LABORATORY TEST REPORT

TESTING PROJECT: 01377
FINAL REPORT - 100 DAYS

December 23, 1975

SUBJECT: LOCA testing of Carbo Zinc 11 at various thicknesses alone and topcoated with Phenoline 305.

REFERENCE: Mr. Chris Kjaer - Olsen, General Electric; Mr. Charles J. Wiegers, Carboline Master BWR Curve.

PURPOSE: To evaluate the performance of Carbo Zinc 11 at film thicknesses from 1 to 15 mils, both untopcoated and topcoated with Phenoline 305, when exposed to the Carboline Master BWR Curve.

CONCLUSIONS: After the 100 days of the Carboline Master BWR Curve, the following conclusions have been reached:

1) Carbo Zinc 11 is acceptable according to ANSI N101.2-1972 Section 4.5 as interpreted by Carboline at dry film thicknesses up to 12.5 mils.

2) The 1c Carbo Zinc/1c Phenoline 305 is acceptable according to ANSI N101.2-1972 Section 4.5 as interpreted by Carboline at dry film thicknesses up to 11.5 mils.

3) At dry film thicknesses in excess of those mentioned above, Carbo Zinc 11 and Carbo Zinc/Phenoline 305 are not acceptable. (Please refer to "Results")

PROCEDURE: A) Test Coupons

2" x 5" x 1/8" sandblasted steel panels (blast profile of 1 to 2 mils)

B) Systems Tested — Dry Film Thickness

1) Carbo Zinc 11 (various thicknesses) — Please Refer

2) Carbo Zinc 11 (various thicknesses) Phenoline 305 — to "Results"

C) Cure Schedule

Carbo Zinc 11: 24 hours at 100% humidity, between coats; 3 days at 75°F, final cure (untopcoated Carbo Zinc 11 only).

Phenoline 305: 3 days at 75°F, 24 hours at 120°F, final cure.

From the Carboline Research & Development Laboratory

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PROCEDURE: (Continued)

D) Exposure

Carboline Master BWR Curve
(Reference: UNWCC Draft #1; G.E. Mark III, Dry Well)

1) Water Chemistry

Deionized Water

2) Time-Temperature-Pressure Curve

Time	Temperature	Pressure*
Initial	Ambient	Ambient
Initial - 10 Seconds	332°F	106 psig
10 Seconds - 7 Minutes	250°F	30 psig
7 Minutes - 4 Hours	200°F	11.5 psig
4 Hours - 96 Hours**	180°F (Hot Soak)	7.5 psig
96 Hours - 100 Days	160°F (Hot Soak)	4.7 psig

*System was held at saturation pressure throughout the test cycle; the maximum temperature and pressure experienced by the panels was 332°F and 106 psig.

**The panels were removed from test at this time for grading and development of an interim report. They were then returned for the completion of the 100 day test cycle.

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 N101.2-1972 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 Subsections 4.5.1 through 4.5.4 shall be dealt with as follows:

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GRADING PROCEDURE: (Continued)

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.

(December, 1973)

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
	#4	Few
	#6	Medium
	#8	Medium-Dense
Chalking ASTM D659		8 (Light)

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

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

Coating System	Dry Film Thickness (Actual Thickness)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
1A) Carbo Zinc 11	1 mil (1.5 mils)	10	None	10	10	Moderate salt deposits	Very good
1B) Carbo Zinc 11	1 mil (1.4 mils)	10	None	10	10	Moderate salt deposits	Very good
2A) Carbo Zinc 11	3 mils (2.8 mils)	10	None	10	10	Moderate salt deposits	Very good
2B) Carbo Zinc 11	3 mils (2.7 mils)	10	None	10	10	Moderate salt deposits	Very good
3A) Carbo Zinc 11	5 mils (5.0 mils)	10	None	10	10	Moderate salt deposits	Very good
3B) Carbo Zinc 11	5 mils (5.0 mils)	10	None	10	10	Moderate salt deposits	Very good
4A) Carbo Zinc 11	7 mils (6.5 mils)	10	None	10	10	Salt deposits	Very good
4B) Carbo Zinc 11	7 mils (7.0 mils)	10	None	10	10	Salt deposits	Very good
5A) Carbo Zinc 11	9 mils (9.0 mils)	10	None	10	10	Slight salt deposits; slight "mudcracking" of surface	Good
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)		

