



 PPG High Performance Coatings

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PROTECTIVE COATING SYSTEMS FOR NUCLEAR POWER PLANTS

INTRODUCTION

In the 1960's Keeler & Long made the commitment to develop Protective Coating Systems for Nuclear Power Plants. Coating Systems were developed and qualified in accordance with accepted standards, with emphasis upon their usage and specification for NEW construction projects. These systems were applied directly to either concrete or carbon steel substrates utilizing ideal surface preparation.

Presently, there is a necessity to apply these same coating systems or newly formulated systems over the original systems or over substrates which cannot be ideally prepared. Several years ago, Keeler & Long initiated a test program in order to test and qualify systems in conjunction with competitors products and/or with methods of preparation which are considered less than ideal. This test program provides OPERATING Nuclear Plants with qualified methods of preparation and a variety of qualified mixed coating systems.

HISTORY

In 1967, we embarked upon a testing program in order to comply with standards being prepared by the experts in the field and under the jurisdiction of The American National Standards Institute (ANSI). Earlier testing had involved research in order to determine the radiation tolerance and the decontamination properties of a variety of generic coating types including zinc rich, alkyds, chlorinated rubbers, vinyls, latex emulsions, and epoxies. This testing was conducted by various independent laboratories, such as Oak Ridge National Laboratory, Idaho Nuclear, and The Western New York Nuclear Research Center. It was concluded from these tests that almost any generic coating type would produce satisfactory radiation resistance and decontaminability.

Upon completion of the first ANSI Standards, however, it became evident that only Epoxy Coatings would meet the specific minimum acceptance criteria set forth in these standards. The single most important change from the earlier testing was the inclusion of a test which simulates the operation of the emergency core cooling system. This test is referred to as the Loss of Coolant Accident (LOCA) or the Design Basis Accident Condition (DBA). The test involves a high pressure, high temperature, alkaline, immersion environment.

Simultaneous with the preparation of these standards, we prepared to test Epoxy Systems in order to comply with the requirements. First hand knowledge of these standards was available since our personnel assisted in the development of these documents. Equipment was designed and built by our laboratory in order to conduct in-house DBA tests. The required physical and chemical tests were either conducted by us or by universities through research grants.

In 1972, the testing program was taken a step further in order to establish more credibility. The Franklin Institute of Philadelphia constructed an apparatus in order to simulate various Design Basis Accident Conditions and we prepared blocks and panels for an independent evaluation. The test results were among the "First" from an independent source, and these tests substantiated more than two years of in-house testing.

The Franklin Institute tests, along with our in-house testing program, were used as a basis for qualification until 1976. During this period also the following ANSI standards were revised and/or developed:

ANSI N5.9-1967 "Protective Coatings (Paints) for the Nuclear Industry" (Rev. ANSI N512-1974)

ANSI N101.2-1972 "Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities"

ANSI N101.4-1972 "Quality Assurance for Protective Coatings Applied to Nuclear Facilities"

Simultaneously, we developed a written Quality Assurance Program in compliance with ANSI N101.4 - 1972, Appendix B 10CFR50 of the Federal Register, and ANSI N45.2-1971 "Quality Assurance Program Requirements For Nuclear Power Plants".

In 1976, Oak Ridge National Laboratory (ORNL) established a testing program in order to conduct Radiation, Decontamination, and DBA tests under one roof. Keeler & Long, under contract with ORNL, conducted a series of tests in compliance with the parameters established by a major engineering firm and the ANSI standards. These tests, and similar series of tests conducted two years later in 1978, became the basis for the qualification of several of our concrete and carbon steel coating systems. From 1978 to the present day we have continued to qualify through ORNL and several other independent testing agencies any modifications to existing formulas and any changes in surface preparation or application requirements. We have also maintained an in-house testing program used to screen new products as well as modifications of existing systems. Furthermore, progress has continued in the revision of the ANSI standards during this time frame. Revision of these documents is presently under the jurisdiction of the American Society for Testing and Materials (ASTM) as outlined in D3842-80 "Standard Guide for Selection of Test Methods for Coatings Used in Light-Water Nuclear Power Plants".

The future dictates significantly less construction of new Nuclear Plants and much more emphasis upon the repair and maintenance of existing facilities. Our commitment remains the same as it was in 1965; that is, to meet the coating requirements of Nuclear Power Plants.

The following Coating Systems are qualified for Coating Service Level One of a Nuclear Power Plant. "Coating Service Level One pertains to those systems applied to structures, systems and other safety related

components which are essential to the prevention of, or the mitigation of the consequences of postulated accidents that could cause undue risk to the health and safety of the public."

