



LABORATORY TEST REPORT

TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975

SUBJECT: L.O.C.A. testing of Carbo Zinc 11 at low film thicknesses, topcoated with Phenoline 305, Phenoline 368WG, and Carboline 191 HB.

REFERENCE: Bechtel 1975 L.O.C.A. Curve, Ref. CP-956; Mr. Charles J. Wiegers.

PURPOSE: To evaluate Carbo Zinc 11 at low film thicknesses, topcoated with Phenoline 305 Finish, Phenoline 368WG, and Carboline 191HB, following exposure to the Bechtel 1975 L.O.C.A. curve, Reference CP-956.

CONCLUSION: After exposure to the 12 day Bechtel 1975 L.O.C.A. criteria, all of the coatings evaluated in this test are exhibiting an acceptable performance when evaluated according to ANSI N101.2-1972, Section 4.5.

PROCEDURE: 1) Test Coupons

2" x 5" x 1/4" sandblasted steel with rounded edges and corners.

2) Systems Tested

Theoretical Dry Film Thickness*

1. 1c Carbo Zinc 11	1.0-1.5 mils
1c Phenoline 305 Finish	3.0 mils
2. 1c Carbo Zinc 11	1.0-1.5 mils
1c Phenoline 305 Finish	6.0 mils
3. 1c Carbo Zinc 11	1.0-1.5 mils
1c Carboline 191HB	3.0 mils
4. 1c Carbo Zinc 11	1.0-1.5 mils
1c Carboline 191HB	6.0 mils
5. 1c Carbo Zinc 11	1.0-1.5 mils
1c Phenoline 368WG	3.0 mils

*Please refer to "Results" for measured Total Dry Film Thickness.

3) Cure Schedule

Carbo Zinc 11: Overnight at high humidity.

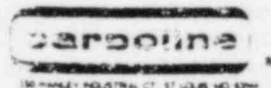
Phenoline 305: Four days at 75°F, final cure.

Carboline 191HB: Seven days at 75°F, final cure.

Phenoline 368WG: Seven days at 75°F, final cure.

From the Carboline Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.



8511060270 851016
PDR FOIA
GARDE85-59 PDR



LABORATORY TEST REPORT

TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975
Page 2

EXPOSURE: Bechtel 1975 LOCA, Ref. CP-956

1) Water Chemistry

Demineralized water test solution containing:

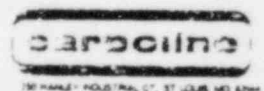
0.28 Molar H_3BO_3 (3000 ppm. Boron),

0.064 Molar $Na_2S_2O_3$,

pH adjusted to 9.5 with reagent grade NaOH.

From the Carbolite Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.



FINAL REPORT - TWELVE DAYS

Page 3

EXPOSURE: (Cont.)

2) Time-Temperature-Pressure Profile

Time Lapse	Pressure, psig	Temperature	Test Conditions
Initial	Atmospheric	70°F - 90°F	Static
0 - 10 Seconds	70 psig (Steam Blast)	300°F	Static
10 Seconds - 30 Minutes	70 psig (Dry Heat)	340°F	Static
30 Minutes - 2 Hours	70 to 30 (Wet) psig Drop at 0.1 psig/second minimum	Decrease to 250°F	Dynamic
2 Hours - 96 Hours	30 psig (Wet)	250°F	Dynamic
4 Days - 12 Days	10 psig (Hot Soak)	200°F	Static

NOTE:

Panels were exposed in pairs so that one panel was suspended in the vapor phase of the chamber while the other was immersed in the liquid phase on the floor of the test chamber.

From the Carboline Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However no guarantee of accuracy is given or implied.

LABORATORY TEST REPORT

Caroline

 $\text{MS} = \text{mean} + \text{error}/\sqrt{n}$, CI, 97% CI, and error



LABORATORY TEST REPORT

TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975
Page 4

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 coating
- 5) Excessive cracking

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

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 2 weeks after removal from the test chamber for the following surface defects: flaking, delamination and/or peeling, blistering, and chalking. Defects listed in Sub-sections 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 (Scaling) 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.

