Ensuring proper tank protection is an important part of your maintenance plan

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With the many demands of running a facility, taking time to consider the most effective ways to protect and maintain the inside of your tanks may not be regarded as the highest priority. However, if it is not properly considered, the impact of faulty maintenance or protection can be significant – with the end product compromised, potentially reducing production capacity, and in extreme cases possibly causing a shut down of the facility.

In the worst-case scenario, an unplanned shutdown may be required for maintenance on an affected tank before production can resume. In any shutdown, time is at a premium with costs potentially running up to $12 million for every day that it is not operational – so every minute counts. Therefore, properly protecting the tank – ensuring it remains safe and operational for as long as possible – and its contents, is vital.

The threat to profitability isn't just internal. Market conditions are continually changing so facilities need to be able to adapt to stay ahead of current trends or respond to market pressure. As a result, todays storage tanks must also be flexible enough to cope with holding a range of feedstocks and chemicals, and adequate protection means allowing you the freedom to change the contents of the tank when you need, or choose, to.

It is critical that the quality of the product stored in tanks is not compromised – whether that is raw materials or the final product. The contamination of either by, for example, rust or a previously stored chemical can impact on the financial performance of the facility. In extreme cases, tanks themselves can fail if they are not protected from the chemicals inside.

Choosing the best protection for your tank

So, choosing the right protection is key and in the maintenance phase of your facility is a good time to plan for this. But what is right for you? The first critical question to ask is, what do you need to protect your tank and product from?

Will the tank hold acid-based products, crude oil or an alkaline solution? The nature of the contents will determine which materials are most appropriate for the tank and any additional protection required.

Different processes and products also require varying temperatures and these will need to be considered. Crude oil or palm oil, for instance, normally need to be stored at temperatures of 60°C or higher to ensure that the stored product remains liquid and can be pumped out of the tank. A chemical will typically be stored at a given temperature. Sometimes it is the case that the temperature fluctuates throughout the tank. Can your tank protect against the internal temperatures?

The ambient conditions at the tank location are also important to consider when looking at protection. The demands on tanks required to withstand the deserts of the Middle East will not be the same as the ones required on the coast of Western Europe. Protection from humidity may also need to be considered.

The second critical question is what is the most commercially viable option? For large tanks, carbon steel with an appropriate lining to protect the tank and its contents can be a preferred commercial option. Depending on your budget, and typically if you have a smaller tank, there are alternatives.

Stainless steel is resistant to most chemicals and products and typically does not require a lining. However, it is a very expensive material when compared to carbon steel with an appropriate lining. Stainless steel tanks are also more challenging to construct, due to the hardness of the material and restrictions on materials used when welding and heat working. Not only is the stainless steel itself more expensive than carbon steel, but the labour costs and time increase when building a stainless steel tank.

For stainless steel, it is imperative that highly qualified personnel are utilised to ensure a properly constructed and well-functioning tank. The advantage of stainless steel tanks is that they are resistant to more or less any chemical, with halogens being the most common exception to the rule.

GRP, or Glass Reinforced Plastic/Polymer tanks, are most frequently used for water tanks. However, certain types of plastic are resilient to acids and, providing the tank is small, there are GRP tank options that are available. These are more expensive than carbon steel but do not require lining. However, it is important to ensure that the correct quality of plastic or polymer is used to ensure the tank survives its intended lifetime. Typically, a GRP tank can only be used to store the chemical it was originally designed for, offering more limited flexibility in the use of the tank. As with all tanks and their contents, it is important to ensure they will be adequately protected and operators must understand the tank's performance capabilities and limitations.

If you choose a carbon steel tank, it's then important to choose the correct lining for your need. Epoxy linings offer the widest chemical resistance as well as the best temperature resistance of the most commonly used types of lining and can protect a huge range of stored products. Depending on the specific product and epoxy chemistry, these linings are able to protect from pH 3 to pH 14. Epoxies are typically used in tanks storing biofuels, petroleum products, water, alkaline solutions or vegetable and mineral oils.

