Preventing Air-Induced Coating Failures on Concrete

By Vaughn O'Dea, Tnemec Company, Inc.

Outgassing caused by bugholes that were not remediated before the coating was applied. Photos courtesy of the author

Typical cast-in-place concrete wall containing exposed bugholes (upper half of photo) and application of a greenish-colored, epoxy-modified cementitious resurfaur (lower half of photo)

Typical cast-in-place concrete following SSPC-SP 13/NACE 6 surface preparation to expose bugholes

If there is a single point of agreement in the industrial protective coatings business, it is that concrete is porous. Many factors influence the porosity of concrete, including the capillary and gel pores found within the concrete matrix, entrapped air during placement (otherwise known as bugholes), and even entrained air voids from the deliberate addition of air-entrainment admixtures. All said, concrete is a challenging substrate for the monolithic application of high-performance protective coatings. If the porosity of concrete is not properly addressed during surface preparation, coatings applied over concrete can develop pinholes, blowholes, or air inclusions (foaming), resulting in a discontinuous film that, at best, provides short-term barrier protection to the underlying substrate.

Surface preparation is always critical to the coatings process. Many industry standards exist to ensure that concrete, both new and existing, is properly prepared before application of a protective coating. SSPC: The Society for Protective Coatings and NACE International jointly developed a surface preparation standard applicable to this process: SSPC-SP13/NACE No. 6 Surface Preparation of Concrete.

Within this standard is a requirement to repair gouges, bugholes, and other surface anomalies before coating application. Otherwise, as indicated in the standard, surface air voids, pinholes, or excessive porosity may affect the application or performance of the coating. The maximum substrate void size or surface porosity that can be tolerated depends on the coating system and the intended exposures (i.e., mild, moderate, severe). But if voids are not filled before the coating is applied, the trapped air vapor expands and may affect the performance of the coating. Trapped air vapor is of real concern for liquid-rich (neat) coatings, which have a tendency to outgass or pinhole because of excess porosity at the concrete surface. Cast-in-place concrete walls generally contain an abundance of bugholes that form during concrete placement.

If a suitable material is not pushed into these bugholes before application of the topcoat, air will become entrapped within the bughole cavities and will then be released into the protective coating. This phenomenon is known as bughole-induced outgassing. To prevent bughole-induced outgassing, a material must be forced into the bughole cavity, to displace the air within. Such materials include epoxy fairing/putty patching compounds, epoxy polymeric mortars, and epoxy-modified cementitious resurfacers (also

Continued

called epoxy modified cements [EMC]).

Of the materials commonly used to reduce the formation of bughole-induced outgassing within a lining system, epoxy-modified cementitious resurfacers, in the author's experience, has proven to provide the most favorable results. The epoxy-polymer modification allows the cementitious product to be applied as a thin-patch material while maintaining its physical properties. In other words, epoxy-modified cementitious materials can be applied as a parge coat (a thin coat of cement mortar applied to concrete for refinement of the surface) at a thickness of approximately 1/16 inch, or even feather-edged down to 1/32 inch. Another benefit of the epoxy modification is that the density of the cementitious mortar increases, thereby eliminating the susceptibility of the mortar to outgassing when topcoated.

A successful protective coating application over concrete achieves a monolithic film to provide barrier protection. Concrete, whether new or existing, is undisputedly porous; has a surface that is often irregular; and likely contains numerous bugholes or other cavities susceptible to outgassing, unless the substrate is resurfaced before coating application. The key to preventing bughole-induced outgassing and other air-induced coating failures on concrete is to fill the voids, bugholes, and other concrete cavities with a suitable material, thereby creating a contiguous concrete surface before topcoating.

Bibliography

SSPC-SP13/NACE No. 6 (latest revision), "Surface Preparation of Concrete," (Pittsburgh, PA: SSPC, and Houston, TX: NACE).

O'Dea, Vaughn and Savage, Dan, "Preparing Concrete for Coating: Make Sure Your Work Is Up to Industry Standards," *JPCL* (December 2005), 34-38.

O'Dea, Vaughn, "Lengthening Tank Life: Rehabilitating Corroded Concrete Structures," *Public Works Magazine* (April 2006).

Feucht, Albert E., "Failure Analysis of Coatings on Concrete: A Failure Avoidance Tool," *JPCL* (March 2001), 41–47.

Vaughn O'Dea is the Technical Sales Manager, Water/Wastewater for Tnemec Co., Inc., Kansas City, MO. He is an SSPC-certified Protective Coatings Specialist, a NACE-certified Coating Inspector, a NACE-certified Corrosion Technician, and an ICBO-certified Reinforced Concrete Special Inspector.

Please visit us at World of Concrete at Booth N1410

Click our Reader e-Card at paintsquare.com/ric

Click our Reader e-Card at paintsquare.com/ric