New Water Tank Lining: Passing the Taste Test

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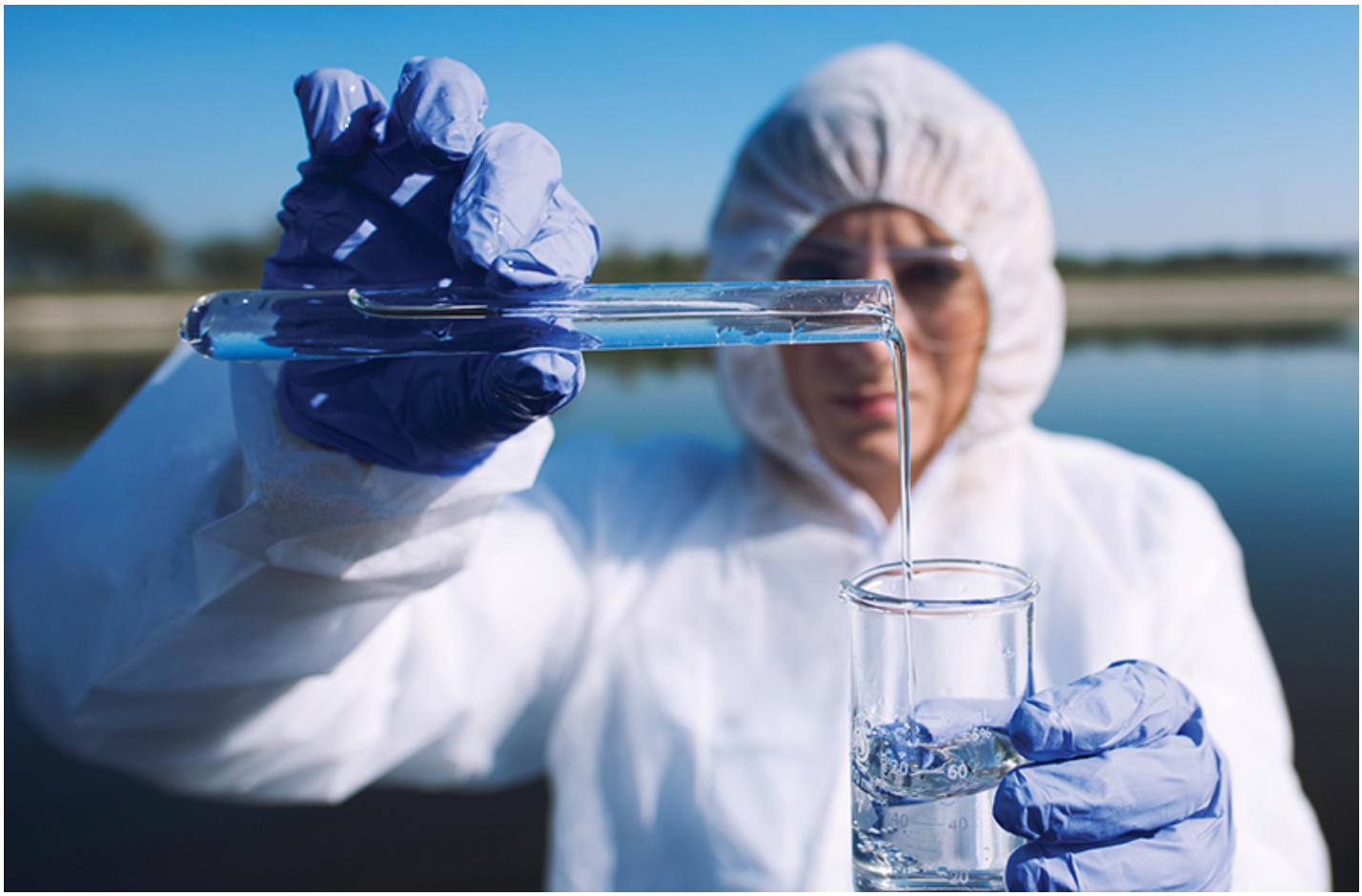

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Potable water storage tank lining systems face a number of tests before a tank can be placed into service. Beyond the initial lab tests that certify a coating for potable water use, newly applied linings must be carefully inspected to ensure they're free of deficiencies that could otherwise cause premature wear and potential water contamination. Thereafter, water utilities must lab test samples from freshly filled tanks to ensure the water is free of solvents and other chemicals that may linger following a lining application. But the test of all tests for many municipal water tanks is a final taste test before approving service.

