The HSE has ruled that a system in which the excess in an overfilling tank could be diverted to one tank in a group as a dedicated 'receiver' tank is impractical. One industry expert discusses whether this decision should be re-considered

# Viability of 'catch' tanks

It is now widely accepted that the main cause of the 2005 explosion at Buncefield was the overfilling of a floating roof petrol tank.

Tank 912 was one of three tanks in a common bund, the capacity of which presumably exceeded the minimum of 110% of the largest tank. Why this is deemed good practice is a mystery, as a spillage into the bund would surround all the tanks in it and if it caught fire would involve them all.

During a delivery by pipeline from an external source, the level controls failed, the tank overfilled and around 300 tonnes of petrol exuded from the roof vents and cascaded down the side of the tank.

Petrol vapour is heavier than air, so the bund filled with vapour, which then flowed over the bund wall and spread widely as a white mist. The mist may have contained ice particles in the chilled and humid air due to evaporative cooling.

The cloud found a source of ignition, the origin of which is under investigation.

The source may have been from a motor starter in the emergency fire pump house or a standby generator at a neighbouring factory offsite.

It could have been an auto-ignition by static electricity formed by the diffusion energy as air entered the vapour cloud to produce a mixture within the explosive limits. Lightning is thought to be formed by the friction of ice particles generating static electricity, so it could be that if a vapour release is big enough it will inevitably ignite.

As the finding of a source of ignition from a widely spread vapour cloud is virtually inevitable, it is paramount to maintain the integrity of product containment.

### Is a catch tank the answer?

Rather than rely on level controls or control systems, one potential solution would be to arrange for one of the tanks in a group to be designated as a 'receiver' or 'catch' tank, so that overfills can be caught. If the designated tank was of equal size to the others in the product group, it would effectively double the filling capacity of a tank in the group and yield a considerable time for investigation and remedial action.

There were a number of recommendations arising from the various reports and inquiries. Recommendation 14 (for new Buncefield type sites) was that: 'Consideration should be given to modifications of tank top design and the safe re-routing of overflowing liquids'. Recommendation 16 was that Recommendation 14 should be applied to existing sites 'as is reasonably practical'.

However the HSE has decided that the 'safe re-routing of overflowing liquids' is impractical and operators instead are allowed to simply improve the level controls and operational practice.

### Overfilling to a receiving tank

One method is to weld a branch pipe just below the top position of the tank floating roof, a pipe connection from which would enter the bottom of the tank designated as a receiver.

The challenge is maintaining the floating roof seal as the roof passes the pipe entry. This could perhaps be solved by a sprung, shaped flap filling the hole until the roof has passed it. The flap could be actuated by a rocker engaging on the top of the roof when it reaches its stops, which would release the spring holding the flap in position so that the pump pressure would open it.

A siphon solution is the subject of US Patent 4,723,682 dated 9 February 1988[1] in which an overflow duct for prevention of overfilling is mounted on the outside of a tank.

A disadvantage of this method, anticipated in the patent, is that once initiated the siphon would tend to empty the entire tank, so a siphon-breaker could be applied to the top of the siphon pipe.

The vapour released from this vent could be a problem. However the emptying of the contents to a full sized receiver tank would stop once the level in the receiver tank reached that in the overfilled but now emptying tank. As the overfilling flow might continue into the tank until noted, the levels in both tanks would rise together

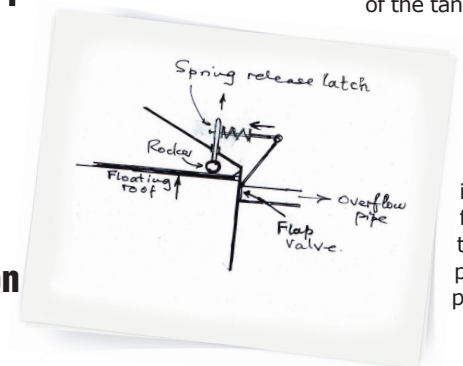
### Impractical or just expensive?

The dedication of one tank in each group of products as a 'receiver' or 'catch' tank would reduce storage capacity and cause significant disruption.

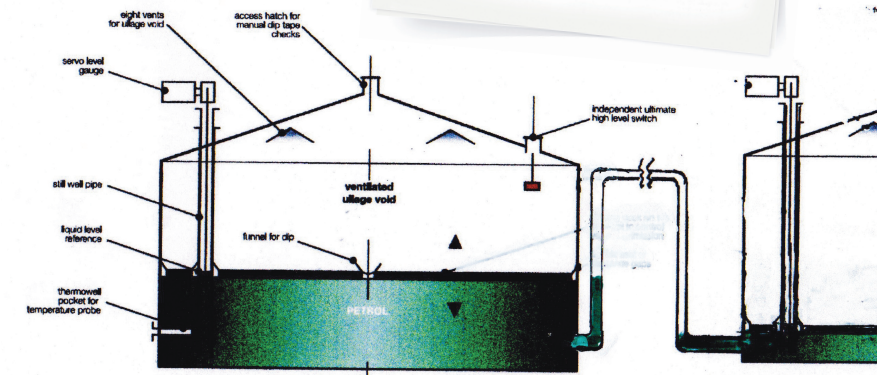
So instead BP has been allowed to re-commission its relatively undamaged part of the site by applying radar level controls and a molecular-level external product detection system.

Understandably using a 'catch tank' is not going to be popular – the universal application of Recommendation 16 would not just be impractical, it would also prove very expensive.

## Sprung flap for top position of overflow




## Siphon overflow solution




**For more information:**

This article was written by John Busby, a retired engineer, once employed as a construction manager for ICI nylon works in Scotland.

1 http://www.patentstorm.us/patents/4723682.html