Look to the Seas for Effective Storm Tank Cleaning

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As climate change drives more extreme weather the occurrences of waste water and sewage systems being unable to cope with excess water is increasing. As a result, storm overfill tanks are being used more and more frequently as is the need to fill and empty them more regularly. It's not surprising then that more storm tanks are being commissioned into the UK's water system and the situation is acknowledged as a current "hot topic" of focus for the environment agency with attention being directed at reducing odour pollution. This means that storm tanks are being used more heavily at exactly the same time as the environment agency is insisting that any foul smelling residues need to be cleaned more thoroughly.

What are the current methods of cleaning?

Tipping buckets

Large buckets of water are emptied into the tank from one end creating a wave that will remove debris from the bottom of the tank.

Eductor / swirl systems

These systems use a large educator nozzle to create a whirlpool as the tanks empty in an attempt to dislodged debris.

Manual cleaning

Operators enter the tank with a pressure washer.

Impingement cleaners

A rotating nozzle head operates through an automated cleaning cycle where powerful cleaning jets target each part of the tank.

The case for impingement cleaning

Impingement cleaning is by far the most water efficient method of cleaning a tank. Although not new this technology has been deployed for cleaning all types of tanks and process vessels for decades. Most large chemical, petrochemical and food processing plants will have impingement tank cleaners as part of their vessel cleaning systems. This technology has been used with mixed results for cleaning storm tanks but often runs into problems for the following three reasons:

Scale

The size of tanks in the chemical and food industries are generally far smaller than storm tanks. A large process vessel may be 7 or 8 meters in diameter but that is very small for a storm tank.

Whilst some of the larger petrochemical storage tanks are comparable to the scale of storm tanks the cleaning systems generally deployed in the process industry are for cleaning much smaller areas.

Environment

Unlike the impingement cleaners deployed in the process industries, storm tank cleaning systems are not situated in a clean factory or maintained by a team of process engineers. Instead they are left in a cold, dirty environments exposed to the elements which are largely unmanned most of the year.

Cleaning fluid quality

When cleaning chemical and food tanks, a reliable supply of clean filtered water is normally assured whereas storm tank cleaning systems will often operate on final effluent with variable particulate content. This puts a significant strain on a cleaning system that is not designed to handle such poor quality cleaning fluids.

What this means

Simply taking a process tank cleaner out of its ‘normal’ environment and deploying it in a storm tank will not work. Some models on the market will have sufficient reach and power to clean large storm tanks but the tough environment and poor quality cleaning fluid quickly results in the machines clogging and failing. Typically these machines have an exposed gear system that can become gummed up with algae, slit or smaller debris which can find its way into the supply water. On the one hand we have a technology that can

deliver more effective cleaning for less water and less cost, but conversely there are reliability issues when it is deployed.

So what is the solution?

A solution comes from a seemingly unlikely source but it is one that after a little reflection is entirely logical. In the shipping industry and in particular cleaning oil tankers, is an essential requirement. Crude oil tends to form thick sticky layers of waxy residue over time and this impedes the carrying capacity of the tanker. The problem is that oil residue is very difficult to clean and using water to clean these tankers creates a massive amount of oil / water mix which needs to be filtered and disposed of. Furthermore, water does not actually clean oil residue off very well (water and oil classically don't mix!). The solution to this problem is to actually use crude oil as the cleaning fluid. Raw oil is put through high powered rotary jet cleaning systems to dislodge residue in the tanker to give it a thorough clean. The tank is mostly emptied and then the remaining oil sludge/mud is circulated through the tank cleaning system. The very large solids removed are then filtered out but the rest of the sludge is passed through the impingement tank cleaner.

Clearly these tank cleaners need to be far more powerful than their counterparts deployed for example, in the food industry. Also, these tank cleaning systems need to remain in place unused for months at a time often submerged in the crude oil in the tank. When not covered with crude oil they are exposed to the salty, corrosive marine environment. Cold, wet and exposed to the elements and very rarely even seen by anyone, let alone maintained, this environment may be starting to sound familiar. This type of tank cleaning technology has been deployed by many of the world's leading shipping and oil companies for over 40 years and is acknowledged as tried and tested and therefore could be applied to the challenges of cleaning storm tanks.

How does it work?

The principles of impingement jet cleaning are exactly the same as those in the food, pharmaceutical and chemical industries. Rotary jets spin through a set cleaning cycle directed to each part of the tank, blasting away residue as the jet "explodes" outwards on impact. However, there are key differences in the design of oil tanker cleaners compared to process tank cleaners.

Sealed gear box

One of the most important design features is the presence of a sealed greased gearbox within the machine. Process industry tank cleaners are normally lubricated by the cleaning fluid with an exposed gear system. This is sensible in hygienic applications where contamination from lubricants is a considerable concern. In the oil tanker cleaning applications such contamination concerns are less important so a sealed lubricated gear box can be used. This then allows far more particulate to be passed through the tank cleaner with little or no risk of clogging the cleaner.

Tough design

When designing rotary tank cleaners used in process vessels the focus is on creating a hygienic and self-cleaning machine. It needs to be polished and free from any traps and crevices where contaminants or bacteria occur. This inevitably means some sacrifices need to be made in ruggedness. In contrast ship tank cleaners have none of these concerns and so have been designed to be extraordinarily tough and this rugged design is perfect for use in cleaning storm tanks.

Large nozzles

The big tanker cleaners will have 14, 16 or even 20 mm nozzles which can throw a cleaning jet over 25 meters and this means a cleaning radius of 25 meters, so a 50 meter diameter tank could be cleaned with a single machine.

Rough clean and opposed to precision

When cleaning a crude oil tanker it does not need to be spotless, as long as the vast majority of the residue is removed, this is sufficient.

In contrast, chemical and food tanks need to be completely cleaned so the cleaning patterns of process tank cleaners tend to be tighter with more rotations and more water. This would be wasteful in storm tanks because they simply do not need to be that clean. The level of cleaning required is very similar to that of oil tankers because storm tanks don’t need to be spotless they just need to have enough residue removed to ensure odour problems don’t occur.

Conclusions

The redeployment of tanker cleaning technology to solve the problems of cleaning storm tanks is entirely logical. The environments that the ship cleaners need to operate in are probably tougher than anything they will be exposed to in storm tanks. They can handle dirty, particle contaminated cleaning fluids easily, they are relatively cheap to install and give by far the best cleaning of any method (with the possible exception of manned entry cleaning). In short, tanker cleaning technology represents a potential solution to storm tank cleaning problems.