To the Massachusetts Joint Committee

On

Telecommunications, Utilities and Energy

Liquefied Natural Gas Tanker Terminals In Densely Populated Areas

Reasoning for House Bill 1418

An Act Regulating Liquefied Natural Gas Tanker Import Terminals

From the office of State Representative David B. Sullivan

Date: August 17, 2005

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Liquefied Natural Gas Tanker Terminals
In
Densely Populated Areas

Introduction:

This report has been written to support House Bill 1418, *An Act Regulating Liquefied Natural Gas Tanker Import Terminals*. House 1418 is not an anti-energy bill. It is strictly a **PUBLIC SAFETY** bill designed to protect the citizens of Massachusetts and their property. This legislation is extremely important to thousands of families located in Somerset, Swansea, Fall River, and for any other location in Massachusetts that may be the future home of an LNG tanker terminal.

It has been publicized that the federal government has complete control over the siting of LNG facilities, and that this is a federal pre-emption issue. I and many others disagree with this notion.

There are three important arguments that give strength to House 1418 and this report will go into each one in detail. To summarize these arguments they are:

1. Article 106 of the Massachusetts Constitution

2. Expert scientific evidence dealing with thermal radiation and gas vapor clouds

3. Expert terrorist information

Each one of these areas will justify voting in favor of House 1418, but together they form an irrefutable barrier to any argument against House 1418.

The report is based strictly upon expert information from numerous sources. All quotes and data used in the report have been cited in a footnote at the bottom of the page.

Since the publication of the *Sandia Report*, commissioned by the U.S. Department of Energy, it has come to my attention that the distances used in the safety exclusion zones are actually conservative in size. If you have any questions dealing with the enclosed information please contact my office.

House Bill 1418
An Act Regulating Liquefied Natural Gas Tanker Import Terminals

Protection of Public Safety and Property

House Bill 1418

Chapter 21E of the General Laws is hereby amended by adding the following two sections:-

Section 20. A LNG import terminal must have a minimum distance of 5,000 feet from the center of the LNG tank to the nearest residential home, elderly housing complexes, schools, hospitals, health care facilities, businesses or developments.

Section 21. A LNG tanker must have 1,500 foot clearance along the shore, as it travels any Massachusetts waterway, from the hull to the nearest residential home, elderly housing complexes, schools, hospitals, health care facilities, businesses or developments.

Amended by the Joint Committee on Public Safety & Homeland Security by inserting at the end thereof the following: The provisions of this act shall apply to all LNG import terminals constructed after January 1, 2005.

As stated in the introduction, there are several arguments to justify House Bill 1418. The first of which is found in the Constitution of the Commonwealth of Massachusetts.

Each elected official in Massachusetts takes an oath to uphold the Constitution. Written by John Adams, it is the oldest constitution in the country and was used as a model for the U.S. Constitution.

Article 106 of the Massachusetts Constitution states:

All people are born free and equal and have certain natural, essential and unalienable rights; among which may be reckoned the right of enjoying and defending their lives and liberties; that of acquiring, possessing and protecting property, in fine, that of seeking and obtaining their safety and happiness. Equality under the law shall not be denied or abridged because of sex, race, color, creed or national origin.[1]

The following report will detail the risks and dangers associated with liquefied natural gas facilities. It will also explain how the construction and operation of any such facility in a densely populated community, in the absence of a safety exclusion zone, would be a violation of the Constitution of the Commonwealth.

LNG Background Information

What is LNG?

Liquefied natural gas, or LNG, is natural gas in a liquid form. When natural gas is cooled to minus 259 degrees Fahrenheit (minus 161 degrees Celsius), it becomes a clear, colorless, odorless liquid. Natural gas is primarily methane, with low concentrations of other hydrocarbons, water, carbon dioxide, nitrogen, oxygen, and sulfur compounds. During the process known as liquefaction, natural gas is cooled below its boiling point, removing most of these compounds. The remaining natural gas is primarily methane with small amounts of other hydrocarbons. LNG weighs less than half the weight of water so it will float if spilled on water.[2]

Where does LNG come from?

Once the cooling process is completed, LNG can then be shipped all over the world, utilizing huge LNG tanker ships that typically measure over 900 feet long. A majority of the world's LNG is exported from Algeria, Australia, Brunei, Libya, Indonesia, Nigeria, Oman, Qatar, and Trinidad and Tobago.

[1] Constitution of the Commonwealth of Massachusetts – Article 106
[2] Taken from California Energy Commission (Frequently Asked Questions About LNG)

Many of these countries have been a haven for terrorists. Even Trinidad and Tobago, the Caribbean country, is home to several Islamic fundamentalist groups. They are the Jamaat al Musclemen, under the control of Iman Yasin Abu Bakr, the Waajihatul Islaamiyyah and the Jaamat al Murabiteen. The Waajihatul Islaamiyyah openly supports Osama Bin Laden and the Al Qaeda terrorist network.[3]

How is LNG stored?

When a tanker ship arrives at a terminal the LNG is transferred to an insulated storage tank built specifically for LNG. These tanks can be constructed above or below ground, and they keep the liquid at a low temperature. LNG is then warmed and converted back to a gaseous state and can be shipped out via pipeline. This process of converting LNG from a liquid state to gas is known as regasification. LNG can also be loaded into tanker trucks in its liquid form and transported to other communities.

LNG Prior to 9/11

Prior to the terrorist attacks of September 11, 2001, the general public probably never thought about safety precautions in regards to LNG. As a matter of fact, many of us did not know much about LNG at all. However in the 1970's the federal government recognized the need for safety regulations at LNG facilities.

