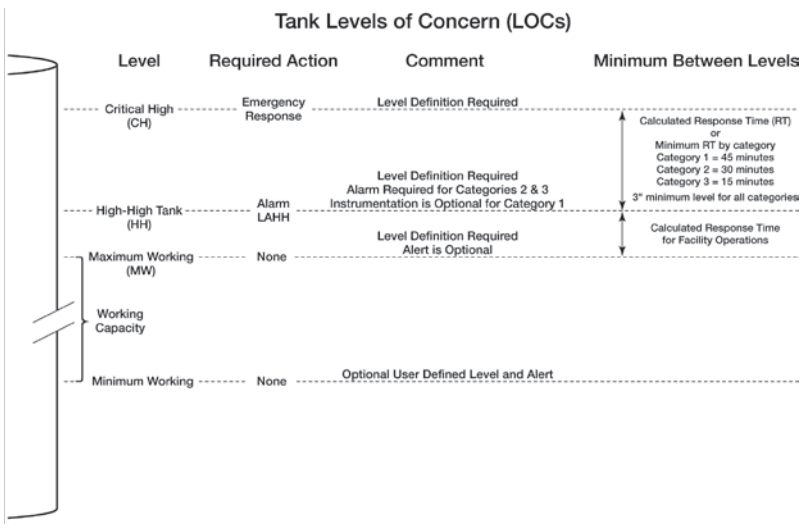
Process Safety

New Tank Over Fill and Spill Protection Standard

As a direct result of the Buncefield explosion, the American Petroleum Institute's Recommended Practice 2350 is being revised and updated to help prevent future incidents. Last updated in 2005 (3rd edition) the new 4th edition is expected in mid 2011.

It should be noted that there are similar storage terminals spread across Canada and the world. Many are currently in the process of updating to these standards. Of particular interest, are storage facilities fed by a pipeline, or from a ship, as the potential spill risk is greater than those fed by truck or rail.



The API 2350 4th edition will require most petroleum storage tanks over 5000 liters to have an independent level alarm for critical high level. Past practices of taking a high level or overfill alarm off the main tank level gauge (commonly a radar level device) are no longer allowed. A back up device is now required that can be a second transmitter (continuous level indication) or more cost effectively a point level switch. Depending on the overfill prevention category of the vessel, these switches may be mechanical or electronic. While there are several potential alarm points, here we are discussing the independent alarm required for the "High-High" alert.

In Canada, as well as worldwide, many of these petroleum storage tanks are floating roof designs. The floating roof may be internal, housed within a closed tank, or external, exposed and unprotected by a second roof. The internal design means there is a primary roof to keep the snow and rain out and a secondary roof that floats on the fluids surface, keeping the vapour space and explosion risk small while the external design has no secondary roof. It is common practice to sense the floating roof position on either of these designs as an indication of high level.

There are some very reliable, simple devices, called displacer level switches that have been used for this purpose for many years.

Top Mounted Displacer Switch

Key features of the displacer switch for floating roof detection are a non-sparking weight or displacer (originally lead, now often brass), plus an arm and cable to conveniently proof test the device from ground level, as required.

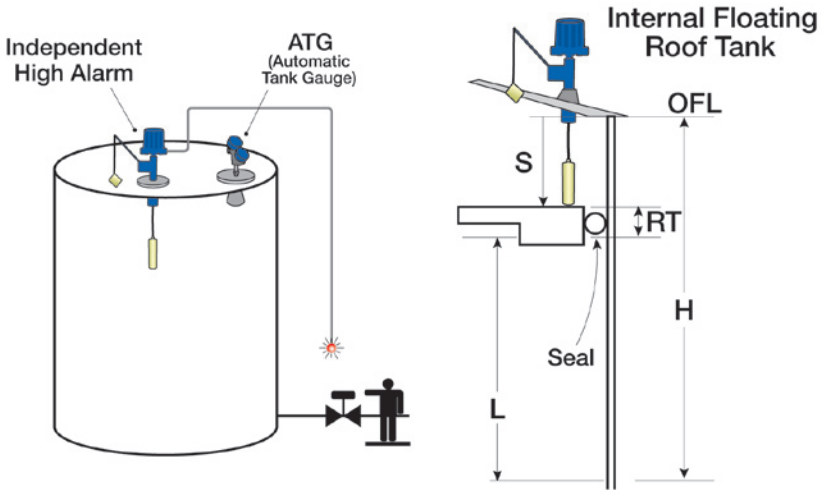
However there have been instances where these floating roofs have, stuck, sunk, or had a seal failure such that the fluid came over the floating roof, where it would not be detected by a level device designed to detect the roof surface only.

Therefore API 2350 specifically notes:

"High-High level sensors used as part of the Overfill Protection System (OPS) on floating roof type tanks that measure the roof position instead of the product level shall also be able to detect the presence of level of product on top of the roof in the event the roof sticks or sinks into the liquid."

Fortunately there is an easy fix for this, existing units can be modified or replaced with a unit with a hollow brass displacer that detects both the roof and the fluid. This dual detection feature is a highly recommended upgrade to existing units. The picture at the lower left shows what these units look like and the description below defines their features.

Displacer Level Switches



Dimensions

H	Tank Height
L	Liquid Level
RT	Effective Roof Thickness (from liquid level to upper seal extension)
S	Storage Available Until Overfill Level is reached
OFL	Overfill Level above which spill or damage will occur

Top mounted displacer switch
- Suitable for SIL 2 environments
- Hollow brass displacer
  - o Suitable for roof or liquid
  - o Non-sparking
- Proof-er ground checker

Where the overfill prevention category of the vessel allows, electronic devices can also be used. One popular device, is a contacting ultrasonic switch, like the Magnetrol® 961 shown here. These devices offer continuous diagnostics, are suitable SIL 2 environments and are available in configurations that require no local power. They incorporate the required "watchdog timer".

A secondary radar transmitter may also be used. This would likely be a different type of radar device than used for the inventory measurement, and would cost much less. Typical inventory radar require line power, and use a principal called FMCW (Frequency Modulated Continuous wave). The backup device can be loop powered using a pulse burst time of flight measurement. Typical devices of this type would be the Magnetrol® R95 shown at left.

Combining these level sensors with the appropriate systems and procedures can significantly reduce the risk of an incident.

This is a topic of safety, so we encourage operators of this type of facility to contact the undersigned for further details.

For further information, please contact the author, kmartyn@magnetrol.com