



LABORATORY TEST REPORT

Testing Project Number: 01978.1

Date: May 14, 1982

Report # Final Time 7 days

Date of Grading: December 22, 1981

Total Design Test Duration 7 days

Requested by: Mr. D. W. McBride

Performance of Carbo Zinc 11 Systems Exposed to 340°F Bechtel
TITLE: CP956-2/76 LOCA Curve.

PURPOSE: The purpose of this testing project is to determine how various Carbo Zinc 11 systems will perform in the upcoming 340°F Bechtel CP956-2/76 LOCA Curve tests at Oak Ridge National Laboratory scheduled for early 1982. The systems to be tested are:

1. 1c Carbo Zinc 11 @ 3 mils
2. 1c Carbo Zinc 11 @ 6 mils
3. 2c Carbo Zinc 11 @ 3/2 mils
4. 3c Carbo Zinc 11 @ 5/2/2 mils
5. 3c Carbo Zinc 11 @ 3/2/2 mils
6. 1c Carbo Weld 11/1c Carbo Zinc 11 @ 1.5/3.0 mils

CONCLUSIONS: Please refer to "Results".

DISCUSSION:

8511070051 851016
PDR FOIA
GARDE85-59 PDR

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.

TEST-012480-1

carboline

207 HANLEY ROAD, ST. LOUIS, MO 63104

A. Test Coupons

Description: 2x4x1/4 steel panels conforming to Carboline Specification ST1 (See Appendix 1)

Surface Preparation: Gritblasted to SSPC-SP 10-63 with a 1.0-3.0 mil profile. Abrasive Medium 50/50 mix of GFH #40 grit and S230 shot.

Note: Before priming, the coupons were vapor degreased.

B. Systems Tested

System Number	Coating System	Color	Batch No.	Dry Film Thinning Thickness		
				Thinner	Ratio	Range
1.	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	10%	3.0-3.3 mils
			B: 1E2388Z	1A2473M		
2.	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	10%	6.2-7.3 mils
			B: 1E2388Z	1A2473M		
3.	1c Carbo Zinc 11	green 0300	A: 0J5543M	#33	12%	3.1-3.4 mils
			B: 9E1683Z	0D3885M		
	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	50%	1.6-2.8 mils
			B: 1E2388Z	1F0964M		
4.	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	10%	6.4-7.0 mils
			B: 1E2388Z	1A2473M		
	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	50%	1.9-2.5 mils
			B: 1E2388Z	1A2473M		
	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	50%	3.5 mils
			B: 1E2388Z	1A2473M		
5.	1c Carbo Zinc 11	green 0300	A: 0J5543M	#33	12%	2.8-3.3 mils
			B: 9E1683Z	0D3885M		
	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	50%	1.6-2.0 mils
			B: 1E2388Z	1F0964M		
	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	50%	1.7-2.0 mils
			B: 1E2388Z	1F0964M		
6.	1c Carbo Weld 11	gray 0700	A: 0M2879M	#33	5%	1.7 mils
			B: 1E2388Z	1A2473M		
	1c Carbo Zinc 11	green 0300	A: 1E5640M	#33	50%	3.0-3.5 mils
			B: 1E2388Z	1A2473M		

C. Cure Schedule				
System Number	Coating System	Time	Temperature Range	Humidity Range
1.	1c Carbo Zinc 11	2 months, 2 weeks	22-83°F	21-97%
2.	1c Carbo Zinc 11	2 months, 2 weeks	22-83°F	21-97%
3.	1c Carbo Zinc 11	7 months, 12 days	21-91°F	10-97%
	1c Carbo Zinc 11	2 months, 16 days	22-83°F	21-97%
4.	1c Carbo Zinc 11	1 month	26-86°F	21-97%
	1c Carbo Zinc 11	24 hours	70-76°F	39-41%
	1c Carbo Zinc 11	34 days	22-69°F	28-97%
5.	1c Carbo Zinc 11	7 months, 12 days	21-91°F	10-97%
	1c Carbo Zinc 11	24 hours	75-79°F	55-60%
	1c Carbo Zinc 11	2 months, 15 days	22-83°F	21-97%
6.	1c Carbo Weld 11	2 weeks	28-69°F	29-97%
	1c Carbo Zinc 11	20 days	22-68°F	28-97%

D. Exposure

Bechtel CP956 (2/76) LOCA Curve

1. Time-Temperature-Pressure Curve

<u>Time</u>	<u>Temperature*</u>	<u>Pressure*</u>
Initial	Ambient	Ambient
Initial to 6 hours	3-5°F (171°C)	70 psig
6 hours to 96 hours	25°F (121°C)	30 psig
96 hours to 7 days	210°F (93°C)	10 psig

*These are theoretical values. The next page are graphs of the theoretical and actual LOCA temperature and pressure curves. The data for the actual LOCA curves are from the chart recording for this test, found on page 97, Lab Book #230.

2. Water Chemistry

Deionized water pH = 7.2

Note: All test panels were suspended in the vapor phase of test.