In 1979 the United States Congress passed Representative Edward J. Markey's LNG safety bill which was intended to encourage remote siting of LNG facilities. According to Markey though, a key feature of the bill has been overlooked by the U.S. Department of Transportation:

When Congress passed my LNG safety bill back in 1979, it directed the Department of Transportation to prescribe standards for the siting of new LNG facilities that were supposed to consider the need to encourage remote siting. I am not satisfied that DOT has been doing enough to comply with this congressional intent. [4]

Congressman Markey was not the only Washington official warning about the dangers of LNG facilities and the need to site them in remote areas. J. Dexter Peach, the Director of the U.S. General Accounting Office (GAO), which is the investigative arm of Congress, testified before the U.S. Senate in regards to remote siting of LNG facilities:

[3] LNG Tanker Terrorism, A Case Study by Candyce Kelshall, 2004

[4] Mobile Register, November 16, 2003

We believe remote siting is the primary factor in safety. GAO is concerned that the DOT response has not met two major GAO recommendations: a requirement that all new large LEG (liquefied energy gases) facilities be built in remote areas, and a prohibition against LEG transportation through densely populated areas. [5]

Markey's legislation passed seven months after Mr. Peach testified. The final bill in the U.S. Code listed six factors that the Secretary of Transportation must consider in setting minimum safety standards. Included in the guidelines is "the need to encourage remote siting."[6]

Although Congressman Markey's legislation was enacted, the federal government has since skirted the intent of the bill and created within the LNG siting regulations "hazard exclusion zones" around LNG terminals. These exclusion zones were developed using small LNG spill models involving less than 1% of the LNG stored at an LNG terminal. According to numerous experts in the field, there are serious flaws in the federal government's hazard exclusion zones.

Expert Opinion on LNG Spills

Professor James Fay

Professor James Fay, Professor Emeritus of the Massachusetts Institute of Technology and a mechanical engineering expert, has written several reports in regards to LNG spills. His background is quite extensive. He served as Chairman of the Massachusetts Port Authority from 1972 to 1977 and served on twelve boards, committees, and panels of the National Research Council, including two terms on the Environmental Studies Board. He is a fellow of the American Academy of Arts and Sciences and of the American Physical Society, among others. Since 1955 he has been a member of the faculty in the Department of Mechanical Engineering at M.I.T.

Professor Fay has been studying the possible hazards from a major LNG spill and has concluded:

The magnitude of the resulting liquid cargo pool fires are unprecedented in scale. There is no possibility of ameliorating the fire's effects, much less extinguishing it, during the short time (several minutes) of burnout. At any point along the inner harbor route of ship travel from sea to berth, pool fire thermal radiation that can burn and even kill exposed humans, and ignite combustible buildings, will be experienced along and well inland from the waterfront. [7]

[5] ibid
[6] ibid
[7] "Spills and Fires from LNG Tankers in Fall River (MA) – James A. Fay – 8/26/2003

Professor Fay has serious doubts about the federal safety requirements for the proposed Weaver's Cove site in Fall River, MA. In a 2004 report he concluded:

The federal safety requirements for the proposed Fall River LNG terminal will not prevent harm to humans outside the site boundary for the spill scenarios that FERC considers. [8]

(FERC is the Federal Energy Regulatory Commission, the agency which, according to its website, "regulates and oversees energy industries in the economic, environmental, and safety interests of the American public.")

Dr. Jerry Havens

Dr. Jerry Havens, Distinguished Professor of Engineering at the University of Arkansas, also has serious concerns about LNG terminals being located in densely populated areas. Dr. Havens received his PhD in Chemical Engineering from the University of Oklahoma in 1969 where he spent an additional one-year period as a post doctoral fellow studying fire and explosion phenomena in the Flame Dynamics Laboratory. He is currently the director of the University of Arkansas's Chemical Hazard Research Center.

Dr. Havens specializes in analyzing and quantifying the consequences of releases of hazardous materials into the environment, with primary emphasis on the consequences that can occur as a result of toxic and/or flammable gas releases into the atmosphere.

Dr. Havens had prepared a report for the U.S. Coast Guard in 1977 entitled *Predictability of LNG Vapor Dispersion from Catastrophic Spills onto Water: An Assessment*. Later, when the University of Arkansas was contracted to develop the DEGADIS model, which is designed to predict the dispersion of denser-than-air gases, including LNG vapor, Dr. Havens was assigned by the university to head the project. The DEGADIS model is now promulgated in the LNG regulations 49 CFR 193.

Today Dr. Havens continues to study LNG vapor dispersion. He has been a consultant to government and industry officials for thirty years and has been actively involved in researching the consequences of major spills of LNG onto water.[9]

Dr. Havens stated the following in a recent report he prepared for the city of Fall River:

My statements that fires as large as one-half mile diameter might occur from spills on water were based on my review, for the past thirty years, of the scientific information that has been published on this matter. Moreover, application of FERC's recently approved methodologies suitable for determining the consequences (both fire radiation and vapor cloud dispersion) of LNG spills on water to the spillage of 12,500 cubic meters of LNG on water through 1 meter and 5 meter holes give the following result:

[8] "Public Safety Issues at the Proposed F.R. LNG Terminal – James A. Fay – 1/12/2004
[9] Dr. Jerry Havens Response to Weaver's Cove Rebuttal – Jerry Havens – 12/08/2004

Hazard Distances Suggested by FERC
For Spillage of 12,500 Cubic Meters LNG Onto Water

	1 m hole	5 m hole
Thermal Radiation (5 kw/m²)	2,100 feet	5,000 feet
Vapor Cloud Dispersion (2.5%)	15,000 feet	19,000 feet

As these predicted thermal radiation hazard zone extends to approximately 1 mile, and the vapor cloud dispersion hazard extends to approximately 3.5 miles following spillage of one-half of one tank on a five tank, 125,000 cubic meter capacity vessel, I believe there is *very good reason to consider these events highly possible to result from a terrorist attack.* [10]

With Dr. Havens' research concluding that thermal radiation from a spill from a 1 meter hole can extend out to 2,100 feet, and a vapor cloud that could travel up to 15,000 feet, it is clear that any LNG facilities sited in densely populated communities pose a threat to the safety of that community.

In a separate report Professor James Fay explains the value of (5 kw/m ²).

For human skin exposure to flame thermal radiation, a thermal flux of 5 kilowatts per square meter (kw/m ²) will result in unbearable pain after an exposure of 13 seconds and second degree burns after an exposure of 40 seconds. Exposure to twice that level, (10kw/m ²), for 40 seconds if the threshold for fatalities. Wood can be ignited after 40 seconds exposure at a thermal flux of (5 kw/m ²). [11]

Dr. Havens, recently testifying before FERC, explained that a large spill of LNG and the resulting fire could not be controlled.

