

GAUGING THE WAY FORWARD

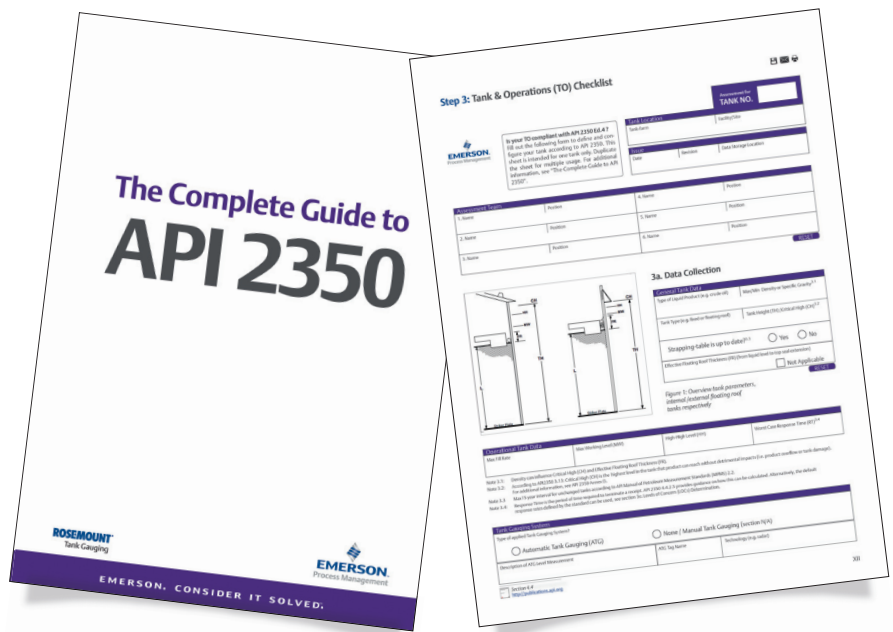
New tank gauging technology takes overfill prevention to the next level, writes Carl-Johan Roos

ARE YOU STILL using old mechanical point-level gauges for overfill prevention? Technology has changed and there are safer and more efficient options available today.

The new API 2350 overfill prevention standard combined with IEC 61508 (SIL)-certified continuous level measurement also for the HiHi-alarm is the path forward to meet current, and future, safety requirements.

Nowadays, petroleum tank spills are major news that can easily escalate from local media to regional and global publicity. The Buncefield overfill accident, which caused Europe's largest vapour cloud since the Second World War, is by far the most famous example. But new accidents are continuously occurring and there are several examples of terminals that have gone into bankruptcy due to oil-spills.

Safety is becoming increasingly important and the underlying driver is clear: a gradual reduction in acceptable societal risk throughout the entire world. The same trend also applies to tank farms and bulk liquid storage facilities where it is driving development of new technologies, standards and best-practices toward safer options.



Emerson and the API committee chairman have developed a guide and checklist to API 2350 for the interested reader available at www.api-2350.com

Overfill prevention is important for numerous reasons. Human safety, environmental protection public relations, clean-up costs and indirect effects such as downtime are pretty obvious. Maybe less obvious is that by better knowing what's in the tank the

insurance cost can be reduced, while simultaneously improving the operational efficiency due to, eg, increased tank utilisation and higher transfer speeds. Often petroleum products with high volatility and flammability are stored. Mixed with the right amount of air and an ignition source this combination can cause a vapour cloud explosion, which is exactly what happened at Buncefield. Besides causing considerable damage to surrounding tanks and nearby assets, vapour cloud



explosions are also a realistic and very serious safety concern for on-site employees.