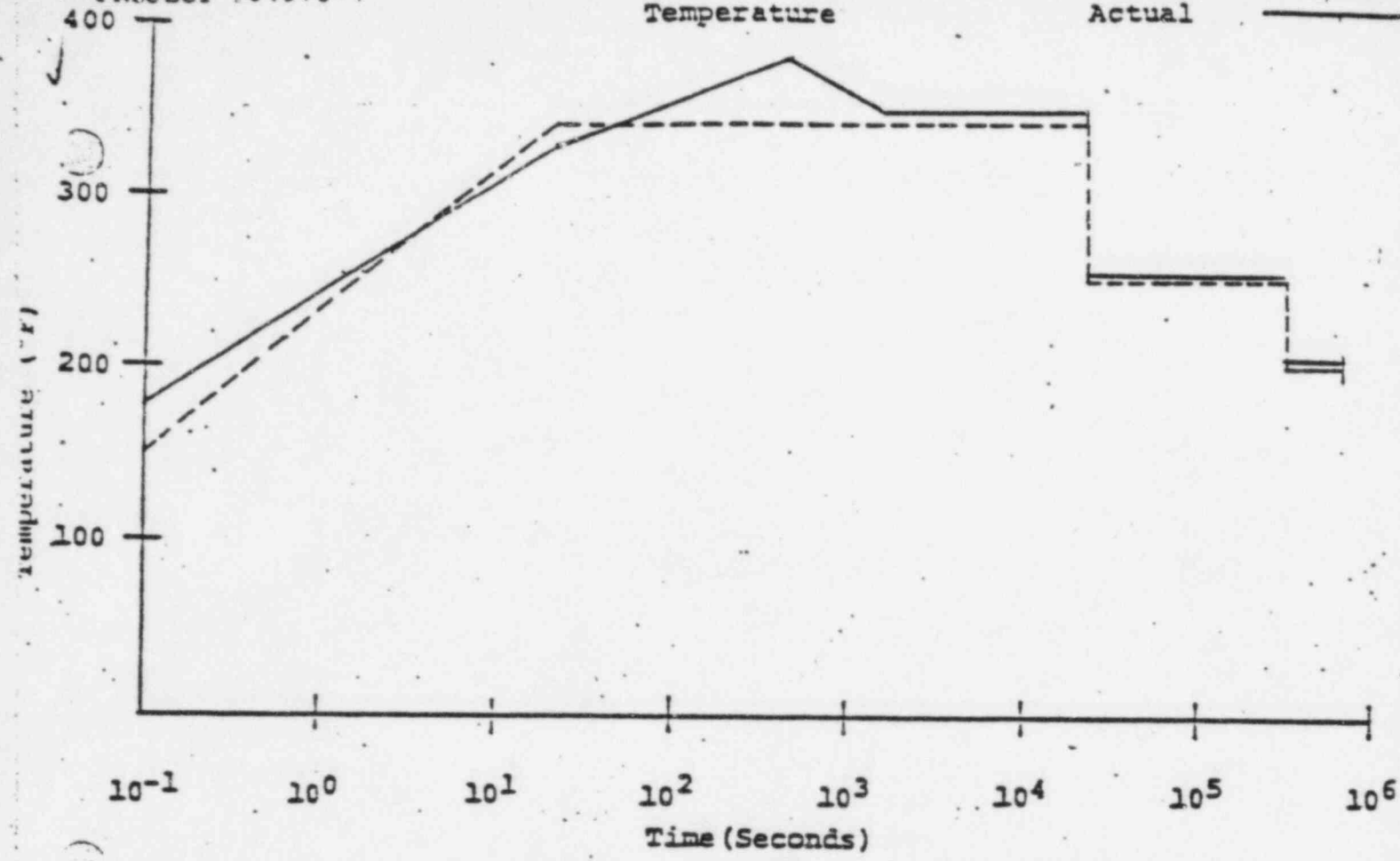
PROJECT #01978-1

SCHEMATIC OF THERMAL - 1/76 LOG CURVE

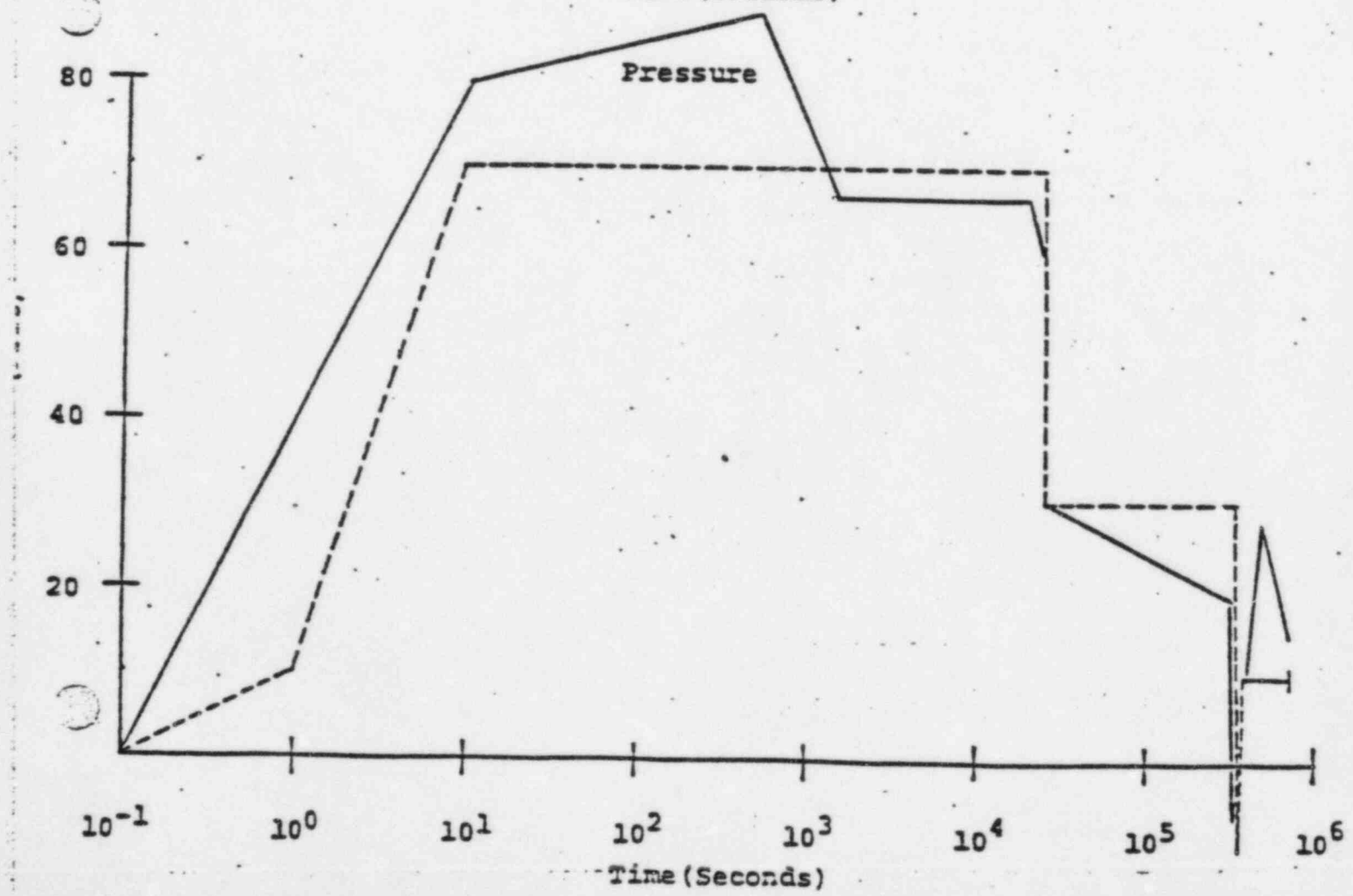
Theoretical

Temperature

Actual



Pressure



LOCA Grading Procedure
(ASTM D3911-80)

The test coupons are examined and evaluated within 4 hours after removal from the test chamber for the following coating defects:

Delamination - report extent
Cracking - report extent
Peeling - report extent
Blistering - report in accordance with ASTM Method D714

Key to Symbols in Results

B-blistering
CD-coating discoloration
F-few

RESULTS:

Panel Identification and Coating System	Dry Film Thickness (mils)	Delamination	Cracking	Peeling	Blistering	Other Performance Characteristics
1A; Side A 1c Carbo Zinc 11	3.0	none	none	none	none	CD
1A; Side B 1c Carbo Zinc 11	3.3	none	none	none	none	CD
2A; Side A 1c Carbo Zinc 11	7.3	none	none	none	none	CD
2A; Side B 1c Carbo Zinc 11	6.2	none	none	none	none	CD
3A; Side A 1c Carbo Zinc 11 1c Carbo Zinc 11	3.4 1.6 5.0	none	none	none	none	CD
3A; Side B 1c Carbo Zinc 11 1c Carbo Zinc 11	3.3 2.6 5.9	none	none	none	none	CD
3B; Side A 1c Carbo Zinc 11 1c Carbo Zinc 11	3.2 2.8 6.0	none	none	none	none	CD
3B; Side B 1c Carbo Zinc 11 1c Carbo Zinc 11	3.1 2.0 5.1	none	none	none	none	CD

✓
Testing Project: 1978.1
Final Report: 7 days

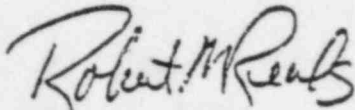
May 14, 1982
Page 7

RESULTS:

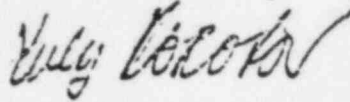
Panel Identification and Coating System	Dry Film Thickness (mils)	Delamination	Cracking	Peeling	Blistering	Other Performance Characteristics
4; Side A						
1c Carbo Zinc 11	6.4	none	none	none	none	CD
1c Carbo Zinc 11	1.9					
1c Carbo Zinc 11	3.5					
	11.8					
4; Side B						
1c Carbo Zinc 11	7.0	From edge	none	none	none	CD
1c Carbo Zinc 11	2.5	spreading 1/2"				
1c Carbo Zinc 11	3.5	onto plane area.				
	13.0					
4; Side A						
1c Carbo Zinc 11	3.0	none	none	none	none	CD
1c Carbo Zinc 11	1.6					
1c Carbo Zinc 11	2.0					
	5.6					
4; Side B						
1c Carbo Zinc 11	3.3	none	none	none	none	CD
1c Carbo Zinc 11	1.7					