It is important to state here also that such fires as are being considered (a pool fire following spillage onto water of one half of a single tank, or approximately 3,000,000 gallons, from an LNG carrier) would be hopelessly beyond any current capability to extinguish or even contain. [12]

Dr. Havens went on to explain his feelings regarding the siting of energy facilities in densely populated areas.

I am extremely concerned that in today's post 9/11 world anyone would proceed to site any new, highly concentrated energy facility in an urban setting without first providing a truly convincing argument that the benefits justify the risks attendant. …I am at a loss to understand how any responsible company or governmental decision maker could possibly conclude that the risks to

[10] Dr. Jerry Havens Response to Weaver's Cove Rebuttal – Jerry Havens – 12/08/2004
[11] Spills and Fires from LNG and Oil Tankers in Boston Harbor - James A. Fay – 3/26/2003
[12] Direct Testimony by Dr. Jerry Havens to the Federal Energy Regulatory Commission, 6-9-2005

public health and safety that would be associated with either the KeySpan or Weaver's Cove proposals would be acceptable.[13]

Clearly, based on his testimony before FERC, Dr. Havens, one of the leading LNG experts in the country, believes the proposed LNG facility in Fall River is irresponsible and unacceptable.

Dr. Havens addressed a question dealing with a large LNG spill taking place at Weaver's Cove or the proposed Key Span site in Providence, Rhode Island.

Considering the tanker operations that would be associated with either installation, a single tank on a typical LNG carrier may contain six or more million gallons of liquefied natural gas. The fire from such a spill, if the spill occurred onto water and was therefore uncontained, would be very large, perhaps to half-mile in diameter, or larger if the other LNG tanks on the ship were to fail. [14]

This half-mile wide fire cannot be extinguished. Also, the heat generated by such a fire would radiate a great distance from the conflagration.

Dr. Havens then testified about the distance the gas vapor could travel from a spill and the distance the heat radiation from a large fire could travel.

It must be understood that the hazard distances that are now substantially agreed to result from a credible marine spill, which suggest fire radiation damage to more than a mile and potential vapor cloud travel exceeding two miles, would result from the rapid spillage of about 3,000,000 gallons of LNG onto water – this amount was chosen as a credible event partly (by most parties that have considered the question, including, most recently, the
Sandia Laboratory) because it represents about one half of one containment vessel on a typical LNG carrier operating today. [15]

Dr. Havens pointed out that this is not the worst case scenario. His best scientific estimate follows from a half-tank ship spill pool fire on water. "I believe that there could be a serious impact on the population in the entire area within two miles," said Havens.

The figures presented by Dr. Havens make it clear that the sizes of the exclusion zones in House Bill 1418 are very conservative. Based on the available scientific evidence, the zones could be adjusted during the legislative process.

Dr. Harry West

Dr. Harry West, a Professor of Chemical Engineering at Texas A & M University, was asked by Dr. Havens to review his work in regards to the proposed LNG terminal in Fall River.

Dr. West also has an impressive background in regards to LNG. He has been involved in LNG technology since the late 1960's and has been part of LNG safety research projects sponsored by

[13] ibid
[14] Direct Testimony by Dr. Jerry Havens to the Federal Energy Regulatory Commission, 6-9-2005
[15] ibid

the American Gas Association among others. In addition, he has been involved in LNG safety studies for proposed LNG import terminals throughout the United States and has also advised the U.S. Coast Guard on the development of LNG regulations.

When testifying before FERC, Dr. West had this to say about Dr. Havens' work:

I did, and following that review I told Dr. Havens that I was in total agreement with the views and judgments expressed in the testimony he is sponsoring. [16]

Dr. West was also concerned with FERC's safety analysis of the Weaver's Cove proposal. Among his chief concerns are:

* Inadequacy of the thermal hazard exclusion zone analysis
* Lack of consideration of modern concepts of Process Safety
* Inadequate consequences modeling
* Potential use of high expansion foams systems to reduce the thermal hazard exclusion zone estimates for LNG terminal impoundment areas

The thermal exclusion zone approved by FERC for the Weaver's Cove site has Dr. West concerned. He cites scientific data relative to thermal radiation. His conclusion is:

This level of thermal hazard is far too high to provide for the congressional intent in the Pipeline Safety Act of 1979 (codified as 49 CFR part 193) which was 'protection of persons and property near an LNG facility from thermal radiation caused by ignition of a major spill of LNG.' [17]

This statement by Dr. West demonstrates the need for a safety exclusion zone.

In one of his final statements made during direct testimony Dr. West was asked if it would be impossible to certify any LNG project.

Absolutely not. However, in the post 9/11 world it is prudent to insure the public against severe consequence events. This translates into locating LNG facilities at a sufficient distance from the adjacent public to insure that catastrophic events will not compromise their safety. [18]

ABS and Sandia Reports

Recently, two studies commissioned by the federal government have been published regarding hazards associated with LNG. ABSG Consulting Inc. completed a report, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*. This report examined many different studies of LNG spills. Included were studies examining thermal radiation, vapor cloud dispersion, and LNG pool spreads.

[16] Direct Testimony by Dr. Harry West to the Federal Energy Regulatory Commission, 6-9-2005
[17] Direct Testimony by Dr. Harry West to the Federal Energy Regulatory Commission, 6-9-2005
[18] ibid

When looking at a vapor cloud it is important to understand the lower flammability limit (LFL). LFL is the maximum distance at which some of the released LNG vapor is within the flammable range. The distance an LNG vapor cloud can travel for a spill from a 1 meter hole in an LNG tanker is anywhere from 4,300 feet to 11,000 feet depending on wind speed, air temperature, and water temperature.[19] Of course the vapor cloud would only form if the initial spill did not ignite.

The report states that if the same size spill from a 1 meter hole ignited soon after the spill, the flame could reach anywhere from 790 feet to 1,000 feet in height and the downwind distance from the flame for (5 kW/m ²) is 2,800 feet away from the flame.[20] If someone was 2,800 feet away they would suffer severe pain within 13 seconds and second degree burns within 40 seconds.

