials are encouraged to implement the 5-step NASFM model in cooperation with the applicant, FERC and other stakeholders and regulators to achieve these objectives.

Glossary of Terms

CLNG - Center for Liquefied Natural Gas. www.lngfacts.org

Import terminal - Facility that has the capability of accepting and storing LNG from overseas. There are currently five terminals operating in the United States and one in Puerto Rico.

Liquefaction - The process of cooling natural gas to -260° F until it becomes a liquid, i.e. liquefied natural gas (LNG).

Liquefaction plant - Facility that has the capability of cooling natural gas to form LNG. This is also called an LNG export facility.

Peak-shaving facilities - Facilities at which LNG is stored during periods of low natural gas demand. When it is needed, it is warmed back to gas and shipped to end users.

Regasification - The process of warming (LNG) until it returns to its gaseous state.

Autoignition temperature - The lowest temperature at which a gas will ignite without the presence of an ignition source.

British Thermal Unit (BTU) - A BTU is the amount of heat required to change the temperature of one pound of water by one degree Fahrenheit.

Cryogenic - The science of producing very low temperatures such as those required for natural gas liquefaction.

Cubic Foot - A unit of measurement of gas volume. It is the amount of gas required to fill a volume of one cubic foot under stated conditions of temperature, pressure, and water vapor.

Density - The property of a fluid equal to volume divided by weight.

Department of Energy (DOE) - The Department of Energy is the 12th Cabinet Position, and it consists of the Office of the Secretary of Energy and the Federal Energy Regulatory Commission. It was created on August 4, 1977 as a result of the Department of Energy Organization Act of 1977. There are many subdivisions within the DOE, but the Economic Regulatory Administration and Energy Information Administration are two groups which have significant bearing on gas utility operations. www.doe.gov

Energy Information Administration (EIA) - The statistical information collection and analysis branch of the Department of Energy. www.eia.doe.gov

Environmental Protection Agency (EPA) - A federal agency created in 1970 to permit coordinated and effective governmental action, for protection of the environment by the systematic abatement and control of pollution, through integration of research monitoring, standard setting, and enforcement activities. www.epa.gov

Explosion - The sudden release or creation of pressure and generation of high temperature as a result of a rapid change in chemical state (usually burning), or a mechanical failure.

Fahrenheit degrees (F) - A temperature scale according to which water boils at 212 and freezes at 32 degrees. Convert to Centigrade degrees C by the following formula: (F -32)/1.8 = C.

Federal Energy Regulatory Commission (FERC) - A U.S. government agency created by Congress in 1977. The act transferred to the FERC most of the former Federal Power Commission's interstate regulatory functions over the electric power and natural gas industries. In 1978, Congress passed the Natural Energy Act, broadening the FERC's jurisdiction and regulatory functions. The FERC now also regulates producer sales of natural gas in intrastate commerce. The FERC establishes uniform ceiling prices for each of several categories of natural gas, and these prices apply to all sales on a nationwide basis. www.ferc.gov

Flammability limit - Of a fuel is the concentration of fuel (by volume) that must be present in air for an ignition to occur when an ignition source is present.

Liquefaction of Gases - Any process in which gas is converted from the gaseous to the liquid phase.

Liquefied Natural Gas (LNG) - Natural gas which has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. It remains a liquid at -116 degrees Fahrenheit and 673 psig. In volume, it occupies 1/600 of that of the vapor at standard conditions.

MARAD - United States Maritime Administration, Department of Transportation, whose mission is to improve and strengthen the U.S. marine transportation system - including infrastructure, industry and labor - to meet the economic and security needs of the Nation.

MCF - Thousand cubic feet.

MTPA - Million Tonnes per Annum. Tonnes or Metric Ton is approximately 2.47 cubic meters of LNG.

National Gas Transportation Association (NGTA) - Formerly the National Transportation & Exchange Association. A group that promotes understanding of the national pipeline grid and is working toward standardization in the industry.

Natural Gas - Naturally occurring mixture of hydrocarbon and nonhydrocarbon gases found in porous geologic formations. The primary component is methane.

Peak shaving LNG Facility - A facility for both storing and vaporizing LNG intended to operate on an intermittent basis to meet relatively short-term peak gas demands. A peak shaving facility may also have liquefaction capacity, which is usually quite small compared to vaporization capacity at such facility.

Pipeline - All parts of those physical facilities through which gas is moved in transportation, including pipe, valves, and other appurtenances attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

Pipeline Capacity - The maximum quantity of gas that can be moved through a pipeline system at any given time based on existing service conditions such as available horsepower, pipeline diameter(s), maintenance schedules, regional demand for natural gas, etc.

Pressure, Atmospheric - The pressure due to the weight of the atmosphere (air and water vapor) on the earth's surface. The average atmospheric pressure at sea level (for scientific purposes) has been defined at 14.696 pounds per square inch absolute.

Receiving Terminal - Coastal plant that accepts deliveries of liquefied natural gas and processes it back into gaseous form for injection into the pipeline system. Also known as regasification or liquid terminal.

Stranded Gas - Gas that is not near a market and that does not have an economic basis for development and production.

Throughput - The volume of natural gas that may be carried through a pipeline over a period of time.

Appendix A: Informational Resources

Further information on LNG issues can be obtained from a variety of government, industry, and organization sources as represented in the sampling below.

LNG hazards in particular are described in three key documents:

"Liquefied Natural Gas: An Overview of the LNG Industry for Fire Marshals and Emergency Responders", NASFM, 2005.

Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water, Sandia, http://www.fossil.energy.gov/programs/oilgas/storage/lng/sandia_lng_1204.pdf

Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers, ABS). http://www.ferc.gov/industries/lng/safety/reports/cons-model.pdf

LNG-Related Websites for General Information

The **Energy Information Administration** (EIA), created by Congress in 1977, is a statistical agency of the U.S. Department of Energy (DOE). A variety of LNG statistics and other information can be found on the EIA website, including the latest updates of the Global Liquefied Natural Gas Market: Status and Outlook and U.S. LNG Markets and Uses. www.eia.doe.gov

The **Federal Energy Regulatory Commission** (FERC) is an independent agency that regulates the interstate transmission of natural gas, oil, and electricity. FERC also regulates natural gas and hydropower projects. The LNG portion of the FERC website includes an LNG overview and provides answers to important questions about all aspects of the value chain and LNG security and safety. www.ferc.gov/industries/lng.asp

The **National Association of Regulatory Utility Commissioners** (NARUC) is a nonprofit organization of governmental agencies engaged in the regulation of U.S. utilities and carriers. The NARUC website contains comprehensive information on its activities and programs (including those related to LNG), testimony and publications, news, upcoming events, and links to state regulatory commissions. www.naruc.org

The **National Energy Technology Laboratory,** the newest of DOE's national laboratories, works to develop breakthrough technologies and approaches that will assure the safe, clean, and affordable use of U.S. fossil energy resources through the 21st century. A search of the website using the keyword LNG reveals papers, presentations, and other information related to a basic understanding of LNG. www.netl.doe.gov

DOT's Pipeline and Hazardous Materials Safety Administration Office of Pipeline Safety (OPS) website can be accessed at http://primis.phmsa.dot.gov/comm/.