TECHNOLOGY TRANSFORMATION

Overfill prevention technology is currently undergoing the same transformation as tank gauging technology once did. The establishment of API 2350, which is becoming the globally recognised overfill prevention standard, is a major step in this development (compare with API 3.1 for tank gauging). New reasonably priced products have emerged that allow for replacement of mechanical and electro-mechanical point-level switches to new and modern electronic level gauges. Traditional and well-proven tank gauging concepts, such as continuous level measurement are

“Petroleum tank spills are major news that can easily escalate from local media to regional and global publicity”

rapidly becoming the preferred industry choice and the new best-practice also for overfill prevention sensors. This transformation is on-going and inevitable. Although traditional switches are well-known, inexpensive

Above: 2 x ATG for level and overfill prevention. An increasingly common view when old mechanical level switches are replaced with modern solutions

and easy to understand the inherent problem with these will always be that it is difficult to know whether they are working or not.

To prevent and mitigate overfills from occurring, a multitude of independent protection layers can be used (IEC 61511-1 figure 9). Secondary containments and dikes are commonly used passive protection layers, but these are only for mitigation. Commonly used for prevention is a combination of a basic process control system (BPCS) and an independent safety layer. Often the BPCS is referred to as the ‘Tank Gauging System’,

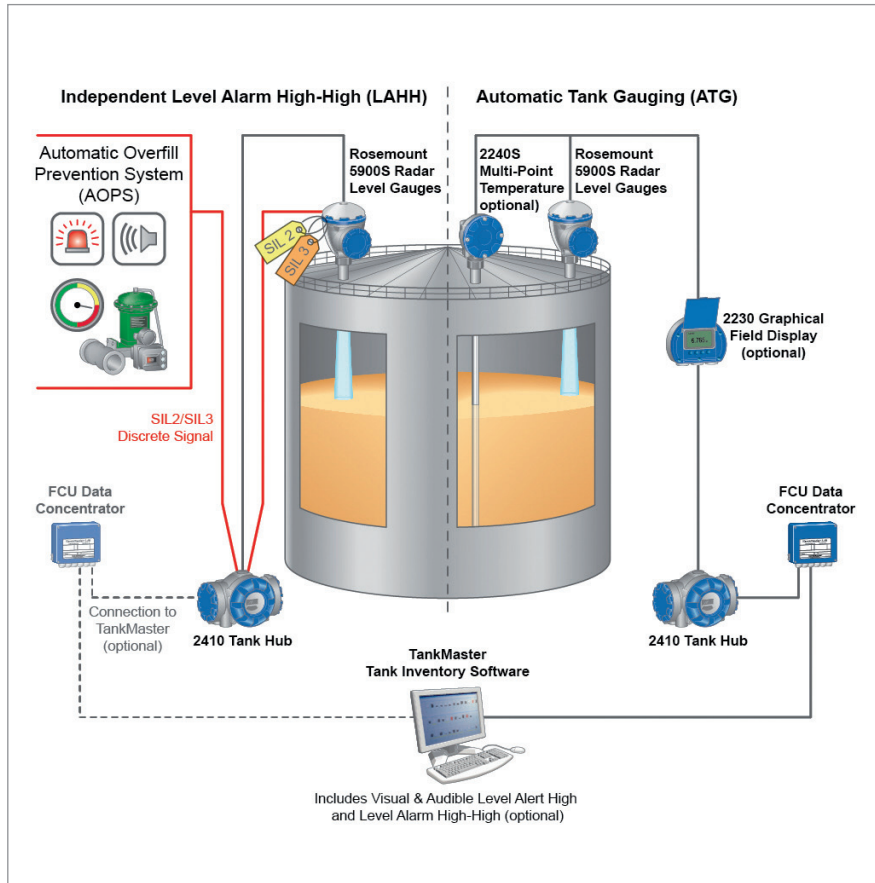
OVERFILL PREVENTION

important to understand that this is a consensus standard covering the bare minimum requirements; alternative solutions that provide equal or better safety are acceptable if they can be technically justified.

Another necessity to get the standard through the consensus process was to limit the scope. API 2350 is intended for atmospheric storage tanks above 1,320 US gallons/5,000 litres containing petroleum products. It is not intended for underground tanks, LPG/LNG tanks, or pressure vessels. The principles however are generic and may with proper pre-cautions be applied also outside the standard's designated scope.