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This pass/fail test—based on the discerning palates of a panel of taste testers—can mean the difference between quickly returning a tank to service or draining thousands of gallons of water, refilling the tank and trying again.

That costly drain and refill scenario is exactly what Saint Paul Regional Water Services in St. Paul, Minnesota was trying to avoid when the utility provider selected a new 100%-solids glass-flake reinforced epoxy lining system for the restoration of its 500,000-gallon Sterling Avenue water tower in fall 2019 **(Fig. 1)**. Nearly every water tank that SPRWS had relined in the region during the past 15 years or so had not passed a taste ?test on its first try. Each failure naturally meant a delay in restoring water service, but it also carried the cost of losing an entire tank's worth of water, with those municipal budget dollars literally going down the drain. The 100%-solids epoxy would hopefully prevent that scenario.

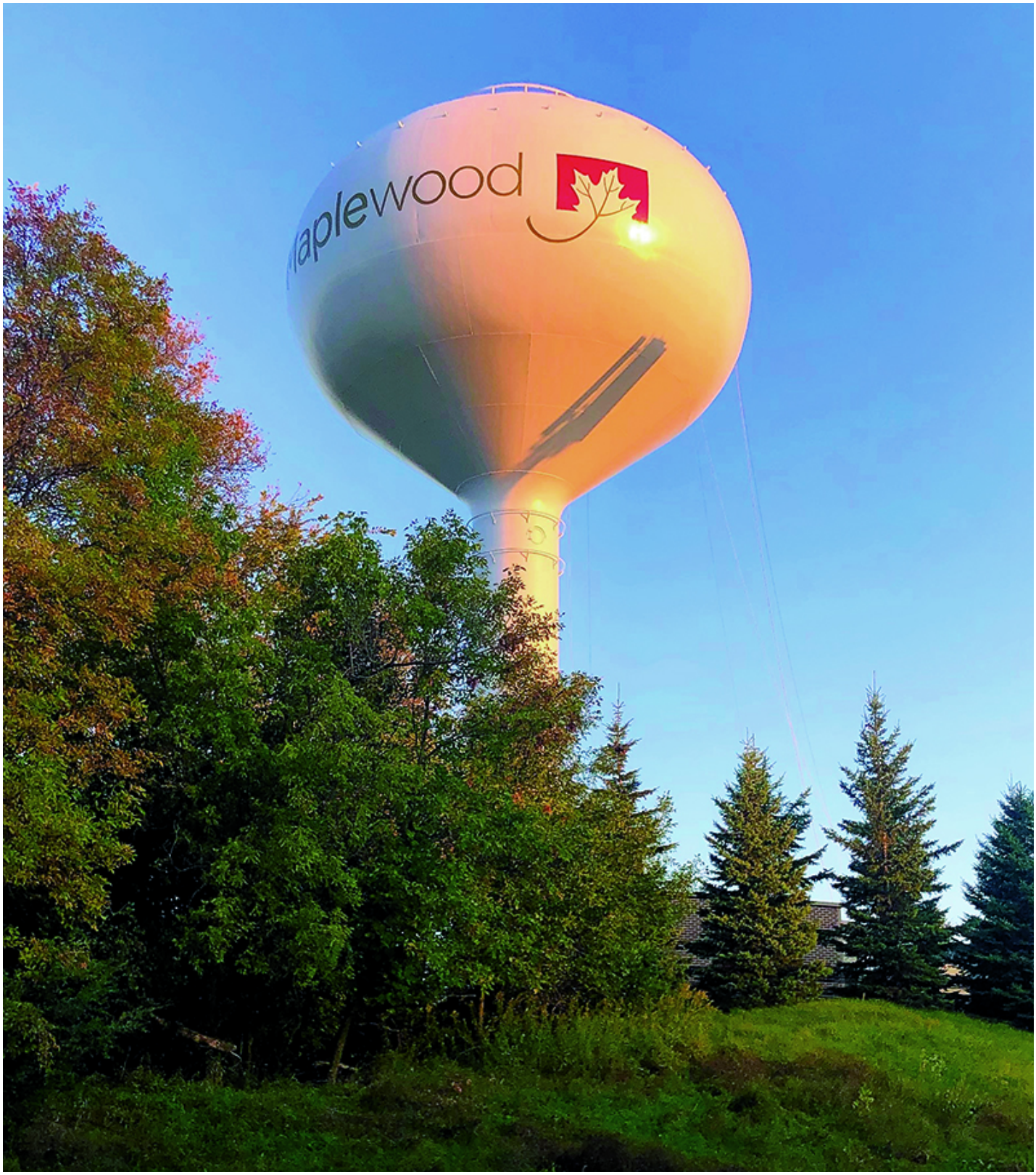

Figure 1: SPRWS selected a newly NSF/ANSI/CAN 600-approved, 100%-solids lining system for its 500,000-gallon Sterling Avenue water tower that helped the restored tank pass a discriminating water panel taste test on the first try. *Courtesy of Sherwin-Williams Protective & Marine*

The need to drain and refill tanks is also something the new NSF/ANSI/CAN 600: “Health Effects Evaluation and Criteria in Drinking Water” standard will indirectly help to avoid. The drinking water safety standard, which will take effect in January 2023, will reduce the amount of xylene, toluene and ethylbenzene allowed in coatings used for potable water service. Such compounds are the most likely culprits when water samples fail taste tests, as panel members may smell or taste a hint of lingering chemicals. Although lab tests may show that water