Coating System	Dry Film Thickness (Actual Thickness)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
5B) Carbo Zinc 11	9 mils (9.0 mils)	10	None	10	10	Slight salt deposits; slight "mudcracking" of surface	Good
6A) Carbo Zinc 11	11 mils (12.5 mils)	10	None	One > #2 blister, cracked but intact	10	Slight salt deposits; slight "mudcracking" of surface	Unacceptable
6B) Carbo Zinc 11	11 mils (13.5 mils)	10	None	10	10	Slight salt deposits; very slight "mudcracking"	Very good
7A) Carbo Zinc 11	15.0 mils (15.0 mils)	10	None	One #2 blister, one 1-inch blister, one side	10	One blister is cracked but intact; slight "mudcracking"	Unacceptable
7B) Carbo Zinc 11	15.0 mils (15.0 mils)	10	None	10	10	Slight salt deposits; moderate "mudcracking"	Good
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)		

Coating System	Dry Film Thickness (Actual Thickness)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
8A) Carbo Zinc 11 Phenoline 305	1 mil 1 mil (2.2 mils)	10	None	#8F-B near edges, both sides	10	Slight coating discoloration	Very good
8B) Carbo Zinc 11 Phenoline 305	1 mil 1 mil (2.1 mils)	10	None	#8M-B at one corner, one side	10	Slight coating discoloration	Good
9A) Carbo Zinc 11 Phenoline 305	3 mils 1 mil (4.0 mils)	10	None	10	10	Very slight coating discoloration	Excellent
9B) Carbo Zinc 11 Phenoline 305	3 mils 1 mil (3.6 mils)	10	None	10	9 (Very Light)	Very slight coating discoloration	Very Good
10A) Carbo Zinc 11 Phenoline 305	5 mils 1 mil (6.7 mils)	10	None	10	10	Very slight coating discoloration	Excellent
10B) Carbo Zinc 11 Phenoline 305	5 mils 1 mil (5.6 mils)	10	None	10	10	Very slight coating discoloration	Excellent
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)		

Coating System	Dry Film Thickness (Actual Thickness)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
11A) Carbo Zinc 11 Phenoline 305	7 mils 1 mil (8.0 mils)	10	None	One #4 blister, one side	10	Very slight coating discoloration	Good
11B) Carbo Zinc 11 Phenoline 305	7 mils 1 mil (7.8 mils)	10	None	10	10	Slight coating discoloration	Very good
12A) Carbo Zinc 11 Phenoline 305	9 mils 1 mil (9.5 mils)	10	None	10	10	Slight coating discoloration; surface has rough texture	Good
12B) Carbo Zinc 11 Phenoline 305	9 mils 1 mil (10.2 mils)	10	None	10	10	Slight coating discoloration	Very good
13A) Carbo Zinc 11 Phenoline 305	11 mils 1 mil (11.5 mils)	10	None	One >#2 blister, one side; #2F-B one side	10	Some blisters are cracked, but intact. Very slight coating discoloration	Unacceptable
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)		

Coating System	Dry Film Thickness (Actual Thickness)	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
13B) Carbo Zinc 11 Phenoline 305	11 mils 1 mil (12.0 mils)	10	None	#4 to #6F-B, one side	10	Slight coating discoloration	Good
14A) Carbo Zinc 11 Phenoline 305	13 mils 1 mil (15.0 mils)	10	None	#2F-B, one side; #6 to #8F-B, one side	10	Very slight coating discoloration	Unacceptable
14B) Carbo Zinc 11 Phenoline 305	13 mils 1 mil (15.0 mils)	10	None	10	10	Slight coating discoloration	Very good
Perfect Performance per ANSI N101.2-1975		10	None	#4F to #8MD	#8 (Light)		

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FROM TEAMS

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TEXAS UTILITIES SERVICES INC.

OFFICE MEMORANDUM

To R.G. Tolson Glen Rose, Texas June 1, 1982

Subject COMANCHE PEAK STEAM ELECTRIC STATION
DBA TEST RESULTS FOR PROTECTIVE COATINGS

Please find attached one copy each of Carboline Test Project Interim Report and Final Report number 01377 involving high CZ11 Primer thickness.

We are transmitting this report to you for entering into the permanant QA records vault.

R.M. Kissinger
Project Civil Engineer

RMK/MW/sgf
cc: ARMS OL, 1A

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