

Hydrocarbon storage tank explosions and static electricity

A worker was pressure washing and vacuuming solids from a hydrocarbon storage tank when an explosion occurred within the tank. The explosion tore off the tank's roof and forcibly threw the worker away from the tank. The worker was seriously injured. Static electricity may have ignited flammable gases and vapours.

In the oil and gas industry, certain processes are known to generate and store static electricity (also known as electrostatic energy). In a flammable or explosive atmosphere, a discharge of static electricity can become an ignition source. A fire or explosion resulting from such a discharge could have devastating consequences for workers and assets.

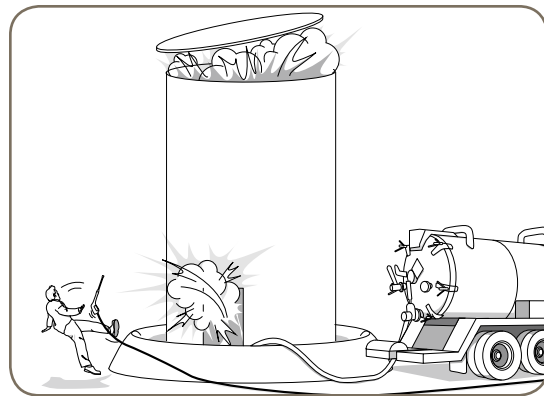
Recognizing the hazard

Static electricity is an electric charge generated when two surfaces in close proximity are moved relative to each other. Common situations where static electricity can be generated in oil and gas processes include:

- Liquid flowing through a hose or pipe (or its opening)
- Containers being filled with liquids
- Liquids being mixed or blended

Preventing and controlling static electricity

Safely discharging static electricity involves bonding and grounding the conductive equipment that produces static electricity.



An explosion occurred while a worker was pressure washing and vacuuming solids from a hydrocarbon storage tank. Static electricity may have ignited flammable gases and vapours.

Bonding involves connecting all components in a system using a conductive material, usually a wire. *Grounding* involves connecting the bonded system to earth, usually with a wire and metal clamp to a grounding rod. A total resistance of 1 megohm is enough to dissipate the accumulated static electric charge.

Safe work practices

Employers

- Educate and train workers in grounding and bonding all equipment. This includes identifying and using proper vacuum hoses,

pressure washing hoses, and wash wands. Workers need to understand how and why to bond and ground their equipment to ensure its effectiveness and safe operation. The vacuum hose and wash wand are often used by one operator. When used by two operators, a differential in static charge could be created. If workers get too close to each other, the charge could be released.

- Ensure that static electricity is controlled by means of effective grounding and bonding to a designated grounding point. Discuss the points for bonding and grounding with the vacuum truck owner or the vacuum truck operator at the worksite to ensure the cables are attached to the correct connection points.
- Ensure that conductivity checks are completed. Proper training and supervision will help verify that correct connection points are being used.
- Complete proper assessments to identify potential hazards such as lower explosive limits (LELs). All potential sources of LELs must be identified through the use of (material) safety data sheets or (M)SDSs for the products present in the atmosphere.

Workers

- Wear fire-retardant clothing made of cotton or similar materials that will not generate static electricity. Don't wear clothing containing polyester beneath fire-retardant clothing.
- Follow the equipment manufacturer's instructions and your employer's written safe work procedures for bonding, grounding, and using the equipment.
- Check that vacuum hoses are rated and bonded for the intended use. Conductive hoses are required. Fittings must be connected properly to ensure a continuous bond.

Legal and regulatory requirements

Workers Compensation Act

- [Sections 115 to 124, General Duties of Employers, Workers and Others](#)

Occupational Health and Safety Regulation

- [Section 5.27, Ignition sources](#)
- [Section 5.53, Workplace monitoring](#)
- [Section 5.71, Combustible or flammable air contaminants](#)
- [Section 9.9\(1\)\(b\), Hazard assessment](#)
- [Part 23, Oil and gas](#)

Resources

- WorkSafeBC: [Vac Truck and Fluid Hauling Inspection Checklist](#)
- Enform: [DACC Industry Recommended Practice Volume #08 - Pumping of Flammable Fluids \(2016\)](#)
- National Fire Protection Association: [NFPA Standard 77, 2014, Recommended Practice on Static Electricity](#)
- Canadian Standards Association: [CSA Standard C22.2 No. 41-13, Grounding and Bonding Equipment](#) (Tri-national standard, with NMX-J-590-ANCE and UL 467)
- American Petroleum Institute (API):
 - [API Standard 2219, Safe Operation of Vacuum Trucks Handling Flammable and Combustible Liquids in Petroleum Service](#)
 - API Publication 1003 (1986), Precautions Against Electrostatic Ignition During Loading of Tank Motor Vehicles
 - [ANSI/API Standard 2015 \(2014\), Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks](#)
 - [API Recommended Practice 2003 \(2015\), Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents](#)