Incident Title	**Methanol Tank Explosion During Maintenance**
Incident Type	Explosion and Fire
Date	11th January 2006
Country	USA
Location	Bethune Point, FL

Fatalities	Injuries	Cost
2	1	Unknown

Incident Description

Credit: City of Daytona Beach/US CSB

The Bethune Point municipal wastewater treatment plant (WWTP) was modified in 1993 to include an anoxic biological nutrient removal (BNR) process to reduce discharge of harmful nitrates that promote algae growth in receiving waters. This involved continuous injection of methanol (MeOH) as a carbon source for the bacteria which convert nitrates into nitrogen gas. The WWTP was modified again in 1999 to enable operation without continuous MeOH feed, but the injection system was retained for sporadic MeOH addition.

On 11-Jan-06, 3 workers were removing a hurricane-damaged roof shading the partially full 37.9 m^3 (10,000 US gal) capacity carbon steel above-ground MeOH storage tank. The roof was approx. 9 m (30 ft) above ground level. Two mechanics were on a man-lift basket cutting the metal roof directly above the tank vent while a crane operator was holding the roof sections as they were being cut. Sparks showering from the cutting torch accidentally ignited MeOH vapour escaping from the tank vent, creating a fireball on top of the tank. The fire propagated through a defective flame arrester on the tank vent, igniting the MeOH/air mixture inside the tank, resulting in an explosion. The explosion caused multiple MeOH piping failures and a large fire ensued engulfing the 3 workers. Two of the workers were killed and the other was critically injured.

Incident Analysis

Basic cause was ignition of methanol (MeOH) vapour by falling sparks from an oxy-acetylene torch used to cut and remove a roof from above the tank.

Critical factors included: 1) MeOH vapour is highly flammable, 2) The MeOH system had been specified with (non fire-resistant) polyvinyl chloride (PVC) piping, valves and fittings, 3) The flame arrester internals and housing were aluminium (MeOH corrodes aluminium), 4) No risk assessment was carried out during the non-routine (roof removal) work planning process, 5) No flammable gas monitoring was done before or during execution of the work.

Root causes included: 1) Inadequate awareness of MeOH hazards (flammability and incompatibility with aluminium), 2) Inadequate equipment design (MeOH piping system and flame arrester materials of construction), 3) Failure to comply with design standards (NFPA 30 required all storage tank valves to be steel), 4) Inadequate maintenance of safety-critical equipment (flame arrester), 5) Inadequate supervision (failure to conduct risk assessment), 6) Inadequate control of work (absence of hot work permit and flammable gas monitoring), 7) Inadequate training (MeOH hazards).

Lessons Learned

1) The likelihood of ignition may be reduced by using an inherently safer cold work method (e.g. cutting with a water-cooled pneumatic-powered saw) instead of a hot work method (e.g. cutting with an oxy-acetylene torch) and by placing fire blankets below the roof to contain any sparks.
2) The likelihood of a fire/explosion may be reduced or eliminated by isolating, draining and removing flammable vapours from the tank before work begins.

More Information

1) "Methanol Tank Explosion and Fire", US Chemical Safety and Hazard Investigation Board, Report No. 2006-03-I-FL (2007).
2) "Seven Key Lessons to Prevent Worker Deaths during Hot Work in and Around Tanks", US Chemical Safety and Hazard Investigation Board (2010).
3) INDG 370: "Controlling Fire and Explosion Risks in the Workplace", UK Health & Safety Executive (2013): https://www.hse.gov.uk/pubns/indg370.pdf.
4) NFPA 30: "Flammable and Combustible Liquids Code", US National Fire Protection Association (2021).

Industry Sector	Process Type	Incident Type
Water	Wastewater Treatment	Explosion & Fire
Equipment Category	**Equipment Class**	**Equipment Type**
Mechanical	Vessel	Storage Tank

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