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CoatingsPro™ MAGAZINE

SOUTHERN STEEL RECOAT

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COATINGS HELP FUEL TANK FARM FILL UP

BY JEN KRAMER

PHOTOS COURTESY OF SPECIALTY PRODUCTS, INC.

We all complain about rising prices at the gas pump, but did you ever stop to think how much higher those prices could be if not for the innovation of the coatings industry? True, OPEC and the major oil companies have a lot to do with the bottom line but that bottom line would be much higher if the storage facilities and pipelines that house and transport said fuel were allowed to fall into disrepair. Often, it is the preventative maintenance of a few mils of paint that means the difference between "business as usual" and a corrosive failure – the cost of which is passed on at the pump.

This is the story of a preventative maintenance coatings project at a diesel and unleaded gasoline storage tank farm that spans the course of two years. It is the story of how cutting-edge coatings technology made that expansive job more efficient. And of how one coatings crew worked for two years, utilizing the new technology to quickly and competently line the tanks and protect the nation's fuel supply.

ABOVE ▲ Working over the course of two years, and coating over 20,000 square feet (1,858.06m2), Allied Energy Corporation has enlisted cutting-edge technology to protect their fuel tank farm.

A LINING TO LAST

As Cliff Haskins, Vice President of Marketing for Specialty Products, Inc. explains, "Allied Energy Corporation knew that they were facing a problem. Their tank farm was aging and they needed corrosion- and chemical-resistant linings for the interiors of their fuel tanks – specifically their tanks used to store a trans-mix of diesel and unleaded gasoline before it is processed into usable fuel. These tanks have capacities ranging from 12,000 barrels to 54,000 barrels." So this would be no small project. And since the cost of taking fuel storage vessels off-line is so high (See "Crude Oil Tank Farm: Coatings Help Investors Make Money," *CoatingsPro* online article, April 2010, www.coatingspromag.com), the job would be done slowly – on an on-going basis, one tank at a time.

SMC Commercial Services, Inc., was the contractor hired to complete the project and Benny Abbott, owner of Abbott Consulting and Coating Inspections, was hired as the inspector/consultant.

During the course of the project, "We worked on several tanks – seven in all – in various sizes from late 2007 until March of 2009,"

Genie Z-60/34
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The tanks coated house a trans-mix of diesel and unleaded gasoline stored before being processed into fuel. With such a widely diverse range of tank types, sizes, and storage needs, it was imperative that the coating used be equally adaptable.

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Write in Reader Inquiry #34

ABOVE ▲ The crew spray-applied PTU, a chemical-resistant polythiourea elastomer from Specialty Products, Inc. using a Gusmer 20/35 Pro hydraulic proportioner and a Graco Fusion mechanical-purge gun. The PTU was applied at a thickness of 100 to 125 mils (2.54mm to 3.18mm) DFT onto the tank floor and 4' (1.22m) up onto the tank walls.

explains Abbott. "The smallest was approximately 30' (9.14m) in diameter. The largest was approximately 90' (27.43m) in diameter. And not all of the tanks were spec'ed for polyurea, but most were. We ended up using about 20,000+ square feet (1,858.06m²) of it." That is a lot of polyurea – especially given the fact that it was applied at 100 to 125 mils (2.54mm to 3.18mm) DFT.

"It is," Abbott agrees. "But the owners wanted to make sure that the tanks were well-protected and that everything was done right."

On a job of this size and scope, making sure that everything was done right was a detailed process. Each tank was approached as an individual project. "We would write a specification for each tank, since each one was different," says Abbott. For the purposes of this article, we'll focus on the application used in the majority of the tanks – SPI's PTU Chemical Resistant Polythiourea. As SPI's Haskins explains, "Allied Energy Corporation had previously used PTU successfully in their bio-diesel, unleaded gasoline, and diesel fuel storage tanks and they felt confident to continue using the same product to provide a protective lining to coat another tank."

As for the tanks themselves, they were in a mixed bag of conditions. "Some of the tanks were brand new carbon steel," Abbott describes. "Others dated from 1952 so were in very poor shape. A few of these had thin areas and even holes in the bottoms."

SAFETY FIRST

Before Abbott and the coatings crew stepped onto the job site, the owners drained the tank to be coated. Then it was time for the four-to-six man coatings crew to suit up and enter the tank.

