

Company experts clash on risks of proposed liquefied natural gas terminal ExxonMobil claims danger would be minimal in event of fire, while scientists outline a more frightening scenario

09/21/03

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Environment Reporters – Mobile Register

In recent weeks, ExxonMobil officials have been defending the safety of a liquefied natural gas - - LNG -- import facility that they propose to build on Mobile Bay.

Responding to concerns from community groups in surrounding neighborhoods, the officials say federal studies show that a fire associated with the docking terminal for LNG supertankers would be so small that its dangers would be confined to ExxonMobil's property.

But leading scientists interviewed last week by the Mobile Register said that ExxonMobil officials are substantially underestimating the damage potential of such an accident.

Company documents presented to the Alabama State Docks say that an LNG tanker fire would be 150 to 600 feet wide. ExxonMobil officials told the Register that a person standing 600 to 1,000 feet away from the edge of such a fire would be safe.

Company officials have stressed that there has never been a major fire on board an LNG tanker, and they said they have a difficult time imagining how such an accident could evolve. They described a tanker fire as "a very low probability event," and said that strict federal regulations and an extensive review process would protect the public.

"An onshore terminal can be safe, and if we can't demonstrate it to ourselves and the regulators, we're not going to build it," said Tom Cordano, head of marketing for ExxonMobil's LNG program.

One official suggested that a person standing just outside the fence surrounding ExxonMobil's proposed facility during a worst-case fire would be virtually unharmed. "I wouldn't expect anybody to sit at the fence and watch the thing burn for an hour, but if they did they'd probably be sunburned," said Jim Galloway, an ExxonMobil engineer and the company's technical adviser on natural gas and production facilities.

Independent scientists contacted by the Register, however, said they were stunned by Galloway's statement.

According to two of the country's top LNG safety experts, a person standing on the Aker Kvaerner property adjacent to the proposed ExxonMobil terminal would be killed within 40 seconds by the heat of an LNG fire from a docked tanker.

One of those experts, Jerry Havens, developed the computer software used by federal agencies to determine safety buffer zones around facilities handling hazardous materials such as LNG. Havens, a distinguished professor of chemical engineering at the University of Arkansas, has consulted with numerous government agencies, including the Army, the Department of Energy,

the Environmental Protection Agency, as well as with Exxon, British Petroleum and other oil companies. He served as an officer in the Army's chemical weapons division.

The other expert, James Fay, is a retired Massachusetts Institute of Technology professor whose work on liquefied natural gas is cited in congressional reports and forms the basis for many of the existing scientific predictions regarding the behavior and dangers of LNG fires.

In one of the worst-case fire scenarios calculated by these scientists, people in the neighborhoods closest to an LNG fire would be "in unbearable pain after an exposure of 13 seconds." They said that trees and wooden buildings within a half mile would ignite within 40 seconds due to superheated air created by the burning natural gas. Wooden buildings and vegetation over a broader area would catch fire soon after, they said.

"If you are standing 1,000 feet away from an LNG pool fire you are simply going to die," Fay said.

The scientists and the ExxonMobil officials agreed that their very different scenarios may hinge on calculations of the potential size of a fire.

The independent scientists estimated that a much larger and more serious fire could result from a serious accident, which they speculated would most likely result from some kind of terrorist attack that penetrated a ship's hull.

They also warned that the federal regulatory process does not address many of the safety issues generated by an LNG terminal and in no way addresses the hazards posed by fires emanating from LNG tanker ships.

The scientists said they were concerned that researchers have never investigated fundamental safety questions regarding the tankers that deliver liquefied natural gas around the world. They also said that all of the existing studies examined the fire risks posed if just one of the five storage containers on an LNG tanker was breached.

"No one should assume a tanker is only going to lose one cargo tank. The ship will be engulfed in an enormous and very intense fire," Havens said. "I do not think anyone has studied what will happen to the ship as a result of this fire. It is possible the other tanks could also lose their cargo. If other tanks fail and contribute to the fire, the fire would get much larger. I certainly think this question needs to be investigated before you put these terminals in populated areas."

Cordano, with ExxonMobil, said that these are technical disagreements that should be decided at a later date by the Federal Energy Regulatory Commission, which signs off on the siting of LNG plants.

