



LABORATORY TEST REPORT

September 12, 1975

TESTING PROJECT: 01377
Interim Report: 96 Hours

SUBJECT: Loss of Coolant Accident testing of Carbo Zinc 11 at various thicknesses, untopcoated and topcoated with Phenoline 305.

REFERENCE: Carboline Master BWR Curve; Mr. Chris Kjaer-olsen, Mr. Jim Neese, Mr. W. R. Shelton, General Electric; Mr. C. J. Wieggers, Carboline.

PURPOSE: Evaluate Carbo Zinc 11 at film thicknesses of 1.4 through 15 mils, both untopcoated and topcoated with 1 mil of Phenoline 305 Finish, when subjected to the Carboline Master BWR/1975 test exposure.

OBSERVATIONS: After the initial four days exposure, all systems are exhibiting an acceptable to excellent performance per the ANSI N101.2-1972, Section 4.5 evaluation criteria.

PROCEDURE: A. Test Coupons

2" x 5" x 1/4" Sandblasted Steel

B. Systems Tested

1.	Carbo Zinc 11	1 mil
2.	Carbo Zinc 11	3 mils
3.	Carbo Zinc 11	5 mils
4.	Carbo Zinc 11	7 mils
5.	Carbo Zinc 11	9 mils
6.	Carbo Zinc 11	11 mils
7.	Carbo Zinc 11	15 mils
8.	Carbo Zinc 11 Phenoline 305	1 mil 1 mil
9.	Carbo Zinc 11 Phenoline 305	3 mils 1 mil
10.	Carbo Zinc 11 Phenoline 305	5 mils 1 mil
11.	Carbo Zinc 11 Phenoline 305	7 mils 1 mil

Dry Film Thickness*



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.

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PDR FOIA
GARDE85-59 PDR



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PROCEDURE: (Continued)

B.	<u>Systems Tested</u>	<u>Dry Film Thickness*</u>
12.	Carbo Zinc 11 Phenoline 305	9 mils 1 mil
13.	Carbo Zinc 11 Phenoline 305	11 mils 1 mil
14.	Carbo Zinc 11 Phenoline 305	13 mils 1 mil

*All dry film thicknesses are given as reported by the Application Department. For measured dry film thicknesses, please refer to "Results".

C. Cure Schedule

Carbo Zinc 11 (no topcoat), 24 hours at 100% Humidity plus 3 days at 75°F.

Carbo Zinc 11, 24 hours at high humidity, Phenoline 305 Finish, 3 days at 75°F plus 1 day at 120°F.

D. Exposure

Carboline Master LOCA Curve, BWR Testing 1/75

1. Water Chemistry

Deionized Water

2. Time-Temperature-Pressure Profile

This test was begun at atmospheric pressure and kept at saturation pressure throughout the complete cycle.

<u>Total Time Lapse</u>	<u>Temperature*</u>	<u>Test Environment</u>
0-10 seconds	(Steam Blast) 332°F	Static
10 seconds-7 minutes	250°F	Static
7 minutes-4 hours	200°F	Static
4 hours-96 hours**	180°F	Static
4 days-100 days	160°F	Static

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Carboline Research & Development Laboratory, 11700 N. 11th St., Dallas, Texas 75243



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PROCEDURE: (Continued)

*These temperatures are the minimum temperature required by the curve; at times the actual temperature may have exceeded this temperature level.

**At this time all test coupons were evaluated for development of this interim report. They were then returned to the chamber for completion of the entire 100 day cycle.

COATING

APPLICATION: Substrate: Carbon Steel coupons sandblasted to a White Metal Finish (SSPC SP-5-63).

Blast Abrasive: 2 parts 5330 Steel Shot, 1 part G40 Steel Grit.

Carbo Zinc 11

Batch Number: 4L5707

Color: Green

Temperature: 85°F

Humidity: 55%

Phenoline 305 Finish

Batch Number: 5E2283M

Catalyst Batch Number: 5D2433

Color: White

Temperature: 85°F

Humidity: 40%



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

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GRADING
PROCEDURE: (Continued)

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:

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.