DOE's **Office of Fossil Energy** supports research and policy options to ensure clean, reliable, and affordable supplies of natural gas for American consumers. The Fossil Energy website contains many features concerning natural gas and LNG, including the web feature, Liquefied Natural Gas–a Basic Understanding. www.fossil.energy.gov

The **California Energy Commission** serves as the state's primary energy policy and planning agency for keeping historical energy data and meeting future energy needs. This website includes LNG news, FAQs, state energy policy, proposed projects within the state, and guidance on public participation, security, and safety. www.energy.ca.gov/lng

The **Center for Energy Economics at the University of Texas-Austin, Bureau of Economic Geology** hosts a website on the role of LNG in North American energy security. This website provides a variety of LNG reference reports in English and Spanish, such as Introduction to LNG, LNG Safety and Security, and The Role of LNG in North American Natural Gas Supply and Demand. www.beg.utexas.edu/energyecon/lng

The **Center for Liquefied Natural Gas** has attracted more than 50 members, including LNG asset owners and operators, gas transporters, and natural gas end users. The Center's website contains FAQs, quick facts, a historical perspective, discussion of issues, and a multimedia area. A short video on LNG is available online. www.lngfacts.org

The **Gas Technology Institute (**GTI) is an independent, not-for-profit technology organization that works with its customers to find, produce, move, store, and use natural gas. A search of the keyword LNG on the GTI website provides visitors with a list of links, including descriptions of LNG research and development at GTI, and other useful documents and information sources. www.gastechnology.org

The **International LNG Alliance** (ILNGA) is sponsored by the United States Energy Association (USEA), the U.S. Member Committee of the World Energy Council (WEC). It works to promote and advance the safe, reliable, cost-effective, and environmentally sound use of LNG, as well as the development of LNG infrastructure. The ILNGA website includes information on the various education, policy, and trade and business development aspects of LNG. www.ilnga.org

Liquefied Natural Gas (LNG) Infrastructure Security: Background and Issues for Congress by Paul W. Parfomak of the Congressional Research Service (September 9, 2003; document RL32073) provides an overview of recent initiatives and key policy issues associated with LNG security. www.pennyhill.com/infrastructure.html

Protecting America's Ports, Maritime Transportation Act of 2002 is a brief document published by the U.S. Department of Homeland Security that describes the new regulations of the Maritime Transportation Act of 2002. Included in this document is a fact sheet outlining the implementation requirements and other security initiatives of the new Act. www.dhs.gov/interweb/assetlibrary/MTSA_Presskit.doc

U.S. Department of Energy, Office of Fossil Energy's mission is to ensure that the United States can continue to rely on clean, affordable energy from traditional fuel resources.

www.fossil.energy.gov

The **Center for Energy Economics at the University of Texas-Austin, Bureau of Economic Geology** hosts a website on the role of LNG in North American energy security. This website provides a variety of LNG reference reports in English and Spanish, such as Introduction to

LNG, LNG Safety and Security, and The Role of LNG in North American Natural Gas Supply and Demand. www.beg.utexas.edu/energyecon/lng

Emergency Response Planning-Other Resources.

FERC has released a guidance document outlining the requirements for LNG terminals under its jurisdiction. See *Draft Guidance for LNG Terminal Operator's Emergency Response Plan (July 11, 2006), FERC.* The draft is reprinted in its entirety in Appendix C.

Federal Emergency Management Agency (FEMA), Emergency Management Guide for Business and Industry describes the importance of incident management control and suggests media training for those who must use the media to communicate. Available at http://www.fema.gov/business/index.shtm.

BP LNG Fire Protection and Emergency Response (Fire Booklet VII), 2nd Edition. Available from the Institute of Chemical Engineers, 165-189 Railway Terrace, Rugby CV21 3HQ, UK. +44(0)1788 578214 or www.icheme.org/shop.

Liquefied Gas Fire Hazard Management-First Edition (2004). Society of Industrial Tanker and Terminal Operators (SIGTTO). This is an excellent resource that provides information about fire hazard management for liquefied gas carriers and terminals. This publication is available from SIGTTO. http://sigtto.re-invent.net/dnn/Home/tabid/36/Default.aspx on the Publications page.

The **National Fire Protection Agency (NFPA)** has several codes that are related to planning emergency response for hazardous materials incidents. *NFPA 471, Recommended Practices for Responding to the Hazardous Materials Incidents, 2002*, contains suggested lists of personal protective equipment that is appropriate for different incident levels. This information could be useful in assessing and developing resource needs and cost-sharing plans.

NFPA 472, Standards of Professional Competencies of Responders to Hazardous Materials Incidents, 2002, describes the different types of competencies needed to responds to different incident levels. This information might help the fire service assess training needs and approaches specific to LNG emergencies.

NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs, 2004, describes the kinds of concerns that a private business has for planning for response and business continuity. This information might help the fire service better understand the planning needs of the facility beyond the emergency response. The document also contains useful information about developing a communications plan including methods to coordinate and clear information for release and responding to the media.

National Response Team's Integrated Contingency Plan Guidance (also called "One Plan") (61 Fed Reg 109, June 5, 1996) is used for certain facilities to prepare ERPs. It guides the consolidation of multiple plans and helps demonstrate compliance with various regulatory requirements for oil and non-radiological hazardous materials substances. There is useful information in the guidance about how to develop an ERP which reflects a hierarchy of responses according to the seriousness of the incident.

Noll, Hildebrand, and Yvorra. *Hazardous Materials: Managing the Incident*, 3rd Edition, Oklahoma State University, Fire Protection Publications. 2005. This textbook describes safe operating procedures for responding to hazardous materials emergencies, including public protective actions such as shelter in place and evacuation.

Appendix B: Waterway Suitability Assessment Process

USCG Waterway Suitability Assessment (WSA) Process

The Department of Homeland Security (DHS) United States Coast Guard (USCG) released guidance for conducting a Waterway Suitability Assessment (WSA) on June 14, 2005 in a Navigation and Vessel Inspection Circular (NVIC). The guidance (COMDTPUB P16700.4 NVIC 05-05) is an important new development in the area of safety and homeland security for the transportation of liquefied natural gas (LNG). The purpose of the guidance is to assist existing terminal operators or applicants seeking to build an onshore terminal in the analysis of safety and security of the port, terminal, and vessels and the surrounding public and infrastructure for the transportation of LNG. This information will be used by the USCG for assessing the proposed marine operations and fulfilling its obligations to the Federal Energy Regulatory Commission (FERC) to provide input to their Environmental Impact Statement under the National Environmental Policy Act (NEPA).

The significance of the new guidance is profound. It sets precedence for the analysis of safety and security risks of the transportation of LNG to onshore terminals at a time when the need is greatest and the concerns for safety and security are heightened. It encourages the involvement of various stakeholders, including the fire service, for the analysis and validation of the WSA. FERC may determine the need to annually review and update the WSA. It tackles challenging issues related to LNG carrier safety and security in port operations and intercoastal waterways.

The basis of the assessment comes from the recent Department of Energy (DOE) funded study by Sandia National Laboratories on the safety implications of intentional and accidental spills of LNG on water.[5] While this study was mostly a consequence analysis, it did recommend that a risk-based approach be used for the site specific analysis of these situations. Consequence-based zones of concern are to be overlaid on carrier routes to assess potential consequences, vulnerabilities, likelihood of attack, and mitigation measures.

This summary discusses the process and focuses on the steps of the WSA process including identification of vulnerabilities, determination of consequences and likelihood, and evaluation of risk associated with vessel transit and unloading operations at the LNG terminal.

Definition of a Risk-Based Approach

The use of the guidance in the NVIC is encouraged. The NVIC describes a risk-based framework but is flexible on the exact approach used. One of the references for the NVIC is the Risk-Based Decision Making, COMDTINST M16010.3 (Series) and USCG 'Guidelines for Risk-Based Decision-Making 3rd edition', which provide further guidance on establishing a risk-based approach.

The analysis should include the following key steps:

A. Port Characterization

[5] Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water, Sandia, 2004, http://www.fossil.energy.gov/programs/oilgas/storage/lng/sandia_lng_1204.pdf

B. Characterization of LNG Facility and LNG Carrier Route
C. Risk Assessments (Safety and Security)
D. Risk Management Strategies
E. Resource Needs for Safety, Security and Response
F. Conclusions and Recommendations

The NVIC itself does not define a specific risk-based approach other than to state that applicants are encouraged to conduct a risk-based assessment. The approach considers risk as the combination of the consequences of an undesired event and the associated probability of that event occurring. Fundamentally, this means asking:

- What can go wrong?
- How severe can the consequences be?
- What is the likelihood that this will occur?