From the Carboline Research & Development Laboratory



LABORATORY TEST REPORT

TESTING PROJECT: 01406
FINAL REPORT TWELVE DAYS

December 26, 1975
Page 5

GRADING
PROCEDURE: (Cont.)

(December 1974)

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

*NOTE: A blister is not
intact when it has resulted
in coating being separated
from the test coupon.

#2
#4
#6
#8

None
Few
Medium
Medium-Dense

Chalking ASTM D659

8 (Light)

*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.

From the Carboline Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.

carboline

50 HAWLEY INDUSTRIAL CT. ST. LOUIS, MO 63104

TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975
Page 6

Coating System	Total Dry Film Thickness (Measured)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
1A)* Carbo Zinc 11 Phenoline 305	4.0 mils	10	None	10	10	Slight coating discoloration	Acceptable
1B) Carbo Zinc 11 Phenoline 305	4.0 mils	10	None	10	10	Moderate coating discoloration	Acceptable
2A)* Carbo Zinc 11 Phenoline 305	6.0 mils	10	None	10	10	Moderate coating discoloration	Acceptable
2B) Carbo Zinc 11 Phenoline 305	6.0 mils	10	None	#6F-B on one edge	10	Moderate coating discoloration	Acceptable
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)	*Panels suspended	in chamber

From the Carbo Zinc Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.



LABORATORY TEST REPORT

CARBOZINC
Carbo Zinc Research & Development Laboratory
10000 1st Avenue, C-11, Dallas, Texas 75243

TESTING PROJECT: 01406
 FINAL REPORT - TWELVE DAYS

December 26, 1975
 Page 7

Coating System	Total Dry Film Thickness (Measured)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
3A)* Carbo Zinc 11 (1) Carboline 191HB	5.5 mils	10	None	10	10	Moderate coating discoloration	Acceptable
4A)* Carbo Zinc 11 Carboline 191HB	8.2 mils	10	None	10	10	Moderate coating discoloration	Acceptable
4B) Carbo Zinc 11 Carboline 191HB	6.0 mils	10	None	10	10	Moderate coating discoloration	Acceptable
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8 MD	#8 (Light)	*Panels suspended in chamber (1) no duplicate panel	

From the Carboline Research & Development Laboratory



LABORATORY TEST REPORT

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.

Carboline
 Carboline Research & Development Laboratory
 1000 W. 10th St., Tulsa, OK 74103

TESTING PROJECT: 01406
 FINAL REPORT - TWELVE DAYS

December 26, 1975
 Page 8

Coating System	Total Dry Film Thickness (Measured)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
5A)* Carbo Zinc 11 Phenoline 368WG	4.5 mils	10	None	10	#9 (Very light)	Moderate coating discoloration	Acceptable
5B) Carbo Zinc 11 Phenoline 368WG	4.7 mils	10	None	10	#9 (Very light)	Moderate coating discoloration	Acceptable
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)	*Panels suspended in chamber	

From the Carboline Research & Development Laboratory

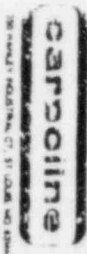
John F. Montle
 John F. Montle
 Vice-President
 Research & Development

Patrick D. Fisher
 Patrick D. Fisher
 Developmental Engineer
 Testing Department

xc: SLL/HDT/JFM/EWS/JDB/JDP/SLS/DRL/CJW/RJT/LAB GROUP LEADERS

LABORATORY TEST REPORT

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.





LABORATORY TEST REPORT

TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975

SUBJECT: L.O.C.A. testing of Carbo Zinc 11 at low film thicknesses, topcoated with Phenoline 305, Phenoline 368WG, and Carboline 191 HB.

REFERENCE: Bechtel 1975 L.O.C.A. Curve, Ref. CP-956; Mr. Charles J. Wiegers.

PURPOSE: To evaluate Carbo Zinc 11 at low film thicknesses, topcoated with Phenoline 305 Finish, Phenoline 368WG, and Carboline 191HB, following exposure to the Bechtel 1975 L.O.C.A. curve, Reference CP-956.