1c Carbo Zinc 11	2.0					
	7.0					
3; Side A						
1c Carbo Zinc 11	3.1	none	none	none	none	CD
1c Carbo Zinc 11	2.0					
1c Carbo Zinc 11	1.7					
	6.8					

RESULTS:

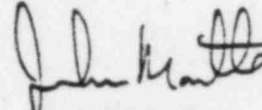
Coating System Identification	Dry Film Thickness (mils)	Delamination	Cracking	Peeling	Blistering	Other Performance Characteristics
; Side B						
1c Carbo Zinc 11	2.8	none	none	none	#2F-B	CD
1c Carbo Zinc 11	2.0					
1c Carbo Zinc 11	2.0					
	6.8					
; Side A						
1c Carbo Weld 11	1.7	none	none	none	none	CD
1c Carbo Zinc 11	3.0					
	4.7					
; Side B						
1c Carbo Weld 11	1.7	From edge	none	none	none	CD
1c Carbo Zinc 11	3.5	spreading 1/2"				
	5.2	onto plane				



Robert M. Reals
Lab Technician
Testing Department



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John Montle
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bic/T.P. 01978.1/
052682

cc: S. Lopata/D. Porthouse/J. Montle/E. Skiles/
S. Steinberg/C. Henson/D. McBride/
M. Dugan/Group Leaders

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 $\frac{1}{2}$ 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".

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
 Oak Ridge National Laboratory
 Date: 10/27/83

REPORT OF IRRADIATION AND DBA TESTING

The irradiation test is conducted in accordance with American Society for Testing and Materials (ASTM) Standard Method D4082-83. The design basis accident (DBA) test is performed in accordance with ASTM Standard Method D3911-80. The tests are designed to meet specifications set in both ANSI report N101.2-1972, Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities, and N5.12-1974, Protective Coatings (Paints) for the Nuclear Industry. The DBA test spray solution was distilled water. The test conditions are listed in Table 1. After both the DBA and irradiation tests, coatings are examined for signs of chalking, blistering, cracking, peeling, delamination, and flaking, according to ASTM standards where applicable. All test panels are returned to the coating manufacturer.