By answering these three questions the stakeholders are able to effectively characterize the risk. Keep in mind that revisions may occur to the initial NVIC so it is imperative that you are sure that the most recent version is being used.

It goes on to state "The applicant may use any assessment methodology deemed appropriate. However, it is recommended that the applicant use a methodology that meets generally accepted risk-based decision-making industry standards and that the assessment is as objective and transparent as possible. The Risk Assessment portion of the WSA looks at the conditions that could result in a release of LNG. The events that could trigger a release may be accidental (collisions, groundings, spills, etc.) or intentional (terrorist act, sabotage, etc). The accidental releases should be considered in a safety assessment that looks at the probability and consequences of various incidents. For the unique case of intentional releases a security assessment is performed."

Each segment along the carrier route inbound and outbound is characterized by describing the maritime conditions, length of route, vessel speed, physical obstructions and hazards, and other required considerations.

The Sandia study is used along with NVIC 05-05 Enclosure 3 Risk Management Quick Reference Tool to define:

- the Risk Factors including Zones of Concern (Zones 1-3)
- the Attack Vectors and Accident Types
- the Risk Mitigation Strategies recommended by the USCG for consideration for each attack vector and accident type.

Sandia National Laboratory could issue new information incorporating new research and understanding so it is important to be sure you are referring to the most recent version.

The potential impacts of an LNG event on port infrastructure, marine traffic, workers, visitors, roadways, and the public were considered by overlaying the Sandia zones and assessing the

population or activity within the zones. If a segment could produce a Zone of Concern that impacted one of the four Risk Factors (Transit near heavy marine traffic, Transit near medium population areas, Transit near high population areas, or Transit near critical infrastructure & key assets), then those impacts were summarized and considered during the risk ranking process.

Interpretation of the Study Zones of Concern

There are numerous references to the Sandia study, as this was meant to be a definitive resource for the issues of spills of LNG on water from carriers. The guidance provides thorough direction for industry to follow, but in practice it doesn't address all of the issues needed to assess consequences for a specific WSA study since that wasn't the objective of the report. As a result, applicants are required to interpret the results of the Sandia study or add to them to complete the WSA. Due to this requirement, there is the potential for some local interpretation leading to national inconsistencies. This will have to be addressed by the USCG during the oversight of the processes.

The Zones are explained in Enclosure 11 of NVIC 05-05 (see below).

Summary of "Zones of Concern" for Intentional LNG Spills

Zone 1: This is the area with the most severe consequences around the LNG carrier, where an LNG spill could pose a severe public safety and property hazard and could damage or significantly disrupt critical infrastructure and key assets located within this area. Zone 1 is considered to extend about 500 m (0.3 miles) for an intentional breach of an LNG carrier. Risk management strategies should address vapor cloud dispersion and fire hazards. The most rigorous deterrent measures should be considered when major critical infrastructure elements, such as population or commercial centers, lie within Zone 1. These measures should include such things as vessel security zones, waterway traffic management, and establishment of positive control over vessels. Coordination among all port security stakeholders is essential. Incident management and emergency response measures should be carefully evaluated to ensure adequate resources (i.e., firefighting, salvage) are available for consequence and risk mitigation.

Zone 2: This is an area with less severe consequences than Zone 1 and is considered to extend from 500 m (0.3 miles) to 1,600 m (1 mile) for an intentional breach of an LNG carrier. Risk management strategies should address vapor cloud dispersion and fire hazards. When major critical infrastructure elements occur within Zone 2, risk management strategies that should be considered include incident management and emergency response measures that ensure areas of refuge (enclosed areas, buildings) are available, the development of community warning procedures, and education programs to ensure that communities are aware of precautionary measures.

Zone 3: This is an area with the least likelihood of severe consequences and is considered to extend from 1,600 m (1 mile) to a conservative maximum of 3,500 m (2.2 miles) from the LNG carrier, in the unlikely event that 3 cargo tanks were breached and a vapor cloud disperses without an initial ignition. Risk management strategies should address the vapor cloud dispersion hazard. When major critical infrastructure elements occur within Zone 3, risk management strategies that should be considered include incident management and emergency response measures that ensure areas of refuge are available and community education programs should be considered to ensure that people know what to do in the unlikely event of the release of a vapor cloud without initial ignition.

Understanding the Zones of Concern

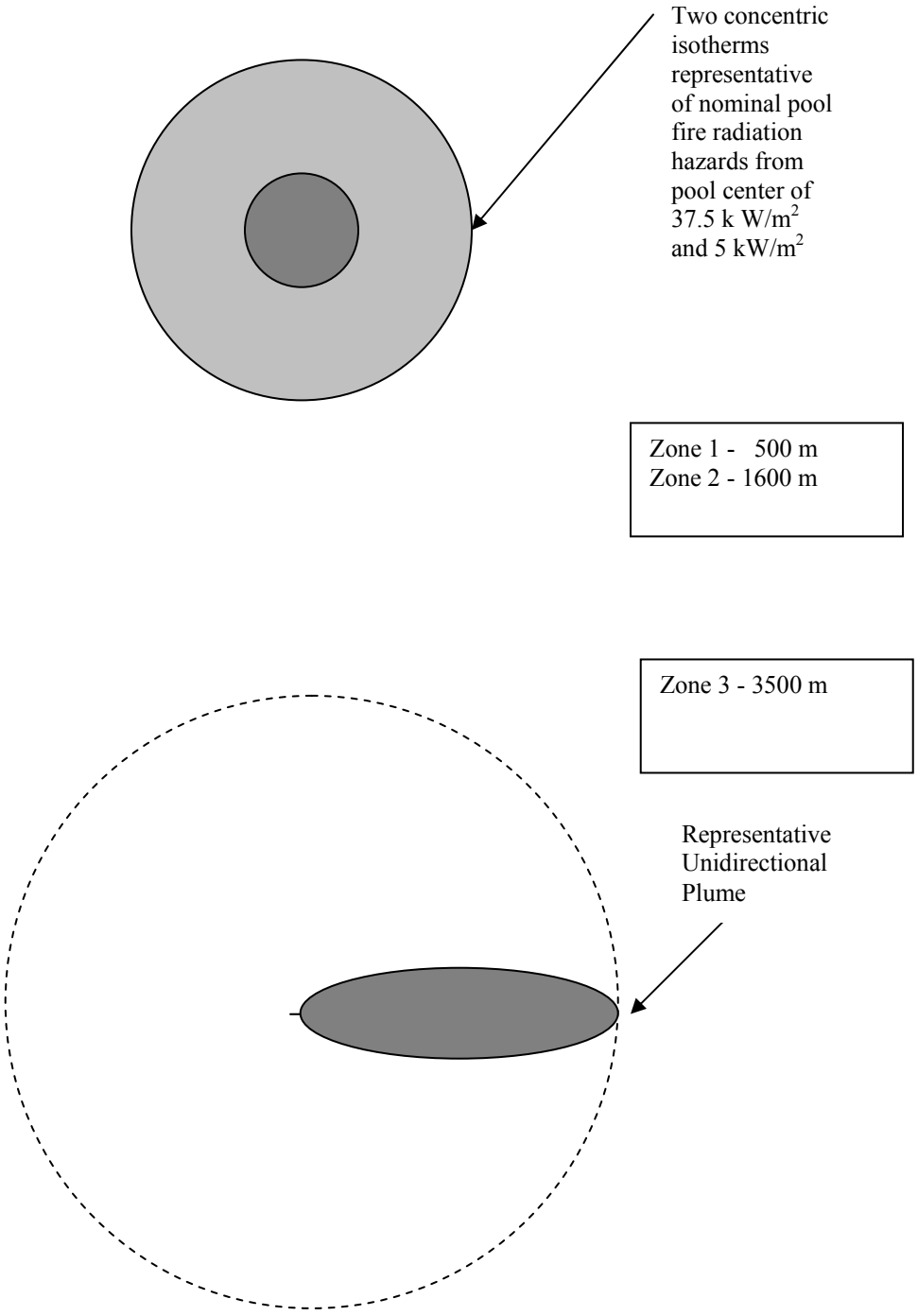
The Zones were not produced to derive specific levels of consequences at all possible locations for WSA studies so each proposed LNG terminal site should be evaluated for its specific vulnerabilities and consequences using these as guidance only. Zones 1 and 2 were to be considered as circles representing isotherms. Zones 1/2 were based on a nominal result from considering up to 1 tank volume released. Zone 1 was 37 kW/M2 and Zone 2 was 5 W/m2. Zone 3 was the distance to the isopleth of the Lower Flammability Level (LFL), but while it may be possible to go in any of 360 degrees direction, it is assumed to be a unidirectional plume shaped cloud.