samples lack solvents and other chemicals, water panel members’ taste buds are the final say for when a storage tower’s water is approved for consumption and distribution. By limiting various solvents in lining systems, the standard will help tanks pass taste tests much more readily.

NSF/ANSI/CAN 600 Explained

The NSF/ANSI/CAN 600: "Health Effects Evaluation and Criteria in Drinking Water" standard creates a single source for the multiple drinking water standards that reference health criteria for potable water, including NSF/ANSI/CAN 60 and NSF/ANSI/CAN 61.

Scheduled to take effect in January 2023, NSF/ANSI/CAN 600 will significantly affect coating and lining products certified for potable water storage use. The proposed changes include a drastic reduction of the Maximum Contaminant Levels of xylene, toluene and ethylbenzene (Table 1). These changes will affect and potentially eliminate a broad number of solvent-based lining products currently used in the potable water market. As a result, coatings manufacturers are anticipating wider use of coating systems featuring 100%-solids technologies and are therefore vetting alternatives, such as the 100%-solids glass-flake reinforced lining system used on the SPRWS Sterling Ave. water tower, to comply with this stringent standard.

Aside from their lack of solvents and potential taste and odor issues, 100% solids linings can enable faster returns to service, higher-film builds, fewer coats, reduced labor, better edge retention, better corrosion protection and overall better lifecycle expectations compared to solvent-borne linings. Therefore, NSF/ANSI/CAN 600 will not only help to reduce chemical exposures in potable water service, but also have the potential to streamline project schedules, reduce costs and enhance long-term durability.

Table 1: Extractable Limit Changes to the NSF/ANSI/CAN 61/600 Standard.