The irradiation tests are run using a spent fuel assembly, removed from the High-Flux Isotope Reactor at ORNL, as the source of radiation. These fuel assemblies are stored under 20 ft of demineralized water. The fuel is 93% enriched U-235 as U₃O₈ combined with aluminum. The spent fuel assemblies are removed after each 23-megawatt-day period. Irradiation is done using the gamma energy from accumulated mixed fission products. This more readily simulates conditions around a reactor than does a cobalt source. Also, the higher gamma activity affords shorter irradiation time to achieve accumulated doses. The dose rate four days after removal of a fuel assembly from the reactor is 1×10^8 rad/h.

The fuel assembly is 20 in. high. A 20-ft-long, 3-1/2-in.-diameter pipe, with one end capped, is used for air irradiation tests. The capped end is lowered into a 4-in. opening at the center of the fuel assembly. The open end, above water level, is covered with an O-ring-sealed flange to which is attached a steel cable and an air outlet hose. The air inlet is located at the bottom of the pipe. Test specimens are connected to the bottom of the cable and lowered into the radiation field. Also at the center of the fuel assembly is a stainless steel-clad cadmium tube used as a neutron absorber. This prevents contamination of the test specimens by induced radiation.

Evaluated RO Emswiler
 Approved WR Loring

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/23/83

ORNL Log Book No. A9675, A10/20/3

Table 1. DBA test conditions

Time	Temperature (°F)	Pressure (psig)	Comments
Start	170		Autoclave preheated.
20 s	340	70 (10 s)	Steam injected.
5 min 50 s	340	70	Steam turned off.
6 h	340	70	Pressure maintained by relief valve.
20 s	220	30	Spray solution added at 75°F.
15 min	220-250	30	Pressure adjusted with N ₂ .
4 d	250	30	
20 s	180	-15	Fresh spray solution added at 75°F after draining autoclave.
10 min	180-200	10	
3 d	200	10	
End of test			

Evaluated *P. B. Smith*
Approved *W. R. Lanning*

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/27/83

Carboline Testing Project #02182

SYSTEM IDENTIFICATION

x Steel panel Concrete block

1c Carbo Zinc 11

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method D4082-83; ORNL Log Book No. A9675, A10-13-3.

Initial dose rate: 1.35×10^7 rad/h

Test conducted in: x air water

<u>Sample No.</u>	<u>Dry Film thickness (mils)*</u>	<u>Cumulative dose</u>	<u>Test results</u>
1	2.5	1.0×10^9 rads	Coating intact, no defects.
2	2.6	1.0×10^9 rads	Coating intact, no defects.
3	2.8	1.0×10^9 rads	Coating intact, no defects.
4	2.8	1.0×10^9 rads	Coating intact, no defects.
9	3.8	1.0×10^9 rads	Coating intact, no defects.
10	4.3	1.0×10^9 rads	Coating intact, no defects.
11	4.5	1.0×10^9 rads	Coating intact, no defects.
12	3.8	1.0×10^9 rads	Coating intact, no defects.

*Dry film thickness values provided by Carboline

Evaluated *R. D. [Signature]*
Approved *W. [Signature]*

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/27/83

Carboline Testing Project #02182

SYSTEM IDENTIFICATION

x Steel panel Concrete block

1c Carbo Zinc 11

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method D4082-83; ORNL Log Book No. A9675, A10-13-3.

Initial dose rate: 1.35×10^7 rad/h

Test conducted in: x air water

<u>Sample No.</u>	<u>Dry Film thickness (mils)*</u>	<u>Cumulative dose</u>	<u>Test results</u>
17	5.8	1.0×10^9 rads	Coating intact, no defects.
18	5.5	1.0×10^9 rads	Coating intact, no defects.
19	6.0	1.0×10^9 rads	Coating intact, no defects.
20	5.8	1.0×10^9 rads	Coating intact, no defects.

*Dry film thickness values provided by Carboline

Evaluated *Robert L. Smith*

Approved *WR Lanning*

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/27/83

Carboline Testing Project #02182

SYSTEM IDENTIFICATION

x Steel panel Concrete block

2c Carbo Zinc 11

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method D4082-83; ORNL Log Book No. A9675, A10-13-3.

Initial dose rate: 1.35×10^7 rad/h

Test conducted in: x air water

<u>Sample No.</u>	<u>Dry Film thickness (mils)*</u>	<u>Cumulative dose</u>	<u>Test results</u>
25	2.1/3.1	1.0×10^9 rads	Coating intact, no defects.
26	2.3/3.2	1.0×10^9 rads	Coating intact, no defects.
27	2.4/3.4	1.0×10^9 rads	Coating intact, no defects.
28	2.4/2.9	1.0×10^9 rads	Coating intact, no defects.
33	3.0/2.3	1.0×10^9 rads	Coating intact, no defects.
34	3.0/2.0	1.0×10^9 rads	Coating intact, no defects.
35	3.0/2.7	1.0×10^9 rads	Coating intact, no defects.
36	3.0/2.7	1.0×10^9 rads	Coating intact, no defects.

*Dry film thickness values provided by Carboline

Evaluated *P. D. Smith*

Approved *W. R. Lamm*

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/27/83

Carboline Testing Project #02182

SYSTEM IDENTIFICATION

x Steel panel

Concrete block

1c Carbo Zinc 11

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A10-20-3.

<u>Sample No.</u>	<u>Dry Film Thickness (mils)*</u>	<u>DBA phase</u>	<u>Test results</u>
**1	2.5	Spray	Coating intact, no defects except discoloration
**2	2.6	Spray	Coating intact, no defects except discoloration
**3	2.8	Spray	Coating intact, no defects except discoloration
**4	2.8	Spray	Coating intact, no defects except discoloration
5	2.7	Spray	Coating intact, no defects except discoloration
6	2.3	Spray	Coating intact, no defects except discoloration
7	2.5	Spray	Coating intact, no defects except discoloration
8	2.6	Spray	Coating intact, no defects except discoloration

*Dry film thickness values provided by Carboline
**Irradiated

Evaluated

R. O. Bartlett

Approved

W. R. Lundy

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/27/83

Carboline Testing Project #02182

SYSTEM IDENTIFICATION

x Steel panel

 Concrete block

1c Carbo Zinc 11

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A10-20-3.