"The judge and jury needs to be after the FERC-supervised work is done. We think we're providing a fair view and a fair estimate of what the danger is going to be," Cordano said.

Possible terror target?

In July, ExxonMobil offered the State Docks \$38 million for a large portion of the former Navy home port at the mouth of the Theodore Ship Canal. The company wants to build a \$600 million receiving terminal that would unload liquefied natural gas from supertankers arriving from

Africa, South America and the Middle East. LNG tankers carry a super-cooled and highly concentrated liquid form of natural gas.

Federal officials promote such LNG terminals as essential to meeting the nation's growing demand for natural gas. Regulators say the tankers represent the only practical way to deliver large amounts of natural gas worldwide.

Supporters say the industry has an excellent safety record after 40 years of delivering gas to Japan and to a handful of terminals in the United States, including one in the heart of Boston.

"This company is incredibly concerned and incredibly attentive to the issue of safety," Cordano said.

But questions of safety have dogged the industry at several existing and proposed LNG ports in the United States, and Mobile community groups have raised their own concerns at meetings with ExxonMobil and civic leaders.

"ExxonMobil has not shown us any studies that demonstrate that an accident would impact only the company's property," said Casi Callaway, director of Mobile Bay Watch, a local environmental group. "I hope that our Port Authority board members take the time to research this issue thoroughly and understand the impact it could have."

At the heart of the opposition's concern is the fact that LNG tankers represent a nearly unprecedented amount of energy concentrated in one place.

If an LNG tanker lost just a fifth of its cargo -- about 6 million of the 33 million gallons of gas on board -- the ensuing fire would put out twice as much energy as all of the nation's gas- and coal-fired powerplants combined, according to Fay, the MIT professor.

Some studies published by government agencies suggest that an accident involving a tanker at the terminal could create a giant plume of methane that might stretch miles before igniting, spreading fatal injuries and damage over a vast area.

The independent experts said they couldn't entirely rule out the possibility of such an incident. But they said they agreed with federal officials and industry representatives that a "sparkless" accident is very unlikely. They said the chain of events required to cause the plume scenario would almost certainly ignite the cargo before such a plume formed.

Fay and Havens believe the most present threat posed by LNG involves a terrorist using an explosives-laden boat to blow a hole in the side of a tanker, immediately igniting the cargo. They point to the Limburg, a double-hulled oil tanker that was attacked in this fashion in October last year off the coast of Yemen. According to news accounts, the attack punctured both hulls, and penetrated 20 feet deep into the belly of the ship.

"The risks posed by an unignited vapor cloud are real, and people should be aware of them, but the principal concern should be for a very large fire centered around the tanker," said Havens. "If a tanker lost the LNG from one of the five tanks, this fire would be in the neighborhood of over a quarter-mile wide. It would be hundreds of feet high."

Fay's calculations indicate that the fire could be almost a half mile wide.

Documents provided to the State Docks by ExxonMobil describe a much smaller fire. "The incident would result in a fire which would be in the vicinity of the ship (preliminary estimates in the 150-600 feet range)," reads one ExxonMobil document.

Fay and Havens said that such statements are far out of line with the existing scientific research. "I don't know where ExxonMobil got those numbers from," Havens said. "I am not aware of any calculations that would limit the damages to those short distances."

ExxonMobil officials said their numbers come from a 1979 U.S. Department of Transportation study. Discussing that federal study with the Register, engineers from ExxonMobil acknowledged that a fire next to a tanker could actually be about 1,200 feet across -- at least twice as large as the fire described in documents provided to State Docks officials.

Fay and Havens said 1,200 feet begins to approach the size of the fires predicted in published LNG research. In fact, Fay's models estimate that if a tanker lost the contents of just half of one of the five tanks on board, the resulting fire would be over 2,000 feet across.

Galloway, the ExxonMobil engineer, agreed that a larger fire, like the one described by Fay, could endanger people over a much larger area. But, he said, "I just don't know how you get a fire that large." Galloway said ExxonMobil has used fairly straightforward calculations, and the fires its models predict "are just not anywhere near that large."

"There are different models, but I wouldn't expect the models to be off by a factor," Galloway said. "Somewhere it sounds like we need to sit down with them and work through it. Technical people have been known to disagree."