CONCLUSION: After exposure to the 12 day Bechtel 1975 L.O.C.A. criteria, all of the coatings evaluated in this test are exhibiting an acceptable performance when evaluated according to ANSI N101.2-1972, Section 4.5.

PROCEDURE: 1) Test Coupons

2" x 5" x 1/4" sandblasted steel with rounded edges and corners.

2) Systems Tested

Theoretical Dry Film Thickness*

1. 1c Carbo Zinc 11	1.0-1.5 mils
1c Phenoline 305 Finish	3.0 mils
2. 1c Carbo Zinc 11	1.0-1.5 mils
1c Phenoline 305 Finish	6.0 mils
3. 1c Carbo Zinc 11	1.0-1.5 mils
1c Carboline 191HB	3.0 mils
4. 1c Carbo Zinc 11	1.0-1.5 mils
1c Carboline 191HB	6.0 mils
5. 1c Carbo Zinc 11	1.0-1.5 mils
1c Phenoline 368WG	3.0 mils

*Please refer to "Results" for measured Total Dry Film Thickness.

3) Cure Schedule

Carbo Zinc 11: Overnight at high humidity.
Phenoline 305: Four days at 75°F, final cure.
Carboline 191HB: Seven days at 75°F, final cure.
Phenoline 368WG: Seven days at 75°F, final cure.

Package dupe

From the Carboline Research & Development Laboratory



LABORATORY TEST REPORT

TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975
Page 2

EXPOSURE: Bechtel 1975 LOCA, Ref. CP-956

1) Water Chemistry

Demineralized water test solution containing:

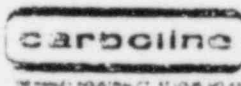
0.28 Molar H_3BO_3 (3000 ppm. Boron),

0.064 Molar $Na_2S_2O_3$,

pH adjusted to 9.5 with reagent grade NaOH.

From the Carboline Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.



The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.

LABORATORY TEST REPORT

From the Carboline Research & Development Laboratory

Time Lapse	Pressure, psig	Temperature	Test Conditions
Initial	Atmospheric	70°F - 90°F	Static
0 - 10 Seconds	70 psig (Steam Blast)	300°F	Static
10 Seconds - 30 Minutes	70 psig (Dry Heat)	340°F	Static
30 Minutes - 2 Hours	70 to 30 (Wet) psig Drop at 0.1 psig/second minimum	Decrease to 250°F	Dynamic
2 Hours - 96 Hours	30 psig (Wet)	250°F	Dynamic
4 Days - 12 Days	10 psig (Hot Soak)	200°F	Static

NOTE: Panels were exposed in pairs so that one panel was suspended in the vapor phase of the chamber while the other was immersed in the liquid phase on the floor of the test chamber.

Carboline



LABORATORY TEST REPORT

TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975
Page 4

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 coating
- 5) Excessive cracking

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

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 2 weeks after removal from the test chamber for the following surface defects: flaking, delamination and/or peeling, blistering, and chalking. Defects listed in Sub-sections 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 (Scaling) 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.

From the Carbolite Research & Development Laboratory



LABORATORY TEST REPORT

TESTING PROJECT: 01406
FINAL REPORT TWELVE DAYS

December 26, 1975
Page 5

GRADING
PROCEDURE: (Cont.)

(December 1974)

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

*NOTE: A blister is not
intact when it has resulted
in coating being separated
from the test coupon.

#2
#4
#6
#8

None
Few
Medium
Medium-Dense

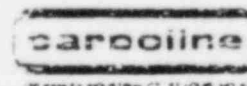
Chalking ASTM D659

8 (Light)

*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.

From the Carboline Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.



TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975
Page 6

Coating System	Total Dry Film Thickness (Measured)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
1A)* Carbo Zinc 11 Phenoline 305	4.0 mils	10	None	10	10	Slight coating discoloration	Acceptable
1B) Carbo Zinc 11 Phenoline 305	4.0 mils	10	None	10	10	Moderate coating discoloration	Acceptable
2A)* Carbo Zinc 11 Phenoline 305	5.0 mils	10	None	10	10	Moderate coating discoloration	Acceptable
2B) Carbo Zinc 11 Phenoline 305	6.0 mils	10	None	#6F-B on one edge	10	Moderate coating discoloration	Acceptable
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)	*Panels suspended	in chamber

From the Carboline Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.



