

Figure 1. An external floating roof (EFR).

Michael Sprung, EnviroEye LLC, USA, examines roofs and storm water management practices relating to aboveground storage tanks.

TO DOME OR NOT TO DOME?

In the world of petroleum storage, few solutions offer as much utility as floating roof tanks. While the technologies available to the industry are vast, the floating roof tank paved the way for bulk storage.

The issue of storm water has been front and centre since the beginning of storage needs. In today's world, however, rain is, for the most part, still a rather unknown and unpredictable factor, which causes much frustration to tank farm operators. One common solution is to put a dome on top of an external floating roof (EFR), and turn the EFR into an internal floating roof, which would thereby remove the complication of storm water on top of the roof and the potential sunken roof. Yet, there are still weather conditions, climates and operator protocols that complicate the decision to use geodesic domes (g-domes)

for this purpose, i.e. locations that are prone to routine Category 4+ storms and/or where torrential rainfall is a regularity. In those locations, an EFR might be the best solution. For detailed guidelines and best management practices (BMP), the American Petroleum Institute (API) should be consulted.

So why bring up this topic? There are currently many best practices for managing aboveground storage tanks (ASTs). However, since there are so many products to be stored and just as many variances with regards to location and weather conditions, there is no one-size-fits-all standard operating procedure. Therefore, each terminal picks its own protocols. When picking a roof for storage tanks, there are several choices, which will be reviewed in this article.

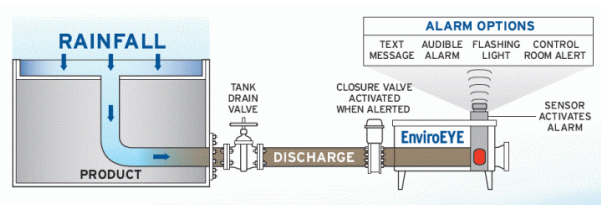


Figure 2. EnviroEye Drain Guard System.

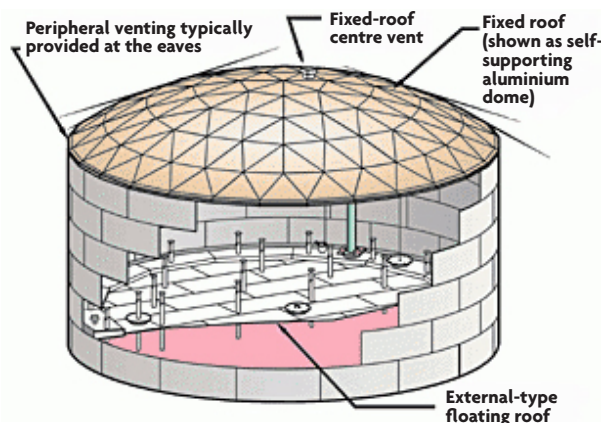


Figure 3. Workings of an EFR tank.



Figure 4. Tank farm with an EFR.

Geodesic domes

Since the creation of the use of g-domes, the industry has been captivated by their strength and appearance. However, there are several examples where domes present future problems. There are even examples of facilities retrofitting roofs from domes back to open roof floaters.

One of the first obstacles when choosing how to protect a storage tank from storm water is the expense of installing a g-dome, with prices starting at US\$300 000. Many operators have invested significant funds into additional man hours in order to solve operational issues, and part of the thought train is the elimination of the storm water issue. One possible solution is to have a simple drain guard system, which would ensure that product will not leak from the roof drain line and would allow the tank to have an open valve to the roof drain.

Domes are so widely used across the US that some states have enacted laws requiring their use. Most municipal water ASTs call for covered roofs. For example, California has

instituted Rule 1178, which states that the vapours around stored product storage tanks must be contained and regulated, and it considers the dome the 'perfect' solution.¹ Overall, the most relevant advice to dome operators is to ensure that service intervals that coincide with historical data for domed tanks are scheduled in. Maintenance upkeep is essential to ensure that the domes continue to meet needs and expectations.