API 2350 has been inspired by IEC61511's life-cycle approach. The entire journey from requirement specification to commissioning, and from operations to decommissioning is covered. An essential part of this is the risk assessment and management system, which now both have become mandatory parts of the standard. A clear indication of the importance of these systems is the Buncefield accident, where the electro-mechanical servo gauge had stuck 14 times in the three months prior to the accident. With a proper management system, this problem could have been solved.

All tank farms are different and the risks vary based on, for example, location, products stored, tank integrity and operational procedures. API 2350 categorises tanks based on attendance level and degree of complexity. Basically any modern tank farm will be classified as a category 3 facility, which has to be equipped with (at a minimum):

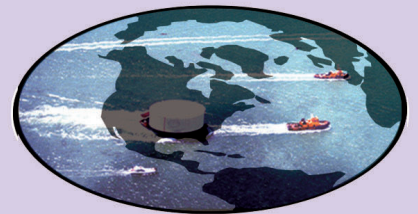


Above: Most bulk liquid storage tanks will be characterised as category 3 according to API 2350. Category 3 tanks are required to have an automatic tank gauge and an independent overfill prevention system

- 1 x Automatic Tank Gauge (ATG) and
- 1 x Independent Overfill Prevention System (OPS)

Automatic overfill prevention systems in new facilities shall be compliant with IEC 61511 according to API2350. For existing facilities, an alternative approach ('loop-hole')

"All tank farms are different and the risks vary based on, for example, location, products stored, tank integrity and operational procedures."



WWW.ARWATSON.COM

**SPECIALISTS IN LIFTING & RELOCATING
ABOVE GROUND STORAGE TANKS FOR OVER 32 YEARS
NO TANK TOO LARGE, NO TANK TOO HEAVY, NO DISTANCE TOO FAR
NO PROBLEM TOO BIG.**



Above: IEC61508/11 (SIL) certified equipment is now a requirement for automatic overfill prevention systems in new facilities according to API 2350

where the automatic overfill prevention system complies with Annex A in API 2350 is also available. However, as it has turned out, this Annex A approach usually requires more or equal amount of work than the IEC61511 approach, but without being future-proof.

2-WIRE GAUGES

The on-going safety trend has also spurred equipment manufacturers to develop new products. An evident advancement in this direction is that nowadays there exist 2-wire radar level gauges certified according to IEC 61508 for up to SIL 3 overfill prevention applications. This is a breakthrough which finally allows the usage of well-proven tank gauging technology also in overfill prevention systems.

With safety applications and overfill prevention systems a requirement for device verification emerge. API2350

requires point-level gauges to be proof-tested every 6 months, and other equipment at least annually (unless a technical justification says otherwise). For point-level gauges, the proof-test has traditionally been performed on the tank-roof, using labour-intensive procedures like water tests, pushing buttons or pulling levers. But as a tank operator explains: “I don’t know if my level switch works right now even if I proof-tested it according to schedule.” Fortunately proof-testing is one of the fields where new continuous level measurement technology can change the entire industry’s behaviour. The most obvious advantage is that the operators obtain two independent measurements that can be compared with each other. Often a fairly generous deviation alarm (eg, 2ins/5cm) is sufficient to help the operators detect any problems early while at the same time avoiding false-alarms. Some users refer to this testing technique as on-line or 24/7 proof-testing. Nevertheless; plenty of research is on-going in this field and it would be no surprise if devices soon exist with the capability to perform proof-test remotely.

Requirements are continuously changing, and overfill prevention is no longer synonymous with mechanical level switches. The completely revised API-standard (2350) for overfill prevention is a major milestone that will streamline and drive the industry forward together with IEC 61511. Equipment that traditionally has been used only for tank gauging can also be used for overfill prevention and will thereby play a major role in this transformation.

Although traditional level switches can still be used, the most efficient and future proof solution today appears to be an IEC61508 (SIL)-certified overfill prevention sensor that measures the level continuously and independently of the automatic tank gauge.



Carl-Johan Roos is business development manager with Emerson Process Management