Issues Related to Accelerated Testing of Materials

During the discussion on January 18, 2008, I indicated that LADWP's Power Test Lab has experience with accelerated weathering testing of power system components, and that I would inquire if there was testing experience that might relate to testing of coatings exposed to drinking water. Table 1 lists a series of ASTM methods with portions that might relate to our testing needs. No one method will suffice for all our needs, but it is important to note the degree of specificity even as regards procedures (e.g., B117). In addition, there are often multiple methods for testing the same characteristic (e.g., D2197, D3359 and D6677). It is likely that elements present in these test methods will guide us to a set of procedures that will produce the information we need to determine coating life.

There is also an informative text on Weathering Test Methods on the Internet, provided by Atlas Materials Testing. The full text of Chapter 10 is given at the following address:

http://www.atlas-mts.com/products/natural-weathering-testing-new/weathering_library/testmeth.shtml

The introduction is so informative and pertinent to our discussion that I have scanned and attached it. An important concept related to accelerated testing is that, as the accelerated test conditions vary increasingly from the service conditions, the applicability one would derive from the test results decreases. It is only through parallel testing in the service environment and the accelerated environment that one can calibrate the accelerated test methods. It is also the case that multiple test methods produce more robust results. We must consider these concepts in developing and/or adopting test methods.

In addition, the duration of the test must produce results that are significantly different from the initial conditions, or an infinite life is predicted. A typical 1000 hr. (40 day), or 2000 hr. (80 day), or even 12 week (84 day) test is useless if it produces results after exposure that are indistinguishable from the initial conditions, be they coating thickness or other diagnostic parameter. Thus any test must have a duration long enough to measure a change in the parameter under study. It is not likely that all materials tested will require the same test duration.

I think that there are established test procedures which we can utilize to determine expected coating life and adhesion with reasonable confidence. This will require study and effort to accomplish.

Table 1

The following ASTM testing methodologies have been used by LADWP employees, and may be of use in understanding coating testing procedures.

B117: Practice for Operating Salt Spray (Fog) Apparatus
D1654: Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
D2197: Adhesion of Organic Coatings by Scrape Adhesion
D2247: Testing Water Resistance of Coatings in 100% Relative Humidity
D3359: Measuring Adhesion by Tape Test
D4585: Testing Water Resistance of Coatings Using Controlled Condensation
D5894: Cyclic Salt Fog/UV Exposure of Painted Metal
D6677: Evaluating Adhesion by Knife
G9: Water Penetration into Pipeline Coatings