Epoxy linings also offer the flexibility to change the product stored in the tank, as they have a wider chemical resistance than other linings. This makes the tank easier to clean, allowing you to change the contents with a lower risk of cross contamination. In addition, solvent free epoxy linings can be applied using a wet-on-wet application, meaning the lining can be applied up to 50% faster, ensuring a faster return back to service.

Zinc silicate linings provide excellent resistance to alcohols, solvents and potable water. These types of linings are able to withstand almost all chemicals between pH5.5 and pH10. Since zinc silicate tank linings are applied in a single coat, they can provide time savings of up to 60% compared to an epoxy tank lining.

Vinyl ester linings are fast curing – again allowing fast return to service after application – and provide excellent protection from acids such as hydrochloric or sulphuric acid, biofuels or aggressive chemicals, and can be used for chemicals with pH 0 to pH 9.

How to get the best out of your tank lining

Once a tank lining has been selected, applying it properly will ensure the maximum benefit is achieved for the tank. If the application or surface preparation is faulty, no matter what lining you have, it will not perform as designed and likely not meet the expected performance levels.

Before any work begins, it is important to ensure the tank is completely emptied of product and gas. This is in order to make it safe before undertaking the application. This is a high risk process as it's critical to ensure that the atmosphere inside the tank is breathable, as CO2 and other noxious gasses can quickly build to lethal concentrations inside the confined space of a tank. Having a considered and effective plan for emptying the tank and ventilating it is crucial to ensuring the safety of personnel.

Blasting and cleaning is one of the most critical steps in the tank lining process. It is vital to ensure no dirt, foreign bodies, remnants of the previous lining or past contents remain on the internal tank walls when the new lining is applied. After blasting and before the lining is started, it is critical to thoroughly vacuum and clean the tank to remove any particles dislodged during the process.

Using dehumidification equipment is a very efficient way of holding the blast of the tank. However, while it might be regarded as an additional expense, it is well worth considering to ensure the best final result when it comes to lining integrity and tank performance. An alternative should dehumidification equipment not be available is to use a holding primer with the appropriate chemical resistance.

Once the blasting and cleaning are complete, the work can begin to apply the lining. The first section the applicators will work on is the walls, using the staging already erected for the cleaning process. Once complete, the staging will be removed and the floor will be blasted and coated, with the applicators working their way out of the tank. Experienced applicators may be able to complete the floor while the walls are drying.

When lining the tank, it is important to have good ventilation and airflow. For solvent-based tank linings, the solvent evaporates during the curing process. If there is insufficient ventilation it is high risk to personnel and in addition, during the curing, the solvent will be unable to evaporate. This can compromise the final quality of the tank lining.

Returning the tank to service as quickly as possible is critical, however finally inspection of the tank cannot be carried out until the final coat of the tank lining has cured sufficiently. The challenge with some lining is that after the first coat the drying time can be several days before the second coat can be applied. Linings that allow for wet-on-wet application can help with this. Lining a tank with a truly solvent-free lining can allow for two applicators working in synchronisation inside the tank.

As the first applicator is working through the tank applying the first coat, the second applicator can follow 20 - 30 minutes behind, applying the second coat. Once the walls are coated, the floor can be applied at the necessary wet film thickness (WFT) since there is no risk of sagging. Using such a method provides the safety of a two-coat system – avoiding holidays, pinholes and low dry film thickness (DFT) – with the speed of a one-coat application.

It is important to reiterate that for wet-on-wet applications a truly solvent free tank lining is beneficial, and to ensure that the fastest applicator goes into the tank first, so that the second applicator is not waiting on the first

Conclusion

By using the appropriate lining or tank material, a properly maintained and protected tank can be an important if largely unappreciated part in the process of providing operators with the confidence of continued production optimisation.

Ensuring a tank is performing optimally is rarely likely to be the first item on the maintenance schedule. However, the impact of not maintaining and protecting tanks properly can have significant operational and financial consequences for asset owners.