ELEVATED WATER TANK REHABILITATION – GETTING IT RIGHT WHEN THINGS GO WRONG

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ABSTRACT

The Town of Cary constructed the 1.0 MG Ridgeview Elevated Tank in 1994. In mid-2011, the Town contracted Highfill Infrastructure Engineering, P.C. to oversee the rehabilitation of the tank. This work included inspecting the tank, producing construction documents specifying surface preparation and coatings, crafting an effective communication plan, and providing construction oversight.

This presentation will discuss the innovative coating solutions we implemented, the various construction challenges we experienced, as well as how we kept the community well-informed during construction.

A pre-bid tank inspection was performed by S&ME to determine the appropriate surface preparation and coating requirements. Upon inspection, S&ME found that the tank coating system showed varying degrees of deterioration. Rather than removing the entire existing coating system, some areas were determined to be suitable for overcoating, which served as cost savings to the Town. A coatings workshop was held that included three different vendors. The qualities, surface preparation requirements, and application methods of different interior and exterior surface coating options that were suitable for the Ridgeview tank were discussed. The advantages and disadvantages were weighed and the coating specifications were developed based on these analyses.

A qualified site observer was enlisted to ensure that the contractor was continuously making good decisions about their work and providing the Town with the quality end product that they expected. Even under close observation, the contractor had numerous mishaps along the way that added to the challenges of managing this project in a high-profile area. These included contractor understaffing, lack of contractor quality control, a diesel fuel spill, and wind storm damage to a containment system and temporary cell tower.

Another issue we faced during construction was coordinating with three communication providers and the Town’s AMI equipment. The contractor had to accommodate for the numerous utility buildings and associated wire racks and ice bridges, as well as keeping the Town’s AMI equipment operational throughout construction.

The community around the tank site represents a diverse group of customers. To the north, east, and west there are retail centers and businesses, including doctors and dentists. To the south, the site is adjacent to the Village of Troon residential neighborhood. Open, effective communication between the project partners and the affected community is vital for a high-profile project’s success. For this reason, we implemented a communication plan to address the project’s specific effects on the community and to keep nearby residents and businesses up-to-date on the project’s progress.

KEYWORDS

Tank Inspection, Tank Rehabilitation, Tank Coatings, Overcoating, Surface Preparation, Containment System, Communication Plan.

INTRODUCTION

The Ridgeview Drive elevated tank was constructed in 1994. After 17 years of service, the tank coating system began to show varying degrees of deterioration. This project consisted of a design phase and a construction administration/observation phase.

The design phase included but was not limited to conducting a surface treatment workshop with the Town of Cary’s personnel to explore the different surface coating options and discuss advantages and...
disadvantages of each; conducting a visual inspection of the tank and all its appurtenances; evaluating the degree and type(s) of shrouding necessary to minimize impacts to the surrounding neighborhoods; developing a communication plan; and providing detailed drawings and specifications for interior and exterior paint removal, paints to be applied, and application methods.

The construction administration and observation phase consisted of full-time construction observation by a NACE Level 1 certified inspector; facilitating community outreach, anniversary paint inspection; and typical construction administration duties.

**DESIGN PHASE**

**Pre-Bid Tank Inspection**

On August 5, 2011, S&ME performed an inspection of the elevated tank. Due to high water demands, the Town could not take the tank out of service; however, visual observations of the interior were recorded. The pre-bid inspection was performed to determine the appropriate surface preparation and coating requirements. Upon inspection, it was found that the existing tank coating system showed varying degrees of deterioration. Rather than removing the entire existing coating system, some areas were determined to be suitable for overcoating. Outlined below in Table 1 is a summary of S&ME’s findings and recommendations.

