Improving Prevention and Mitigation Efforts Related to Accidental Releases of LNG

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Liquefied Natural Gas (LNG) is a rapidly growing industry, both in terms of the increase in export terminals, as well as the growing number of regasification plants required to put natural gas back into pipelines. Sometimes as new facilities are built or residential developments begin to approach plant boundaries, an accidental release of LNG can affect the public if the release is not adequately prevented from occurring or mitigation measures are insufficient. Some of these protective measures are dictated by 49 CFR 193 and NFPA 59A. In the United States, these measures are reviewed by the US Pipeline and Hazardous Materials Safety Administration (PHMSA) and approved by the Federal Energy Regulatory Commission (FERC). Others measures, however, are not mandated, but through evaluations from computational fluid dynamics (CFD) modeling as well as known mechanical failures, there is room for improvement.

PHMSA requires both pool fire and dispersion models from scenarios of accidental releases of LNG accumulating in containment basins in order to meet the NFPA and 49 CFR 193 standards. Containment basins include LNG tank impoundments, trenches, and sumps, which are oftentimes modeled with LNG accumulating due to a guillotine break of the largest pipe.

While accidental releases of LNG are mitigated by trenches, sumps, and other forms of impoundment, the consequence is impacted by the nature of the trenches and containment basins. Any positive or negative impact is difficult to predict without complex evaluation. For example, if the tank itself is designed in such a way that a seam rip of both the inner and external tank walls is a credible scenario, the elevation of the hole as well as the size of it could render the basin walls inadequate depending on the location and extent of tank damage and impoundment geometry. Also, in terms of trenching used to direct LNG to containment basins, the geometry of the trench itself combined with the wind direction can have a significant impact on the generated plume size with LNG accumulation. In particular, a long linear span of trenching that is parallel with the wind direction may result in enough accumulation to generate a large plume well in excess of 1 kilometer.

CFD models show that the magnitude and location of an LNG release, the weather conditions, the regional terrain, release impingement, and the duration of the release can all greatly influence how far a combustible gas cloud will travel. Proximity of pipelines to vehicular or railway traffic can lead to an increased frequency of pipe breaks, and sometimes older facilities may be lacking in protective measures such as vapor fences that could better protect the public. Potential causes of releases will be explored and a range of possible improvements with prevention and mitigation measures will be discussed.