Another report commissioned by the United States Department of Energy and conducted by Sandia National Laboratories, is the *Sandia Report*.

The *Sandia Report* was conducted by experts in fire analysis, structural mechanics, explosives, and energy. The researchers also received information and technical evaluation from experts such as Captain Dave Scott of the U.S. Coast Guard, Mike Edens of the Office of Naval Intelligence, and Dr. Ronald Koopman, a consultant on LNG spills and modeling.

The *Sandia Report* established zone classification for LNG spills. In other words, it set up defined sections for LNG spills, classifying these zones based on potential risk level and consequences of a spill. This report will look at the Zone 1 classification prescribed by the *Sandia Report*.

The following is an explanation of Zone 1:

Guidance on Risk Management for Intentional LNG Spills

These are areas in which LNG shipments occur in narrow harbors or channels, pass under major bridges or over tunnels, or come within approximately 500 meters (approximately 1,640 feet) of people and major infrastructure elements, such as military facilities, population and commercial centers, or national icons. Within this zone, the risk and consequences of an accidental LNG spill could be significant and have severe negative impacts. Thermal radiation poses a severe public safety and property hazard, and can damage or significantly disrupt critical infrastructure located in this area. [21]

Based on the zones established in the *Sandia Report*, Fall River and much of the surrounding area would fall into the Zone 1 classification. The route the LNG tanker will take when delivering its cargo to Weaver's Cove will bring the vessel within 250 to 500 meters of residential neighborhoods, marinas, and commercial buildings.

[19] Consequence Assessment Methods for Incidents Involving Releases from LNG Carriers – ABS Consulting – 5/13/2004

[20] ibid

[21] Sandia Report, Page 22 – December 2004

The close proximity of the ship to populated areas presents a tremendous burden to public safety personnel and posses a huge risk to the people living and working along the route. The oil and gas industries often point out that the chances of a major disaster occurring with an LNG shipment are small. However, allowing an LNG tanker to travel along 26 miles of shoreline, past numerous communities, under four bridges, and then docking in a terminal in a densely populated neighborhood, significantly increases the chances of a catastrophe.

According to the *Sandia Report*, thousands of citizens will be living in a thermal hazard zone due to the short distances between the tanker ship and their homes along the Taunton River and in Fall River.

From the assessment conducted, thermal hazards will occur predominantly within 1,600 meters (5,249 feet) of an LNG ship spill, with the highest hazards generally in the near field (approximately 250 – 500 meters of a spill).[22]

Major injuries and significant structural damage are possible in this zone. People, major commercial / industrial areas or other critical infrastructure elements, such as chemical plants, refineries, bridges or tunnels, or national icons located within portions of this zone could be seriously affected.[23]

The vapor cloud from an LNG spill is also addressed in the *Sandia Report*. Information within the report gives credence to statements from Professor Fay, Dr. Havens, and the ABS Report. If LNG does not ignite when released, the vapor cloud could travel a great distance from the spill. The oil and gas industries have asserted in the past that a vapor cloud is extremely difficult to ignite due to the mixture of oxygen and gas. According to the *Sandia Report* though, this appears to be false premise.

…a vapor cloud from an LNG spill could extend to 2,500 meters, if an ignition source is not available. The potential thermal hazards within a vapor cloud could be high.[24]

In congested or highly populated areas, an ignition source would be likely; as opposed to remote areas, in which an ignition source might be less likely.[25]

It is important to note that the *Sandia Report* clearly shows that an LNG vapor cloud will ***most likely*** find an ignition source in a highly populated area. 'Highly populated' surely describes almost the entire Fall River waterfront and a great deal of waterfront in Somerset, MA.

The *Sandia Report* then makes a shocking recommendation. According to the report, if an LNG spill occurs in a densely populated area and the vapor does not ignite, the report recommends that the spill be ignited on purpose to prevent the spread of a dangerous vapor cloud.

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[22] ibid, page 19
[23] ibid, page 19
[24] Sandia Report, page 20 – December 2004
[25] ibid, page 46

Risk mitigation measures, such as development of procedures to quickly ignite a dispersion cloud and stem the leak, should be considered if conditions exist that the cloud would impact critical areas.[26]

This recommendation, if implemented during a spill, would put anyone along the shoreline in Fall River or Somerset in jeopardy. If it is not implemented though, we risk having a gas vapor cloud spreading out over several thousand feet, searching for an ignition source. This would increase the number of people put at risk.

It is important to understand why the *Sandia Report* recommends such a radical procedure. If a major leak takes place due to a terrorist attack or human error, and the spill is not ignited, the number one priority becomes the containment of the vapor cloud. According to the *Sandia Report*, there is tremendous danger if a vapor cloud is allowed to spread in a Zone 1 setting.

The thermal radiation from the ignition of a vapor cloud can be very high within the ignited cloud and, therefore, particularly hazardous to people.[27]

The analysis from the fire and vapor dispersion calculations suggest that high thermal hazards from intentional events extend significantly from the spill location.[28]

Boston Pilot Association

The oil and gas industries have claimed that the transport of LNG is no different than other high interest cargo. Testimony submitted by the Boston Pilot Association to the Massachusetts Joint Committee on Public Safety proves this assumption to be false. The Boston Pilot Association, the group responsible for safely piloting vessels in and out of Boston Harbor, told the committee:

…some of the comments at the hearing seemed to suggest that the movement of conventional tankers within Boston Harbor somehow presents a danger comparable to the movement of LNG.