COMPOUND	PREVIOUS CRITERIA IN PPB (TAC/SPAC*)	NEW CRITERIA IN PPB (TAC/SPAC*)	IMPLEMENTATION DEADLINE
Benzo(a)pyrene	0.2/0.02	0.04/0.004	Immediate
Perfluorooctanoic Acid (PFOA) & Perfluorooctanesulfonic Acid (PFOS)	3/0.3	0.07/0.007 (Total)	Products must comply by 1/1/2020
Triphenylphosphine Oxide	3/0.3	1/0.1	Products must comply by 1/1/2020
Total Xylenes	10,000/1,000	90/9	Products must comply by 1/1/2023
Toluene	1,000/100	60/6	Products must comply by 1/1/2023
Ethylbenzene	700/70	140/14	Products must comply by 1/1/2023

*TAC/SPAC (Total Allowable Concentration/Single Product Allowable Concentration)

Source: NSF International, 2019

The new next-generation, advanced technology, 100%-solids glass-flake reinforced lining system that SPRWS chose had recently secured NSF/ANSI/CAN 600 approval for potable water storage, making the Sterling Avenue tower the first to feature it. In selecting this system, the utility provider hoped to fill the tank just once before restoring water service, thereby realizing a timely, and less costly, return to service. The choice paid off with the water panel approving the first samples from the freshly filled tower, enabling immediate approval for service. The return to service was also accelerated by fast curing times for both the lining system and the tower's exterior coatings.

From September to October 2019, applicators installed the lining system inside the tower for SPRWS and restored the tower's exterior using a zinc/epoxy/polyurethane system with excellent color and gloss retention. An independent consulting services firm served as the project's engineering and coatings inspection firm. The fast-track project earned all three parties an honorable mention in the 2020 Sherwin-Williams Impact Awards program.

NEW LINING INSTALLATION

Serving the Maplewood, Minnesota, community, the Sterling Ave. water tower was due for a restoration following about 15 years of service since its last coatings work. The tank's exterior had faded and was in need of a refresh **(Fig. 2)**, and its interior was showing signs of minimal corrosion. Touchups and repairs were a possibility, but they would have taken longer to perform than a full restoration. With time of the essence to minimize the tower's time offline and stay ahead of the rapidly approaching Minnesota winter, SPRWS decided on a full rehabilitation using fast-curing coating systems, including the new 100%-solids lining system.

