level until the clouds temperature is greater than that of air and becomes buoyant. Also, the density of the cloud decreases due to continuous mixing with air and contact with other materials and surfaces; however, the cloud density is never lower than that of the ambient air. The result is that the cloud is always heavier than air and disperses hugging the ground (with highest vapor concentrations at ground level). As stated above, the vapor is ignitable only in the 5% to 15% concentration range. Because in the initial stages the dispersing cloud is cold (starting from -260 ºF), the dispersing cloud is visible as a white cloud due to the condensation of water vapor from the atmosphere. However, as the overall cloud temperature increases due to mixing with ambient air, and as the cloud temperature increases to above the "wet bulb" temperature corresponding to the relative humidity of the atmospheric air, the condensed water re-evaporates and the cloud becomes non-visible. The flammable region of the vapor cloud is enclosed within the visible vapor cloud if the ambient relative humidity is greater than or equal to 55%. For regions with relative humidity less than this value, the flammable cloud is outside the visible cloud. An ignition source can ignite the vapor cloud only when it is "on" and the vapor concentration is in the 5% to 15% vapor concentration in air. Once ignited, the vapors will burn back to the LNG source.

Methane in vapor state can be an asphyxiant when it displaces oxygen in a confined space. When spilled on the ground, into a confined area such as bound by a dike, the LNG will initially boil-off rapidly forming a vapor cloud, but the boil-off will slow down as the ground cools due to heat being extracted from the ground to provide for the evaporation of LNG. If spilled on water, the LNG will float on top of the water, spread in an unconfined manner, and vaporize very rapidly. This rapid vaporization will occur even at water temperatures near freezing since freezing water is significantly warmer than the spilled LNG.

In either scenario, the vapor cloud will be very cold and visible due to the condensation of water out of the air. Initially, if not ignited, the cloud will be dense and hug the ground. If there is no wind, the cloud will spread laterally from the spill. If there is a breeze, the visible cloud will initially hug the ground as it moves downwind from the spill. The subsequent dispersion behavior of the vapor cloud is as indicated earlier.

The distance over which an LNG vapor cloud remains flammable is difficult to predict. Local weather conditions (wind speed, atmospheric stability or turbulence), terrain, surface cover (i.e., vegetation, trees, and buildings) will influence how a vapor cloud disperses, and how rapidly it dilutes. If an LNG vapor cloud is ignited before the cloud has been dispersed or diluted to below its lower flammability limit, a flash fire may occur. An LNG vapor cloud will not entirely ignite at once. If ignited, the methane in LNG has a flame temperature of about 1,330°C (2,426°F). The resulting ignition leads to a relatively slow (subsonic) burning vapor fire which travels back to the release point producing either a pool fire or a jet fire. Such a slow burning vapor fire will not generate damaging overpressures (i.e., explosions), if propagating in the open with no significant obstructions. To produce an overpressure event, the LNG vapors need to be within the flammability range and ignited, and either be confined within a structure or the travelling flame in the open encounters densely packed structural obstructions (houses, trees, bushes, pip racks, etc.) that can increase the flame turbulence significantly. Other hydrocarbons that are transported by rail and highway, such as propane and butane, are more susceptible to vapor cloud explosions when they become vaporized and are ignited in much less confined conditions.