An insulation coating is applied to a crude oil tank roof in Louisiana, US, an area known for its high humidity, heavy rainfall, and where conventional insulation has numerous problems

Insulation coatings: *when you should use them*

With the multitude of products requiring bulk storage, there are a percentage of tanks that require thermal insulation. Though thermal insulation is a necessity for these specific products, the expense of installing and maintaining it can outweigh any costs saved by decreasing energy usage or vapour loss.

Due to its ability to absorb moisture, an aged insulation system will not only promote corrosion under insulation (CUI), but also have drastically reduced insulating properties. CUI will then significantly increase maintenance costs and may lead to the need for an entirely new tank. Occasionally, these issues have led to the decision not to insulate in order to prevent future maintenance or structural concerns. Fortunately, there is a technology that has industry acceptance and can solve these issues while providing thermal insulation as an easily applied coating.

Thermal insulating (or insulation) coatings came onto the market in the mid-1990s and were mainly used in commercial and industrial applications. These were not reflective rooftop coatings or radiant barriers, which solely reflect UV rays due to their bright white colour. Thermal insulating coatings are usually acrylic resins filled with ceramics and silica among other things, creating a true thermal barrier between two environments. The market was slow to accept them as it was hard to believe that a coating thickness 1-5mm could effectively insulate and replace inches of conventional insulation, but today there are countless applications in a wide spectrum of industries, in all corners of the globe.

Most insulating coatings manufacturers will say that they are not always the perfect solution for every tank application, but can help with many of them.

Bulk storage tanks are typically very large, so there is no choice but to have them exposed to the elements. If traditionally insulated, it is likely that moisture will make its way into the insulation and to the surface of these tanks. Due to their large surface area, it is not possible to check everywhere for signs of corrosion, so it is not uncommon to see them re-insulated every few years (depending on the amount of corrosion present). Tanks that hold product over 160°C may seem to be resistant to CUI due to the higher temperatures however, that temperature is only up to the fill line. Areas above the fill line that do not reach the higher temperatures will be subject to corrosion.

The tank roof is the most difficult to insulate properly and is sometimes left un-insulated to begin with because of the increased probability of corrosion when insulated with conventional products. The roof usually contains exhaust pipes, vents or other types of protrusions that can eliminate the

possibility of achieving a perfect seal with traditional panel systems. Also, personnel can compromise the jacketing and damage the insulation by walking on it when accessing the roof for a routine inspection. The coatings can also greatly reduce the effects of flash cooling due to a passing rainstorm.

Since insulating coatings are applied (just like paint) to the exterior of the tank, they adhere directly to the substrate or primer. This forms a seamless barrier that rain and moisture cannot penetrate, effectively negating the possibility of CUI occurring. There are no gaps, like with steel jacketing or panel systems. Also, their performance is not diminished by regular foot traffic.

The geographic region in which the tank is located can affect how the coatings will perform and can be the deciding factor on whether or not to use them. Coastal areas that are humid and do not experience harsh winters are prime candidates for insulating coatings. With high humidity and elevated ambient conditions, traditional insulation will hold moisture against the substrate and the corrosion process will progress rapidly.

In colder climates, applications must be carefully scrutinised. The combination of freezing temperatures and wind load do not bode well for a thin film coating. Though they can still adhere to the surface at low temperatures, their performance value can be reduced. Where 60 mils (1.5mm) may be sufficient in the Gulf Coast of the US, an application may require 180 mils a climate similar to the Netherlands. Or, depending on the application, an insulating coating may not be recommended at all. It may be in the best interest to apply the coating only to the roof of the tank, while the sidewalls remain conventionally insulated because higher surface temperatures +160°C keep corrosion from being an issue, or a certain thermal performance value may be required. Regardless, there must always be a heat source. Freeze protection applications are usually not recommended for insulating coatings.

Some facilities are not trying to keep heat inside the tank, rather they are looking to insulate against radiant heat gain to minimise vapour loss or stabilise contents. Some newer tank farms are constructed with this in mind and have taken measures, such as floating roofs, to combat the issue.

However, there are tanks in-service that are older than the new vapour recovery technology, therefore it is still an issue for them. Fixed roof tanks depend, mainly, on being white or light-coloured for UV reflection. Some insulating coatings companies have developed products that are bright white. Combining the thermal insulation with the highly reflective colour is more effective than just a white paint. Radiant heat gain applications, in most cases, require no more than 40-60 mils.

With products stored at less-than-ambient temperatures, radiant heat gain can impact the storage conditions. With a product like LPG, as temperature increases, so does the vapour pressure. This makes it beneficial to use an insulating coating over a white paint, due to the fact that the products will maintain at a lower temperature, yielding a lower vapour pressure.

Insulating coatings can easily be used for personnel protection on storage tanks. The coating can only be applied to areas that are susceptible to being touched by personnel. It is not necessary to coat any other areas, so the amount of material needed can be very low. Conventional insulation requires custom fabrication when trying to insulate next to stairways, or really anything other the sides of the tank.

In an application in Pasadena, Texas, one company chose to only insulate along the stair well and the bottom 7 feet of the tank. Also, if these areas were conventionally insulated, the promotion of corrosion in the smaller areas can still warrant the replacement of the insulation, or even the entire tank, in the future.

As mentioned before, a large number of tank roofs remain un-insulated. Rainwater and melting snow will undoubtedly find their way to the surface and then the corrosion process will begin. Heat rises, therefore a thermal insulating coating that can bond directly to the surface and reflect the rising heat back into the tank will conserve energy while stopping the risk of corrosion. Some companies have application examples where the customer coated the roof and even extended down the sidewalls 10 feet (3m). This not only kept the corrosion process from beginning on the fixed roof, but also limited moisture from getting behind the conventional insulation panels on the rest of the sidewalls.

All of the different types of thermal insulation have their strengths and weaknesses. Though thermal insulating coatings have not been around as long as more conventional forms of insulation, it has become fairly clear where they are and are not successful. The benefits yielded on the successful applications make believers out of the most resistant skeptics. By using insulating coatings in their comfort zone, this ensures a sustainable system that will provide a return on the investment well before any maintenance concerns arise.

A man lift is used instead of scaffolding to install an insulation coating to the sidewalls of this fuel oil tank to reduce energy loss

For more information:
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