Table 1

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<th>LOCATION</th>
<th>COATING RECOMMENDATION</th>
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| **Exterior**  | Condition: The existing coating on the tank shell and fluted column appears to be suitable for overcoat based on coating adhesion, coating thickness, and quantified percent of coating breakdown. The roof topcoat was estimated to be 65% delaminated from the underlying coat.  
• Due to the exposed epoxy and percentage of topcoat delamination on the roof, the roof is not a candidate for overcoating. It should be removed and a new coating system applied.  
• Recommendation for overcoating of the shell and fluted column should consist of spot repair of areas with corrosion and two additional full coats.  
• Existing coating does not contain lead, but containment may be required during coating removal and coating application.  
• Work should be conducted within one year to extend the coating service life. |
| **Interior, dry** | Condition: The existing coating is suitable for coating spot repair based on measured coating adhesion, coating thickness, and quantified percent of coating breakdown.  
• Recommend spot coating repair on areas exhibiting corrosion. A full overcoat not recommended at this time.  
• Existing coating does not contain lead. |
| **Interior, wet** | Condition: The existing coating is not suitable for coating repair based percent of coating breakdown.  
• Recommend removal of coating system and application of a new coating system.  
• The interior coating was not tested for lead.  
• Work should be conducted within one year to avoid further corrosion and metal loss. |
Coatings Workshop

A coatings workshop was held to allow three vendor presentations to discuss different interior and exterior surface coating options that were suitable for the Ridgeview tank. The discussion included qualities, surface preparation requirements, application methods, and advantages and disadvantages of each available surface treatment and coating options.

Tank Interior, Wet

There were three interior coating systems that were recommended by paint vendors and are as follows:

- Zinc primer with two-coat high-solids epoxy system
- Three-coat high-solids epoxy system
- Two-coat 100% solids system

All of the systems required surface preparation with a SSPC-SP10 blast. The Town was concerned about using a zinc system on the interior of the tank. Although it is an accepted practice now, there is an industry-wide increased focus on metals. The two-coat 100% solids system has some performance advantages at sharp edges and angles, but it requires heat and special atomizing equipment for proper application. The higher number of application variables and the limited number of qualified contractors makes application of this product more risky than the other systems identified. Also, since this product is applied with a thick build, removal in the future is expected to be much more costly than the removal of other coating systems. The Town ultimately choose the three-coat high-solids epoxy system because of its record of good performance in similar applications.

Tank Interior, Dry

Since the areas of damage on the dry portions of the tank were minimal and the existing paint was adhering very well, we recommended spot preparation and painting.

Tank Exterior, Excluding Roof

The coating systems for the tank exterior, excluding the roof, included two different surface preparations (high-pressure wash and blast to bare metal) and two different finish paint products (aliphatic polyurethane and fluoropolymer urethane). The options were as follows:

1. High-pressure wash with bicarbonate solution and two-coat system including an aliphatic polyurethane finish coat.
2. High-pressure wash with bicarbonate solution and two-coat system including a fluoropolymer urethane finish coat.
3. Surface preparation with an SSPC-SP6 blast to bare metal followed by a three-coat system including an aliphatic polyurethane finish coat.
4. Surface preparation with an SSPC-SP6 blast to bare metal followed by a three-coat system including a fluoropolymer urethane finish coat.

Since the existing coatings on the accessible portions of the support column were adhering very well, the overcoating option was attractive; however, the adhesion and existing paint thickness on the inaccessible portions of the tank would need to be verified during construction. Taking the tank to bare metal would provide the most assurance of service life on the exterior of the tank, but at a significant increase in costs.

The primary focus of discussion on coatings for the exterior of the tank was on options 1 and 2 above. Both options had been used on other Town of Cary owned tanks and these tanks had held their color and gloss very well. Option 1 had a probable life of about 15 years, whereas Option 2 had a probable life of about 30 years; however, the products in Option 2 were newer products, and the probable life was projected based on accelerated environmental testing. The actual long-term performance is not known.
There are several manufacturers that could provide Option 1, but because Option 2 was a newer product, there were a limited number of manufacturers and there was concern about whether they could provide products of comparable quality.

Ultimately, the Town chose to incorporate Option 1 into the final design documents.