LABORATORY TEST REPORT

Carboline
Carboline Research & Development Laboratory
1000 W. 10th St., Suite 100
Oklahoma City, OK 73106

TESTING PROJECT: 01406
 FINAL REPORT - TWELVE DAYS

December 26, 1975
 Page 7

Coating System	Total Dry Film Thickness (Measured)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
3A)* Carbo Zinc 11 (1) Carboline 191HB	5.5 mils	10	None	10	10	Moderate coating discoloration	Acceptable
4A)* Carbo Zinc 11 Carboline 191HB	8.2 mils	10	None	10	10	Moderate coating discoloration	Acceptable
4B) Carbo Zinc 11 Carboline 191HB	6.0 mils	10	None	10	10	Moderate coating discoloration	Acceptable
Perfect Performance per ANSI N101.2-1975		10	None	04F to 08 MD	08 (Light)	*Panels suspended in chamber (1)no duplicate panel	

From the Carboline Research & Development Laboratory

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.

LABORATORY TEST REPORT

CARBOLINE

TESTING PROJECT: 01406
FINAL REPORT - TWELVE DAYS

December 26, 1975
Page 8

Coating System	Total Dry Film Thickness (Measured)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
5A)* Carbo Zinc 11 Phenoline 368WG	4.5 mils	10	None	10	#9 (Very light)	Moderate coating discoloration	Acceptable
5B) Carbo Zinc 11 Phenoline 368WG	4.7 mils	10	None	10	#9 (Very light)	Moderate coating discoloration	Acceptable
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)	*Panels suspended in chamber	

John F. Montle
John F. Montle
Vice-President
Research & Development

Patrick D. Fisher
Patrick D. Fisher
Developmental Engineer
Testing Department

xc: SLL/HDT/JFM/EWS/JDB/JDP/SLS/DRL/CJW/RJT/LAB GROUP LEADERS

From the Carboline Research & Development Laboratory

LABORATORY TEST REPORT

carboline

The technical data furnished is true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.



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

The technical data furnished are true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.

carboline

Dupe 9511060236

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	Green	#33		
	B) OE1981Z	0300	9L1818M	12%	3.0-3.5 mils
1c Phenoline 305 Finish	A) OH1395M	Gray	Phenoline		
	B) OH1491M	C705	9M2285M	10%	4.0-4.5 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.

1c Carboline 191 Primer	A) OC3362M	Red	#15		
	B) OC3361M	0500	9L0859M	15%	4.0-4.5 mils
1c Phenoline 305 Finish	A) OH1395M	Gray	Phenoline		
	B) OH1491M	C705	9M2285M	10%	3.0-3.5 mils

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 "Rotapeen"
 - 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

<u>Time</u>	<u>Temperature**</u>	<u>Pressure**</u>
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 nozzle in LOCA chamber. Time was added to test to make up for interruption.

