

What's an Acceptable LEL Detector Reading?

August 2022



Figure 1. Aftermath of the explosion and fire

Hydrogen sulphide (PPM)	Carbon monoxide (PPM)	Hydrocarbon (% lower explosive limit)	Oxygen (%)
10	213	67%	20.9

Table 1. Gas test results taken inside the tank before off-loading

A tank exploded as it was being emptied using a vacuum truck with a non-conductive hose. Four contractors were killed and a fifth experienced life-altering injuries. The company and the contractors were fined more than 8 million USD, and plant operations were interrupted for weeks.

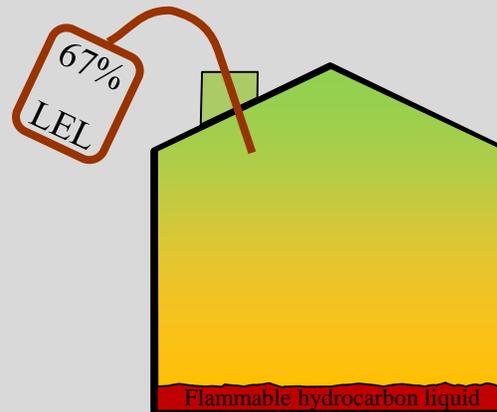
The workers had not expected to find flammable vapor in the tank. Due to a process change about 10 years before the incident, flammable liquid hydrocarbons could slowly accumulate on top of the liquid in the tank. There were several incidents that warned of flammable materials in the tank.

There were several causes for this accident but focus this month on just one. The operator took a “gas reading” inside the tank’s vapor-space as he prepared the work permit; he got a reading of 67% of the Lower Explosive Limit (LEL) inside, near the top of the tank. (see Table 1) It’s not clear why, but the work continued despite the high reading. The ignition source for the explosion was electrostatic spark and self-ignition of pyrophoric material; neither were recognized when preparing for the work.

<https://www.hse.gov.uk/comah/chevron-pembroke-report-2020.pdf>

Did You Know?

- Several regulators, including US OSHA, prohibit a confined space permit being issued if the concentration of flammable vapors is above 10% of the LEL.
- Many flammable vapors are heavier than air, so they can be more concentrated at the lowest point – near the bottom of the tanks, in sumps or trenches.
- Sludge in the bottom of a tank may contain pockets of flammables. These can be released as the sludge is disturbed and cleaned out.
- The movement of fluids – even of solids - through hoses can generate static charge. It’s important to bond and ground all equipment in or near hazardous locations.



What Can You Do?

- Perform the gas tests thoroughly by using a properly calibrated LEL meter and following your procedure for LEL testing.
- A reading above the limits in the LEL testing procedure, means that something is wrong. Do not proceed until the problem is fixed and you get acceptable readings.
- See Beacons from August 2020 about where to test for flammables, and the March 2020 on vacuum truck hazards .
- Your site should follow good engineering practices for tank cleaning, like Energy Institute Part 16 “Tank Cleaning Safety Code” or API 2015 “Safe Entry and Cleaning of Petroleum Storage Tanks”.

An LEL reading means there is some flammable vapor