Note that the zones of concern are guidance, but further analysis may be needed using computational fluid dynamics (CFD) to better characterize spill consequences in a specific geographic area. The Sandia Report describes the application of CFD modeling to LNG releases. CFD is an expensive modeling approach to use and requires a specialist with significant scientific and consequence modeling experience to ensure quality.

There seems to be some confusion on Zone 3 and how to evaluate risk from it including flash fire risks. Sandia stated that "large, unignited LNG vapor releases are unlikely. If they do not ignite, vapor clouds could spread over distances greater than 1600 m from a spill. For nominal accidental spills, the resulting hazard ranges could extend up to 1700 m. For a nominal intentional spill, the hazard range could extend to 2500 m. The actual hazard distances will depend on breach and spill size, site-specific conditions, and environmental conditions." Zone 3 was a vapor dispersion case from up to 3 tanks released and was anticipated to be a plume resulting from an unignited release. Zone 3 was 100% of the Lower Flammable Limit for methane. Zone 3 should be considered a vapor cloud directed towards a populated area and evaluated as to confinement, likelihood of ignition, and effects.

Figure B-1 illustrates the concept. These zones are to be overlaid along the carrier route to determine potential consequences.

Figure B-1
Illustration of Zones of Concern (Intentional Release)
(Based on NVIC 05-05, Enclosure 11)
(Not to Scale)



Sandia concluded that releases from intentional acts against an LNG carrier would create a larger potential consequence than from accidental causes as shown in Figure B-2. The NVIC guidance (Enclosure 3) provides recommended Risk Management Strategies against these Zones, but note that they do not distinguish between safety and security zones. The authors referred to the original Sandia report and considered the more limited impacts consistent with their conclusion for accidental consequences.

Figure B-2
Guidance for Impacts on Public Safety from LNG Breaches and Spills

EVENT	POTENTIAL SHIP DAMAGE AND SPILL	POTENTIAL HAZARD	POTENTIAL IMPACT ON PUBLIC SAFETY*		
			High	Medium	Low
Collisions: Low speed	Minor ship damage, no spill	Minor ship damage	None	None	None
Collisions: High Speed	LNG cargo tank breach and small - medium spill	Damage to ship and small fire	~ 250 m	~ 250 – 750 m	> 750 m
Grounding: <3 m high object	Minor ship damage, no breach	Minor ship damage	None	None	None
	Intentional breach and medium to large spill	Damage to ship and large fire	~ 500 m	~ 500 m – 1600 m	> 1600 m
Intentional Breach	Intentional, large release of LNG	• Damage to ship and large fire	~ 500m	~ 500 m – 1600 m	> 1600 m
		• Vapor cloud dispersion with late ignition	~ 500 m	> 1600 m	> 2000 m

* Distance to spill origin, varies according to site
Low – minor injuries and minor property damage
Medium – potential for injuries and property damage
High – major injuries and significant damage to property

The three zones are characterized in Figure B-3. Note that there is an implied low likelihood of delayed ignition and flash fire risks making the 'likelihood' of Zone 3 impacts lower given an attack is assumed than Zone 1 or 2.

Figure B-3 Summary of Zones of Concern (derived from NVIC 05-05, Enclosure 11 and Sandia report)					
Zones of Concern (NVIC 05-05, Enclosure 11)	**Type of Initial Event**	**Extent of Impacts (m)[6]**	**Hazards**	**Level of Concern**	**Likelihood of Impacts Given Initial Event Occurs**
1	Intentional single tank to up to 3 tank breach (5 m2 hole size)	391 – 529 (Nominal 500 m)	Thermal radiation from resulting pool fire (conductive, convective, and radiative) leading to severe public safety and property hazards and could damage or significantly disrupt critical infrastructure and key assets	$\geq$ 37.5 kW/m^2	Likely
2	Intentional single tank to up to 3 tank breach (5 m2 hole size)	1305 – 1652 (Nominal 1600 m)	Fire (radiative) leading to less severe public safety and property hazards	37.5 to 5 kW/m^2	Likely
3	Intentional release from single and 3 tanks (both assumed 5m2 hole size)	Single tank 2450m 3 Tanks 3614m Nominal 3500 m)	Vapor cloud (flash fire and possible confined space overpressure) disperses without an initial ignition leading to even less severe public safety and property hazards (down wind impacts as compared to radial for Zone 1 and Zone 2.	Within flammable envelope of dispersed cloud to LFL endpoint	Very Unlikely due to need for delayed ignition and consequences dependent on wind direction. Overpressure requires confinement

[6] Table 41, Sandia SAND2004-6258, pg. 144.

Consequence Scales

The guidance referenced in the NVIC did not specify that consequences needed to be quantified, but in practice it was helpful to frame the risks across broad categories of consequences such as potential fatalities or injuries, economic impacts, and environmental impacts.

Sandia did not publish a prescribed factor for estimated fatalities, injuries, or damages within each zone, so the applicant would have to draw those conclusions if more detailed results are desired.

Stakeholder Involvement

The WSA is to address the safety and security issues of the various stakeholders. It accomplishes that goal by ensuring there is a representative committee formed to address the WSA process. Sandia recommended that the "risk identification and risk management processes should be conducted in cooperation with appropriate stakeholders, including public safety officials and elected public officials. Considerations should include site-specific conditions, available intelligence, threat assessments, safety and security operations, and available resources." The information is protected by Sensitive Security Information (SSI) requirements, which precludes public disclosure.

Appendix C: FERC Draft Guidance for LNG Terminal Operator's Emergency Response Plan

9/21/2006 Draft (subject to change)

Introduction and Purpose

Each LNG terminal operator must develop an *Emergency Response Plan* with written procedures for responding to: emergencies within the LNG terminal; emergencies that could affect the public adjacent to an LNG terminal; and emergencies that could affect the public along the LNG vessel transit route. The *Emergency Response Plan* must be prepared in consultation with the U.S. Coast Guard and state and local agencies, and it must be approved by the Commission prior to the start of construction. The principal requirements that apply to the *Emergency Response Plan* result from:

A. Section 311of the Energy Policy Act of 2005 (see Attachment 1).
B. The emergency response plan condition in the Commission Order authorizing an LNG terminal (see Attachment 2).
C. The U.S. Department of Transportation (DOT) regulations in 49 CFR Part 193.2509 "Emergency Procedures" (see Attachment 3).
D. The U.S. Coast Guard regulations in 33 CFR Part 127.019 "Operations Manual and Emergency Manual: Procedures for Examination"; Part 127.307 "Emergency Manual"; and Part 127.309 "Operations Manual and Emergency Manual: Use" (see Attachment 4).

Agency Roles

The U.S. Coast Guard Captain of the Port or designated Marine Safety Unit serves as the initial contact point for consultation in developing the *Emergency Response Plan*. During the typical 3-year construction period, the requirement to annually review and update the project's Waterway Suitability Assessment (WSA) may identify changes to the project and/or port that require the Coast Guard to review and validate the updated WSA. This may also necessitate revisions to either the *Emergency Response Plan* or the associated Cost Sharing Plan.