The Boston Pilots stated in their earnest professional counsel, that this suggestion is fundamentally wrong. To emphasize that point they continued:

…the movements of LNG ships involve a vastly different, and much more demanding and invasive approach.[29]

The Boston Pilots also pointed out that there is a difference between LNG and other high interest cargo:

> One important distinction is that a fire aboard a conventional ship (tanker or

[26] ibid, page 46
[27] ibid, page 46
[28] ibid, page 53
[29] Letter to MA Committee on Public Safety, 11-10-2004 by Cetrulo & Capone LLP, representing Boston Pilots

otherwise), while certainly serious, can actually be put out – even a fire in a gasoline carrier's cargo tank can be extinguished using foam, applied by shipboard apparatus.[30]

Terrorism and LNG

Over the course of the last few years, we have seen acts of terrorism carried out on sea vessels and acts of terrorism which utilize sea vessels. There is no doubt that terrorists have, and will try again, to attack Western vessels. This issue has become a source of study, and has prompted officials to explore possibilities of terrorism at sea and in ports. In this section we will explore what experts are saying about the possibilities of a terrorist attack on an LNG tanker. The *Sandia Report*, commissioned by the federal government, addresses this issue:

A ship hijacking should be considered credible through coordinated efforts by insiders and others.[31]

Candyce Kelshall

We will now examine a report conducted by Candyce Kelshall, Director of Bluewater Defense & Security Ltd., and Director of Task International. Ms. Kelshall, who also sits on the U.K. SITO National Port Security Standards Commission, has studied the hazards pertaining to terrorism and LNG shipping. She warns about the difficulty of protecting waterways and harbors. This concern undoubtedly pertains to the proposed LNG site in Fall River. The site is 26 miles from the sea and there are numerous coves and inlets along the route. Ms. Kelshall said:

Quite simply not enough has been done to ensure that safety criteria demanded of air transport is afforded to maritime transport, cargo and facilities. Coastlines are the most porous of our borders.[32]

Ms. Kelshall highlights an event that took place in March, 2002, which demonstrates terrorists' interest in hijacking tankers.

Almost as an illustration of this fact is the incident in March 2002 when 10 intruders took control of the oil tanker Dawi Madrim off the coast of Sumatra and for one hour practiced steering and slowing the vessel, a complicated and lengthy process aboard a tanker. At the end of the exercise they left the ship as they found it, taking only the master and first officer with them.[33]

Ms. Kelshall also warns us about the effects an LNG catastrophe would have on the shoreline of a heavily populated area.

LNG terminals and tankers present especially attractive targets. The physical effects of an LNG pool fire would be off the scale of anything ever experienced in the hemisphere and indeed would

[30] ibid
[31] Sandia Report, Page 62
[32] LNG Tanker Terrorism, A Case Study by Candyce Kelshall, 2004
[33] ibid

be potentially surpassing the effects of the World Trade Centre death toll due to the density of population along coastlines and harbours in the region.[34]

The statements made in Kelshall's report regarding the effects of the pool fire match what has already been noted in the *Sandia Report* and the ABS Report, both reports commissioned by the federal government.

Richard A Clarke

Richard A. Clarke is a chief expert in matters concerning homeland defense and terrorism prevention. He is widely considered to be one of the most intelligent and most successful anti-terrorism experts in the world today. Clarke was Deputy Assistant Secretary of State for Intelligence in the Reagan Administration, former Assistant Secretary of State for Politico-Military Affairs in the George H.W. Bush Administration, served on the National Security Council in the Clinton Administration, and served in the George W. Bush Administration until January 2003. Recently Mr. Clarke submitted direct testimony to FERC on June 9, 2005. One of the first items Clarke spoke of was the consequences of an attack upon an LNG tanker.

First, the location of an on-shore LNG facility in an urban environment and the passage of LNG tankers along populated in-land waterways would present an exceedingly attractive target for terrorists, the very type of target that terrorists have identified for priority consideration. Second, it simply is not possible to conclude that those types of targets can successfully be defended from terrorist attack. Third, consequences of a successful attack could well exceed in fatalities, in the inflection of unimaginably painful life-long injuries, and in the destruction of infrastructure, even the consequences of the attacks of 9/11.[35]

Mr. Clarke was questioned directly about an on-shore LNG facility in an urban environment and if he thought there were any possible ramifications.

…it behooves us to minimize the opportunities that would be most attractive to terrorists precisely because of the catastrophic consequences they offer. An urban LNG facility would necessarily rank high on any terrorist's list of target opportunities. This is not a matter of speculation.[36]

The hearing then moved to the subject of what organized terrorists look for when choosing a target. Clarke said they seek energy infrastructure, energy laden tankers, ability to inflict maximum human suffering, maximum economic loss, and maximum chaos. He then testified:

All of those objectives would be achieved were terrorists to succeed with an attack on …the Weaver's Cove facility…[37]

As previously mentioned in this report, many of the countries that supply LNG are currently safe havens for terrorists. Mr. Clarke emphasized this fact.

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[34] LNG Tanker Terrorism, A Case Study by Candyce Kelshall, 2004
[35] Direct Testimony by Richard A. Clarke to the Federal Energy Regulatory Commission 6-9-2005
[36] ibid
[37] ibid

LNG supplies originate from areas that are politically unstable and that host intensive terrorist activity enhancing the possibility that timed or remotely activated explosive devices could be hidden on tankers and remain undetected.[38]

Mr. Clarke is worried, not only with the possibility of a terrorist attack, but he is concerned with the safety and security zones that will be set up by the United States Coast Guard (USCG) as they escort the LNG vessel. The security zone, where all unauthorized ships will be excluded, consists of two miles in front of the LNG tanker, one mile behind, and 1,000 yards on either side. Clarke feels that it would be extremely difficult for USCG ships to, in a matter of seconds, make the decision to destroy an incoming vessel. He also suggested that an attack could consist of several small crafts to divert the attention of the escort vessels. In addition, Mr. Clarke pointed out that the geography of the route an LNG tanker would take to reach Fall River is conducive to a terrorist attack:

The in-land waters of Rhode Island and Massachusetts through which these tankers will have to pass are both close to the shoreline and pass in close proximity to what is perhaps the densest population of marinas and anchorage to be found anywhere in the world. That proximity means that a craft could be launched and reach a tanker in but moments.[39]

As Candyce Kelshall cited the event that took place with the oil tanker Dewi Madrim, Richard Clarke highlighted another incident.

