

## AMERICAN INSTITUTE OF CHEMICAL ENGINEERS 3 PARK AVENUE NEW YORK, NEW YORK, USA 10016









# Canadian Society for Chemical Engineering

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# U.S. AND CANDADIAN ENGINEERS EXPLORE SAFE SITING OF LIQUID NATURAL GAS TERMINALS

As liquid natural gas grows in importance as an energy source, paper identifies priority issues and reviews findings from second joint conference.

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NEW YORK & OTTAWA — In a search for "cleaner" replacements for petroleum, several new liquid natural gas (LNG) terminals have come on-line in North America in the last few years. However, applications for additional LNG facilities face serious challenges from communities concerned about safety. According to two groups of chemical engineers, while these facilities have laudable safety records, they do pose major hazards. And, the engineers say, the traditional process of balancing risks from such hazards with the benefits to society that come from a reliable energy supply, has been made even more contentious by perceived terrorist threats.

In response to this situation, members of the American Institute of Chemical Engineers (AIChE) and the Canadian Society for Chemical Engineering (CSChE) have identified issues that merit priority consideration when siting LNG terminals. Through months of work, these findings were developed from presentations at their second joint conference on LNG, which was held last summer in Montreal. Participants included major energy and engineering companies and representatives of the U.S. Federal Energy Regulatory Commission (FERC), the U.S. Coast Guard, the National Fire Protection Association, and the Canadian Standards Association.

Engineers in attendance observed that most future natural gas may well come from offshore sources and will need to be transported as a liquid. Re-gasification, formerly done on-shore, will increasingly be taking place offshore to address concerns about large carriers docking in populated areas.

Operations in the U.S., where most of North America's operating or proposed facilities are located, can be subject to confusing or overlapping regulation, due to FERC's responsibility for land-side operations and the Coast Guard's oversight of processes beyond the waterline, where it is charged not only with safety, but also with security concerns. Regulations in the U.S. have created buffer zones around LNG facilities based on risks categorized as "high," 'moderate," or "low," but with no specific quantitative measures defining these categorizations.

At the same time, the U.S. Department of Transportation (DOT), another involved agency, has developed "remote siting" requirements based on an assumption that the primary hazard is a fire from an unintended release of LNG, rather than an explosion. The resulting fire could be either a "pool fire," in which LNG immediately ignites, or a "vapor cloud fire," in which spilled LNG evaporates and forms a cloud that ignites as it drifts downwind. DOT has used mathematical models to define exclusion zones that suggest the maximum distances at which such fire conditions could pose significant hazards. However, some experts at the conference suggested that the assumptions underlying these calculations may be inconsistent or flawed and that better or different approaches are needed to reflect more likely scenarios and to adequately protect workers and the public.

European engineers at the meeting said that their more commonly applied approach involves quantitative risk assessment (QRA). This methodology was employed when the Dutch government decided to site two LNG import terminals at Hoek van Holland in the Netherlands at the mouth of the main ship channel to Rotterdam. The QRA approach considers maximum credible and maximum noncredible accident risks and the potential domino affects on nearby facilities. The risks posed by these two terminals satisfied the Netherlands' criteria, which are less than one in 1,000,000 per year for individual risk and less than one in 100,000 chance of greater than 10 fatalities per year to residents and people in surrounding plants.

The U.S. and Canadian engineers concluded that the issue of siting LNG facilities requires "significant additional effort" to better quantify risks and prevent accidents "in a manner acceptable to stakeholders." There are a number of uncertainties on both the land side and the marine side that require "improved technical data and analysis techniques." These include, on the land side, better definition of "maximum credible spill," the resolution of modeling issues for both vapor clouds and pool fires, the survivability of LNG tanks when exposed to fire, and limiting the danger of explosions (in addition to fire) from vapor clouds. On the marine side, questions about spills, especially as they relate to failures on carriers, need to be addressed.

For a copy of the full report, visit

http://apps.aiche.org/chemeondemand/preview.aspx?ID=84a30bb0-9ecf-47b2-90fe-4ea9f7cba972

#### **About AIChE:**

AIChE is a professional society of more than 40,000 chemical engineers in 92 countries. Its members work in corporations, universities and government using their knowledge of chemical processes to develop safe and useful products for the benefit of society. Through its varied programs, AIChE, which was founded in 1908, continues to be a focal point for information exchange on the frontier of chemical engineering research in such areas as nanotechnology, sustainability, hydrogen fuels, biological and environmental engineering, and chemical plant safety and security. More information is available at www.aiche.org.

#### **About CSChE:**

CSChE is the national, not-for-profit, technical association that unites chemical engineering professionals who work in industry, academia, and government. CSChE is one of three constituent societies of the Chemical Institute of Canada. It creates valuable networking and knowledge-sharing opportunities; provides opportunities for career enhancement and professional development; establishes and strengthens links between academic, industrial and government chemical engineers; lobbies the federal, provincial, and territorial governments regarding research funding and leadership, as well as regulatory affairs; takes positions as the national voice for fields related to chemical engineering; recognizes significant individual and organizational contributions through an awards program; and advances the public's understanding and appreciation of chemical engineering. More information is available at <a href="https://www.cheminst.ca">www.cheminst.ca</a>.

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