STREAMLINING TANK INSPECTIONS WITH VISUAL FEEDBACK

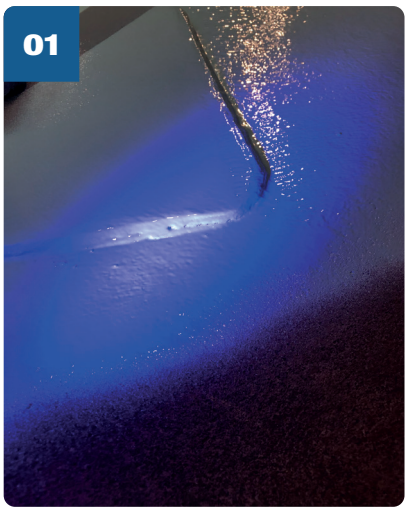
Optically activated pigments highlight areas in need of repair, explain Justin Hair and Michael Harrison from Sherwin-Williams Protective & Marine

FOR aboveground petroleum storage tank owners, 10-year inspection intervals often present some challenges. Inspections are necessary to ensure owner compliance, tank integrity and safety, but they also carry a high cost – sometimes upwards of US$500,000 (€424,000). The longer a tank is out of service for repairs, inspections and lining applications, the higher the cost due to lost storage capacity.

The ongoing cost of ensuring tank integrity is unavoidable. Most often, the American Petroleum Institute's API 653 standard (Tank Inspection, Repair, Alteration and Reconstruction) is required or referenced. Depending on the tank, it will either require a thorough evaluation of an existing lining for return to service (if it's performing as expected with only minor damage) or the installation of a new lining. The faster you can complete these activities, the quicker you can return the tank to service.

An existing lining needs to be visually inspected. Such inspections can move much faster – and be more thorough – when the existing lining is embedded with optically activated pigments (OAPs), such as linings featuring Sherwin-Williams Opti-Check technology. The embedded OAPs will provide obvious visual indicators of coating deficiencies when inspectors shine an eye-safe ultraviolet (UV) light on the lining, following techniques and equipment guidelines described in SSPC Technology Update No. 11 – Inspection of Fluorescent Coating Systems (Figure 1). This pronounced visual feedback enables inspectors to move faster, while helping them better spot pinholes, holidays or discontinuities in the lining that should be repaired.

Tank lining systems embedded with OAPs also offer quality assurance and time-saving advantages when applying a new lining. The pigments enable applicators to detect and repair coating deficiencies during the application process, which reduces repair needs following holiday detection processes on newly applied linings. This OAP-enabled efficiency allows tanks to be put into or returned to service more quickly.



This article will review brief lining specification fundamentals, as well as two common field inspection scenarios – assessing an existing lining featuring OAP technology and inspecting an unlined tank that requires a new lining. In both cases, OAP-embedded lining systems provide a greater likelihood for streamlined inspections and longer-term service.

TANK LINING FUNDAMENTALS

The first step to enabling faster tank inspections is to use robust lining materials that can withstand the rigours of long-term corrosive chemical storage, cleaning, and inspection activities. That means selecting linings that:

- have sufficient flexibility as well as chemical and temperature resistance to accommodate various contents at ambient and elevated temperatures;
- resist damage from impacts and abrasions that may occur during operation or cleaning processes; and
- are easier to clean.

The above properties help to accelerate the inspection process because the linings themselves are more likely to remain in excellent condition between assessments. With a well-applied, durable lining in place, inspection-related repairs are often limited to mechanical damage that occurs during tank cleaning, minimising touch-up needs. Choosing systems that are also embedded with OAPs provides a further inspection efficiency boost.

Per API 653 guidelines, owners need to periodically take tanks out of service for various inspections. Operators will first drain the contents and wash the interior. Draining may be relatively fast with light hydrocarbons, but contents like crude oil will require shovelling out solidified material – hence, the need for an abrasion-resistant liner. High-pressure water washing occurs next to remove oily deposits. Here, an easy-to-clean lining is especially advantageous. Thereafter, inspectors will perform mechanical checks of the tank surface, including visual, ultrasonic, liquid penetrant and other non-destructive testing. They may also conduct destructive cross-cut and pull-off adhesion tests on the lining. These compromised areas will require repairs.

For the final assessment, inspectors will perform a careful visual check of the entire lining to ensure no pinholes,

holidays or discontinuities are present. Such voids in a lining indicate weak areas that may be prone to cracking, blistering or delaminating – any of which can open the door for pitting and corrosion of the steel tank substrate. Therefore, catching these deficiencies is critical during inspections to extend the tank lining life.

