



PREVENTING OVERFILL CATASTROPHES

Overfills constitute a significant problem to the tank storage industry in general, but especially so for large bulk liquid storage tanks where the consequences can be catastrophic. Buncefield, Jaipur, Puerto Rico and West Virginia are just a few of the locations where chemical and petroleum overfills have affected thousands of people through impacts on the environment resulting in asset and property damages, injuries and in some cases, multiple fatalities.

Accidents still occur. One of the reasons is that there are still considerable amounts of old and not adequately maintained storage tanks in service with non-existing, non-functioning or obsolete overfill prevention equipment.

The industry and society, in general, are currently investing considerable resources to increase safety in tank farms. Yet implementing new standards can only work effectively if the industry uses its ever-evolving technologies to its advantage.



Christoffer Hoffmann, Product Manager at Emerson, spoke to *Tank News International* about its latest developments in floating roof monitoring and its single-housing Rosemount™ 5900S 2-in-1 Radar Level Gauge. The company recently won the Excellence in Environmental Protection Technology Award for its automatic floating roof monitoring and 2-in-1 overfill prevention system at the Tank Storage Awards in March.

Floating roofs serve a vital role in the storage of highly volatile and dangerous petroleum products, and roofs are an inherent source of risk at most liquid bulk storage terminal. Failure of floating roofs can lead to a wide variety of devastating events, but new technology can significantly aid in the prevention of accidents related to floating roofs.

Floating Roof Monitoring

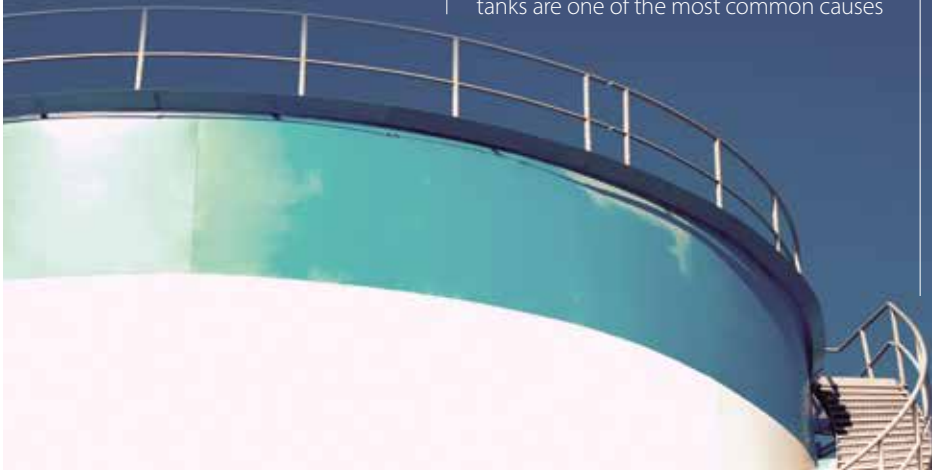
Floating roofs on storage tanks offer advantages in terms of the reduced need for vapour recovery, but can also create operational and safety issues. A sinking, tilting, leaking or collapsing roof can cause significant mechanical damage and create overfills and the release of explosive hydrocarbon vapour. The product in the tank may also become contaminated. In the petroleum storage industry, floating roof tanks are one of the most common causes



of incidents. Despite this, there is little focus on floating roof tanks as a safety hazard in the industry.

However, with the continually increasing focus on safety in combination with high profile events such as hurricane Harvey (reported to have caused dozens of floating roofs to sink in under 24 hours), this can be expected to change. One possible reason for the low focus is that floating roof failures have so far been regarded as unpredictable events. However, a white paper titled 'Floating Roof Tanks in Petroleum Storage' by PEMY Consulting showed that most serious floating roof failures are in no way unforeseeable. Instead, they are the logical consequence of less critical failures that are not emergencies, but that were not detected – or sometimes even neglected – and thus allowed to escalate to serious failures that cause major damage and process upsets.

The causes of the tank malfunctioning may be that the roof is stuck due to damaged or wrongly mounted rim seals. Leaking pontoons,





overfills, strong winds and inadequate draining during heavy rain or snowfall can also dangerously affect buoyancy and roof position.

A multi-point roof tilt monitoring system is a safety tool that monitors the difference in height between multiple points on a floating roof surface. These points are converted into a distance, and a user specifies the distance parameters that will trigger an alarm or alert on the system computer. This early alert system will prevent the tilt of a floating roof from reaching critical levels before action can be taken to avert an event.

Rosemount 3308 Wireless Guided Wave Radar and Rosemount 5900C Non-Contacting Radar both monitor roof position and tilt with the devices mounted on the tank top or the floating roof. The data collected by the radar gauges on the tilt of the tank roof and other parameters is displayed to operators in the Rosemount TankMaster Inventory Management software. The radar gauges can be combined with liquid level measurement in a still-pipe for complete tank inventory and overfill prevention.

"Both the Rosemount 3308 and the Rosemount 5900C are radar level gauges using similar principles, where the 5900C is the premium choice for floating roof monitoring, whilst the 3308 has the advantage of being fully wireless," says Christoffer.

2-in-1 Overfill Prevention

Tank overfills do not always occur

randomly – they are in many cases predictable and thereby preventable. Dual radar gauge-based tank gauging enables the tank terminal to reach a higher level of safety than with traditional mechanical overfill prevention methods. A safer terminal also pays off in economic terms in higher reliability and fewer costly interruptions.

The Rosemount Tank Gauging System is the Automatic Tank Gauging (ATG) system which is part of the Basic Process Control System (BPCS) used for tank monitoring and inventory management and acts as the first Independent Protection Layer (IPL) in overfill prevention. The system includes radar level gauges, multiple spot precision temperature measurements, pressure transmitters, inventory management software and wireless connection capabilities. The available measurement devices range from SIL 2 to SIL 3 depending on configuration, with the Rosemount 5900S 2-in-1 being the only single-housing device in the world to achieve SIL 3.

Through the use of a Rosemount 5900S 2-in-1 Radar Level Gauge, the terminal may reap the benefits of an Automatic Overfill Prevention System (AOPS) using the same high-performance devices as in the ATG system as part of the BPCS. Using only one tank opening, the 2-in-1 feature maintains the required level of separation between the AOPS and the BPCS layers.

Proof-testing can be carried out automatically and remotely from the

control room without affecting tank operations.

"We're currently the only company supplying a SIL 3 certified single housing level device, all others must use two separate devices," notes Christoffer. One of the unique features of this system is that the Rosemount 5900S 2-in-1 gauge will support two level gauges in one housing and a single tank nozzle. The level output from the safety layer sensor is available as a backup level measurement for day-to-day operations and installation time and cost is also reduced - not least in tanks with only one opening such as floating roof tanks with still-pipes and LPG tanks.

Today, risk assessment together with learnings from previous incidents have reached the point where most serious floating roof incidents and overfills are entirely preventable. In combination with new technology that continuously and around the clock monitors the status of the product levels and/or the floating roof, this has the potential to dramatically decrease one of the main risks associated with oil storage. Emerson's technology for overfill prevention and roof monitoring maintain the safety requirements needed at a terminal.

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