Working with chemicals in a tank that has housed fuel immediately raises a red flag and on this job site, nobody took any chances. "We wore air-supplied or standard full-face air-purifying respirators (APRs) and the ventilation system that we had established helped keep the fumes away too," explains Abbott. In addition the crew wore Tyvek suits designed to withstand chemical

JOB AT A GLANCE

PROJECT:

Recoat seven tanks at power plant over the course of two years

COATINGS CONTRACTOR:

SMC Commercial Services
Birmingham, AL

COATINGS INSPECTOR:

Abbott Consulting & Coating Inspections
(205) 717-0292
babbott@abbottcoatinginspections.com

SIZE OF CONTRACTOR:

A 4-6 man crew worked this project

PRIME CLIENT:

Allied Energy Corporation, Birmingham, AL

SUBSTRATE:

Carbon steel

SUBSTRATE CONDITION:

Varied; some tanks new, some built in 1952 and in very poor shape

SIZE:

Approximately 20,000+ sq. ft. (1,858.06m²)

DURATION:

2 years

UNUSUAL FACTORS:

- Duration of project
- Each tank required individualized specification
- All spent water cleaned on site in facility's microbiological treatment system

MATERIALS/PROCESS:

- Clean drained tank using 4,000 psi (27.6MPa) Mighty Mite pressure washers and water mixed with Krud Kutter and microbiological agents
- Sweep-blast floor of tank and 4' (1.22m) of lower walls to NACE No. 3/SSPC-SP6 Commercial standard using Clemco 6 cubic foot pots with 1 1/2" (3.81cm) piping and Harsco Mineral's Black Beauty
- Third party welders on the job to do repair work
- Test and treat for chlorides using Chlor-Rid's test kit
- Abrasive blast floor and 4' of lower walls to NACE No. 1/ SSPC-SP 5 White Metal standard using same blasting equipment to create 5-6 mil (0.13mm-0.15mm) anchor profile
- Apply SPI's PTU onto floor and 4' (1.22mm) onto lower walls at 100-125 mils (2.54mm-3.18mm) DFT using Gusmer 20/35 Pro hydraulic proportioner and Graco Fusion Mechanical Purge gun
- Check for DFT using DeFelsko PosiTector 6000
- Check for holidays using Tinker & Rasor AP high voltage holiday detector

SAFETY CONSIDERATIONS:

- Crew wore Tyvek for chemical service, air-supplied respirators or standard full-face APRs, gloves, safety goggles, and hard hats
- Working in tanks meant crew always monitored with spotter on top of tank
- The contractor had a safety training program and the owner had a site-specific training program as well
- The ventilation system used to help speed the coatings' cure also helped keep the air inside the tank free from toxic fumes

ABOVE ▲ When specifying coatings for crude oil tanks, it is common to only coat the bottom and a few feet up the walls. This is a protection against the salt water that naturally forms at the bottom of tanks in which crude oil is stored.

service, as well as gloves and hardhats. They checked in and out with a safety monitor whenever they entered the tank. Not only did SMC provide their own company safety training, but also "there was a mandatory site-specific training program run by the facility owner as well," Abbott says.

Dressed to coat, Abbott and the coatings crew first cleaned the freshly drained tank using a Mighty Mite 4,000 psi (27.6MPa) pressure washer and a multiple mix of water, Krud Kutter (a water-based surfactant), and a microbiological agent. This cleaning process took from two to four days depending upon the size of the tank. And the tanks weren't all that was getting cleaned.

"The dirty water was then vacuumed out of the tank via vacuum trucks and sent to Allied Energy's micro-biological on-site treatment system," Abbott recounts. "There, at the treatment center, micro-organisms actually eat the dirt and toxic particles in the water. By the time the processed water leaves the treatment facility, it is cleaner than drinking water."

Then, the crew used Clemco's 6-cubic-foot blast pots with 1 1/2" (3.81cm) piping and Harsco's Black Beauty media, to sweep blast the tank's floor as well as 4' (1.22m) up onto the walls of the tank. "We blasted the steel substrate to the NACE No. 3/SSPC-SP 6 Commercial standard in order to remove any mil scale and/or rust," states Abbott. Then, a third-party inspection firm was hired to inspect the tank according to American Petroleum Institute (API) standards using ultrasonic equipment.