At least 30 days before transferring LNG, the LNG terminal operator must submit two copies of its emergency manual (*Emergency Response Plan*) to the Captain of the Port. If the Captain of the Port finds that the emergency manual meets the requirements, one copy will be marked "Examined by the Coast Guard" and returned to the operator (33 CFR Part 127.019).

The Community Assistance & Technical Services (CATS) Managers in each DOT region are the primary contacts for state and local governments concerning the Commission's process for approving *Emergency Response Plans*. When requested, CATS Managers will respond to inquiries from state and local agencies as well as the public; and will attend meetings with FERC staff on these matters.

After an LNG terminal is commissioned, LNG inspectors from the DOT Pipeline and Hazardous Materials Safety Administration (PHMSA) Regional Office will examine the emergency response and preparedness plans (*Emergency Response Plan*) for compliance with 49 CFR Part 193.2509 as part of their standard facility inspections.

Content of the Emergency Response Plan

To assist LNG terminal operators with developing the facility's *Emergency Response Plan* for our subsequent review and approval, we have prepared this guidance document. At a minimum, the *Emergency Response Plan* must address each of the sections identified below with a level of detail appropriate for the design of the facility and the nature of development adjacent to the site and vessel transit. As each site presents unique challenges, it is essential for a prospective LNG terminal operator to consult during the pre-filing phase with the U.S. Coast Guard, first responders, and appropriate state and local agencies.

This document provides guidance on what topics must be addressed in the *Emergency Response Plan*. To assist LNG terminal operators on how to develop the components of plan, selected references are listed in Appendix B of the NASFM Guidance.

While recognizing that certain components of the *Emergency Response Plan* will contain Critical Energy Infrastructure Information (CEII), it is the desire of the Commission to have as much information as possible available to the public. Therefore, each section has a recommended classification as either "PUBLIC" or "CEII".

I. Organization and Contacts (CEII)

A. Structure of the incident management organization of the LNG terminal, including:

- Organizational structure (flow chart);
- Identification of primary personnel and team members;
- Team responsibilities and functions; and
- Liaison with U.S. Coast Guard and LNG vessel masters.

B. List of designated agency contacts – name, title, organization, and phone number of all required agency contacts including:

- U.S. Coast Guard – Captain of the Port, Marine Safety Unit;
- State, county, and local emergency planning groups;
- Local fire departments;
- State and local law enforcement; and

- Appropriate federal agencies (FERC, DOT/PHMSA Regional Office, etc.).

II. Response to Emergencies within LNG Terminal (CEII)

A. Identification of the types and locations of specific emergency incidents that may reasonably be expected to occur at the LNG terminal due to operating malfunctions, structural collapse, personnel error, forces of nature and activities adjacent to the terminal, including but not limited to:

- LNG spills with no fire;
- LNG spills with fire;
- Release of LNG vapors or natural gas;
- Releases of flammable refrigerants, highly volatile liquids, or other combustible gasses;
- Building fires;
- Grass fires, forest fires;
- Electrical fires;
- Severe weather (lightening, tornado, blizzard, etc.);
- Hurricanes;
- Emergency ship departure; unexpected disconnects;
- Bomb threats; and
- Accident involving LNG truck on site or enroute.

B. Description of the terminal alarm system for the identified emergency incidents in II A.

C. Procedures for in-plant communication and external notification in response to each identified emergency incident in II A, including incident reporting requirements (see appendix 2, and 49 CFR Part 191.25).

D. Procedures for responding to each identified emergency incident in II. A, using equipment appropriate for handling the emergency.

E. Procedures to shelter, evacuate, assemble and account for plant personnel, contractors and visitors.

F. Description of detection and shutdown systems:

- Emergency shutdown systems (ESD) – automatic and manual actuation; location and function of ESD stations; and
- Hazard detection initiated shutdown systems.

G. Hazard fire control equipment – quantity, capacity and location of all units (fire water, deluge, dry chemical, high expansion foam, etc). Include a matrix and a plot plan.

H. Local agency response for each of the identified emergency incidents in II A.

III. Emergency Evacuation Adjacent to the LNG Terminal and Along LNG Vessel Transit Route (PUBLIC)

A. Detailed procedures for recognizing an uncontrollable emergency and taking action to minimize harm to terminal personnel and the public.

B. Scalable procedures for the prompt notification of appropriate officials and emergency response agencies based on the level and severity of potential incidents, and the sequence of such notifications.

C. Procedures for notifying residents and recreational users within areas of potential hazard, including:

- Locations of permanent sirens and other warning devices; and
- Emergency coordinator on each LNG vessel to activate sirens and other warning devices.
-

D. Emergency procedures, including evacuation, for areas adjacent to LNG terminal and LNG vessel transit route. Procedures need to be developed with the local agency(ies) having the authority to implement evacuation, shelter in place, and control of highway access/egress.

E. Include maps of: (1) areas or zones to be evacuated; and (2) evacuation routes and methods of egress for residents, workers and any visitors adjacent to LNG terminal and along the route of the LNG vessel transit.

F. Emergency evacuation instructions explaining the types of emergencies, methods of notification, company and local authority contacts, and maps of emergency planning areas and evacuation routes should be clearly explained in a public pamphlet or booklet and distributed to all residences, institutions, commercial establishments and recreational areas that are located within areas potentially exposed to a hazard from an incident adjacent to LNG terminal and along the route of the LNG vessel transit.

IV. Training and Exercises (CEII)

A. Provisions for the annual review of Emergency Response Plan by terminal operator and appropriate agencies.

B. Plan for the initial and continuing training of terminal emergency personnel.

C. Plan for the initial and continuing training of first responders.

D. Procedures for emergency response drills and exercises.

E. Provision for annual emergency response drills by terminal emergency personnel, first responders, and appropriate federal, state and local officials and emergency response agencies.

V. Documentation of Required Consultation (PUBLIC)

The Energy Policy Act of 2005, the DOT regulations and the Commission Order(s) authorizing LNG terminals require consultation and coordination with the appropriate agencies in developing the *Emergency Response Plan*. Documentation should include:

A. Minutes or notes of coordination meetings, including a list of attendees (name, title, organization) to document consultation with the applicable agencies that were consulted in preparing the *Emergency Response Plan*, including:

- U.S. Coast Guard – Captain of the Port, Marine Safety Unit;
- State and county Local Emergency Planning Commissions;
- State and local law enforcement; and
- Local Fire Department(s).

B. Correspondence with consulting agencies to document their consultation in preparing the *Emergency Response Plan*.

VI. Cost Sharing Plan (CEII)

Both the Energy Policy Act of 2005 and Commission Orders authorizing LNG terminals require that the *Emergency Response Plan* include a Cost-Sharing Plan identifying the mechanisms for funding all project-specific security costs and safety/emergency management costs that would be imposed on state and local agencies.

A. The cost-sharing plan must specify what the LNG terminal operator will provide to cover the cost of the state and local resources required to manage the security of the LNG terminal and LNG vessel, and the state and local resources required for safety and emergency management including:

- Direct reimbursement for any per-transit security and/or emergency management costs (for example overtime for police or fire department personnel);
- Capital costs associated with security/emergency management equipment and personnel base (for example patrol boats, fire fighting equipment); and
- Annual costs for providing specialized training for local fire departments, mutual aid departments, and emergency response personnel; and for conducting exercises.

B. Include the LNG terminal operator's letter of commitment with agency acknowledgement for each state and local agency designated to receive resources.

Emergency Response Plan Appendices:

1. Contingency Plan for the Failure of the LNG Outer Tank Containment.

2. FERC LNG incident reporting requirements.

3. PHMSA incident reporting requirements.

‘‘(e)(1) In any order authorizing an LNG terminal the Commission shall require the LNG terminal operator to develop an Emergency Response Plan. The Emergency Response Plan shall be prepared in consultation with the United States Coast Guard and State and local agencies and be approved by the Commission prior to any final approval to begin construction. The Plan shall include a cost-sharing plan.