Key considerations

Companies should review their management protocols, considering factors such as the type of stored product, the location, weather and possible risks. Many facilities are reasonably well-established, meaning that they are old and already built. Over decades of use, routine servicing keeps the assets in working condition, and new owners find themselves needing to stay on top of upkeep and upgrades.² However, operators still struggle with stormy weather and the loss of product and potential of tank failures that come with it.

Below are some 'flashpoints' for inspectors when discussing ASTs. The use of domes has many advantages over the simple external floater. However, there are several complexities of having both a confined and hazardous space under the dome, which requires service workers to work for shorter times and with breathing devices. These conditions can more than triple the costs of most routine service work.

Wear and tear on the seals, seams, nodes, gaskets and other connection points can result in leaks, which could allow water to reach under the dome.

There are several options for treating the top of a storage tank. The use of domes can reduce the smell or emissions from product vapours, and they can all but eliminate the problem of having rain water trapped on top of a roof that has a closed roof drain line. However, there are several factors to consider for a long-term plan.

In addition to the leak points that can exist with a dome, the dome's connection points to the top of the storage tank can act as shear points at the connection bolts. High velocity winds can lift a dome off of the top of a tank. The wind on a g-dome creates flexing, and exposure to the elements causes the caulking to become brittle, which can crack as it ages. Again, proper upkeep can minimise this problem. Continuously having a load and then no load creates additional stress on the 'batten bar'. Reducing the surface area of the roof so that the wind has less to catch can protect some farms from certain wind damage. Also, during storm season or torrential rains, storm water is still present in the dike around the tank, which creates another set of challenges for the operator. Regardless of the owner's choice of solution, there are cost savings for a tank wishing to use a g-dome if installed during the construction of new tanks. Older tanks have the option of having the roof remain external or move to an internal model. Regardless of the age of the tank, new pressure calculations need to be considered.

The owners should consider why they want a quick and easy fix. It can be difficult to get new technology approved for many of these situations. For example, consider the type of footwear that service operators prefer on top of a dome, and the requirements of the facility. Steel toed boots are probably standard, but shoes with good grip are often preferred by workers on top of a dome to avoid slipping and falling. But, it would be tough to get this footwear approved by the facility.



Figure 5. System connected by a flange.

Facility regulations can conflict with best practices for tank servicing, which can backlog a service that is waiting for approval. The need for a waiver under such circumstances can create a delay in service, which is costly.

Another example is that many domed tanks do not have walkways around them – service personnel must therefore ‘tie off’ to work, an impediment to service work. In any event, timing service accordingly can reduce some of these issues, and timing service during the less harsh weather season is a real cost-saving endeavor. Regardless, dome operators need to check on the seals and taping every three to five years, along with other routine preventative maintenance measures.

During acute weather events, some systems that are in place year-round may need to be bypassed. Best practice involves planning for failure. It is not every day that a facility might be evacuated. Some conditions cannot be avoided, yet they can be ‘handled’. A proactive safety department can make modifications and workarounds before conflict occurs. An effective manager will look at both sides of an issue for potential answers. With the advent of new technologies, the industry is moving towards standard practices. Modern technologies bring economic benefits and time-savings.

In the world of EFRs, a drain guard system for the roof drain valve would allow operators to avoid using a dome, have an insight into the condition of the drain line, as well as protection from its failure.

The EnviroEye Drain Guard System senses storm water from a tank roof and can detect product in the runoff from the roof. If product is leaking from the drain line, this solution triggers automatic valves to close while simultaneously sending an alert, such as a text message, to those that need to know and/or using audible and visual signaling.

Conclusion

Each year, operators and managers prepare for the next storm season, as well as performing routine maintenance throughout the year. There is an ongoing role for the EFR in the storage industry, with the help of solutions that can, in turn, help to monitor storm water. [I&T](#)

References

1. 'Rule 1178', California, revised 2006.
2. 'Manual of Petroleum Measurement Standards', API.