SYSTEM IDENTIFICATION	COATING SYSTEMS	DRY FILM THICKNESS RANGE
CARBON STEEL COATING SYSTEMS		
System S-1 Primer Finish	KL65487107 EPOXY WHITE PRIMER KLE1SERIES EPOXY ENAMEL	3.0 - 14.0 mils DFT 2.5 - 6.0 mils DFT
System S-10 Primer Finish	KL65487107 EPOXY WHITE PRIMER KLD1SERIES EPOXY HI-BUILD ENAMEL	5.0 - 12.0 mils DFT 3.0 - 6.0 mils DFT
System S-11 Primer/Finish	KL65487107 EPOXY WHITE PRIMER	8.0 - 18.0 mils DFT
System S-12 Primer/Finish	KL4500 EPOXY SELF-PRIMING SURFACING ENAMEL	5.0 - 18.0 mils DFT
System S-14 (FLOORS ONLY) Finish	KL5000 EPOXY SELF-LEVELING FLOOR COATING	10.0 - 25.0 mils DFT
System S-15 Primer Finish	KL65487107 EPOXY WHITE PRIMER KL9600N HI-SOLIDS EPOXY COATING	2.5 - 6.0 mils DFT 5.0 - 8.0 mils DFT

CONCRETE COATING SYSTEMS		
System KL-2 Curing Compound/Sealer Surfacer Finish	KL4129 EPOXY CLEAR CURING COMPOUND KL6548S EPOXY SURFACER KLE1SERIES EPOXY ENAMEL	0.5 - 1.75 mils DFT Flush - 50.0 mils DFT 2.5 - 6.0 mils DFT
System KL-8 Curing Compound/Sealer Surfacer Finish	KL4129 EPOXY CLEAR CURING COMPOUND KL6548S EPOXY SURFACER KLD1SERIES EPOXY HI-BUILD ENAMEL	0.5 - 1.75 mils DFT Flush - 50.0 mils DFT 4.0 - 8.0 mils DFT
System KL-9 Curing Compound/Sealer Surfacer Finish	KL4129 EPOXY CLEAR CURING COMPOUND KL65487107 EPOXY WHITE PRIMER KLD1SERIES EPOXY HI-BUILD ENAMEL	0.5 - 1.75 mils DFT 5.0 - 10.0 mils DFT 3.0 - 8.0 mils DFT
System KL-10 Curing Compound/Sealer Surfacer Finish	KL4129 EPOXY CLEAR CURING COMPOUND KL4000 EPOXY SURFACER KLD1SERIES EPOXY HI-BUILD ENAMEL	0.5 - 1.75 mils DFT Flush - 50.0 mils DFT 3.0 - 6.0 mils DFT
System KL-12 Curing Compound/Sealer Surfacer/Finish	KL4129 EPOXY CLEAR CURING COMPOUND KL4500 EPOXY SELF-PRIMING SURFACING ENAMEL	0.5 - 1.75 mils DFT 10.0 - 50.0 mils DFT
System KL-14 (FLOORS ONLY) Primer/Sealer Finish	KL6129 EPOXY CLEAR PRIMER/SEALER KL5000 EPOXY SELF-LEVELING FLOOR COATING	1.5 - 2.5 mils DFT 35.0 - 50.0 mils DFT

SUMMARY OF QUALIFICATION TEST RESULTS

KEELER & LONG maintains a complete file of Nuclear Test Reports which substantiate the specification of the carbon steel and concrete coating systems listed in this bulletin. This file was initiated in the early 1970's and provides complete qualification in accordance with ANSI Standards N5.12 and N101.2. Results for radiation tolerance,

decontamination, and the Design Basis Accident Condition are reported as performed by independent Laboratories. Also reported are the chemical and physical tests which were conducted by the Keeler & Long Laboratory in compliance with the ANSI Standards.

K&L COATING SYSTEM	SUBSTRATE	KEELER & LONG TEST REPORT NO.						
		76-0728-1	78-0810-1	85-0404	85-0524	90-0227	93-0818	93-0601
S-1	Steel	*	*					
S-10	Steel		*					
S-11	Steel		*					
S-12	Steel			*				
S-14	Steel					*		
S-15	Steel						*	
KL-2	Concrete	*	*					
KL-8	Concrete	*						
KL-9	Concrete	*	*					
KL-10	Concrete		*					
KL-12	Concrete				*			
KL-14	Concrete					*		*