Incorporating Asphyxiation and Cryogenic Hazards into Risk Analysis

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Traditionally quantitative and semi-quantitative risk assessments tend to focus on process related risks associated with toxic, thermal and explosion consequence events. Other hazards associated with a potential release, such as asphyxiation and cryogenic hazards, are either assumed to have less of an impact than the above mentioned consequences or assumed to be less probable events than the above mentioned events. One area where less probable events may make a significant contribution is the field of LNG processing, particularly when this processing or regassification occurs in tight areas such as an offshore platform, a floating installation or a regassification vessel.

LNG is odorless, colorless, non-corrosive, and non-toxic. One cu ft of LNG contains approximately 600 cu ft of natural gas at atmospheric pressure, thus there is considerable expansion possibility, potentially creating hazardous areas in poorly ventilated or confined areas. The American Conference of Governmental Industrial Hygienist (ACGIH) has classified LNG as a simple asphyxiant because of its ability to displace oxygen in air, but has not determined a Threshold Limit Value (TLV) for human exposure; nor has OSHA not determined a Permissible Exposure Limit (PEL) for personnel exposure.

Industrial guidelines and OSHA requires a minimum oxygen content of 19.5% in air for personnel. The human response to an oxygen deficient atmosphere varies some what; however asphyxiation will be noticed when oxygen is reduced to below 16%. Signs and symptoms may occur in several stages including disturbed muscular coordination and impaired judgment, creating an escape and evacuation hazard as well. An LNG vapor cloud can also pose a cryogenic hazard because of the relative ability to sustain an “atmosphere” of -259°F over a long period of time. This cryogenic atmosphere poses a cold burn and inhalation hazard to personnel. In addition, the facility maybe subjected to a structural embrittlement hazard that can impede escape, evacuation and rescue.

This paper will attempt to incorporate the asphyxiation and cryogenic hazards into risk analysis using LNG processing as a case study.