<u>Sample No.</u>	<u>Dry Film Thickness (mils)*</u>	<u>DBA phase</u>	<u>Test results</u>
**9	3.8	Spray	Coating intact, no defects except discoloration
**10	4.3	Spray	Coating intact, no defects except discoloration
**11	4.5	Spray	Coating intact, no defects except discoloration
**12	3.8	Spray	Coating intact, no defects except discoloration
13	4.3	Spray	Coating intact, no defects except discoloration
14	3.8	Spray	Coating intact, no defects except discoloration
15	3.8	Spray	Coating intact, no defects except discoloration
16	3.8	Spray	Coating intact, no defects except discoloration

*Dry film thickness values provided by Carboline
**Irradiated

Evaluated

P. B. Smith

Approved

W. R. Loring

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/27/83

Carboline Testing Project #02182

SYSTEM IDENTIFICATION

x Steel panel

Concrete block

1c Carbo Zinc 11

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A10-20-3.

<u>Sample No.</u>	<u>Dry Film Thickness (mils)*</u>	<u>DBA phase</u>	<u>Test results</u>
**17	5.8	Spray	Coating intact, no defects except discoloration
**18	5.5	Spray	Coating intact, no defects except discoloration
**19	6.0	Spray	Coating intact, no defects except discoloration
**20	5.8	Spray	Coating intact, no defects except discoloration
21	5.8	Spray	Coating intact, no defects except discoloration
22	6.0	Spray	Coating intact, no defects except discoloration
23	5.5	Spray	Coating intact, no defects except discoloration
24	5.8	Spray	Coating intact, no defects except discoloration

*Dry film thickness values provided by Carboline
**Irradiated

Evaluated

R. D. Carlisle

Approved

W. R. Larson

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/27/83

Carboline Testing Project #02182

SYSTEM IDENTIFICATION

x Steel panel

Concrete block

2c Carbo Zinc 11

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A10-20-3.

<u>Sample No.</u>	<u>Dry Film Thickness (mils)*</u>	<u>DBA phase</u>	<u>Test results</u>
**25	2.1/3.1	Spray	Coating intact, no defects except discoloration
**26	2.3/3.2	Spray	Coating intact, no defects except discoloration
**27	2.4/3.4	Spray	Chalking, discoloration
**28	2.4/2.9	Spray	Coating intact, no defects except discoloration
29	2.3/3.2	Spray	Chalking, discoloration
30	2.4/3.1	Spray	Coating intact, no defects except discoloration
31	2.3/3.5	Spray	Coating intact, no defects except discoloration
32	2.4/3.1	Spray	Coating intact, no defects except discoloration

*Dry film thickness values provided by Carboline
**Irradiated

Evaluated

P. B. L. Stouli

Approved

W. R. Loring

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 10/27/83

Carboline Testing Project #02182

SYSTEM IDENTIFICATION

x Steel panel

Concrete block

2c Carbo Zinc 11

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A10-20-3.

<u>Sample No.</u>	<u>Dry Film Thickness (mils)*</u>	<u>DBA phase</u>	<u>Test results</u>
**33	3.0/2.3	Spray	Chalking, discoloration
**34	3.0/2.0	Spray	Chalking, discoloration
**35	3.0/2.7	Spray	Coating intact, no defects except discoloration
**36	3.0/2.7	Spray	Coating intact, no defects except discoloration
37	3.0/2.3	Spray	Coating intact, no defects except discoloration
38	3.0/2.3	Spray	Coating intact, no defects except discoloration
39	3.0/3.0	Spray	Coating intact, no defects except discoloration
40	2.8/2.5	Spray	Coating intact, no defects except discoloration

*Dry film thickness values provided by Carboline
**Irradiated

Evaluated

CRB. [Signature]

Approved

CRB. [Signature]

TEST PANEL PREPARATION DATA

Testing Project #02182

Coating System: 1c Carbo Zinc 11

Substrate Type: Steel, Certified ST1 Surface Prep.: SSPC-SP10-63

For: DBA ☒ Radiation ☒ Decon ☐ Physical ☐ Chemical ☐ Other: ☐

I. Coating System

<u>1c Carbo Zinc 11</u>	at <u>2.0-3.0</u> Mils DFT
_____	at _____ Mils DFT
_____	at _____ Mils DFT
_____	at _____ Mils DFT
_____	at _____ Mils DFT
Total	_____ Mils DFT

II. Batch Numbers

Product <u>CZ 11</u>	Part A <u>3C0841M</u>	Part B <u>3F5182Z</u>
Product _____	Part A _____	Part B _____
Product _____	Part A _____	Part B _____
Product _____	Part A _____	Part B _____
Product _____	Part A _____	Part B _____

III. Application Criteria

Specimen Number	Product	Side	Date Applied	Method Applied	°F Temp.	% Rel. Hum.	Actual Dry Film Thickness	
							DFT/Coat	Total DFT
1	CZ11	A	8/18/83	Spray	78°	75	2.5	2.5
2		B					2.6	2.6
3		A					2.8	2.8
4		B					2.8	2.8
5		A					2.7	2.7
6		B					2.3	2.3
7		A					2.5	2.5
8		B					2.6	2.6

Issued: November 1, 1983

Submitted by: *Yully Kitcher*
Title: Supervisor, Testing Dept.

Sheet 1 of 7

jas/110183
test panel prep data 02182



TEST PANEL PREPARATION DATA

Testing Project #02182

Coating System: 1c Carbo Zinc 11

Substrate Type: Steel, Certified ST1 Surface Prep.: SSPC-SP10-63

For: DBA x Radiation x Decon _____ Physical _____ Chemical _____ Other:

I. Coating System

1c Carbo Zinc 11	at 3.0-5.0 Mils	DFT
	at	Mils DFT
	at	Mils DFT
	at	Mils DFT
	at	Mils DFT
	at	Mils DFT
Total		Mils DFT

II. Batch Numbers

Product CZ 11	Part A 3C0841M	Part B 3F5182Z
Product	Part A	Part B
Product	Part A	Part B
Product	Part A	Part B
Product	Part A	Part B

III. Application Criteria

Specimen Number	Product	Side	Date Applied	Method Applied	°F Temp.	% Rel.Hum.	Actual	
							Dry Film Thickness DFT/Coat	Total DFT
9	CZ11	A	8/17/83	Spray	86°	50	3.8	3.8
10		B					4.3	4.3
11		A					4.5	4.5
12		B					3.8	3.8
13		A					4.3	4.3
14		B					3.8	3.8
15		A					3.8	3.8
16		B					3.8	3.8

Issued: November 1, 1983

Submitted by: Wally Jackson
Title: Supervisor, Testing Dept.