Similar to the Dewi Madrim was a 1998 attack on the Petro Ranger, a tanker loaded with diesel and jet fuel. Pirates boarded and repainted the ship and renamed it the Wilby and they flew a Honduran flag. The pirates posed as the crew while the real crew was tied up below deck. The ship sailed into a Chinese port but luckily a few of the crew were able to escape and alert authorities. A U.S. Coast Guard official said: “If we have a vessel in our port that’s a problem, (such as the Petro Ranger), it’s too late.”[40]

Many have tried to rationalize the siting of an LNG facility in an urban area for economic reasons. This argument was taken on by Mr. Clarke.

Finally, on the issue of comparative cost, a successful attack in or around Providence or Fall River would quickly render any issue of comparative economics moot. Indeed, it surely would embarrass those who allowed comparative economics to influence so fundamental a matter of national security and public well-being. It is inconceivable to me that any public official could conclude that authorization of either the Key Span or Weaver’s Cove facility would be consistent with preservation of the public interest.[41] (Note: The Key Span facility was denied by FERC)

Ali M. Koknar

[38] Direct Testimony by Richard A. Clarke to the Federal Energy Regulatory Commission 6-9-2005
[39] ibid
[40] LNG Facilities in Urban Areas – by Principal Investigator Richard Clarke, May 2005
[41] Direct Testimony by Richard A. Clarke to the Federal Energy Regulatory Commission 6-9-2005

Worldwide experts realize that the threat of terrorism has had an affect on the security of global shipping. As a result of the capture of Abd al Rahman al Nashiri, the man thought to have planned the attack on the oil tanker Limburg, we have learned that the terrorists have developed a four-pronged strategy to attack Western targets. These include ramming, blowing up ships near other vessels or at ports, attacking large vessels such as supertankers by using explosive-laden small aircraft, and attacking vessels by using underwater demolition teams.

Another concern is the lack of security on foreign vessels. Known terrorist groups have been engaged in commercial activities such as narcotics trade, arms dealing, and human trafficking. Some of these terrorist groups actually owned and operated ocean going freighters flying Panamanian, Honduran and Liberian flags.[42]

An example of this activity took place in Italy, 2004. A Turkish vessel en route to New York was searched by Italian police while docked in Italy. On board the ship was discovered over 8,000 AK 47 assault rifles and 11 submachine guns.[43]

According to the Lloyds List, the United States and Norwegian intelligence agencies identified 23 freighters as owned or controlled by the Al Qaeda network. This number does not include other terrorist tankers, freighters, or small vessels that are unknown to the intelligence community.

When it comes to natural gas cargo, Ali M. Koknar, an Associate Fellow at the Institute for the Analysis of Global Security, said:

Oil, natural gas and other hazardous cargo laden ocean going vessels could also be used as such weapons by terrorists against port facilities. A Phalanx battery can defend against a TNT-laden Zodiac boat, but would be useless against a terrorist commandeered LNG tanker heading full steam toward its target.[44]

Local Public Safety Officials

At a recent hearing in Fall River sponsored by the USCG, Captain Mary Landry explained the role the USCG would play in the security of an LNG tanker. Captain Landry spoke of the need to work with state and local public safety officials.

[42] Energy Security, Ali M. Koknar, Associate Fellow at the Institute for the Analysis of Global Security
[43] ibid
[44] Energy Security, Ali M. Koknar, Associate Fellow at the Institute for the Analysis of Global Security

Additionally, we must ensure that there are adequate federal, state, and local law enforcement assets to carry out the plan. …we rely heavily on federal, state, and local resources to maintain the security during transit and offload high interest cargoes.[45]

Captain Landry made it very clear that the USCG would "ensure" that the state and local public safety officials would be able to carry out a security plan. However, Fall River Police Chief John Souza highlighted the difficulties in implementing an effective security plan.

As one of the officials of Fall River with principle responsibility for safeguarding the health and well being of our population, and for the protection of infrastructures that are so critical to the safety of that population, I am loathe to believe that any threat would be beyond our ability to cope. Since the consequences of an accidental or intentional spill have been made clear to me I have struggled to get comfortable with our ability to prevent intentional attacks and to deal with the aftermath of a spill. Regrettably, I have been forced to reach the conclusion that we lack the ability to eliminate a significant possibility of intentional breach and we cannot assure safe evacuation in the event of a breach. I see no way of protecting as many as 10,000 or more members of our local population from the life-threatening burns that Drs. Havens and West indicate could be associated with an LNG fire.[46]

It is clear that the top public safety official in the city of Fall River believes his department lacks the resources to adequately protect the citizens of Fall River in the event of an LNG disaster.

Chief Souza has met for numerous security meetings attended by federal, state, and local public safety officials, along with officials from Weaver's Cove / Hess LNG, to discuss security plans for the proposed LNG facility in Fall River. Chief Souza had this to say about those security meetings:

Frankly, that was my greatest source of frustration in working with the team that was supposed to develop security plans. The representatives from Weaver's Cove and, sadly even federal officials, were willing to assume that it is satisfactory simply to minimize the risk, even if substantial vulnerability with the potential for the most dire consequences to public safety and to human health remain.[47]

Chief Souza was then asked what would be needed to reduce the ability to attack an LNG tanker or LNG terminal.

It would require the constant deployment of far more resources than we can hope to muster. The transit of LNG up the Taunton River has the potential, if attacked, to result in catastrophic loss of life and/or catastrophic economic loss to the City of Fall River and the surrounding region.[48]

Chief Souza, in his expert opinion, testified that he and his department would not be able to protect the citizens of Fall River if the Weaver's Cove proposal was allowed to move forward.

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[45] Captain Mary Landry, U.S. Coast Guard – Public Hearing December 9,2004
[46] Direct Testimony by F.R. Police Chief John Souza to the Federal Energy Regulatory Commission 6-9-2005
[47] ibid
[48] ibid

I can tell you, with one hundred percent confidence, that it will not be possible to protect a vast segment of the Fall River area, and a vast population in Rhode Island as well, from the horrors of an attack or from the consequences either of an attack or of an accident.[49]

Public safety officials in Somerset have addressed safety concerns regarding the proposed LNG facility as well. Fire Chief Stephen Rivard was asked by public officials in Somerset to research the dangers, if any, that LNG would pose to the town. He gave his opinion in direct testimony to FERC.