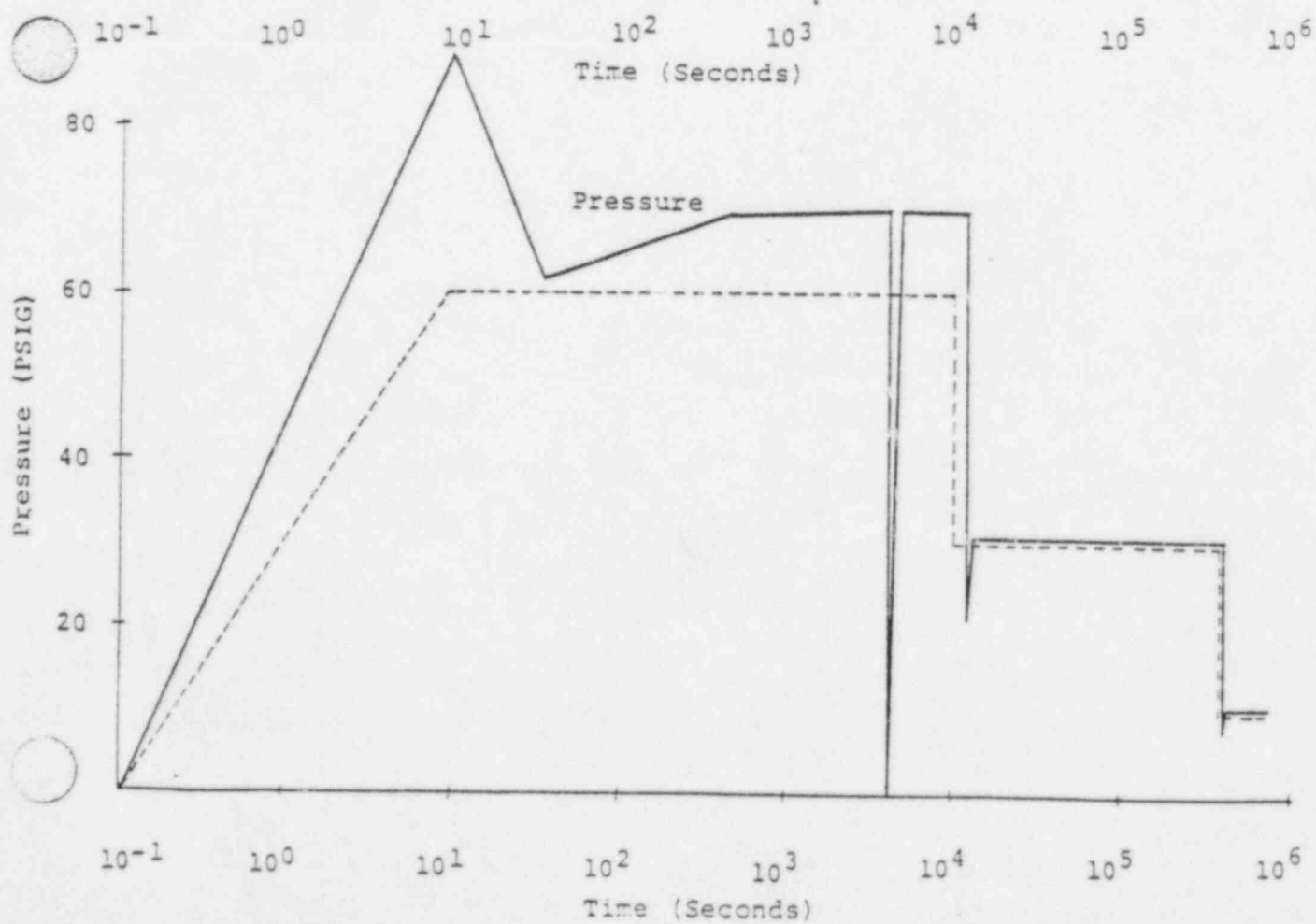
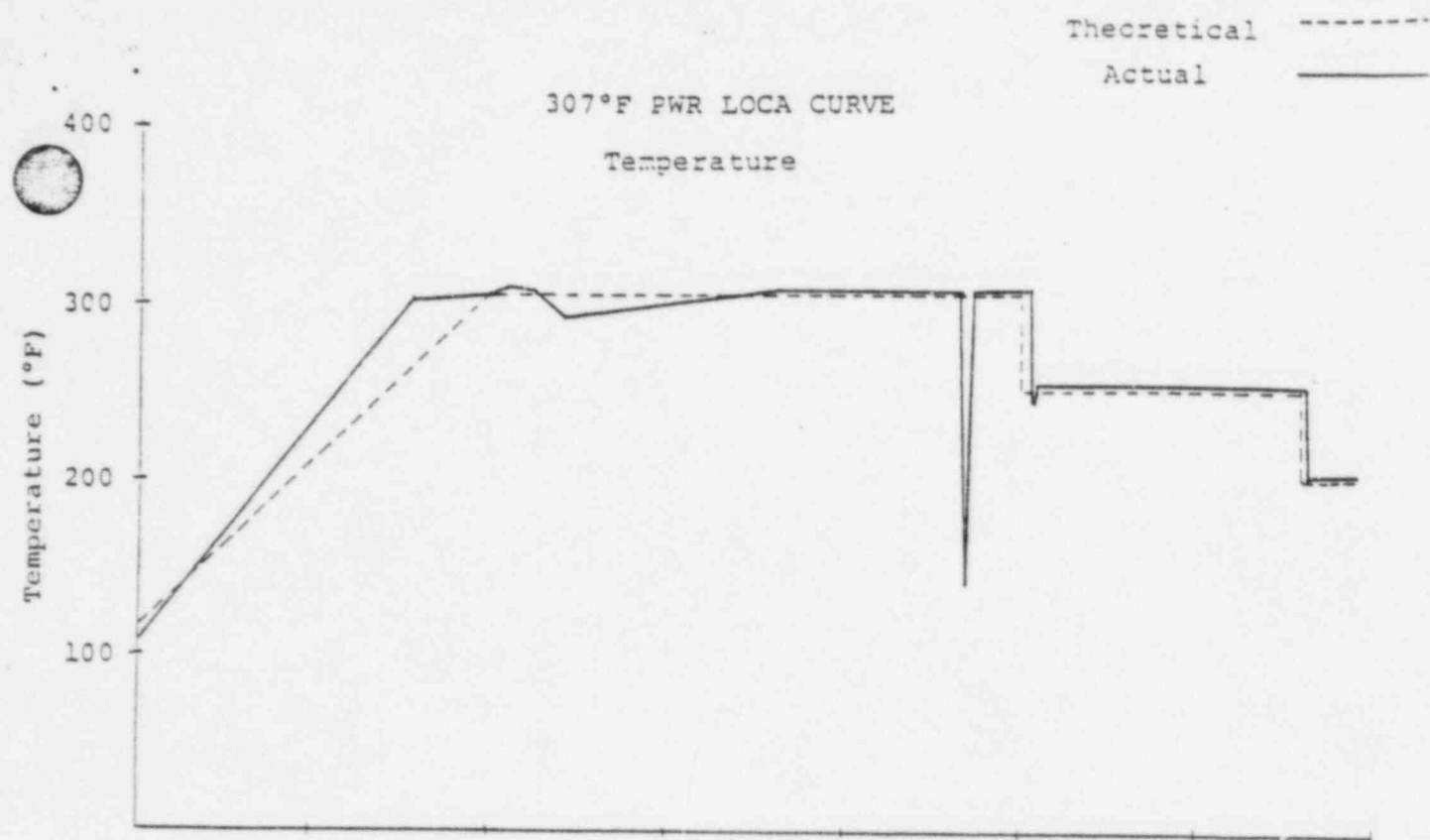
GRADING