**Tank Exterior, Roof**

Delamination the finish coat on the roof required a SSPC-SP6 blast to bare metal. The two coating alternatives discussed were a three-coat system including an aliphatic polyurethane finish coat and a three-coat system including a fluoropolymer urethane finish coat. To be consistent with the other parts of the tank exterior, the Town choose to incorporate the three-coat aliphatic polyurethane finish coat.

**Shrouding Systems**

The community around the tank represents a diverse group of customers. To the north, east, and west there are retail centers and businesses that include doctors and dentists. To the south, the site is bordered by the Village of Troon, a residential neighborhood.

A common approach to minimizing off-site disturbances on projects like this is to install a temporary containment system. Containment systems consist of textile tarps and/or sheets that are raised along a cable system into place prior to sandblasting or painting operations. The containment system includes a ventilation system that is sized to offset blasting and painting equipment air input and to force a controlled air current through the containment curtain.

Without a temporary containment system, dust and paint would likely be carried off-site by wind and could have a negative impact on adjacent properties. To minimize impacts to the adjacent property owners and surrounding community the town required the renovation contractor to provide a full containment system.

**Communication Plan**

A Communications Planning Workshop was held to draft a communication plan that outlined the goals, objectives, and methods to be used to notify the surrounding residents and businesses of the project’s progress. The goals and objective of this plan were as follows:

**Goals:**

1. Provide surrounding businesses, residents, and the traveling public with timely, accurate, and complete information about the project.
2. Town of Cary is the first and best source of information about the project. The Town will inform, manage expectation, and provide accurate information about the project.
3. The Town will get the word out early and often about the project, engage stakeholders, and actively respond to concerns and questions in a timely manner.

**Objectives:**

1. Inform 100% of businesses and residents within the designated notification area about the project at least two weeks in advance of beginning repainting activities using the notification strategies outlined in this plan.
2. Respond to 100% of stakeholder inquiries within two business days.
3. Receive less than three complaints about noise and debris surrounding the tank site during implementation.
4. Provide a 30-day written notice to cellular service providers to minimize disruption to the cellular collocation and AMI communication services.
CONSTRUCTION PHASE

Implementation of Communication Plan

Prior to the contractor beginning construction, the project team informed affected stakeholders, including surrounding businesses and residents, of the project using a variety of tactics, including in-person communications and distribution of both electronic and print information.

Community Meeting

An Open House was held two weeks prior to the start of surface restoration. Project team representatives were made available to discuss the project with attendees. The project fact sheet, maps, comment forms, and other materials were available.

Fact Sheets

The project team distributed fact sheets notifying the surrounding property owners and residents of the repainting project. The fact sheets included the project description, schedule, milestones, and contact information. They were hand-delivered by the project team two weeks prior to the surface restoration and again midway through the project to provide an update. Extra copies of the fact sheet were made available to be posted on bulletin boards in the neighborhood community areas and in nearby shopping centers. Electronic copies of the fact sheet were emailed to neighborhood and business contacts for distribution to their employees and residents.

Website/Social Media

A project page was maintained on the Town’s website providing project information and updates throughout the project. Notifications of the repainting were made available on community bulletin websites, including the Town of Cary “This Week” Public Notice and other area online or print community calendars. An update linking to the project news release was placed on the Town’s Twitter feed four days prior to repaint and additional announcements were made via twitter at mid-restoration and after restoration was complete.

Communications Systems

The tank has been modified to accommodate five cell phone carriers (T-Mobile, Alltel, AT&T, Clearwire, and Sprint) and the Town’s automatic meter reading equipment. It was anticipated that the utility buildings and associated wire racks and ice bridges related to the communication providers and the Town’s automatic meter reading equipment would provide some challenges to the painting contractor. With that in mind, the Town requested that all communication carriers relocate their equipment (antennae, cables, and cable trays between the buildings and the tank) during painting operations. In order to do this, the communication cell carriers provided two temporary cell on wheel (COW) units to mount the antennae. They also boarded up the buildings and other structures to protect them from dust and paint.