My analysis disclosed the fact that in the event of a breach of containment occurring at the onshore terminal or at a tanker while it is in the vicinity of the terminal, a significant segment of the population then within the limits of Somerset would be in the zone of danger, to the point of being vulnerable to life threatening second degree burns.

I have been told that there is now a consensus among the experts that because of concern over the potential for pool fires, and because of the near instantaneous onset of life threatening consequences should a fire occur, safety can be assured only by the establishment of an exclusion zone of no less than one mile and more.[50]

In regards to the affect a major LNG spill would have on the town of Somerset, Chief Rivard responded by saying:

The adverse consequences would be well beyond anything in our experience and well beyond our capability to manage. The potential for the loss of thousands of lives could not be ruled out, with thousands more exposed to life-altering injuries.[51]

Fall River Fire Chief David Thiboutot seems to be in total agreement with Chief Rivard when it comes to the capability of fighting a large pool fire. Chief Thiboutot was asked the following question. 'Would you be able to extinguish an LNG pool fire or would you have to allow it to run its course?'

The latter. The heat intensity would preclude effective extinguishment. Fire fighters, even with protective clothing, would be unable to get close enough to allow their effort at extinguishment to be effective.[52]

Based on the testimony from local fire departments, it is clear that these officials, even with years of education and experience in fire fighting, would not be able to handle a large LNG spill and pool fire. Chief Thiboutot was also asked about the need to evacuate the area in case of an LNG spill and how that would affect his ability to fight a vapor cloud or fire:

Fire fighters, and emergency medical personnel would at precisely the same time be required to utilize those same roadways, but going in the opposite direction. I do not see how both efforts can

[49] ibid
[50] Direct Testimony by Somerset Fire Chief Stephen Rivard to the Federal Energy Regulatory Commission 6-9-2005
[51] ibid
[52] Direct Testimony by F.R. Fire Chief David Thiboutot to the Federal Energy Regulatory Commission 6-9-2005

simultaneously be pursued successfully. The resulting chaos is certain to frustrate both efforts and magnify the tragedy.[53]

While Captain Landry had said that the Coast Guard will "ensure" that the local public safety departments will have the resources to provide protection to the citizens of Massachusetts and Rhode Island, it appears that they themselves are having problems. A recent story published in USA Today claims that Coast Guard ships, planes, and helicopters are breaking down at record rates.

Senator Olympia Snowe of Maine, Chairwoman of a Senate Coast Guard Subcommittee said, "This nation must understand the dire situation in which the Coast Guard now finds itself."[54]

Senator Snowe favors replacing the ships and aircraft over a 10 to 15 year period, while under a White House plan that time line could reach 25 years. She said that idea is a "violation of common sense" amid mounting concern that terrorists will try to sneak weapons of mass destruction into the United States through a port.[55]

James Loy, former Coast Guard commandant and Homeland Security Deputy Secretary, said that the stakes are too high in the post-9/11 environment to continue to allow the Coast Guard's aging equipment to continue to deteriorate.

The statistics outlining the problems the Coast Guard is facing are incredible. An excerpt from the article sums up what is taking place:

In fiscal 2004, the engines on the Coast Guard's 95 HH-65 helicopters suffered power losses at a rate of 329 per 100,000 flight hours, up from 63 per 100,000 flight hours in fiscal 2003. The comparable Federal Aviation Administration standard is 1 per 100,000 flight hours. There have been 23 hull breaches – holes that let in water – requiring emergency dry-dock repairs in the 49 110 – and 123-foot patrol boats since 2001. Each of the dozen 378-foot cutters, most of which operate in the Pacific, suffers a significant engine or hydraulic or refrigeration system breakdown on every patrol. For all major cutters and patrol boats, the number of unscheduled maintenance days was 742 in fiscal 2004, up from 267 in fiscal 1999. The loss of cutter days in fiscal 2004 equated to losing 10% of the major fleet for an entire year.[56]

Stephen Flynn, maritime security expert and former Coast Guard officer said that the agency is "operating at the level, in many instances, of a Third World Navy."[57]

It appears that it will be difficult for the Coast Guard to ensure their own resources, let alone ensuring the public safety resources of numerous towns and cities all along the 26 mile route from Newport, RI to Fall River.

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[53] ibid
[54] USA Today – "Coast Guard Plagued by Breakdowns" 7-6-2005
[55] ibid
[56] ibid
[57] USA Today – "Coast Guard Plagued by Breakdowns" 7-6-2005

LNG Site Comparisons

Since 2003, FERC has approved construction of five new terminals since and the expansion of two others. According to a recent newspaper investigation there is no comparison in terms of safety threats between the Fall River site and the other sites.

The seven sites approved since 2003 are starkly different from those proposed for Providence and Fall River. The most telling statistic of how they differ is the number of residential homes within a half-mile of the facilities. Of the seven LNG terminals approved by the commission, five had no residential homes within a half-mile of the facility. One of the remaining two had three homes, and the other had nine.

In Fall River, 1,200 homes are within a half-mile of the proposed Weaver's Cove site, according to a FERC report.[58]

In a report completed by Fire Chief Peter Burke of Swansea, we can see that the conditions surrounding existing LNG terminals in the United States cannot compare to the one planned for Fall River. Here is the table that Fire Chief Burke produced: [59]

Facility	**LNG Storage**	**# of tanks**	**Closest Residential Home**
Everett, MA	165,000 m3	2	4,000 feet
Cove Point, MD	235,974 m3	6	1 mile
Elba Island, GA	193,400 m3	3	1 mile
Lake Charles, LA	297,000 m3	3	1.2 miles
Fall River, MA	200,000 m3	1	1,200 feet

NOTE: The area of the proposed LNG terminal in Fall River would be very difficult to evacuate. There are a number of dead-end streets near the site and the evacuation route would require people to initially drive toward the site. All these streets would then empty onto North Main Street, the same access route for all public safety personnel.

Dominion, the company that owns the LNG terminal at Cove Point, Maryland, has created a booklet for the residents that live near the plant. (There are no residents within a mile of the terminal.) This booklet contains an emergency plan which includes an evacuation plan. Their publication asks the question "Why evacuate the area?"

