# THE FOUR P'S TO SUCCESSFUL COATINGS PROJECTS

Often, the mindset of clients and engineers is one of 'it's just paint, how hard can it be?' Everyone thinks it is a slam dunk afterthought, until the system fails pre-maturely. Many engineers and architects are put in charge of managing, specifying and ensuring the quality assurance of coatings on their projects because they are in charge of the project. That is, if the engineer is responsible for designing the tank, that individual is often also specifying the coatings that protect it.

However, coating materials are NOT part of the curriculum of many engineering and architecture programmes, yet these same degreed professionals are asked to perform these tasks as consultants. The only way to obtain this specialised knowledge is through coatings industry organisations such as NACE or SSPC, or through on the job training, typically under a mentor.

The number one way atmospheric structures are maintained from erection to retirement is protective coatings. Given the typical service life to first maintenance of a coatings system is 10-20 years, (depending on several factors), coatings maintenance may happen many multiples of times during the lifecycle of the structure. When looking at bridge structures that might have 100-year service lives, there may be 5-10 times that the coatings will be repaired or replaced.

## JUST SCRAPING BY

There was a presentation recently on the factors that affect coatings materials performance and their importance to the ongoing integrity and longevity of all steel structures, but specifically aviation fuel tanks.

After the presentation by Pond's David Hunter, one of the company's fuel tank clients contacted Pond about six deteriorating aviation fuel tanks at their site. The tanks were recoated only three years ago, and, unfortunately, the coating system is deteriorating to the point that the steel is exposed.

The proposal from the contractor three years ago called out to 'scrape and sand all loose rust areas on the six tanks where needed. Power wash tanks prior to painting. Apply two full coats of rust-inhibitive alkyd paint.' That was the entire specification. The tanks of this size normally come coated from the original equipment manufacturer (OEM). No information was available about what the tanks were coated with originally.

Importantly, as with any project, choices upfront tend to predict the outcomes. The balancing act between cost and performance should always be discussed considering what the expectations (or expected outcomes) of a project are desired. For this case, if the owner was only looking for three years of performance, then no disappointment should be expected. However, in this case, the service life of the structures is well beyond three years. Coating performance is most effected by the four P's: performance, prep, procedure and product.

## PERFORMANCE

Corrosion engineers can design structures by selecting materials designed to last a very long time. The key to this is does the design work fit within the constraints of the project. A series of questions that must be answered, just to name a few are:

- What is the design life of the structure?
- What is the environment the structure will be placed?
- How accessible will the structure be for maintenance?
- Is there a desired maintenance interval, such as 5, 10 or 20 years based upon operations or other factors?
- Does the structure operate at elevated or low temperatures? Is it insulated? What temperatures does the structure see during transients?
- Can the structure be taken out of service? If so, for how long?
- What is the existing coating system? Does it contain hazardous constituents?
- Are there limitations on the type of surface preparation due to other items being around the structure?

The above list is not in any way exhaustive, but for this tank project, the answers are below:

- What is the design life of the structure? *30 years*
- What is the environment the structure will be placed? *Coastal atmospheric, subject to hydrocarbon exhaust, winter snow. No insulation*
- How accessible will the structure be for maintenance? *Fairly accessible with room to scaffold/rig, but controlled security access*
- Is there a desired maintenance interval, such as 5, 10 or 20 years based upon operations or other factors? *As long as possible within a reasonable budget, to minimise operational disruptions*
- Does the structure operate at elevated or low temperatures? Is it insulated? What temperatures does the structure see during transients? *Ambient conditions, no insulation*
- Can the structure be taken out of service? If so, for how long? *Yes, each tank can be taken out of service individually, for extended time periods (1 month)*
- What is the existing coating system? Does it contain hazardous constituents? *The overcoat was 2 coats of alkyd; the OEM coatings is unknown. Hazardous materials test results pending.*
- Are there limitations on the type of surface preparation due to other items being around the structure? *A fuelling transfer area is adjacent to the tanks (15 feet), as well as an operating airport taxiway within 100 yards*

## PREP (SURFACE PREPARATION)

Surface preparation is one of the most critical keys to a long-lasting coating. Although there are many claims on performance over marginal surface

preparation, one would be hard pressed to find any coating manufacturer that would put in writing that their product will last longer on less surface cleanliness. Much research has been done in this area, and one item holds true: The cleaner the surface prior to applying the coatings, the longer the coating will last. If you look at the dollars spent for a typical coatings project, painters would not be called painters, they would be called 'surface preparers'. Luckily there are standards for surface cleanliness that have been established by the coatings industry. With minor simplifications to remain germane to the subject, surface preparations methods/standards, ranging from the least to most clean are as follows:

| METHOD/STANDARD | LEVEL OF CLEANLINESS |
|---|---|
| SSPC SP-1 solvent cleaning | Low |
| SSPC SP-2, hand tool cleaning | |
| SSPC-SP3, power tool cleaning | |
| SSPC-SP11 power tool cleaning to bare metal | |
| SSPC-SP7/NACE 4 brush-off blast cleaning | |
| SSPC-SP6/NACE 3 commercial blast cleaning | |
| SSPC-SP10/NACE 2 near-white metal blast cleaning | |
| SSPC-SP5/NACE 1 white metal blast cleaning | High |