"For this job, we followed the API 652 standard for the lining of petroleum tank bottoms. It wasn't specifically stated in any of the specifications, but that is what we used when we approached the coating of each tank. We also followed all NACE/SSPC standards," explains Abbott.

HIGH SALTS AND GAS

Once the tank passed API standards, sub-contracted welders arrived on site to perform any necessary repair work.

After all of the third-party work was finished, it was time to re-clean the tank. Abbott and the coatings crew re-entered and, using a Chlor-Rid kit, tested the substrate to be coated for salts, chlorides, nitrates, and sulfides. "We found high levels

of salts," says Abbott. "So we applied the Chlor-Rid solution and removed it using plain water run through the 4,000 psi (27.6MPa) pressure washers. The water was then vacuumed out and recycled through the plant's micro-biological treatment facility." The cleaned surface was re-tested for salts and found to be within acceptable levels.

Next, using Black Beauty media and the same Clemco 6-cubic-foot abrasive blasting pots with 1 1/2" (3.81cm) piping, 130 lbs. (58.96kg) of pressure, and nozzles ranging in size from #7 to #8, the crew abrasively blasted the tank's floor and 4' (1.22m) up onto the tank's walls to the NACE No. 1/SSPC-SP 5 White Metal standard. "This created the 5 to 6 mil (0.13mm to 0.15mm) anchor profile specified for tank corrosion protection," Abbott states. The spent media was vacuumed out and the tank walls were "blown down with clean, dry, compressed air in preparation for the coating application."

The coating process itself was perhaps the quickest part of the entire job as the team used state-of-the-art materials and equipment to get the job done. Every day that a tank is out of service represents a monetary loss, so speed was paramount. Given this, the specs called for the use of PTU, a chemical-resistant, spray-applied, polythiourea elastomer from Specialty Products, Inc.

ABOVE ▲ Each tank had its own specification. "Some of the tanks were brand new carbon steel," Abbott describes. "Others dated from 1952 so were in very poor shape. A few of these had thin areas and even holes in the bottoms."

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Write in Reader Inquiry #164

ABOVE ▲ Working with chemicals in fuel tanks is a dangerous job. "We wore air-supplied or standard full-face air-purifying respirators (APRs) and the ventilation system that we had established helped keep the fumes away too," explains Abbott. And a safety monitor was present whenever anyone entered a tank.

PTU is self-priming which meant that the crew could spray the 100% solids, no VOC coating directly onto the cleaned and prepped carbon steel substrate without having to apply a primer – thus trimming time and money off of the project's bottom line.

They used a Gusmer 20/35 Pro hydraulic proportioner and a Graco Fusion mechanical-purge gun to spray-apply 100 to 125 mils (2.54mm to 3.18mm) DFT of the PTU onto the tank floor and 4' (1.22m) up onto the tank walls.

"The mechanical-purge gun has the best properties for spraying this material," Abbott says. "We never experienced any down-time due to gun-related problems during the course of this entire project. And no, I don't have an endorsement deal to say that," he adds. "It just consistently works really well."

After spraying the PTU, the crew checked for DFT and Shore D hardness. "We used a gage from PTC Instruments to check for Shore D hardness. We used DeFelsko's PosiTector 6000 to measure the coating thickness. And we used Tinker & Rasor's AP model, high voltage holiday detector to check for any voids or holidays in the coating," Abbott says.

FILL 'ER UP

Once all of the various inspections had been performed the crew exited the tank for the final time. "After completion, the tank sat for 72 hours before it was placed back into service," recounts Abbott. "This ensured a full cure." According to the technical data, PTU will cure to recoat from minutes after the original application up to six hours, so a 72 hour window for curing was more than enough for the fast-curing coating. And it would seem that the patience has paid off.

"Every tank has now been opened, drained, and cleaned and no problems have been found with the linings," Abbott explains. "In fact, the tank with the oldest lining – one that we coated in the fall of 2007 – was recently opened and the lining looked good." SPI's Haskins concurs, "The owner is very pleased with PTU's performance."

Two years, seven tanks and counting. Seems like no matter what the issue, when the discussion turns to fuel, the numbers keep increasing. This, however, is one instance in which that increase represents a savings in time and money — thanks in part to coatings technology and the men who apply it. CP

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COATINGS SCIENCE HELPS FUEL OIL AND GAS INDUSTRY

By Mike Cork, Director of R&D and Inventor of PTU, Specialty Products, Inc.