[58] Providence Journal, "LNG in our back yards" June 26, 2005
[59] Report on the Effects of LNG Facilities to the Town, By Swansea Fire Chief Peter Burke, 2-11-2004

For safety. Prudent emergency planning dictates that for certain types of emergencies, persons not required to be in the area immediately surrounding the terminal be evacuated to ensure safety and provide a buffer area around the terminal.[60]

The LNG terminal at Cove Point currently has a buffer zone surrounding the site. However, in Fall River there are thousands of people living only several hundred feet away from the proposed site.

Political Figures & Government Agencies

Governor Mitt Romney

There is simply no way that it makes sense to site an LNG facility in this location in the post 9/11 world. A thorough review would confirm this conclusion.[61]

Senator Edward Kennedy

…this project (Weaver's Cove LNG project) unnecessarily puts residents at great personal risk and opens up our coastline to terrorist attack.[62]

Senator John Kerry

I will continue to fight with Mayor Lambert and others to stop the Fall River LNG proposal from going forward.[63]

Congressman Barney Frank

Allowing the construction of LNG facilities in urban areas is at best reckless, and at worst a disaster waiting to happen.[64]

Congressman James McGovern

We will use every means to stop this. At the end of the day, I believe we will be successful.[65]

[60] "Public Emergency Response Information" Dominion Company
[61] MA Governor Mitt Romney – Letter to FERC – 9/20/2004
[62] Fall River Herald News
[63] ibid
[64] ibid
[65] Fall River Herald News

Fall River Mayor, Edward Lambert

The proposed site poses a significant danger to the citizens of our city and LNG facilities the size and scope of this project simply do not belong in dense urban, residential environments.[66]

State Representative David B. Sullivan

Allowing the LNG facility to be built in this area would be forcing residents to take a needless risk. The only alternative to this risk would be to move their homes and businesses, an alternative not feasible to most.[67]

Massachusetts Attorney General Thomas Reilly

This project makes absolutely no sense whatsoever, and it is up to us to stop it. I think what you are seeing is an effort by this (Bush) administration to trample states' rights.[68]

Senator Joseph R. Biden Jr.

State and local governments have always had the power to determine whether a new or expanded terminal would pose a serious threat to public safety, the environment and coastal resources, …We believe strongly that states should continue to play this critical role in the siting of such facilities.[69]

Former Fall River Fire Chief Edward Dawson

I'm looking at it from a public safety prospective, and I do not feel the facility being proposed for the old Shell Oil site is in the best interest of the residents of the North End. The potential is there and should an incident occur, there could possibly be a significant loss of life should it occur in that area.[70]

Massachusetts Energy Facilities Siting Board

With respect to the Weaver's Cove project, it is clear that there are real and significant safety issues.

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[66] ibid
[67] ibid
[68] ibid
[69] Press Release, 7/22/2005
[70] Fall River Herald News

The Massachusetts Energy Facilities Siting Board echoes the safety concerns voiced by Massachusetts Governor Mitt Romney in his September 20, 2004 letter to the Federal Energy Regulatory Commission.[71]

Rhode Island Turnpike & Bridge Authority (Approved a resolution on June 14, 2005 in opposition to the Weaver's Cove proposed terminal)

Fall River City Council (Voted 9 to 0 opposing the Weaver's Cove proposal)

Communities Opposed to Siting an LNG Terminal in Fall River

Fall River	Somerset	Swansea	Freetown	Newport	Tiverton
Middletown	Jamestown	Bristol	Portsmouth		

Organizations Opposed to Siting an LNG Terminal in Fall River

Fall River Chamber of Commerce	MASSPIRG	Toxics Action Center
Conservation Law Foundation	Save the Bay	Green Futures
Coalition for the Responsible Siting of LNG Facilities		
Coalition for Social Justice	Coalition Against Poverty	
North-End Neighborhood Association	Bank Street Neighborhood Association	
Sandy Beach Association	Corky Row Association	Niagara Association
Public Citizen's Energy Program		

[71] Out of Time Response, filed with FERC – 6/16/2005

Conclusion

This report has utilized information from experts in the fields of terrorism, fire safety, public safety and LNG. I have strived to demonstrate the inherent danger of siting an LNG terminal in a densely populated area not by using my opinion, but the opinions of people who have spent years studying the risks involved. The distances that a gas vapor cloud can travel, the height an LNG flame could reach due to a large spill, the distance from a flame that the thermal radiation can injure the public, and the catastrophic consequences of a terrorist attack upon an LNG facility, were all based on expert opinion. Many times the experts agreed with each other.

In addition, this report used information taken directly out of reports commissioned by federal agencies. Again the information in those reports seems to corroborate with what was said by Professor Fay, Dr. Havens, and Dr. West.

In regards to terrorism, this report once again relied on expert information. These experts point out that the threat is real and should not be brushed aside as some have suggested.

There is one other person that deserves to be quoted in this report, **Chief Executive Officer of Weaver's Cove Energy / Hess LNG, Gordon Shearer.** While addressing a group of citizens in Somerset earlier this year, he was asked what would happen if an LNG storage terminal should fail. He said:

> **It would be the world's largest Roman Candle…**[72]

It is my belief, based upon all the expert information that I have examined that if we allowed an LNG terminal to be built in a densely populated area we would be allowing our citizens to live near, as Mr. Shearer himself said, the worlds largest "Roman Candle."

The people of the United States expect and deserve protection, and they look to their government for this protection. They expect their water to be safe to drink. They expect that the foods they purchase will meet high standards. They surely expect that their government will not allow a profit-seeking corporation to locate a dangerous LNG terminal only several hundred feet away from neighborhoods, schools, hospitals, and businesses.

With all the expert opinion and information offered in this report I am confident that the House of Representatives, the Senate, and the Governor of the Commonwealth of Massachusetts will not jeopardize the citizens by allowing a public safety hazard to be built in a heavily populated area. The line in the sand must be drawn now and we must send a message to the Federal government.

That message is:

We the elected officials of Massachusetts will not allow FERC to step on the Massachusetts Constitution and override the unalienable right of our citizens to enjoy safety and protection of property!

[72] Providence Journal, 4/20/2004