Sheet 2 of 7

jas/110183
test panel prep data 02182



Testing Project #02182

Surface Prep.: SSPC-SP10-63

For: DBA x Radiation x Decon _____ Physical _____ Chemical _____ Other:

1c Carbo Zinc 11		at 5.0-7.0 Mils DFT
		at _____ Mils DFT
		at _____ Mils DFT
		at _____ Mils DFT
		at _____ Mils DFT
	Total	Mils DFT

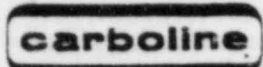
Product	CZ 11	Part A	3C0841M	Part B	3F5182Z
Product		Part A		Part B	
Product		Part A		Part B	
Product		Part A		Part B	
Product		Part A		Part B	

Specimen Number	Product	Side	Date Applied	Method Applied	°F Temp.	% Rel.Hum.	Actual	
							Dry Film DFT/Coat	Thickness Total DFT
17	CZ11	A	8/18/83	Spray	78°	75	5.8	5.8
18		B					5.5	5.5
19		A					6.0	6.0
20		B					5.8	5.8
21		A					5.8	5.8
22		B					6.0	6.0
23		A					5.5	5.5
24		B					5.8	5.8

Submitted by: July 1960
Title: Supervisor, Testing Dept.

Sheet 3 of 7

jas/110183
test panel prep data 02182



380 HAWLEY INDUSTRIAL CT. ST. LOUIS, MO 63104

TEST PANEL PREPARATION DATA

Testing Project #02182

Coating System: 2c Carbo Zinc 11

Substrate Type: Steel, Certified ST1

Surface Prep.: SSPC-SP10-63

For: DBA ☒ Radiation ☒ Decon ☐ Physical ☐ Chemical ☐ Other: ☐

I. Coating System

1st coat Carbo Zinc 11	at	2.1-2.4	Mils DFT
2nd coat Carbo Zinc 11	at	2.9-3.5	Mils DFT
	at		Mils DFT
	at		Mils DFT
	at		Mils DFT
Total			Mils DFT

II. Batch Numbers

Product <u>CZ 11</u>	Part A <u>3C0841M</u>	Part B <u>3F5182Z</u>
Product <u>CZ 11</u>	Part A <u>3C0841M</u>	Part B <u>3F5182Z</u>
Product <u></u>	Part A <u></u>	Part B <u></u>
Product <u></u>	Part A <u></u>	Part B <u></u>
Product <u></u>	Part A <u></u>	Part B <u></u>

III. Application Criteria

Specimen Number	Product	Side	Date Applied	Method Applied	°F Temp.	% Rel. Hum.	Actual	
							Dry Film Thickness DFT/Coat	Total DFT
25	CZ11	A	8/18/83	Spray	78°	75	2.1	2.1
26		B					2.3	2.3
27		A					2.4	2.4
28		B					2.4	2.4
25	CZ11	A	8/19/83	Spray	86	54	3.1	5.2
26		B					3.2	5.5
27		A					3.4	5.8
28		B					2.9	5.3

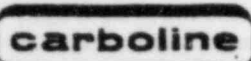
Issued: November 1, 1983

Submitted by: Vicky Koorlor

Title: Supervisor, Testing Dept.

Sheet 4 of 7

jas/110183
test panel prep data 02182



350 PARKLEY INDUSTRIAL CT. ST. LOUIS, MO 63104

TEST PANEL PREPARATION DATA

Testing Project #02182

Coating System: 2c Carbo Zinc 11Substrate Type: Steel, Certified ST1Surface Prep.: SSPC-SP10-63For: DBA ☒ Radiation ☒ Decon ☐ Physical ☐ Chemical ☐ Other: ☐I. Coating System

1st coat Carbo Zinc 11	at	2.1-2.4	Mils DFT
2nd coat Carbo Zinc 11	at	2.9-3.5	Mils DFT
	at		Mils DFT
	at		Mils DFT
	at		Mils DFT
Total			Mils DFT

II. Batch Numbers

Product CZ 11	Part A 3C0841M	Part B 3F5182Z
Product CZ 11	Part A 3C0841M	Part B 3F5182Z
Product	Part A	Part B
Product	Part A	Part B
Product	Part A	Part B

III. Application Criteria

Specimen Number	Product	Side	Date Applied	Method Applied	°F Temp.	% Rel. Hum.	Actual Dry Film Thickness	
							DFT/Coat	Total DFT
29	CZ11	A	8/18/83	Spray	78	75	2.3	2.3
30		B					2.4	2.4
31		A					2.3	2.3
32		B					2.4	2.4
29	CZ11	A	8/19/83	Spray	86	54	3.2	5.5
30		B					3.1	5.5
31		A					3.5	5.8
32		B					3.1	5.5

Issued: November 1, 1983Submitted by: Euly KetterTitle: Supervisor, Testing Dept.