SCENARIO 1: INSPECTING AN EXISTING TANK LINED WITH OAP-EMBEDDED COATINGS

In this first scenario, inspectors will assess an existing 10-year-old aboveground petrochemical storage tank that was lined prior to initial service with one coat of an OAP-embedded lining system.

Visually inspecting a lining without embedded OAPs requires careful attention, as tiny pinholes can be quite difficult to see. Inspectors will concentrate heavily on weld seams, annular plates, chime areas, rim plates, vapour spaces and any visible wear. Inspectors are most often at the mercy of their vision to catch hard-to-see lining voids.

In addition, because this tank has been in service, applicators do not have the advantage of using holiday spark testing to inspect the lining for voids. Such testing is only suitable for newly lined tanks as per NACE SP0188 – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates. Existing linings that have been in service tend to absorb commodities and could therefore spark significantly, providing erroneous holiday test readings. There's also a safety concern, as tanks may contain fumes or hydrocarbon deposits that could ignite during a spark test. In addition, sparks may damage the lining and are not recommended for evaluating existing linings.

When OAPs are embedded in a single-coat lining, any deficient areas stand out distinctly under UV light. The lining will fluoresce with a pink hue where inspectors shine their UV light. Dark areas indicate a lining deficiency, such as damage, pinholes as small as 0.25 mils (0.006 mm), holidays, nonuniform coverage or improper film thickness (Figure 2). These easy-to-spot areas can then be repaired or touched up before returning the tank to service.

Because the OAPs provide such noticeable visual feedback, inspectors can move faster through a tank, streamlining the process, and are more likely to catch tiny defects, extending the lining system's life expectancy.

SCENARIO 2: INSPECTING A NEW TANK LINING PROCESS USING OAPS

In this second scenario, inspectors will evaluate a 10-year-old aboveground petrochemical storage tank that was not lined prior to its initial service. Owners may forgo linings in cases in which a tank's contents are not expected to rapidly compromise the integrity of the steel.

Still, most unlined tanks will show at least some pitting – if not a lot of it – after a decade of storing hydrocarbon products, which almost always contain water. Therefore, tank owners and operators know lining installations are likely required following inspections. In these cases, linings embedded with OAPs can help installations go faster, while increasing the likelihood of long-term performance.

Due to the prevalence of pitting in existing unlined tanks taken out of service, lining such tanks usually requires two coats. When using OAPs, the primer will feature the embedded pigments, providing two helpful quality control measures:

- OAPs enable inspectors and applicators to easily and immediately identify voids during the primer application process – in this case, a flowable primer. Just like in scenario one, the OAP-embedded linings will fluoresce pink in most areas, while any holidays will contrast sharply as dark voids. Inspectors and applicators can check for such areas while the coatings are still wet, enabling them to immediately respray deficient areas. The visual feedback helps to ensure the entire primer application is essentially holiday free.
- Second, when applicators apply the final finish coat and use a UV light, OAPs embedded in the base layer will shine through the non-pigmented finish coat anywhere it has not been applied properly (Figure 3). Applicators can then repair those areas while the linings are still wet during the application process.

Using lining systems embedded with OAPs not only helps to ensure the integrity and quality of the lining installation but also enables future inspection efficiencies. Much like in scenario one – but in the opposite way – the visual feedback of fluoresced areas shining through the finish coat under UV light will be obvious.

OAPS ENABLE FASTER, BETTER RESULTS

With the goal to streamline both tank inspections and the application process, tank owners and operators can benefit by specifying lining systems that are embedded with OAPs. The pigments are a unique asset evaluation tool that allows inspectors to locate areas of non-compliance in a lining much more easily, compared to inspecting non-pigmented linings that offer no visual feedback. Applications, inspections and repairs can therefore move quicker, enabling faster returns to service, while also ensuring more robust linings that will provide extended long-term service.

For more information:

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01 Optically activated pigments (OAPs) embedded in this single-coat lining system featuring Sherwin-Williams Opti-Check technology provide a distinct visual indication of a pinhole and some coating discontinuities in the weld seam

02 When inspecting single-coat linings featuring OAPs, dark areas will indicate coating deficiencies. The rest of the coated areas will fluoresce

03 In this two-coat system, OAPs embedded in the base coat shine through the topcoat and appear pink under UV light (right), indicating a pinhole and some thin areas that will need to be repaired

* All photos courtesy of The Sherwin-Williams Company