Modification to Pedestal Surface Preparation

As mentioned above, a tank inspection was performed that included testing consisting of adhesion testing per ASTM D3359 “Standard Test Method for Measuring Adhesion by Tape Test” and SSPC-PA-2 “Measurement of Dry Film Thickness with Magnetic Gages.” The test data from numerous test patches supported the over coating procedure on the fluted pedestal and tank shell. The contractor began surface preparation to the fluted pedestal and shell wall by pressure washing at 4,000 psi with baking soda injection to aid in the removal of the existing coating chalking and the etch the existing coating. A test patch showed that the pressure washing was removing the topcoat from the fluted pedestal. A review of the coating showed that the topcoat had compromised adhesion in various locations so the surface preparation was changed to a sweep blasting. The sweep blasting aided in the removal of the loose topcoat but left tightly adhered material in place. The coating system was also modified for these areas. The initial coating system
called for spot epoxy primer and spot epoxy intermediate coat with one full urethane topcoat. That was modified to include a full epoxy primer followed by one full urethane topcoat.

Site Observation

Full-time construction observation was performed by a NACE Level 1 certified inspector during the contractor’s surface preparation and painting activities. It became apparent early on that the contractor was not living up to the Town’s expectations due to problems caused by subpar equipment, understaffing and lack of quality control. These issues resulted in more intensified observation. Although the project hit a few bumps in the road, the Town appears to have ultimately received a quality product which can be attributed partly to the inspector’s continuous and meticulous observation.

Construction Mishaps

Diesel Fuel Spill

The contractor maintained a 500 gallon diesel fuel tank onsite to be able to supply fuel to multiple pieces of equipment. Late in the day a laborer began to fuel up a piece of equipment. Shortly after the laborer was called to attend to a different matter and consequently left the fuel hose unattended. The laborer forgot about the refueling which resulted in a fuel spill for an undetermined amount of time. It was not until the inspector noticed the stream of fuel on the access drive that it was stopped.

According to the contractor superintendent, only a small amount of fuel was spilled. The diesel fuel drained down the site directly into a storm drain where it was thought to be contained. The contractor was instructed to clean up the spill immediately. After further investigation the following day it, was determined that a much larger volume of fuel was spilled and that the fuel had traveled through the stormwater system into the stormwater detention pond. Once this was realized, the contractor was instructed to bring in a professional hazmat crew to handle all the clean-up required.

Fortunately the fuel never made it to the outfall of the detention pond. The hazmat crew was able to isolate the fuel in the detention pond and absorbed it. They were also able to excavate all the fuel contaminated soil. The contractor was required to replace the asphalt in which the diesel fuel came in contact.

Containment System Damage

During summer afternoons in North Carolina, it is not unusual for a thunderstorm to pop up in the area. One such thunderstorm occurred late one afternoon while the contractor was painting the exterior of the tank with the full containment system in place. The contractor was surprised by the storm and was unable to lower the containment system before the wind began to tear apart the tarps. By the end of the storm, the entire side containment had been ripped off of the support cables and the roof containment was hanging on by a thread. Multiple outriggers had been ripped off the top of the tank as well.

Fortunately no one was injured. The only damaged done outside of the containment system itself was damaged sustained to a temporary cell tower. Part of a tarp wrapped around a tower and bent it in half. The project was delayed one week as the contractor repaired the containment system.

CONCLUSIONS

Though the project did see its setbacks along the way during construction, the overall project proved to be a successful one. The coatings workshop was beneficial in that it educated the project team and allowed them to make cost effective decisions while determining the appropriate surface preparation and coating systems for the Ridgeview Tank. The Communication Plan proved be effective in reaching all project stakeholders and keeping them well informed about the status of the project. The communication providers were able to relocate their antennas onsite and were able to maintain service to their customers throughout the duration of the project. Finally, under close observation from a qualified observer, it appears the contractor was able to provide the Town with the quality end product that was expected.