

Purpose

- Understand the properties and behavior of liquefied natural gas (LNG)
- Identify LNG fuel tenders, locomotives, tank cars, and intermodal portable tank cars
- Understand potential chemical, cryogenic, and flammability hazards
- Execute the basics of LNG emergency response

Properties and behavior of LNG upon release

- LNG is a cryogenic liquid formed from natural gas (NG) cooled to a very low temperature of $-260\text{ }^{\circ}\text{F}$ ($-162\text{ }^{\circ}\text{C}$) at atmospheric pressure.
- When heat is added to LNG at atmospheric pressure, it boils and is converted into NG.
- LNG is colorless, odorless, and non-toxic.
- The volume ratio of LNG at $-260\text{ }^{\circ}\text{F}$ to atmospheric pressure NG at $70\text{ }^{\circ}\text{F}$ is 1:600.
- LNG or vapor leakage is detected using only certified instrumentation, such as hydrocarbon concentration sensors.
- LNG is stored in insulated, thermos-like double-walled tanks.
- LNG leaks and spills lead to the formation of a cold, ground-hugging, white, visible natural gas cloud, which is visible due to water vapor from the atmosphere condensing into the cloud as a fog.

More Information

For more information on emergency response guidance:

- *BP Process Safety Series: LNG Fire Protection & Emergency Response*, Institution of Chemical Engineers, 2007
- *Emergency Response Guidebook*, U.S. Department of Transportation, 2012



Emergency Responder Guidance



Liquefied Natural Gas (LNG)

Identification of LNG tenders and tank cars

- A fuel tender will always be coupled to a locomotive. It may have decals indicating that the tank content is "Liquefied Natural Gas."
- An LNG tank car or intermodal portable tank will have a placard with "UN 1972" and will be marked "Refrigerated Methane Liquid."

Potential hazards — respiratory, cryogenic, and flammability

• Chemical hazards

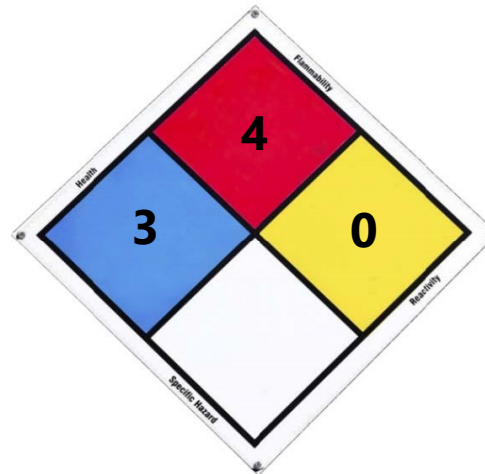
- The rapid evaporation of released LNG into vapor can displace air and can cause asphyxiating conditions in confined spaces.
- If only a small amount of LNG is released, it will evaporate and the vapors generated will quickly dissipate in the atmosphere.

• Cryogenic hazards

- Contact with cryogenic liquid, cold surfaces, or cold vapor can cause burns, also known as cold burns.
- Breathing cold vapors can damage lung tissue.
- LNG contact with materials, such as carbon steel, can lead to material embrittlement.

• Flammability hazards

- The natural gas cloud formed by LNG vaporization and mixed with air will ignite only when the gas-air mixtures is in concentrations between **5% – 15%** by volume.
- If a vapor cloud ignites, a flash fire will form and propagate (upwind) to the source of vapor. Occasionally, for short distances downwind of ignition point, the cloud may propagate a flash fire.
- Natural gas flames burn cleaner and more luminously than gasoline flames of the same size.
- LNG vapor mixed with air in the flammability range is not explosive in unconfined conditions.




Basics of LNG emergency response

- Stay upwind. Keep unauthorized personnel away.
- Do not enter an LNG cloud.
- Look for recognizable signs of escaping gas (sound and/or white cloud). Escaping gas is odorless.
- Eliminate ignition sources (no smoking, flares, sparks, or flames in the immediate area).
- Use thermal protective clothing and gloves in addition to respiratory protection.
- Initiate emergency shutdown functions.
- Stop the release if possible and safe to do so.
- Do not direct water at spill or source of leak.
- Verify whether cab sensor/detector has been activated in the locomotive if unsure about whether there is a leak.

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