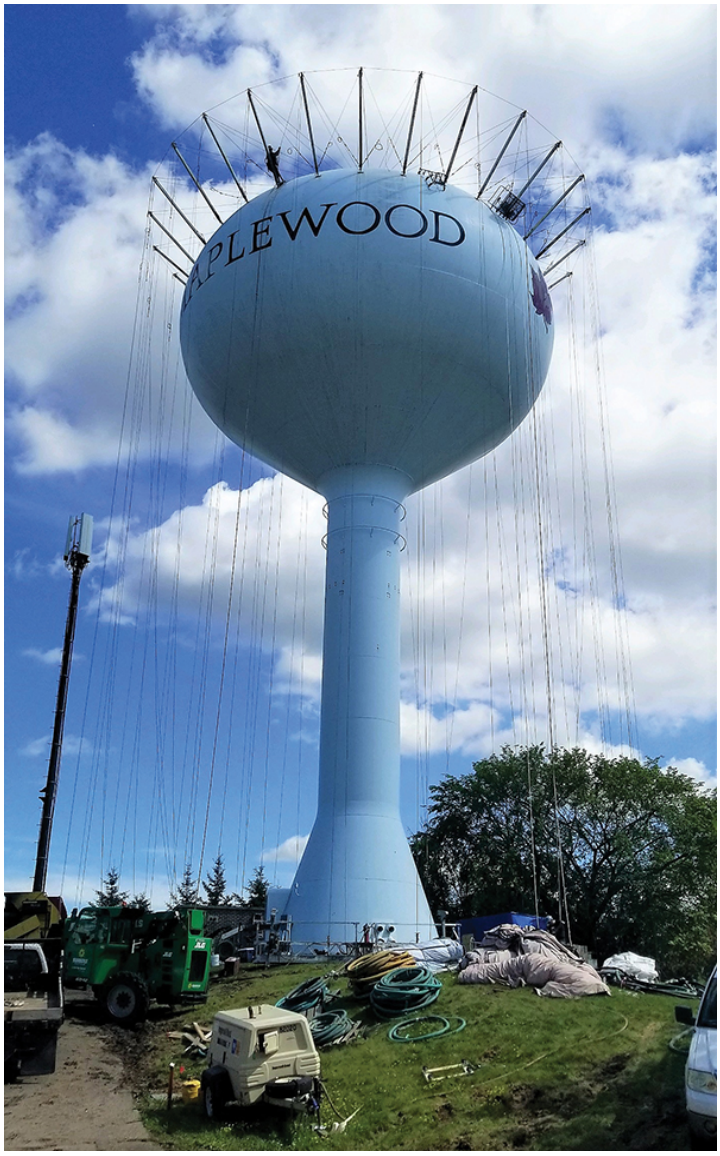

Figure 2: The water tower's exterior had faded and was in need of a refresh to liven up the image of the Maplewood, Minnesota, community. *Courtesy of Sherwin-Williams Protective & Marine*

To install the lining system inside the spheroidal tower, a crew of applicators first prepared the interior tank surfaces to the SSPC SP-10/NACE No. 2 Near-White Metal blast-cleaning standard. Next, crew members spray-applied a full coat of a single-component, moisture-curing urethane zinc-rich primer on the interior surfaces at 2–4 mils dry film thickness. The primer provides resistance to corrosion, abrasions and chemicals to help protect the tank's steel from deteriorating. It also allows for cathodic protection inside the tank.

Applicators then brushed and rolled a stripe coat of the 100%-solids, glass-flake reinforced lining to welded areas **(Fig. 3)** before spray applying the lining at 30–40 mils DFT in a single coat using plural spray equipment. Due to the coating's high-build capabilities, applicators could spray the material up to 125 mils DFT where needed to fill in any pits. The lining's glass-flake reinforcements give it extremely low permeability and excellent abrasion and chemical resistance, helping to deliver a life expectancy greater than that of a conventional three-coat zinc/epoxy/epoxy system. Best of all for the Sterling Avenue tank project's accelerated timeline, the lining offered a return-to-service time of just 10 hours following the final application.

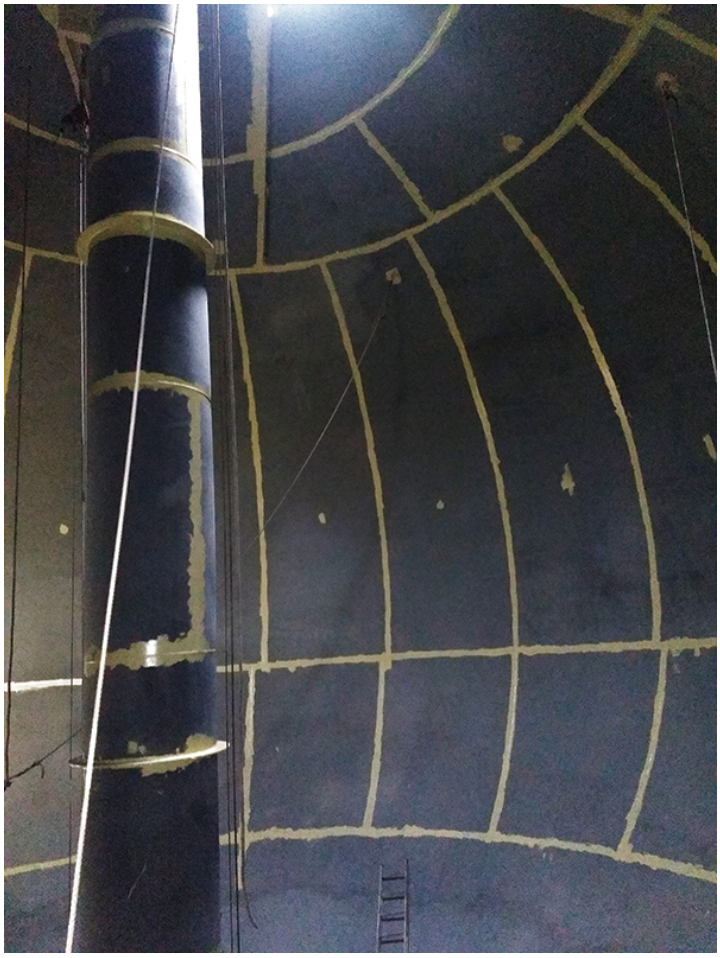

Figure 3: Applicators blasted the tower's interior to a Near White Metal standard, applied a zinc primer to the entire interior and then applied a stripe coat of the lining system to weld seams and edges to ensure full coverage of these hard-to-coat areas. A full coat of the 100%-solids, glass flake-reinforced lining followed. *Courtesy of Sherwin-Williams Protective & Marine*

