

TerranearPMC Safety Share

Week of February 15, 2016 – Methane, Natural Gas and Explosive Limits

On Oct. 23, 2015, an underground containment system for natural gas ruptured just north of Los Angeles, California in the quiet community of Porter Ranch. This facility is owned and operated by the Southern California Gas Company and is referred to as the Aliso Canyon Storage Facility. Natural Gas is mostly methane, however other hydrocarbons, in varying, trace amounts, are also present. Natural gas is found in deep underground rock formations and is typically associated with coal beds and petroleum reservoirs. The source for the natural gas at the Aliso Canyon Facility comes from extractions hundreds of miles away in Texas, the Rocky Mountains and the Midwest.

So far, natural gas has been escaping into the atmosphere at a rate of nearly 1,300 metric tons a day. The leak already has forced the evacuation of 1,700 homes in nearby neighborhoods, while closing two schools. There have also been widespread reports of residents being sickened by the stench of the gas (note: natural gas is odorless – what residents are smelling is the odorant, ethyl mercaptan or some similar material – that is used as a warning property should a natural gas leak occur). Airborne methane concentrations over the area have been measured at 127 parts per million (ppm) (67 times normal levels).

There are two concerns associated with this leak. One is that natural gas is a greenhouse pollutant. A **greenhouse gas** (sometimes abbreviated **GHG**) is an atmospheric gas that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Without greenhouse gases, the average temperature of Earth's surface would be about 27 °F colder than the present average of 57 °F (*"NASA Science Mission Directorate article on the water cycle". Nasascience.nasa.gov. Retrieved 2010-10-16.*). Thus, as global warming advocates expound, the more greenhouse gases in the atmosphere, the higher the Earth's temperature will become, and thus result in a disturbance of our delicate ecosystems.

The second, and more immediate concern associated with the release of methane is that it is combustible and therefore has the possibility to cause an explosion. Similar to fires, explosions require three elements: fuel, Oxygen, and an ignition source. In the case of Porter Ranch, California, the fuel is methane; the oxygen is supplied by the air and the ignition source? That is the factor that must be controlled. Each combustible gas or vapor will ignite only within a specific range of fuel/oxygen mixtures. Too little or too much gas will not ignite. These conditions are defined as the Lower Explosive Limit (LEL) and the Upper Explosive Limit (UEL). Any amount of gas between the two limits is explosive. It is important to note that each gas has its own LEL and UEL. In the case of methane, the explosive range is 5% to 15%, which is generally considered to the range of natural gas (however, due to other hydrocarbon constituents, this range can slightly shift to 4% - 14%).



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A 5% airborne gas concentration is equivalent to 50,000 ppm; this is substantially higher than the current airborne concentration of 127 ppm due to the recent leak at the Aliso Canyon Storage Facility. Therefore, one would think that the risk of an explosion is very low. And while methane's density is 0.717 grams per liter (compared to the density of air: 1.293 grams per liter), the likelihood of methane accumulating within Earth's atmosphere is rather small as there would be a tendency for methane to rise. Yet substantial amounts of methane have leaked from the ruptured line (72,000 metric tons since January 1, according to Scientific American - <http://www.scientificamerican.com/article/5-facts-to-know-about-the-california-methane-leak/>), and therefore, the chances of a substantial methane accumulation at the source must be considered.

There have been a number of notable explosion disasters that have etched in history. Of course the German Zeppelin, Hindenburg (look at the cover of the first Led Zeppelin Album) is one of the most famous. Occurring in 1937 as it was landing in New Jersey, the actual ignition source has remained a mystery to this day. The zeppelin's airborne ability was due to hydrogen (zeppelins and "blimps" are often referred to as "lighter-than-air" ships). Hydrogen is a highly flammable gas with an extremely extended explosive range of 4% - 75%. Typically, helium is used for lighter-than air ships, as it is not flammable or reactive. The majority of helium comes from fields in the US; however, under the US, under the Helium Control Act of 1927, exportation of this material was banned.

In the same year, a **natural gas leak** caused an explosion in New London, Texas, destroying the local school. The disaster killed more than 295 students and teachers, making it the deadliest school disaster in American history. According to the investigation, an "instructor of manual training" turned on an electric sander, where, it is believed that the sander's switch caused a spark that ignited the leaking gas-air mixture.

An important control at the Alison Canyon Storage Facility and surrounding areas, is to monitor for explosive atmospheres. The instruments used are typically referred to as explosimeters, and record explosive concentrations – as a percentage of the LEL, on a continuous basis. It is typical for work (involving a flammable material) to stop when 20% of the LEL is reached (10% for confined spaces) and to investigate so that flammable gases are controlled. This means all work involving open flames in the surrounding areas need to cease. In the case of Aliso Canyon, extensive monitoring needs to be conducted throughout the area to identify gas accumulations and to ensure all ignition sources are banned until the natural gas leak is fixed/controlled.

As it turns, this past week the leak has been temporarily contained. Authorities say that this an important first step towards permanently capping what has become the largest single release of methane into the atmosphere ever recorded. The leak has been called the largest environmental disaster since the 2010 BP oil spill. The question now is, how can this be prevented in the future, which means understanding how this incident occurred and what can be done to ensure emergency response procedures are appropriately enacted and thus protect the public and environment.

I envy paranoids; they actually feel people are paying attention to them - Susan Sontag (American Author)

