LABORATORY TEST REPORT

Testing Project Number: 01931 Date: February 10, 1981

Report # Final Time 7 days Date of Grading: 2-3-81

Total Design Test Duration 7 days Requested by: Mr. D. W. McBride

TITLE: LOCA Testing of Carbo Zinc 11/Phenoline 305 Finish repairability

PURPOSE: To determine the performance of 1c Carboline 191 Primer/1c Phenoline 305 Finish as a repair system for Carbo Zinc 11/Phenoline 305 Finish over a surface preparation of 3M "Clean 'n Strip" and 3M "Rotopeen" when exposed to the PWR 307°F. LOCA Curve and evaluated according to ANSI N101.2-1972, Section 4.5, as interpreted by Carboline. This is a proposed repair procedure for the Waterford Nuclear Station Unit #3 which is being engineered by Ebasco Services, Inc.

CONCLUSIONS: After 7 days of the LOCA Curve, the 1c Carboline 191 Primer/1c Phenoline 305 Finish system over a surface preparation of 3M "Clean 'n Strip" and 3M "Rotopeen" exhibits an acceptable performance when evaluated according to ANSI N101.2-1972, Section, 4.5, as interpreted by Carboline.

DISCUSSION:

From the Carboline Research & Development Laboratory

PROCEDURE:

A. Test Coupons

Description: 2"x4"x1/4" steel certified Carboline ST1 (See Appendix 1)

Surface Preparation: Gritblasted to SSPC-SP5-63 with a 2.0-3.0 mil blast profile.

Abrasive Medium: 50/50 mix of GFH #40 grit and S230 shot.

B. Systems Tested

System	Batch Number	Color	Thinner	Thinning Ratio	DFT Range
1c Carbo Zinc 11	A) OE5477M B) OE1981Z	Green 0300	#33 9L1818M	12%	3.0-3.5 mils
1c Phenoline 305 Finish	A) OH1395M B) OH1491M	Gray C705	Phenoline 9M2285M	10%	4.0-4.5 mils
1c Carboline 191 Primer	A) OC3362M B) OC3361M	Red 0500	[illegible]	15%	4.0-4.5 mils
1c Phenoline 305 Finish	A) OH1395M B) OH1491M	Gray C705	Phenoline 9M2285M	10%	3.0-3.5 mils

Carbo Zinc 11/Phenoline 305 Finish was removed by SSPC-SP3-63, power tool cleaning method. Detailed procedure is outlined in Section C; Repair Procedure.

C. Repair Procedure

1. Remove Carbo Zinc 11/Phenoline 305 Finish with 3M's "Clean 'n Strip" wheel

   a. A residual amount of Carbo Zinc 11 is left on substrate.

2. Restore surface profile with 3M's "Rotopeen"

   a. Operate power tool in two directions over substrate.

3. Solvent wipe substrate to remove grease and oil which may be present from power tool cleaning.

D. Cure Schedule

Carbo Zinc 11: Seven days at 100°F and 100% RH. Phenoline 305 Finish: 48 hours at 72-76°F and 27-32% RH. Carboline 191 Primer: 24 hours at 73-77°F and 29-32% RH. Phenoline 305 Finish: 72 hours at 72-78°F and 28-34% RH and a final cure at 150°F for 24 hours.

E. Exposure

PWR 307°F LOCA Curve

1. Time-Temperature-Pressure Curve

Time	Temperature**	Pressure**
Initial	Ambient	Ambient
Initial to 2 hours, 47 minutes	307°F (153°C)	60 psig
2 hours, 47 minutes to 96 hours*	250°F (121°C)	30 psig
96 hours to 7 days	200°F (93°C)	10 psig

2. Water Chemistry

0.28 Molar H_3BO_3 (3000 ppm Boron)

0.064 Molar $Na_2S_2O_3$

NaOH added to adjust to a pH of 9.5 at 77°F (25°C) in deionized water

*After 2 hours and 47 minutes of exposure, temperature of the test environment was reduced by spraying test solution at 200°F (93°C) into the test chamber which was at 307°F (153°C), giving a final temperature of 250°F (121°C).