The global demand for energy continues to grow, driving the need to maximize offshore and onshore oil production, oil refining, and storage operations. The companies that face the ever-changing challenges to meet the world's energy demands need reliable coating solutions to protect their valuable infrastructure. Although coating technology has steadily advanced over the past few decades, most of the coating advancements brought to market have struggled to provide a long-lasting and eco-friendly (VOC free) solution. Many of these coatings have failed in full immersion, primary contact service with many reagents, including hydrocarbons, acids, caustics, and other materials used by the oil and gas industry. Dramatic temperature changes can cause various substrate materials to expand and contract which only adds to the complexity of meeting this challenge.

Modern polymer chemistry has recently evolved with the development of PTU polyurea by Specialty Products, Inc. (SPI) of Lakewood, Washington. PTU is a durable, flexible polyurea coating that when sprayed creates a seamless membrane that is resistant to most chemicals, including many hydrocarbons and other caustic substances.

This coating is touted as "the next generation of chemical-resistant coatings," by Mike Cork, inventor of PTU polyurea, and Director of R&D at SPI. Cork goes on to say, "I have worked with epoxy, novolac, vinylester, phenolic, and polyurea coatings for many years, but PTU represents the first polyurea breakthrough that offers the best of both worlds, with flexibility and true chemical resistance."

PTU (polythiourea) is a thermosetting polymer with good elastomeric properties. This cutting-edge polyurea coating exhibits chemical resistant properties comparable to most epoxies. Due to the product's ductile nature, PTU offers a unique solution for primary containment applications. This is especially true in instances when storage tanks or over-the-road tank trailers experience expansion and contraction, due to extensive temperature changes, varying product storage levels, or walls flexing during transportation in the case of tank trailers.

PTU provides excellent resistance to ethanol containing gasoline for primary, as well as secondary, containment. The storage and transportation of jet fuel, including JP-7, which contains 60% toluene, are other applications where PTU is suitable for primary containment. A free-film test sample of PTU polyurea immersed in JP-3 jet fuel gained only 1.4% in weight after 5 years of immersion. In comparison, testing with a common polyurea immersed in JP-3 jet fuel had a weight gain of 11.7% in just 24 hours. In most tested reagents, PTU proved chemical resistance superior to that of Nitrile, Nitrile Butadiene Rubber, and Viton. (For more information on specific values, please refer to the PTU chemical resistance chart on SPI's Website, www.specialty-products.com).

How can a plural-component sprayed system provide chemical resistance of this magnitude, yet be flexible? Mike Cork explains, "PTU is the result of years of R&D work, and several patents utilizing unique prepolymers and thiol terminated polysulfides. The resulting matrix can provide resistance to chemicals, where other polyureas have historically not performed well."

Benny Abbott, NACE certified instructor and owner of Abbott Consulting & Coating Inspections states, "In my 20 plus years of experience, when you read the fine print, a lot of other chemical-resistant coating product's testing is based only on incidental contact. SPI's PTU polyurea testing is based on true immersion service contact."

One industry concern commonly voiced by field technicians tasked with the responsibility of correctly applying polyurea coatings is the user-friendliness of the product. PTU is sprayed through conventional high pressure, heated, plural-component spray equipment under similar processing conditions as standard polyurea coatings. Abbott states, "PTU sprays just like any other high quality, pure polyurea product. It has great adhesion to the substrate, especially with SPI's AE-4 adhesion enhancer additive."

AE-4 adhesion enhancer additive in most cases eliminates the need of using a primer. This admixture helps to form a chemical adhesive bond to a properly prepared substrate and eliminates the time consuming process of applying primer. Abbott adds, "The product's self-priming and rapid curing properties save valuable time, and allows projects to be returned to service within hours, not days. This saves our clients considerable time and money."

As the oil and gas industry is painfully aware, storage tanks, pipelines, and equipment are extremely expensive to replace. Leading-edge protective coating solutions like PTU polyurea can drastically extend the service life of valuable infrastructures at a fraction of replacement costs. Dan Helton, SPI president and founder states, "PTU polyurea offers a value-added, tough, flexible liner that goes beyond the capabilities of other coating technologies." CP