UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

NRC INSPECTION MANUAL

PART 9900 TECHNICAL GUIDANCE

ORGCOAT.TG

MAINTENANCE - FILLED ORGANIC COATINGS USED IN MAINTENANCE OF SAFETY RELATED EQUIPMENT

A. PURPOSE

To provide information to inspectors regarding a licensees use of filled organic coatings in the maintenance of fluid systems.

B. BACKGROUND

Filled organic coating is a generic name encompassing numerous types of organic resins used as coatings which have enhanced or added properties obtained through the coating manufacturers' addition of solid filler. The basic coating type is typically one of several: epoxy, polyester, urethane or phenolic. The solids are typically one of a variety of possibilities including: ceramic beads, glass flakes, garnet (powdered aluminum oxide), powdered zinc, chopped glass fibers, or chicken feathers. The filler is selected according to the material property desired. Ceramic, glass, and garnet provide greatly increased hardness and erosion resistance compared to the relatively soft and weak organic resin constituting the basic coating. Powdered zinc additions create a coating that actively prevents corrosion by means of ongoing chemical reactions throughout its service life. Feather or chopped glass fiber additions result in relatively inexpensive high strength-to-weight ratio castable composites.

On a volume basis, these materials are predominantly employed during new plant construction or major upgrades to existing systems. A common use is as a lining for service water systems at coastal plants (coatings are normally termed linings when used in immersion service as in sumps and pipes). Typically, the specified lining will be a flake glass polyester or an aluminum filled epoxy. Service life can be 20 years.

These materials are regarded as high performance coatings because of their chemical resistance and durability. The disadvantages include cost of application due to the requirement for stringent surface preparation measures prior to and during application. No chemical residues, mill scale, or rust can be tolerated on the surfaces to be coated. Failure to achieve and maintain suitably prepared surfaces results in greatly shortened coating life.

A number of filled coatings are available which are aggressively marketed to plant maintenance forces as corrective/protective materials for equipment experiencing erosion or corrosion problems. Vendors of such coatings include Belzona, Chesterton, Palmer and others. The staff makes no endorsement of specific claims of any particular product, but recognizes that this class of

materials is useful in power plants and does possess desirable attributes. However, the staff is concerned that un-engineered uses of such materials, possibly suggested by some marketing claims, may lead to uses contrary to nuclear plant safety.

C. STAFF POSITION

Use of such coating materials is appropriate when applied as erosion or corrosion resisting coatings. Use should be consistent with the manufacturers recommendations regarding service temperature limits, immersion, and chemical environment. These materials are sensitive to errors during application and manufacturer's recommendations need to be closely followed to avoid premature failure.

Use over eroded/corroded areas is appropriate provided the Code minimum thickness has not been violated. Coatings are not ASME Code materials and thus cannot be used to perform structural repairs. Areas where the Code minimums are not met must be replaced, or, restored by weld build-up in the location of the wall loss prior to application of a coating.

Some instances exist where these coatings were used to patch leaks in room cooler tubes. The staff recognizes that repair of such heat exchanger tubes is not a Code controlled activity. In addition, such use of a coating is contrary to good engineering practice and the coating manufacturer's recommendations.

D. INSPECTION GUIDANCE

This guidance is intended for maintenance activities when coatings are used as linings in pumps, valves, pipes and other water conveying components of safety related systems and systems that have a path to a reactor or spent fuel pool without an intervening filter or resin bed.

In reviewing the licensees use of a filled coating, determine the level of the plant staff's experience and history with similar coatings applications. Determine whether the decision to coat the component involved an engineering assessment or if it was motivated largely as a result of marketing claims. In difficult application cases, such as coating pump casings or impellers, determine whether the licensee considered the effect the coating may have, on pump performance, and also whether coating failures may degrade pump performance.

The inspector should ensure that the licensee has considered the following items in determining that a filled coating is appropriate for the intended safety related application, and executed properly, with sufficient 10 CFR 50, Appendix B controls:

1. Is the selected coating appropriate for the system temperature, immersion service, chemical environment (pure water, sea water, borated water), and intended purpose (corrosion barrier versus erosion resisting)? The coating manufacturer's technical literature is the prime source material here.

2. Was ultrasonic testing performed prior to application of the coating to verify that minimum wall thickness requirements were satisfied?

3. Have the consequences of a coating failure been analyzed? Have different failure modes been examined, and is there a program for monitoring coating condition/performance?

4. Were coating application procedures in place and followed? Procedures should include references to coating vendor's recommendations. Key elements include: surface preparation requirements, compatibility with previous coatings (if present), pot life, application method(s), wet or dry film thickness limits (per coat and total), recoating and cure times (minimums/maximums), temperature and humidity limits for application and cure.

5. Were the coating manufacturer's specified time and temperature for adequate cure followed prior to returning the equipment to service?

6. Following coating applications to pumps, examine what performance testing was performed to verify pump acceptance.

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