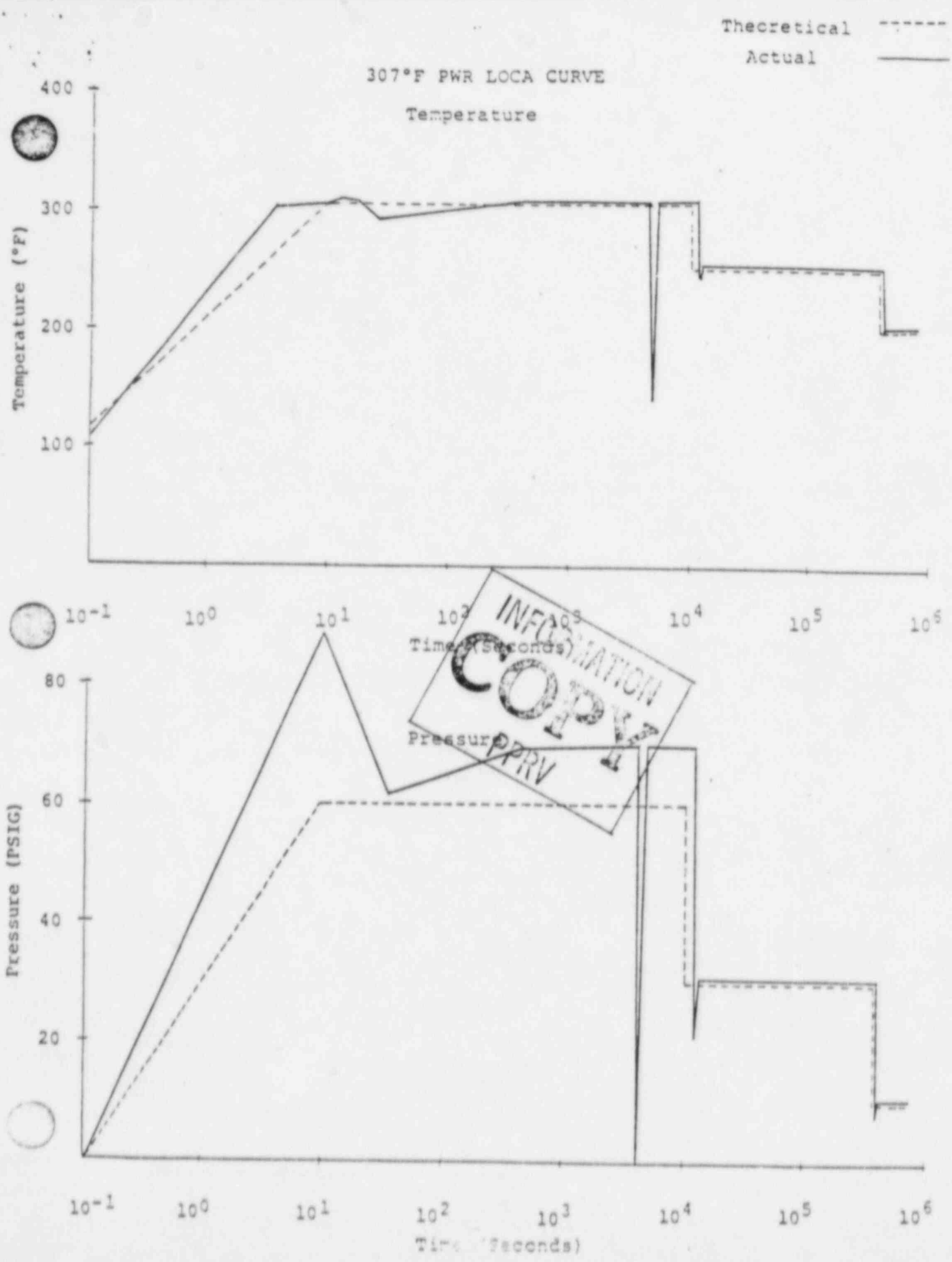
**These are theoretical values. The next page contains graphs of the theoretical and actual LOCA temperature and pressure curves. The data for the actual LOCA curves are taken from the chart recording for this test, which is stored in lab book #230, page 57.

Note: Test was interrupted to place spray nozzles in LOCA chamber. Time was added to test to make up for interruption.

GRADING PROCEDURE: The test coupons were evaluated for performance in the following areas:

1) Material flaking off. 2) Delamination between coats and/or peeling. 3) Blistering of the topcoat. 4) Chalking of the topcoat. 5) Excessive cracking.

Grading procedures specified in Report N101.2-1972 of the American National Standards Institute - Protective Coatings for Light Water Nuclear Reactor Containment Facilities:


Thecretical
Actual
307°F PWR LOCA CURVE
Temperature
400
300
200
100
Temperature (°F)
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
Time (Seconds)
INFORMATION COPY
Pressure
PRV
80
60
40
20
Pressure (PSIG)
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
Time (Seconds)

GRADING
PROCEDURE: (continued)

4.5 Methods of Examining and Evaluating the Exposed Test Specimens

The dynamic and/or static elevated temperature-pressure and irradiation test panels shall be evaluated within 2 hours and again after two weeks after removal from the test chamber for the following surface defects: flaking, delamination and/or peeling, blistering and chalking. Defects listed in Subsection 4.5.1 through 4.5.4 shall be dealt with as follows:

4.5.1 Flaking. ASTM D772, Evaluating Degree of Resistance to Flaking (Sealing) of Exterior Paints, Part 21, American Society for Testing and Materials, Philadelphia, PA 19103. Flaking shall not be permitted.

4.5.2 Delamination and/or Peeling. Delamination and/or peeling shall not be permitted.

4.5.3 Blistering. Blistering shall be limited to a few, intact blisters, Size No. 4, ASTM D714, Standard Method of Evaluating Degree of Blistering of Paints, Part 21, American Society for Testing and Materials, Philadelphia, PA 19103. The number and the size of blisters shall be recorded.