‘‘(2) A cost-sharing plan developed under paragraph (1) shall include a description of any direct cost reimbursements that the applicant agrees to provide to any State and local agencies with responsibility for security and safety—

‘‘(A) at the LNG terminal; and

‘‘(B) in proximity to vessels that serve the facility.’’

- (*LNG terminal*) shall develop an Emergency Response Plan (including evacuation) and coordinate procedures with the Coast Guard, state, county, and local emergency planning groups, fire departments, state and local law enforcement, and appropriate federal agencies. This plan shall include at a minimum:

  a. designated contacts with state and local emergency response agencies;

  b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

  c. procedures for notifying residents and recreational users within areas of potential hazard;

  d. evacuation routes/methods for residents along the route of the LNG vessel transit;

  e. locations of permanent sirens and other warning devices; and

  f. an "emergency coordinator" on each LNG vessel to activate sirens and other warning devices.

  The Emergency Response Plan shall be filed with the Secretary for review and written approval by the Director of OEP prior to initial site preparation. (*LNG terminal*) shall notify FERC staff of all planning meetings in advance and shall report progress on the development of its Emergency Response Plan at 3-month intervals.

- The Emergency Response Plan shall include a Cost-Sharing Plan identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. In addition to the funding of direct transit-related security/emergency management costs, this comprehensive plan shall include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. The Cost-Sharing Plan shall be filed with the Secretary for review and written approval by the Director of OEP prior to initial site preparation.

TITLE 49--TRANSPORTATION

CHAPTER I--PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION, DEPARTMENT OF TRANSPORTATION (CONTINUED)

PART 193_LIQUEFIED NATURAL GAS FACILITIES: FEDERAL SAFETY STANDARDS

Subpart F Operations

Sec. 193.2509 Emergency procedures.

(a) Each operator shall determine the types and places of emergencies other than fires that may reasonably be expected to occur at an LNG plant due to operating malfunctions, structural collapse, personnel error, forces of nature, and activities adjacent to the plant.

(b) To adequately handle each type of emergency identified under paragraph (a) of this section and each fire emergency, each operator must follow one or more manuals of written procedures. The procedures must provide for the following:

(1) Responding to controllable emergencies, including notifying personnel and using equipment appropriate for handling the emergency.

(2) Recognizing an uncontrollable emergency and taking action to minimize harm to the public and personnel, including prompt notification of appropriate local officials of the emergency and possible need for evacuation of the public in the vicinity of the LNG plant.

(3) Coordinating with appropriate local officials in preparation of an emergency evacuation plan, which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank.

(4) Cooperating with appropriate local officials in evacuations and emergencies requiring mutual assistance and keeping these officials advised of:

(i) The LNG plant fire control equipment, its location, and quantity of units located throughout the plant;

(ii) Potential hazards at the plant, including fires;

(iii) Communication and emergency control capabilities at the LNG plant; and

(iv) The status of each emergency.

[Amdt. 193-2, 45 FR 70405, Oct. 23, 1980, as amended by Amdt. 193-18, 69 FR 11337, Mar. 10, 2004]

ATTACHMENT 4

TITLE 33--NAVIGATION AND NAVIGABLE WATERS

CHAPTER I--COAST GUARD, DEPARTMENT OF HOMELAND SECURITY (CONTINUED)

PART 127_WATERFRONT FACILITIES HANDLING LIQUEFIED NATURAL GAS AND LIQUEFIED HAZARDOUS GAS

Subpart A General

Sec. 127.019 Operations Manual and Emergency Manual: Procedures for examination.

(a) The owner or operator of an active existing facility shall submit two copies of the Operations Manual and of the Emergency Manual to the Captain of the Port of the zone in which the facility is located.

(b) At least 30 days before transferring LHG or LNG, the owner or operator of a new or an inactive existing facility shall submit two copies of the Operations Manual and of the Emergency Manual to the Captain of the Port of the zone in which the facility is located, unless the manuals have been examined and there have been no changes since that examination.

(c) If the COTP finds that the Operations Manual meets Sec. 127.305 or Sec. 127.1305 and that the Emergency Manual meets Sec. 127.307 or Sec. 127.1307, the Captain of the Port returns a copy to the owner or operator marked ``Examined by the Coast Guard".

(d) If the COTP finds that the Operations Manual or the Emergency Manual does not meet this part, the Captain of the Port returns the manual with an explanation of why it does not meet this part.

Sec. 127.307 Emergency Manual.

Each Emergency Manual must contain--

(a) LNG release response procedures, including contacting local response organizations;

(b) Emergency shutdown procedures;

(c) A description of the fire equipment and systems and their operating procedures;

(d) A description of the emergency lighting and emergency power systems;

(e) The telephone numbers of local Coast Guard units, hospitals, fire departments, police departments, and other emergency response organizations;

(f) If the waterfront facility handling LNG has personnel shelters, the location of and provisions in each shelter;

(g) First aid procedures and if there are first aid stations, the locations of each station; and

(h) Emergency procedures for mooring and unmooring a vessel.

Sec. 127.309 Operations Manual and Emergency Manual: Use.

The operator shall ensure that--

(a) LNG transfer operations are not conducted unless the waterfront facility handling LNG has an examined Operations Manual and examined Emergency Manual;

(b) Each transfer operation is conducted in accordance with the examined Operations Manual; and

(c) Each emergency response is in accordance with the examined Emergency Manual.

[CGD 78-038, 53 FR 3376, Feb. 7, 1988, as amended by CGD 88-049, 60 FR 39796, Aug. 3, 1995]

Appendix D: LNG Safety and Security Considerations

LNG Shipping Considerations

The positive safety record of LNG vessels and the LNG transportation industry over the history of global LNG shipping (past 40 years) is indicative of the extensive attention to safety for the industry. It shows the cooperation of LNG importers, LNG transporters, and the USCG, and the risk and safety management considerations employed to improve LNG shipping and handling operations. Such considerations include:

- Construction of special materials and equipped with systems designed to safely store LNG at temperatures of -260 °F (-162.2°C).
- All LNG ships are constructed with double hulls. This construction method not only increases the integrity of the hull system but also provides additional protection for the cargo tanks in the event of an accidental collision or grounding.
- Gas detectors and safety alarms for continuous leak detection and monitoring
- Security management and escort of LNG ships operating in harbors and waterways.
- Vessel movement and control zones (e.g., safety and security zones) to reduce the potential for impacts with other ships or structures.
- LNG vessels must comply with all appropriate Federal and international standards regarding LNG shipping. As such, ships that transport LNG will be fitted with an array of cargo monitoring and control systems. These systems would automatically monitor key cargo parameters while the ship is at sea and during the unloading operations. The systems include provisions for:
    - Pressure monitoring and control;
    - Temperature monitoring of the cargo and surrounding ballast tanks;
    - Emergency shutdown of cargo pumps and closing of critical valves;
    - Monitoring of tank cargo levels; and
    - Gas and fire detection.

LNG ships are fitted with active fire protection systems that meet or exceed design parameters outlined in USCG regulations and international standards, such as the International Maritime Organization's (IMO) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), and Safety of Life at Sea (SOLAS) 74, including:

- Water spray deluge system that covers the accommodations house and cargo control room, cargo compressor room, and all main cargo control valves and manifolds;
- Traditional fire water system that provides water to fire monitors on deck and to fire stations found throughout the ship;

- Dry powder extinguishing system for LNG fires; and
- Carbon dioxide system for protecting main machinery space, ballast pump room, emergency generators, cargo compressors, etc.

LNG Terminal Considerations

- Construction with specialized materials and equipped with systems designed to safely store LNG at temperatures of -260 °F (-162.2°C).
- Secondary containment designed to mitigate the consequence of release, and also reduce the likelihood of a much larger release.
- Active mitigation systems (detection and shutdown) limit the size of release, thereby limiting the potential consequence of release.
- Various codes and standards for maintenance and inspection of equipment in LNG service.

