

THE ENGINEERED SYSTEM APPROACH FOR QUALITY POLYMER COATINGS AND LININGS APPLICATION”

By

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Abstract

Corrosion of concrete and steel is becoming a significant issue in water and wastewater facilities. Removal of I/I from sewer systems and encapsulating treatment facilities for controlling of odors is resulting in wastewater structures experiencing a much higher rate of corrosion. An Engineered System with well tested products, specialty equipment and application by highly trained applicators are needed to improve the success rate of coating applications. Quality assurance requirements tied to documented Quality control and testing by trained knowledgeable inspectors is also key to successful coating and lining projects.

INTRODUCTION:

Corrosion of concrete and steel is becoming a significant issue in water and wastewater facilities. I/I removal from collection systems and encapsulation of wastewater treatment plant structures for odor control are resulting in an increased awareness of the need for protecting our infrastructure while costing in excess of \$36 billion annually according to AWWA/WIN 2001. This means that corrosion control is big business and manufacturers must deliver higher performing products that stand up to this aggressive exposure. Properly selected, specified and applied these higher performing products can easily meet and exceed customer expectations.

Like many other technologies protective coatings have evolved through trial & error and now are specified where they were previously not considered. Thick film, monolithic and well bonded applications of 100% solids coatings can effectively restore deteriorated water and wastewater infrastructure to a better than new condition. Structures previously planned for replacement can now be candidates for rehabilitation at significantly lower costs.

DISCUSSION OF TOPIC:

What is the purpose of coatings and linings?

Coatings and linings can generally be described as high performing barriers used in corrosive environments to prevent deterioration. Coatings and linings encapsulate or separate the host structure from potentially corrosive agents. A monolithic coating will protect the substrate material from environmental conditions of all kinds when applied correctly.

In general the purpose of a monolithic coating or lining is to provide a defect free barrier against corrosion, infiltration and exfiltration, installed to significantly extend the infrastructure service life while improving operation and maintenance.

These high performing coatings and linings are typically used for new facilities to extend the useful service life by protecting structures against known corrosive elements. Coatings and linings are a cost effective method of rehabilitating existing structures that may have exceeded their service life and require reconstruction, without the increased cost associated with replacement and new construction. Coatings and linings are effectively used in a variety of applications including water storage, water pipelines, wastewater collection, wastewater treatment and industrial applications.

The Engineered System Approach includes combining high quality coating materials with state-of-the-art application equipment and providing a delivery system of trained and qualified applicators.

HIGH QUALITY COATING AND LINING PRODUCT SELECTION:

How is the best coating or lining selected to fit a specific project?

With so many coating material options available in the market today it becomes increasingly more important to understand the correct application for each of the systems and then apply the correct solution or multiple solutions to the project.

Engineers and specifiers must be diligent when researching technologies to select the correct coatings without being influenced.

- Definitely determine the problems being experienced by the structure under evaluation and determining the envisioned extent of restoration required.
- Key factors to consider include, structure rebuild or restoration, protection from infiltration/Inflow/exfiltration, protection against current/future corrosion, rehabilitate requirements for an existing structure, structurally rebuilding a deteriorated structure or improved operation and maintenance.
- The selection process should include a determination of the intended service and expected life of the coating in a variety of environments such as water, wastewater, industrial and chemical exposure. After the environment is determined the type of service the coating will be subjected to must be defined. Will it be a submerged, gas/vapor or incidental splash environment? Coatings will react differently under different environmental conditions
- The required thickness or build-back requirements should be evaluated and how the selected coating can be applied quickly and efficiently to the required thickness specified.
- Other project conditions could include abnormal or extreme operating conditions including reduced or elevated temperatures, highly corrosive environments and the potential effects of abrasion.
- Project access limitations may be a key factor in the selection process including manholes or man-way locations. Difficult rights-of-ways, may limit application equipment. Another key limiting factor could be access into buildings and building rooftops where specialty equipment or hand applications might be appropriate
- Project size can be a major factor when selecting a coating system. Large projects require consistently mixed product, application equipment that can be used to apply product consistently, in high volumes to meet expected project timelines.
- Expected life of the coating system based on proven and tested history in similar applications and environments should be verified. The specifier should evaluate only coatings with a proven track record.

