Spent Scavenger Tank Explosion

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Enform

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Description of Incident:

A tank truck driver and chemical company representative were unloading the contents of a spent scavenger tank into their tank truck and trailer, when the scavenger tank caught fire and exploded.

The explosion occurred after approximately 28 m^3 of spent scavenger had been unloaded into the tank truck and trailer. As a result, the liquid level in the tank proceeded to drop below the level of the electric immersion heater located inside the tank.

As the vapour space temperature in the tank dropped below 25 °C, the immersion heater was automatically activated. The heater elements of the unsubmerged electric immersion heater caused the scavenger fluid to vaporize. When mixed with air, this created a flammable atmosphere.

It is believed that the unsubmerged electric immersion heater coils quickly rose to a temperature exceeding the auto ignition temperature of the flammable gas, leading to a fire and then explosion inside the tank.

What Caused It?

The risks of operating the immersion heater above liquid level in the spent scavenger tank had not been identified and mitigated during the design phase of the system.

Contributing Factors:

Substandard Acts and Conditions: The engineering design did not provide adequate protection for this system.

Job Factors: Inadequate hazard information communication between the tank manufacturer, heater manufacturer and the engineering design team resulted in a hazardous condition to exist without further safe guards in place.

Basic/Root Cause: The design of the system with the immersion tank heater installed was not adequate for a flammable hydrocarbon environment.

Corrective/Preventative Actions:

Electric immersion heaters in hazardous atmospheres should be installed with high integrity liquid level control and surface temperature limit systems. This ensures that the element will be de-energized by a temperature limiter if it is no longer submerged.

If possible, eliminate the hazards associated with electric immersion heaters, rather than minimizing the risks through design. External tank tracing is a potential option.

Glossary:

Scavenger	Scavengers are chemical compounds that remove H2S in a process, sometimes known as "stripping".
Auto-ignition Point	The auto ignition temperature or kindling point of a substance is the lowest temperature at which it spontaneously ignites in normal atmosphere without an external source of ignition, such as a flame or spark. This temperature is required to supply the activation energy needed for combustion. The temperature at which a chemical ignites decreases as the pressure or oxygen concentration increases. It is usually applied to a combustible fuel mixture.