Based on the number of safety systems that are employed for both LNG shipping and LNG facility operations the likelihood of a large LNG release appears to be very low. Additionally, the LNG shipping record is excellent with no accidental releases during transport.

Once the consequences and impacts are determined and the likelihood analysis complete these results are combined in a risk assessment to develop the overall risk results. Again, the current LNG siting regulations are based solely on consequence, but a general discussion of the level of risk posed by LNG activities is presented in this section.

While the potential consequences of a major LNG release could be significant, the overall risk that LNG poses to the communities that surround these facilities is driven to be as low as is reasonably practicable. For both the LNG terminals and shipping activities, through regulation and industry standards, efforts have been made to ensure not only that the potential likelihood of release is reduced, but also that if a release were to occur that the consequence is minimized through the use of secondary containment and active safety mitigation systems. In addition to primary and secondary containment of LNG and active safety mitigation systems, the separation distance ensures that the surrounding public is protected from the consequences of an LNG release at the terminal.

From this risk-based review the following is determined:

- The risk of an LNG terminal catastrophic loss is low as there are regulations and industry practices in place to minimize both the consequence, through exclusion zones, and the likelihood of release, through the layers of protection detailed above.
- While the potential consequence of an LNG shipping accident could be significant, especially if the accident occurred in route to the terminal or while the ship is moored at the terminal, the risk is also deemed to be low. Even though there is no means to mitigate the consequence if there were a collision or intentional act that resulted in a breach of the

inner hull, as discussed above there are several preventive measures that are taken to protect against this type of event from occurring.

LNG Carriers Considerations

The USCG uses a preventative approach when analyzing the shipping risks associated with a proposed LNG terminal, and developing the mitigation measures required for permitting. Unlike onshore terminals, exclusion zones are not calculated based on the modeling of LNG spills (on water). This has been a topic of considerable debate between industry, regulators, and the public.

The consequences of a LNG release on water are calculated and reported in the Environmental Impact Statements (EISs) for terminals. To support this effort, ABS conducted a study for the Federal Energy Regulatory Commission (FERC) and Sandia National Laboratory conducted a study for the Department of Energy (DOE) to provide perspective on potential consequences from releases from LNG vessels on water. These studies include:

- Discharge calculations
- Pool spread calculations
- Pool vaporization calculations
- Suggested models for thermal radiation and flammable vapor-gas dispersion

The findings of both reports (*Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water*, Sandia, and *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, ABS) are that the dynamics and dispersion of a large spill, and the potential extent of the potential consequences are not fully understood, specifically:

- The combination of current LNG ship designs and safety management practices for LNG shipping have resulted in a very low number of accidents and incidents. Therefore there is little historical or empirical information on the consequences of large spills from LNG carriers.
- Existing experimental data on LNG spill dynamics and its dispersion over water address spill sizes that are more than a factor of one hundred smaller than spill sizes currently being postulated for some intentional events. Additionally, variations in site conditions, LNG ship designs, and environmental conditions further complicate hazard predictions.

While the ABS Study focused solely on the consequence modeling issue, there are additional key findings from a more recent study undertaken by Sandia for the U.S. Department of Energy:

- Risks from accidental LNG spills, such as from collisions and groundings, are small and manageable with current safety policies and practices.
- Risks from intentional events, such as terrorist acts, can be significantly reduced with appropriate security, planning, prevention, and mitigation.

- The consequences from an intentional breach can be more severe than those from accidental breaches. Multiple techniques exist to enhance LNG spill safety and security management and to reduce the potential of a large LNG spill due to intentional threats. If effectively implemented, these techniques could significantly reduce the potential for an intentional LNG spill.

- Management approaches to reduce risks to public safety and property from LNG spills include operation and safety management, improved modeling and analysis, improvements in ship and security system inspections, establishment and maintenance of safety zones, and advances in future LNG off-loading technologies. If effectively implemented, these elements could reduce significantly the potential risks from an LNG spill.

- Risk identification and risk management processes should be conducted in cooperation with appropriate stakeholders, including public safety officials and elected public officials. Considerations should include site-specific conditions, available intelligence, threat assessments, safety and security operations, and available resources.

While there are limitations in existing data and current modeling capabilities for analyzing LNG spills over water, existing tools, if applied as identified in the guidance sections of this report, can be used to identify and mitigate hazards to protect both public safety and property. Factors that should be considered in applying appropriate models to a specific problem include: model documentation and support, assumptions and limitations, comparison with data, change control and upgrade information, user support, appropriate modeling of the physics of a spill, modeling of the influence of environmental conditions, spill and fire dynamics, and peer review of models used for various applications. As more LNG spill testing data are obtained and modeling capabilities are improved, those advancements can be incorporated into future risk analyses.

Steps Taken Since 9/11 to Improve Homeland Security[7]

In an effort to increase homeland security following the September 11, 2001, terrorist attacks on the United States, President Bush issued the *National Strategy for Homeland Security* in July 2002 and signed legislation creating the Department of Homeland Security (DHS) in November 2002.[8] The strategy sets forth overall objectives to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism, and minimize the damage and assist in the recovery from attacks that may occur. To accomplish these overall objectives, the strategy describes six critical mission areas and 43 initiatives.

The National Strategy for Homeland Security sets out a plan to improve homeland security through the cooperation and partnering of federal, state, local, and private sector organizations on an array of functions.[9] The strategy organizes these functions into six critical mission areas:

[7] *HOMELAND SECURITY Agency Plans, Implementation, and Challenges Regarding the National Strategy for Homeland Security*, GAO-05-33.
[8] *Homeland Security Act of 2002*, Pub.L. 107-296 (Nov. 25, 2002).
[9] There were several other related national strategies issued subsequent to the *National Strategy for Homeland Security*. These include the *National Money Laundering Strategy*, the *National Security Strategy*, the *National Strategy to Combat Weapons of Mass Destruction*, the *National Strategy for Combating Terrorism*, the *National*

- Intelligence and Warning – involves the identification, collection, analysis, and distribution of intelligence information appropriate for preempting or preventing a terrorist attack.

- Border and Transportation Security – emphasizes the efficient and reliable flow of people, goods, and material across borders while deterring terrorist activity.

- Domestic Counterterrorism – focuses on law enforcement efforts to identify, halt, prevent, and prosecute terrorists in the United States.

- Protecting Critical Infrastructure and Key Assets – stresses securing the nation's interconnecting sectors and important facilities, sites, and structures.

- Defending Against Catastrophic Threats – emphasizes the detection, deterrence, and mitigation of terrorist use of weapons of mass destruction.

- Emergency Preparedness and Response – highlights damage minimization and recovery from terrorist attacks.

The fourth mission area – commonly referred to as Critical Infrastructure Protection (CIP) – includes programs that improve protection of the interconnecting sectors that make up the nation's critical infrastructure. The sectors are agriculture, banking and finance, chemical and hazardous materials, emergency services, defense industrial base, energy, food, government, information technology and telecommunications, postal and shipping, public health and health care, transportation, and drinking water and water treatment systems. Programs associated with the physical or cyber security of federal assets also belong in this mission area. Finally, programs designed to protect the nation's key assets – unique facilities, sites, and structures whose disruption or destruction could have significant consequences – are also included in this mission area.[10] In addition to the homeland security strategy, the National Strategy for the Physical Protection of Critical Infrastructures and Key Assets and the National Strategy to Secure Cyberspace provide detailed discussions of Critical Infrastructure Protection.

The homeland security strategy identifies the following major initiatives in the critical infrastructure protection mission area:

- unifying America's infrastructure protection effort in the Department of Homeland Security,

- building and maintaining a complete and accurate assessment of America's critical infrastructure and key assets,

- enabling effective partnership with state and local governments and the private sector,

- developing a national infrastructure protection plan,

Strategy for the Physical Protection of Critical Infrastructure and Key Assets, and the National Strategy to Secure Cyberspace. For our analysis of all of these strategies, see GAO-04-408T.