Note that all surfaces do not get the best level of surface preparation due many factors such as cost, ability to perform in a given area, access, service life requirements and practicality.

Unlike other construction disciplines, the quality steps that go into a good coating application are very difficult to verify after completion. The level of surface preparation is nearly impossible to verify after the coating has been applied, which is the most expensive part of the project, and a key to coating

**PROCEDURE (SPECIFICATIONS)**

The owner's original specifications from the coatings contractor three years ago consisted of two lines on a quote sheet. Qualified and conscientious people can do anything, with less direction, but it takes an indeterminate amount of one thing on the purchaser's part: trust. A well-written specification has, at its heart, the goal of setting the level of expectation of the outcome. The reason that a specification is so critical in coatings application is that all the quality assurance goes in while the coating is being installed, and cannot be easily verified after the fact.

A format that the industry has partially embraced is from the Construction Specification Institute (CSI), which breaks the specification into three general sections which are 'general, products & execution'. An abbreviated list might include the following:

**GENERAL**

- Scope of project
- Areas to be coated and not to be coated
- Site access and storage area
- Site investigation clause
- References (sometimes called 'applicable documents')
- Definitions
- Submittals
- Contract errors, omissions, and other discrepancies, including conflicting requirements, ambiguous requirements
- Qualifications of the coating contractor
- Pre-construction conference, coordination and progress meetings

**PRODUCTS**

- Coating materials and thinners (other than as specified by mfg.)
- Proof of compatibility if mixing systems
- Finger printing of materials
- Contrasting colours for multi-coat systems
- Abrasives
- Test kits
- Amine blush testing
- Salt testing

**EXECUTION**

- Deliver, store, mix, apply, and cure coatings
- Equipment for surface preparation and coating application
- Kits and equipment for testing for surface cleanliness and profile and film
- Thickness
- Specified types of coating materials delivered and their verification
- Field mock-up (as part of verifying procedures during start-up
- Acceptable ambient conditions
  - Periods of control
  - During surface preparation
  - During coating application and initial curing (specify initial cure time)
  - During other operation
  - Parameters of control
  - Air temperature/Surface temperature
  - Dew point/relative humidity/wind speed
  - Surface contaminants
  - Lighting for all work areas (as prescribed in SSPC-Guide 12)
- Blast cleaning of surfaces for coating application
- Pre-cleaning of surfaces for painting prior to surface preparation
- Required level of results
- Allowable methods
- Ambient conditions for surface preparation
- Pre-cleaning of surfaces for painting prior to surface preparation
- Coating application
- Instruction for mixing components
- Amounts of thinner, if any, permitted
- Ambient conditions for application and curing (length of cure)
- Pot life at different temperatures
- Allowable application methods
- Stripe coating
- Initial cure period
- Recoat window
- Acceptable wet/dry film thickness range
- Repairs (how much allowable and special requirements)
- QC Inspection and documentation Requirements
- Final inspection
- Punch List
- Warranty & correction period requirements/criteria
- Clean-up and proper disposal of wastes

All the steps above affect quality and longevity of the coating system.

**PRODUCT**

Selecting the right product for the environment and the allowable surface preparation is critical. In this case, the coating system was a rust inhibited alkyd. Its coating system has worked over abrasive blasting, but with simple scraping and lack of feathering of the existing coating. Feathering is the process of decreasing the edge thickness of a coat film that has been applied to prevent the corrosion of a material. It is done in order to create an even, smooth application area to a surface that has been partially corroded before applying a fresh coat.

**ASSIGN A COATING INSPECTOR**

For this client, a coating inspector was not hired. Had the client initially utilised a coating inspector, they would have been onsite and shadowing the contractor in every phase of the process – ensuring the coating was correct, surface preparation and application were done to published standards, the whole mess might have been avoided.

The Pond team is proposing a timeline to upgrade and maintain the client's coating systems, based on the client's budget. Because of the need by operations, remediation of one tank at a time will be required. Realistically, if a client has the budget, recoating three tanks within a month is possible.

**FOR MORE INFORMATION**

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