

NIOSH Science Blog

Reports of Worker Fatalities during Flowback Operations*

***Actually flowback and production testing**

Data Sources

This summary was compiled by the NIOSH Oil and Gas Extraction Safety and Health Program. Cases were included if:

- 1) The case was listed in the OSHA Oil and Gas Extraction Worker Fatality Dataset provided to NIOSH (through an MOU) and the preliminary description of the fatality mentioned flowback tanks or produced water (and was not a traumatic injury) OR
- 2) The case was reported to NIOSH through media or other professional contacts (this is the most recent cases on 4/28/14 and 5/5/14). Professional contacts were Robert Harrison, MD UC San Francisco School of Medicine (NIOSH Board of Scientific Counselors, CA FACE Program Director), Michael Hodgson, MD, Medical Director, OSHA

Case 1

- Preliminary Description: 28 April, 2014.
McKenzie County, ND. A 20-year-old man died at a well site in on Monday. Flow tester was found unresponsive on the well pad site located five miles south of Williston, ND.

Case 2

- Preliminary Description: 18 July, 2013.
McKenzie County, ND. A "pumper" arrived to the well site and noticed the decedent slumped over a railing on top of the tank battery. Source reports the decedent was wearing a hydrogen sulfide monitor and FRC.

Case 3

- Preliminary Description: 17 January, 2012.
McKenzie County, ND. Deceased was found on sitting on tank battery manwalk and unresponsive. Victim had just finished gauging a crude oil tank in a tank battery at a well site. Deemed not work-related based on coroners report (but autopsy reports lists cause of death as inhalation of petroleum vapors.

Case 4

- Preliminary Description: 9 July, 2010. Richland County, MT. Deceased was found slumped over on the catwalk by the oil storage tank at an oil well servicing site. The victim was found by a second crew member and with the help of a third crew member was removed from the catwalk to the level ground below. Crew members 2 and 3 administered CPR until the Ambulance and EMTs arrived. CPR was continued in route to the Sidney, MT hospital where employee was pronounced deceased. No cause of death has been determined.

Others

- 3 March, 2014. It was reported that an employee was gauging a tank, fell into the tank, and was hanged by his sweatshirt hood.
- 20 March, 2014. Truck driver pumping and hauling crude oil from a tank battery was found on the catwalk next to a tank slumped over and non responsive. There were no signs of physical trauma and both the employee and a second driver who found the employee were wearing H2S monitors that did not alarm.

Others

- There were 2 fatality reports associated with gauging/flowback found in the NIOSH FACE (Fatality Assessment and Control Evaluation) Archives.
 - FACE 9217. 4 June, 1992. A 39-year-old male driller and a 28-year-old male service rig helper (the victims) died after entering a fracturing tank located at a well within a natural gas storage field. The workers had been assigned the duty of monitoring the fluid level and wellhead pressure at the well during the final stages of an hydraulic fracturing operation.
 - FACE 8502. 4 October, two workers died while attempting to rescue a third worker who had entered a fracturing tank at a natural gas well. A total of four men entered the tank and were overcome by natural gas. The two workers who died drowned in 30 inches of liquid (water, gas, acid, and possibly oil) which had been released into the tank during "blow down" procedures. The other two workers, both rig hands, required medical treatment at local hospitals.

Probable Cause

- While H₂S is a well recognized inhalation hazard in the upstream oil and gas industry, gases and volatile hydrocarbons in petroleum production streams can also present a hazard.
- Besides their inherent flammability, natural gas and volatile hydrocarbons in petroleum production are acutely toxic at high concentrations. Volatile hydrocarbons can effect the eyes, breathing, and the nervous system and at high concentrations may also effect the heart causing abnormal rhythms.

Hydrocarbons- BTEX and other Volatile Organic Compounds

HAZARDS:

Flammability: typically lower flashpoint than natural gas. LEL monitor selection/calibration issues.

Acute effect: transient VOC peaks at very high concentrations may cause CNS depression. Workers feel light headed-dizzy. Can effect heart rhythm

Acute toxicity: irritating to eyes, respiratory system, skin

Chronic toxicity: may be toxic to organs (liver, kidneys), cancers of the blood forming tissues, neuorpathies

Flammability-Monitor Response When Calibrated to Methane Scale

- Many VOCs found in hydrocarbon streams have lower LEL than methane
- Catalytic sensor/Wheatstone Bridge monitors typically underestimate actual concentration of flammable VOCs as percent LEL
- Many VOCs in hydrocarbon streams have Occupational Exposure Limits much lower than their LEL.

Occupational Exposure Limits for Volatile Organic Compounds Found in Upstream Oil and Gas

Compound	PEL	IDLH	LEL	UEL
Total Hydrocarbons*	500 ppm	1100 ppm	1.1%	5.9%
			11,000 ppm	59,000 ppm
Crude Oil	380 ppm	400	0.4%	15%
	(varies)	(= 10% LEL)	4000 ppm	15,000 ppm
Benzene	1 ppm	500 ppm	1.2%	7.8%
			12,000 ppm	78,000 ppm
Ethyl Benzene	100 ppm	800 ppm	0.8%	6.7%
			8000 ppm	67,000 ppm
Toluene	200 ppm	500 ppm	1.1%	7.1%
			11,000 ppm	71,000 ppm
Xylenes	100 ppm	900 ppm	0.9%	6.7%
			9000 ppm	67,000 ppm
n-Hexane	500 ppm	1100 ppm	1.1%	7.5%
			11,000 ppm	75,000 ppm