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:



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	<u>Blister Size</u>	<u>Blister Density</u>
	#2	None
	#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.

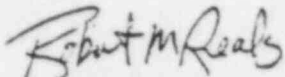
RESULTS: PWR 307°F LOCA Curve

Panel Identification and Coating System	Dry Film Thickness	Flaking	Delamina- tion or Peeling	Blister- ing	Chalking	Other Performance Characteristics	Performance Evaluation
1A)* Carboline 191 Primer Phenoline 305 Finish	4.5 mils 3.5 mils 8.0 mils	10	None	#4F-B	None	--	Acceptable
2A) Carboline 191 Primer Phenoline 305 Finish	4.5 mils 3.5 mils 8.0 mils	10	None	#6M-B	None	--	Acceptable

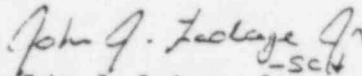
Acceptable Performance ANSI N101.2-1972, Section 4.5, As Interpreted By Carboline	10	None	#4F to #6M to #8MD	#6 (Moderate)	*Panel suspended in the vapor phase. LAB/T-21878-1
---	----	------	--------------------------	---------------	--

TESTING PROJECT: 01931
Final Report: 7 days

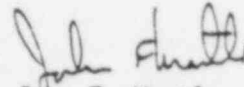
February 10, 1981
Page 6



Robert M. Reals
Lab Technician
Testing Department



John J. Ladage, Jr.
Group Leader
Testing Department



John F. Montle
Vice President
Research and Development

jag/t.p. 01931

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

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 \pm 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 \pm 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".