WRITING THE COATING SPECIFICATION:

Technical specifications are a vital component to the success or failure of the final product. They should be clear as to the end result expected, the qualifications of the applicator providing the finished product, how the project should be executed, quality assurance requirements, construction quality control, testing requirements and the inspection requirements.

The end result expected should be a protective coating that meets or exceeds the Owners expectations based on good written documentation accumulated throughout the application process. Clear quality assurance requirements should be defined and a

written quality control procedure established for documentation during construction. Testing should be independent third party and controlled by the Owners representative. With few exceptions the specification writer is typically lacking in the hands on knowledge of the specified product and relies on data provided by the product manufacturers therefore, performance based specifications are typically best suited for assuring that the Owner's expectations are met.

Even with the most complete and comprehensive specifications, the process of selecting an applicator becomes one of the most difficult aspects of a successful project. Typical specifications will require that the contract be awarded to the lowest, qualified and responsible bidder. The lowest bid should reflect fair pricing based on the specifications without unbalancing of any one item. The qualified bidder should be just that, qualified to apply the coating material in accordance with the specification requirements. The responsible bidder should be financially capable of executing the project on time and budget and warranty the completed work to the satisfaction of the Owner.

To insure a well thought out and quality based specification, appropriate products should be researched and evaluated during the design phase not the bid phase of the project. Last minute submittals either during or after the bid phase puts the specifier at a disadvantage and under undue pressure to make a decision without the appropriate research necessary to make an informed decision.

COATING APPLICATION:

This segment of the coating application is certainly a key time when the Owner and project inspectors can control the quality of the applied product.

Applicators must be trained/certified and experienced in the application of the proposed product. Full documentation must be submitted to the Owner prior to proceeding with the work. Training/certification of the applicator should be through the manufacturer of the product and should be drilled down to the field personnel performing the actual application.

After the applicator and crew have been adequately qualified and the project awarded, a detailed performance plan should be submitted by the applicator, specifying the material to be applied, equipment to be used, safety procedures to be implemented, quality controls to be implemented and testing to be accomplished all in accordance with the requirements of the project specifications.

The plan should identify the necessary steps required to properly prepare the substrate to be coated including equipment to be used, materials to be furnished for any repairs or patching complete with compatibility documentation, the recommended installation equipment and procedures as required by the product manufacturer and the quality controls and inspection points critical to the success of the project.

The methods of coating application may vary from manufacturer to manufacturer depending on the type, temperature and viscosity of the material being applied. Different materials can be sprayed, brushed or trowelled, can be applied cold, warm or hot. They come in a variety of component ratio's and can be mixed 5 gallons at a time in pails and applied or can be statically mixed and applied in a continuous, uniform operation. The coatings specified should be applied with manufacturers recommended state-of-the-art equipment to achieve the best possible finished product.

COATING QUALITY ASSURANCE/QUALITY CONTROL:

QA/QC is becoming a key component for the successful application of long lasting quality coating applications.

Some methods that are commonly used for implementing a quality control plan would include:

1. Random material sampling – assumes acceptable performance if a number of random samplings are found to meet the quality assurance requirements
2. Third Party Testing of specified elements of the application with all independent data supplied to both the customer and the contractor in a specified timeframe.
3. Scheduled Sampling – used to identify pre-determined quality assurance requirements.
4. Regular performance reviews by a trained representative or inspector assigned by the customer.