Sheet 5 of 7

jas/110183

test panel prep data 02182



TEST PANEL PREPARATION DATA

Testing Project #02182

Coating System: 2c Carbo Zinc 11

Substrate Type: Steel, Certified ST1 Surface Prep.: SSPC-SP10-63

For: DBA ☒ Radiation ☒ Decon ☐ Physical ☐ Chemical ☐ Other: ☐

I. Coating System

1st coat Carbo Zinc 11	at	2.8-3.0	Mils DFT
2nd coat Carbo Zinc 11	at	2.0-3.0	Mils DFT
	at		Mils DFT
	at		Mils DFT
	at		Mils DFT
Total			Mils DFT

II. Batch Numbers

Product CZ 11	Part A 3C0841M	Part B 3F5182Z
Product CZ 11	Part A 3C0841M	Part B 3F5182Z
Product	Part A	Part B
Product	Part A	Part B
Product	Part A	Part B

III. Application Criteria

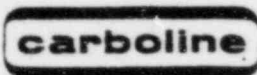
Specimen Number	Product	Side	Date Applied	Method Applied	°F Temp.	% Rel. Hum.	Actual Dry Film Thickness	
							DFT/Coat	Total DFT
33	CZ11	A	8/17/83	Spray	86	50	3.0	3.0
34		B					3.0	3.0
35		A					3.0	3.0
36		B					3.0	3.0
33	CZ11	A	8/19/83	Spray	86	54	2.3	5.3
34		B					2.0	5.0
35		A					2.7	5.7
36		B					2.7	5.7

Issued: November 1, 1983

Submitted by: *July Carter*
Title: Supervisor, Testing Dept.

Sheet 6 of 7

jas/110183
test panel prep data 02182



250 HAWLEY INDUSTRIAL CT. ST. LOUIS MO 63104

TEST PANEL PREPARATION DATA

Testing Project #02182

Coating System: 2c Carbo Zinc 11

Substrate Type: Steel, Certified ST1

Surface Prep.: SSPC-SP10-63

For: DBA x Radiation x Decon Physical Chemical Other:

I. Coating System

1st coat Carbo Zinc 11	at	2.8-3.0	Mils DFT
2nd coat Carbo Zinc 11	at	2.0-3.0	Mils DFT
	at		Mils DFT
	at		Mils DFT
	at		Mils DFT
Total			Mils DFT

II. Batch Numbers

Product <u>CZ 11</u>	Part A <u>3C0841M</u>	Part B <u>3F5182Z</u>
Product <u>CZ 11</u>	Part A <u>3C0841M</u>	Part B <u>3F5182Z</u>
Product <u> </u>	Part A <u> </u>	Part B <u> </u>
Product <u> </u>	Part A <u> </u>	Part B <u> </u>
Product <u> </u>	Part A <u> </u>	Part B <u> </u>

III. Application Criteria

Specimen Number	Product	Side	Date Applied	Method Applied	°F Temp.	% Rel. Hum.	Actual Dry Film Thickness	
							DFT/Coat	Total DFT
37	CZ11	A	8/17/83	Spray	86	50	3.0	3.0
38		B					3.0	3.0
39		A					3.0	3.0
40		B					2.8	2.8
37	CZ11	A	8/19/83	Spray	86	54	2.3	5.3
38		B					2.3	5.3
39		A					3.0	6.0
40		B					2.5	5.3

Issued: November 1, 1983

Submitted by: Willy Cox

Title: Supervisor, Testing Dept.

Sheet 7 of 7

jas/110183
test panel prep data 02182

SURFACE PREP AND CURE DATA FOR TESTING PROJECT 02182

2"x4"x½" certified ASTM A36 Steel

Surface Preparation: gritblasted to SSPC-SP10-82 with a
2.0-3.0 mil profile

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

CURE DATA

Coatings	Cure Time	Temperature Range	Humidity Range
1c CZ 11 @ 2.0-3.0 mils	30 days	80°F (27°C)	80%
1c CZ 11 @ 3.0-5.0 mils	30 days	80°F (27°C)	80%
1c CZ 11 @ 5.0-7.0 mils	30 days	80°F (27°C)	80%
2c CZ 11 @ 2.0/3.0 mils	First Coat:		
	24 hours	74-86°F (23-30°C)	53-78%
	2nd Coat:		
	30 days	80°F (27°C)	80%
2c CZ 11 @ 3.0/2.0 mils	First Coat:		
	48 hours	74-86°F (23-30°C)	50-78%
	2nd Coat:		
	30 days	80°F (27°C)	80%

All CZ11 panels were cured in Thermotron Environmental Chamber at 80°F, 80% R.H. In addition, panels remained in ambient room conditions a few days at Carbolin plus additional time at ORNL prior to testing.

jas/042784

Surface Prep/Cure Data TP02182

carbolinePRODUCT IDENTIFICATION

Product Name Carbo Zinc Product Number 11

Generic Description Inorganic Zinc Primer

Weight Per Gallon Part A Base Range From 8.7 To 9.1 Green
8.6 To 9.0 Grey

Part B Zinc Range From N/A To N/A

Part C N/A Range From N/A To N/A

Viscosity Brookfield Part A - Range From 100 To 300 cps
(list method) 75 ± 2°F Part B - Range From N/A To N/A
Part C - Range From N/A To N/A

Total Solids Part A - 35 ± 3 % Weight N/A % Volume
Part B - 100 % Weight 100 % Volume
Part C - N/A % Weight N/A % Volume

Flash Point D-93-73 ASTM Part A - 56 °F
Part B - Powder °F
Part C - N/A °F
Mixed Components - N/A °F

Mixing Ratio Part A 100 By Weight N/A By Volume
Part B 220 By Weight N/A By Volume
Part C N/A By Weight N/A By Volume

Recoat Time at 40°F 36 hrs. Full Cure Time 36 hrs. At 40 °F
at 50°F 24 hrs. 24 hrs. At 50 °F
at 70°F 12 hrs. 12 hrs. At 70 °F
at 90°F 8 hrs. 8 hrs. At 90 °F

Service Temperature Limits Maximum 110** °F Wet 750 °F Dry
Minimum -60 °F Wet -60 °F Dry

Storage Life 12 Months Pot Life - @ 50°F 16 hrs@70°F 8 hrs@90°F 4 hrs

Compressive strength ASTM C-579-68 7 days @ 70°F N/A
Tensile strength ASTM C-307-61 7 days @ 73°F N/A
Modulus of Elasticity ASTM C-580-74 7 days @ 73°F N/A
Flexural strength ASTM C-580-74 7 days @ 73°F N/A
Initial set time ASTM C-308-71 @ 73°F N/A