Tanker enveloped in fire

The independent experts said that the relatively limited loss of cargo considered in existing studies may not be realistic. They say they have concerns about the structural integrity of the tanker ship during a worst-case accident.

"Even the largest LNG tankers (typically more than 900 feet in length) might be completely enveloped in a pool fire following a complete spill of a single 6.5 million gallon tank," reads an August article Havens wrote for the Bulletin of Atomic Scientists. Most LNG tankers have five of the 6.5 million gallon tanks.

"The basic problem is that we are going to have a very intense fire that envelops the entire ship. That fire could threaten the contents of the other tanks," Havens said in an interview. "Engulfed in fire, that tanker is out of commission. No one on board could survive. That means it's drifting, or maybe still under power but out of control. You couldn't get close enough to it to tow it, besides there wouldn't be time. If it hits land and the other tanks become involved, you could have an escalating situation with a fire that might burn for over an hour."

Fay also expressed concern that a breach in one compartment on a ship could lead to an escalating fire.

"It would be kind of like the World Trade Center fires. After about half an hour the steel was weakened to the point where it collapsed and the buildings came down," Fay said. "You might have a series of failures, with the other four cargo holds disgorging their contents over an hour or so. It's difficult to say what would happen. It's a possibility that needs to be examined."

Both men said this gap in the scientific research compounds a glaring hole in the safety net used by the federal government when deciding where to allow LNG terminals.

Havens said tanker fires are simply not considered in the federal regulations used to determine if a site is suitable for an LNG terminal.

Havens developed the methods used by federal regulators to establish safety zones -- called hazard exclusion zones -- around LNG terminals.

"The regulations only apply directly to the onshore facilities and do not require estimates to be made for catastrophic tanker spills," Havens wrote in the Atomic Scientist article. "As a result, hazard exclusion zones are usually made substantially smaller and often do not extend beyond a plant's boundaries. Such a zone would not be large enough to protect people from one of the low-probability, high-consequence disaster scenarios."

Fay said the federal standards are simply not protective.

"The federal standard allows people to be exposed to a radiant heat level of 5 kilowatts per square meter. If you are exposed to that heat level, you get second degree burns within 100 seconds," Fay said. "The government should have a standard low enough that no one would be injured no matter how long they were exposed to a fire. They know how far from an LNG fire that distance would be. People would have to be kept 5,000 feet, or about a mile, away from the ship to be safe in the event of an accident."

Galloway said that ExxonMobil would set its safety boundary wherever necessary, "so no one would be hurt." If Fay's calculations are correct, that one-mile boundary could encompass parts of several residential neighborhoods, an elementary school and numerous businesses and manufacturing plants near the former home port on Mobile Bay.

'Incredibly robust ships'

Docks and industry officials have said that speculation about fire and disasters ignores the fact that LNG tankers have never had an accident that resulted in a major fire. And ExxonMobil officials said the design of the double-hulled ships means it is highly unlikely they could be damaged. "These are incredibly robust ships. It would be very difficult to put a hole in one of the tanks," Cordano said.

Fay noted that the Yemen terrorists blasted a hole more than 30 feet square in the double-hulled Limburg, which led to a massive oil spill and fire.

"This is a credible scenario. Terrorists putting a hole in a double-hulled tanker has already happened," Fay said.

Both Fay and Havens said they did not want to be labeled alarmists for raising questions about LNG terminals. They agreed that LNG terminals constructed offshore, and away from populated areas, present no danger to the public.

"I don't want to scare everyone, but I feel like I have a responsibility to tell people what I think the risks are," Havens said. "This is an amazing concentration of energy. When you make a tremendous concentration of energy you have to consider what happens if the energy gets out of the box. In this case, it could be catastrophic."

Cordano said he has no doubt that Havens and Fay believe what they're saying, but he said their concerns are best studied and addressed during the official approval process.

"At the end of the day, there's the ExxonMobil approach, and the Fay approach," Cordano said. "The good news is there's going to be a FERC-guided series of work projects that are going to be done, and that are Mobile-Bay-specific, and we believe that the data will show that this is a safe facility. But the work hasn't been done yet."