Additional thoughts when developing the Quality Assurance Plan:

1. Develop documentation/inspector tools that provide the Owner representative or inspector with clear guidance of the intent of the Quality Assurance requirements. Form A
2. Execute a testing control program that is based on the Quality Assurance program outlined in the specifications. When tests are conducted by an independent third party testing house, it should be verified, that the lab is qualified and has a history of performing similar tests. Test performed by different laboratories will usually produce different results. Document all Quality controls in writing

COATING WARRANTIES:

Project warranties (Maintenance Bonds) offer the customer some assurance that the product applied will perform for a reasonable period of time. Most rehabilitation products are designed to stand up to the rigorous corrosive environments found in wastewater systems. Unless, however, issued by an insurance company most warranties are the contractor's personal assurance that he will return to the project site and repair any defects in the product. If the contractor is no longer in business the personal warranty is worthless.

There is a trend in the industry to require longer or extended applicator installation warranties on coating projects. Most insurance companies will provide a one (1) year Maintenance Bond with some extending the time to three years for their best customers. With the great losses suffered by the insurance industry in the last three years, very few if any, will offer a maintenance bond beyond the three-year limit. In some cases these installation warranties are requested of the manufacturer (as the product provider) who really has minimal participation and no control of the application process.

Warranties whether one year or longer should be a meaningful method for the Owner to be assured that the project meets expectations. Extended warranties, if not properly administered, add unnecessary costs to the project while positioning both the Owner and applicator for future legal conflicts.

The warranty terms should include interim inspection requirements that document the condition of the coating at specific intervals of the warranty. For instance a poorly applied coating will show defects within 6 to 11 months after application. A mandatory inspection 11 month into a one-year warranty would give the Owner substantiation of a successful or unsuccessful coating application and mitigate catastrophic failure of the coating in the future.

FORM A

Quality Assurance/Quality Control

Contract Name: Manhole Rehabilitation Contract No: _____

Contractor/Installer: _____ Construction Observer/Inspector: _____

Report No. _____ Weather: _____ Structure Temp: Ambient _____ Surface _____

Other Work in Progress: _____

		Performance	Acceptable		Inspection	
					Results	
No.	Quality Assurance	Standard	Quality	Quality Control	Pass/Fail	Comments
1	Visual inspection of structure substrate after cleaning and preparation	Industry Standard	100%	Visually inspect surfaces to be coated for effective removal of existing coatings, unsound substrate, laitance, infiltration. Visually identify problem areas.		
2	Test substrate for soundness.	SSPC- SP 13 NACE No. 6	100%	Lightly scratch prepared concrete surfaces with a screwdriver or pocketknife. The scratch should leave a shiny mark with no loose particles from the surface. Otherwise, re-prep and re-inspect.		
3	Visual inspection of product application and documentation of proper material ratio/usage	Product Technical Data Sheet (ratio)	100%	Visually observe mixed color, which should be homogenous without marbling effect. Inspect cured material for consistency. Inspection record-keeping of applicator for material usage of product components, verify proper usage.		
4	Wet Film Thickness (WFT) measured during application.	ASTM D-4414	No less than 90% or greater than 120%	Measure and record the WFT in at least four locations for every 500 sf and each coat of material applied.		
5	Holiday Detection using a high voltage holiday detector.	NACE RPO-188	100%	Confirm conductivity by inducing holiday and calibrating detector. Test entire coated surface. Repair and retest as required.		
6	Adhesion Testing using a specified Model on a minimum of 10% of the manhole structures coated.	ASTM D-4541	As specified	Perform a minimum of three pull tests per manhole at locations randomly selected. Evaluate results and repair coating where tested.		Record dolly location, pull strength (psi), mode of failure and whether dolly was scored or un-scored.
Owners Representative: Name		Signature		Date		
Contractor/Installer Representative: Name		Signature		Date		

All QA/QC as per specific manufacturer's recommendations.

CONCLUSION:

Coatings and Linings play a key role in the rehabilitation and protection of water, wastewater and industrial structures. Well documented and tested products, applied with state-of-the-art equipment by well trained applicators is a step forward in raising the quality bar of the coating industry,..... thus meeting customer expectations.