**Continuous Immersion Service

Date 5/4/84 Approved Melinda J. Harn Test Report No. N/A
TS- 06376-2

carboline

PRODUCT IDENTITY AND QUALITY ASSURANCE CERTIFICATION RECORD

PURCHASER Carboline Company

CUSTOMER P.O. # _____

SHIP TO
ADDRESS 350 Hanley Ind Ct
St Louis, Mo 63144CARBOLINE INVOICE # 17544ATTENTION Robt Reals

NAME OF PROJECT _____

FORMULATION AND TEST DATA	STANDARD		BATCH	
	Batch Number	N/A	3C 0841m	
Date of Manufacture	N/A	March 1983		
Shelf Life	12 Months	3-84 Exp. Date		
Weight Per Gallon (FTMS 141a, 4-84)	8.5-9.3 lbs.	8.95 lbs.		
Viscosity - Method	Brookfield	Brookfield		
Viscosity	150-250 cps	162 cps		
Temperature	75 ± 2°F	75 °F		
Color - Visual	Depends on Order	GREEN		
Number	N/A	0300		
This Batch Tested By—Initial/Date <u>D.J.</u> <u>4/27/83</u>				

MIXED MATERIAL FORMULATION DATA	MIXING RATIO BY WEIGHT				THEORETICAL COVERAGE			
	100	Parts Base	to	220	Parts Zinc Filler			
Pot Life 8 (minimum) Hours at	75	°F	50	% R.H.				
Flash Point—Pensky-Martens Closed Cup (ASTM D-93) (This Component Only)	56	°F						
Tack Free Time 1/2 (minimum) Hours at	75	°F	50	% R.H.				
Recoat Time 12 (minimum) Hours at	75	°F	50	% R.H.				
Final Dry Time 12 (minimum) Hours at	75	°F	50	% R.H.				
Specified Carboline Thinner #33 or #21								
Recommended Dry Film Thickness Per Coat					2 - 3	Mils		

This product is hereby certified as manufactured in accordance with the Carboline Quality Assurance Program. When mixed in accordance with Carboline printed instructions, it is within manufacturing tolerances of the batches originally tested in accordance with ANSI N101.2, ANSI N101.4 and ANSI 512.

Q.A./Q.C. Supervisor

Signature: John P. StetelDate: 5-2-83Production Services Department—Signature: Wm. B. BrannonTitle: Inspector5-4-83Form Date: 6/18/80Approval: John F. Mittle

QB 61330 4

carboline

PRODUCT IDENTITY AND QUALITY ASSURANCE CERTIFICATION RECORD

PURCHASER Creboline CoCUSTOMER P.O. # "SHIP TO"
ADDRESS 350 HANLEN IND. CT.CARBOLINE INVOICE # 31749St Louis Mo. 63144ATTENTION Susan HamiltonNAME OF PROJECT

Carboline Zinc Filler / Zinc Dust

FILLER NAME & NUMBER / GENERIC TYPE

FILLER NAME AND TEST DATA

	STANDARD	BATCH
Batch Number	N/A	3F5182Z
Date of Manufacture	N/A	June 1983
Shelf Life	24 Months	6/85 Exp. D.
Color - Visual	Metallic Gray	Metallic Gray
Sieve Analysis 325 mesh	5% Maximum Retained	1.5% Retained
(QCT# 127) 100 mesh	99.9% Minimum Through	100% Through
This Batch Tested By—Initial/Date	M.L. 1 7-15-83	

Mixing Ratio: See Liquid Component Product Identity Certifications or Application Instructions.

This product is hereby certified as manufactured in accordance with the Carboline Quality Assurance Program. When used in accordance with Carboline printed instructions, it is within manufacturing tolerances of the batches originally tested in accordance with ANSI N101.2, ANSI N101.4 and ANSI 512.

Q.A./Q.C. InspectorSignature: James Z. Brannon Date: 7-14-83Production Services Department—Signature: Title: Inspector 8/11/83Form Date 4/28/81Approval John F. Mante

QB 42881-1

OAK RIDGE NATIONAL LABORATORY

OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37831

May 2, 1984

Mr. Tom Aldinger
M&QS
Bechtel Group, Inc.
50 Beale Street
P. O. Box 3965
San Francisco, CA 94119

Dear Tom:

This is in response to my phone conversations with Mr. Yuly Korobov and yourself concerning Carboline Testing Project #02182 and your request for clarification of our comments on samples 27, 29, 33 and 34. The comments read "chalking, discoloration". The discoloration occurred on all samples in this test; the color changed from green to dark gray. The chalking as reported for the above samples was not excessive and indicates that some material could be removed from the samples by wiping with a cloth.

If there are any questions or we can be of further service, please call on us.

Sincerely,

R D Brooksbank

R. D. Brooksbank
Chemist

RDB:lp

cc: Yuly Korobov ✓

TESTING PROJECT: 02182

<u>Sample No.</u>	<u>DFT Before</u>	<u>DFT After</u>
1	2.5	2.5
2	2.6	2.6
3	2.8	2.8
4	2.8	2.8
5	2.7	2.3
6	2.3	3.0
7	2.5	2.9
8	2.6	2.3
9	3.8	3.4
10	4.3	3.3
11	4.5	3.3
12	3.8	3.3
13	4.3	2.9
14	3.8	3.3
15	3.8	3.1
16	3.8	3.5
17	5.8	7.0
18	5.5	8.0
19	6.0	7.2
20	5.8	8.0
21	5.8	6.7
22	6.0	7.1
23	5.5	8.0
24	5.8	7.8
25	5.2	5.6
26	5.5	7.4
27	5.8	6.0
28	5.3	6.0
29	5.5	5.8
30	5.5	6.3
31	5.8	6.6
32	5.5	6.2
33	5.3	6.3
34	5.0	6.3
35	5.7	6.3
36	5.7	7.2
37	5.3	6.3
38	5.3	6.6
39	6.0	6.2
40	5.3	6.5