FAST-TRACK EXTERIOR REFRESH

Long-term aesthetics and a fast turnaround were the focus for the water tower's exterior, prompting the team to specify a fast-curing zinc/epoxy/polyurethane system featuring a high-performance acrylic polyurethane for the topcoat.

Applicators first prepared the tank's exterior to the SSPC SP-6/NACE No. 3 Commercial blast-cleaning standard. They then applied a 2–4-mil DFT primer coat using the same moisture-curing urethane zinc-rich primer used on the tank's interior to resist corrosion and damage.

Crew members next spray-applied an intermediate coat of a two-component, high-solids polyamide epoxy mastic to the tank's exterior at 4–6 mils DFT. With its high solids content, this protective coating layer ensured adequate protection of sharp edges, corners and welds on the tank. The epoxy is also fast-drying, helping the crew move quickly from the intermediate layer to the topcoat.

For the topcoat, the coating contractor used a two-component, high-performance acrylic polyurethane that will provide long-term UV protection for the high visibility structure. The coating offers exceptional long-term color and gloss retention, as well as excellent resistance to corrosion and weathering. Saving time on the application, crew members were able to apply the coating at thinner DFTs of just 2–3 mils compared to the 3–5-mil DFTs typically required for conventional polyurethanes.

For the finishing touches, applicators hand painted a logo featuring the Maplewood community name and an artistic maple leaf drawing. To ensure long-term color and gloss retention for the brown and maroon logo, applicators used a premium, ultra-durable fluoropolymer urethane finish that offers superior exterior durability and color and gloss performance.

Throughout the project, the coating contractor was careful to prevent dust, debris and coating overspray from reaching nearby houses and structures by installing a full containment system around the tower **(Fig. 4)**.