4.5.4 Chalking. ASTM D659, Standard Method of Evaluating Degree of Resistance to Chalking of Exterior Paints, Part 21, American Society for Testing and Materials, Philadelphia, PA 19103. Heavy chalking shall not be permitted.

Any other changes in coating properties which are not also associated with the separation, or the release, of coating from the substrate shall not be a cause for rejection.

ANSI N101.2-1972 Criteria
(As interpreted by Carboline)

	Maximum Degree of Failure Allowable	
Flaking ASTM D772		10 (None)
Delamination or Peeling		None
*Blistering ASTM D714-56	Blister Size	Blister Density
	#2	None
*Note: A blister is not intact when it has resulted in coating being separated	#4	Few
	#6	Medium
	#8	Medium-Dense
Chalking ASTM D659		6 (Moderate)

Note: Flaking, blistering and chalking are all evaluated according to ASTM Standards, with a rating of 10 indicating that no failure was observed in the specific grading area.

RESULTS: PWR 307°F LOCA Curve

Panel Identification and Coating System	Dry Film Thickness	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
1A)*							
Carboline 191 Primer	4.5 mils	10	None	#4F-B	None	--	Acceptable
Phenoline 305 Finish	3.5 mils						
	8.0 mils						
2A)							
Carboline 191 Primer	4.5 mils	10	None	#6M-B	None	--	Acceptable
Phenoline 305 Finish	3.5 mils						
	8.0 mils						
Acceptable Performance ANSI N101.2-1972, Section 4.5, As Interpreted By Carboline		10	None	#4F to #6M to #8MD	#6 (Moderate)	*Panel suspended in the vapor phase.	

carboline

Appendix 1

Carboline Specification CB1

Preparation of Concrete Specimens:

Concrete Composition

Cement, ASTM C150, Type II. Low alkali
Gravel, ASTM C33, size 3/8 inch
Sand, ASTM C33
Water reducing admixture, ASTM C494
Air entraining admixture, ASTM C260
Pozzolans, ASTM C618
Water - Demineralized or distilled water

Concrete Proportions

Cement, 7 sacks per cubic yard
Sand-Gravel ratio, 55 sand, 45 gravel by volume
Pozzolans, to 15 percent replacement of cement
Air entraining admixture, 4-7 percent
Water reducing admixture, as per manufacturer's instructions
Water, to produce a 3 inch slump

Preparation of Test Specimen:

Make and cure the specimen according to ASTM C192, except that no form oils may be used. The face to be tested shall be composed to the form to simulate poured walls and the wood troweled surfaces: Broom finish top surface to simulate floors. No test face shall be saw cut. When applicable, concrete curing agents compatible with the coating system shall be used.

Panels:

The size for concrete panels shall be 2 by 4 inches by 2 inches thick ± 0.2 inches.

Curing Time:

Before concrete specimens are coated, they shall be cured a minimum of 28 days in accordance with ACI 301, "Specifications for Structural Concrete for Buildings." If a concrete curing primer is used, it shall be applied on the concrete within 24 hours after removal of the forms.

Carboline Specification ST1

Steel Test Specimens

Panels: The size for carbon steel panels shall be 2 by 4 inches by 1/4 inch thick ± 0.1 inches with rounded edges and corners. The steel for each specimen shall meet the requirements of ASTM A36, "Standard Specifications for Structural Steel".

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Testing Department

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jag/t.p. 01931

cc: S. Lopata/D. Porthouse/J. Montle/E. Skiles/S. Steinberg/P. Litzsinger/
M. Dugan/Group Leaders

RECEIVED FROM TUSCO (TOLSON) 29 AUG 83 @ 1330 NCW
TOLSON STATED THAT THIS IS THE 5TH PACKAGE FROM THE VAULT

AREA CODE 314
644-1000

carboline.

CABLE-CARBOCO-ST LOUIS
TELEX 44-7332

PROTECTIVE COATINGS
FOR CORROSION RESISTANCE • WATERPROOFING • FIRE PROTECTION • ROOFING

November 7, 1983

Mr. J. T. Merritt, Jr.
Commanche Peak Station
P.O. Box 1001
Glen Rose, TX 76043

Attn: R. G. Tolson

Subject: DBA TEST DATA ON CARBOLINE 191 PRIMER/PHENOLINE 305 FOR TOUCH-UP WORK, TESTING PROJECT 01931

Dear Mr. Tolson:

Per your request from Mr. Tom Kelly, enclosed please find the DBA Test data for your files.

If we can be of further assistance, please do not hesitate to call us.

Sincerely yours,

CARBOLINE COMPANY

Steven J. Harrison

Steven J. Harrison
Power Industry Specialist

SJH/bgf
Enclosure

cc: Tom Kelly

"VAULT PACKAGE" #5