Corrosion Control Coatings for FGD Systems

By Ed Sullivan, freelance writer

One of the main problems to put flue-gas desulfurization (FGD) systems out of operation is corrosion. Severe problems in FGD installations are caused when condensates of acids are formed, which accelerate pitting and crevice corrosion, particularly in scrubbers with high sulfate solutions. Scrubbers lined with 2205 duplex stainless are among the most vulnerable, failing frequently due to pit or crevice corrosion from both chlorides and fluorides.

The FGD failure that spawned the December news article is at GenOn Energy's Cheswick coal-fired plant, located near Pittsburgh, Pa.

According to a Dec. 7, 2010 GenOn letter to the Allegheny County Health Department, the emissions control equipment installed at the 637 MW power plant is already so severely corroded it can't be used.

An article in the December 2010 Pittsburgh *Post-Gazette* newspaper advised that corrosion problems in power plant FGD scrubbers are quite widespread.

"The corrosion problem in the scrubber vessel has occurred at as many as 70 other power plants across the country and appears to be caused by the type of metal alloy used for that part of the equipment. GenOn will install protective liners and coatings to correct the problem and expects to have those repairs finished by early March (2011)," the newspaper reported.

After a two-month shutdown, the article continued, the county health department agreed to let the Cheswick power plant resume operation without the scrubber until March 2011, when the repair work was to have been completed.

In fact, the scrubber failures due to corrosion may be far more common than the 70 problematic plants cited in the article, said Art Rak, CEO of Ultimate Corrosion Control (UCC). He attributed much of the problem to the use of 2205 duplex stainless as FGD linings.

"While all FGD systems are somewhat different, over a 15-year history of working in the power plant market, abrasion, pit corrosion and chlorides in FGD systems have commonly caused failures," said Rak. "Given the potentially aggressive corrosive conditions present in FGD systems - dew point, acidity, high temperature, concentrations of chlorides and fluorides, wet-dry cycles and gas velocity – no two systems are exactly the same. When it's all said and done, what is really needed is the combination of chemical, abrasion and permeation resistance."

The latter has worked well for UCC, who uses vinyl ester products called VE 62 and VE 62-AR, manufactured by Houston-based KCC Corrosion Control.

Thomas Priest, KCC CEO, added another dimension to the possible benefits of permeation resistance.

"While we talk about chemicals and abrasives in a FGD system, what the industry should fear most is water vapor transmission," said Priest. The water vapor transmission permeates through a polymer lining on steel or concrete substrates occurs due to interior tank temperatures being higher that exterior tank temperatures. He said this sets up a pressure or "driving force" to move water vapor through the lining, causing osmotic blisters on steel surfaces and star cracks on concrete surfaces. Permeation resistance of a polymer lining is the single greatest determinant of life expectancy of a polymer lining system.

"KCC VE 62 / VE 62 AR was used to coat test panels that were installed in an FGD ductwork section (specifically the gas cooler) ahead of a part of a Chiyoda CT-121 FGD system," said Bryan Louque, PE of the Pipeline & Hazardous Materials Safety Administration.

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The FGD unit served a 500 MW-plus power station in the Midwest. Other coatings that were tested included troweled on, thick film vinyl esters, a spray epoxy and vulcanized rubber. After six months of operation, the VE 62 test coupons—three in total—showed no visible signs of abrasion or delamination. One of the coupons was removed and DFT measurements obtained. The VE 62 DFT measurements obtained after six months of operation were essentially unchanged from the date of installation, Louque said.

Louque said that KCC VE 62 exhibits excellent abrasion and chemical resistance for a spray applied vinyl ester. Corrosion resistance is excellent based on its inherent abrasion resistance and adhesion to the base metal. Temperature performance is similar to that of other spray applied vinyl ester systems.

Priest says that, in terms of permeation resistance, his firm's vinyl ester coatings (VE 62 and VE 62-AR) have moved the benchmark three decimal places.

"Typical permeation occurs at .01 inches," he explained. "Permeation of our vinyl ester coatings occurs at 0.0003 inches, another order of magnitude."

Rak said that the vinyl ester coating's design also provides high performance when it comes to chemical and temperature resistance.

For even more abrasion resistant on high impact areas in limestone slurry tanks and other high-abrasion environments, KCC has developed top coat (VE 62AR) that Rak said scores very well in Taber abrasion tests – as VE 62AR wears the CS17 wheels out on the test (ASTM D 4060) with no abrasion of the lining. pe

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