[10] This definition is from OMB's *2003 Report to Congress on Combating Terrorism* (Washington, D.C.: Sept. 2003).

- securing cyberspace,
- harnessing the best analytic and modeling tools to develop effective protective solutions,
- guarding America's critical infrastructure and key assets against "inside" threats, and
- partnering with the international community to protect our transnational infrastructure.

Maritime Transportation Security[11]

After the events of September 11, 2001, concerns were raised over the security of U.S. ports and waterways. In response to the concerns over port security, Congress passed the Maritime Transportation Security Act (MTSA) in November 2002. The act created a broad range of programs to improve the security conditions at the ports and along American waterways, such as identifying and tracking vessels, assessing security preparedness, and limiting access to sensitive areas.

MTSA was landmark legislation that mandated a quantum leap in security preparedness for America's maritime ports. Prior to the terrorist attacks of September 11, 2001, federal attention at ports tended to focus on navigation and safety issues, such as dredging channels and environmental protection. While the terrorist attacks initially focused the nation's attention on the vulnerability of its aviation system, it did not take long for attention to fall on the nation's ports as well. Besides being gateways through which dangerous materials could enter the country, ports represent attractive targets for other reasons: they are often large and sprawling, accessible by water and land, close to crowded metropolitan centers, and interwoven with highways, roads, factories, and businesses. Security is made more difficult by the many stakeholders, public and private, involved in port operations. These stakeholders include local, state, and federal agencies; multiple law enforcement jurisdictions; transportation and trade companies; and factories and other businesses.

Passed in November 2002, MTSA imposed an ambitious schedule of requirements on a number of federal agencies. MTSA called for a comprehensive security framework – one that included planning, personnel security, and careful monitoring of vessels and cargo. MTSA tasked the Secretary of DHS, and the Secretary in turn tasked the Coast Guard, with lead responsibility for the majority of its requirements. Timetables were daunting, with the Final Rule issued on October 25, 2004, Plan Submission to the Coast Guard by December 31, 2003, and USCG approval on July 1, 2004.

Examples of key MTSA activities include:

- Planning – Conduct vessel, facility, and port vulnerability assessments to determine potential risks. Develop transportation security plans for vessels, facilities, port areas, and the nation. Develop security incident response plans for vessels and facilities. Assess foreign ports for security risk.

[11] *MARITIME SECURITY Progress Made in Implementing Maritime Transportation Security Act, but Concerns Remain*, GAO-03-1155T.

- Identification of personnel – Create security cards required of any person seeking to enter a secure area of a vessel or facility; cards would have biometric information (such as fingerprint data) to guard against theft or counterfeiting.

- Tracking of vessels – Install automatic identification systems on numerous categories of vessels. Authorized to create and implement a long-range vessel tracking system.

Shipping Security Countermeasures

As a result of September 11, 2001, the IMO agreed to new amendments to the 1974 SOLAS addressing port facility and ship security. In 2003, the IMO adopted the International Ship and Port Facility Security (ISPS) Code. This code requires that vulnerability assessments be conducted for ships and ports and the development of security plans. The purpose of the code is to: prevent and suppress terrorism against ships; improve security aboard ships and ashore; and reduce the risk to passengers, crew, and port personnel on board ships and in port areas, for vessels and cargoes. Cargo vessels 300 gross tons and larger, including all LNG vessels, as well as ports servicing those regulated vessels, must adhere to these IMO and SOLAS standards.

For ships, the IMO requirements include:

- Ships must develop security plans and have a Ship Security Officer;

- Ships must be provided with a ship security alert system. These alarms transmit ship-to-shore security alerts to a competent authority designated by the Administration, which may include the company, identifying the ship, its location and indicating that the security of the ship is under threat or has been compromised;

- Ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships; and

- Ships may have certain equipment onboard to help maintain or enhance the physical security of the ship.

For port facilities, the IMO requirements include:

- Port facility security plan;

- Facility Security Officer; and

- Certain security equipment may be required to maintain or enhance the physical security of the facility.

Both ships and ports must include the following:

- Monitoring and controlling access;

- Monitoring the activities of people and cargo;

- Ensuring security communications and that they are readily available; and

- Completion of the Declaration of Security.

In addition to the security measures listed above, the USCG has numerous additional security provisions that it can use based on a location-specific risk assessment of LNG shipping:

- Inspection of security and carrier loading at the port of origin;
- On-board escort to destination terminal by Coast Guard "sea marshals";
- Ninety six-hour advanced notice of arrival of an LNG carrier;
- Advance notification of local police, fire, and emergency agencies, as well as the Federal Aviation Administration and the U.S. Navy;
- Boarding of LNG carriers for inspection before final approach or entering port;
- Harbor escort by armed patrol boats, cutters, or auxiliary vessels;
- Enforcement of a security zone closed to other vessels two miles ahead and one mile behind an LNG carrier;
- Suspension of over-flights by commercial aircraft; and
- Additional security measures that cannot be disclosed publicly.

Such a measured approach, which is the de facto US standard, facilitated by the USCG in its Letters Of Recommendation (LOR) to FERC regarding LNG terminal projects in the USA, revolves around the preparation of a comprehensive safety and security plan which guides the security and safety aspects of the LNG facility, the LNG vessels during transit, and the docking area which will be used for offloading of the LNG vessels when at the facility. In general, the documents prepared include a Facility Security Plan (33 CFR Part 105), a Vessel Security Plan (33 CFR Part 104), and a Vessel Management and Security Plan. The Vessel Security Plan will include planning for the security arrangements for the LNG vessel from the Pilot boarding area to the terminal berth during her inbound and outbound transits and while the vessel is at the terminal berth. In addition, the USCG has recently released Navigation and Vessel Inspection Circular (NVIC) 05-05 providing guidance on assessing the suitability of a waterway for LNG traffic. This guidance recommends a risk-based approach to develop safety and security measures that are specific to the project and the port. The recommended process involves a multi-disciplinary team of stakeholders and representatives along the transit route. The results of the waterway suitability assessment will be incorporated into the USCG's Letter of Intent (LOI)/LOR process.

LNG Security Risk Summary

On a national or global scale, LNG is one of numerous possible terrorist targets. However, LNG is also one of the more highly protected. The higher levels of protection make the degree of difficulty of attack more significant and reduce the attractiveness of LNG as a target. LNG also is judged to be a less attractive target based on the limited geographic use (generally remote location with limited potential impacts), the uncertain value of an LNG vessel as a weapon (due

to the limited population that can be targeted), and the lack of symbolic importance of LNG vs. other assets.

It is more likely that terrorists are interested in creating fear, instability and insecurity by attacking 'softer' targets, which refers to those targets that are unprotected and highly vulnerable to attack. Softer targets include buildings, public transportation systems, and other assets that affect the public directly. This has been the pattern of terrorist acts to date.

LNG facilities and ships require a higher degree of planning, resources, knowledge, and risk to attack than softer targets. Terrorists want to be successful, so they look for ways to execute crimes that will have a desired impact with a high likelihood of success. Lastly, they work with the resources they can acquire to conduct their acts so they are less likely to attack assets requiring sophisticated and complex methods as is evidenced by the vast majority of events. Their strategic objectives are sometimes profound, but their weapons, tactics, and choice of targets tend to be common.

Placing the security risks in perspective, it is clear that LNG is but one of a number of critical infrastructures/energy assets that the US is obligated to protect from the threat of terrorism. US assets requiring protection include power plants, city water reservoirs, shopping malls, etc. The extraordinary design and operating features employed by the LNG industry, along with the additional security measures taken by the Department of Homeland Security (DHS) and other Federal, State, and local authorities to manage security risks of LNG reduce this risk to the point that is acceptable.