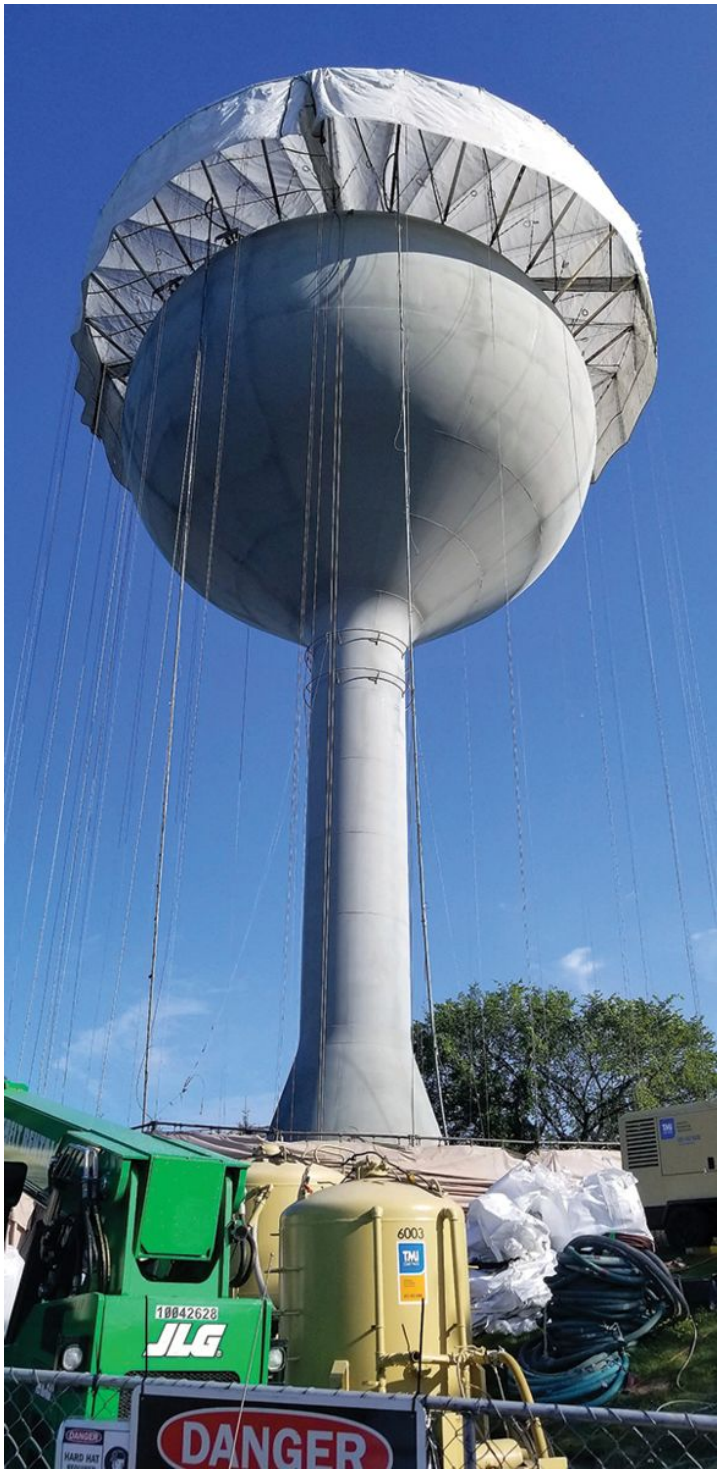

Figure 4: The coating contractor installed a full containment system around the tower to prevent dust, debris and coating overspray from escaping the job site during restoration work. *Courtesy of Sherwin-Williams Protective & Marine*

THE FINAL TASTE TEST

Upon completion of the interior and exterior coating applications, the Sterling Avenue tower rehabilitation project faced its final test. The utility's discerning panel of taste testers had to approve water samples from the newly lined and filled tank before it could be approved for servicing the Maplewood community. With most tanks failing the panel's palates on the first try for well over a decade, SPRWS anxiously awaited the results. If the panel expressed any taste or odor concerns, the utility provider would need to drain and refill the 500,000-gallon tank—perhaps multiple times—until the panel approved the latest samples.

Given the 100%-solids lining system's solvent-free chemistry and NSF/ANSI/CAN 600 approval, the project team felt confident about the test. Still, the team was relieved to learn that the panel passed the first samples without hesitation—no tank refills required.

CONCLUSION

Due to the selection and successful application of the 100%-solids lining system, SPRWS was able to place the tank online immediately after passing of the final taste test, saving the hassle and cost of losing at least half a million gallons of water. This rapid return to service was able to take place just 30 days after the restoration commenced thanks to the fast-curing properties of the lining and exterior coating systems, along with their streamlined applications.

ABOUT THE AUTHORS

Murray Heywood is the North America Market Manager – Water & Wastewater for Sherwin-Williams Protective & Marine. He has been in the paint and coating business for more than 39 years. He is an SSPC-certified Master Coatings Inspector, Protective Coatings Specialist and Concrete Coating Inspector (Level 2); a NACE-certified Coating Inspector (Level 3) and holds Master Painters Institute Architectural Coating Specialist certifications. Heywood is also a NACE and SSPC instructor, teaching the Coating Inspection courses, is the current Chair of the SSPC Ontario, Canada, Chapter and serves on several SSPC and AWWA Technical committees.

John Sierzega is Business Development Manager, Water Infrastructure for Sherwin-Williams Protective & Marine. He started in the coatings industry at a young age, building concrete water tanks with his stepfather during summers, and has since served the industry for 24 years, working in coatings research and development, technical service, and project and business development. He is a NACE-certified Coating Inspector, the secretary of the SSPC North Central Region Chapter, the social chair for the Minnesota Section American Water Works Association (MN AWWA) Manufacturers & Associates Council (MAC) and a member of the NASSCO Manhole Rehabilitation committee.