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GRADING
PROCEDURE: (Continued)

(December, 1973)

ANSI N101.7-1972 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.



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TESTING PROJECT: 01377
Interim Report: 96 Hours

RESULTS:

Coating System and I.D.	Measured Dry Film Thickness	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
1A. Carbo Zinc 11 (1)	1.5 mils	10	None	10	10	Slight salt deposits	Excellent
1B. Carbo Zinc 11 (2)	1.4 mils	10	None	10	10	Slight salt deposits	Excellent
2A. Carbo Zinc 11 (1)	2.8 mils	10	None	10	10	Slight salt deposits; Cracking at vapor-liquid interface (intact)	Very Good
2B. Carbo Zinc 11 (2)	2.7 mils	10	None	10	10	Very slight salt deposits	Excellent
3A. Carbo Zinc 11 (1)	5.0 mils	10	None	10	10	Slight salt deposits	Excellent
3B. Carbo Zinc 11 (2)	5.0 mils	10	None	10	10	Very slight salt deposits	Excellent
Perfect Performance		10	None	#4F to #8MD	#8 (Light)		

- (1) Panels suspended in chamber
(2) Panels set on bottom of chamber

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RESULTS: (Continued)

Coating System and I.D.	Measured Dry Film Thickness	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
4A. Carbo Zinc 11 (1)	6.5 mils	10	None	10	10	Slight salt deposits; Slight cracking at interface (intact)	Very Good
4B. Carbo Zinc 11 (2)	7.0 mils	10	None	10	10	Very slight salt deposits	Excellent
5A. Carbo Zinc 11 (1)	9.0 mils	10	None	10	10	Moderate "Mud-cracking" (intact); Slight salt deposits	Very Good
5B. Carbo Zinc 11 (2)	9.0 mils	10	None	10	10	Moderate "Mud-cracking" (intact); Slight salt deposits	Very Good
6A. Carbo Zinc 11 (1)	12.5 mils	10	None	10	10	Moderate "Mud-cracking" (intact); Slight salt deposits	Very Good
6B. Carbo Zinc 11 (2)	13.5 mils	10	None	10	10	Slight surface cracking (intact); Slight salt deposits	Very Good
Perfect Performance		10	None	#4F to #8MD	#8 (Light)		

- (1) Panels suspended in chamber
(2) Panels set on bottom of chamber

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RESULTS: (Continued)

Coating System and I.D.	Measured Dry Film Thickness	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
7A. Carbo Zinc 11 (1)	15.0 mils	10	None	10	10	Slight salt deposits	Excellent
7B. Carbo Zinc 11 (2)	15.0 mils	10	None	10	10	Slight "Mud-cracking" (intact); Slight salt deposits	Excellent
8A. Carbo Zinc 11 (1) Phenoline 305	2.2 mils	10	None	Smaller than #8F-B at bottom edge, (3) one side	10	Slight coating discoloration	Excellent
8B. Carbo Zinc 11 (2) Phenoline 305	2.1 mils	10	None	10	10	Slight coating discoloration	Excellent
9A. Carbo Zinc 11 (1) Phenoline 305	4.0 mils	10	None	10	10	Chipping on corners and 1 edge due to mechanical damage (4)	Excellent
9B. Carbo Zinc 11 (2) Phenoline 305	3.6 mils	10	None	10	10	Slight coating discoloration (4)	Excellent
Perfect Performance		10	None	#4F to #8MD	#8 (Light)		

- (1) Panels suspended in chamber
(2) Panels set on bottom of chamber
(3) Due to edge effect
(4) Pin-holes in topcoat from application

TESTING PROJECT: 01377
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RESULTS: (Continued)

Coating System and I.D.	Measured Dry Film Thickness	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
10A. Carbo Zinc 11 (1) Phenoline 305	6.7 mils	10	None	10	10	Slight coating discoloration (3)	Excellent
10B. Carbo Zinc 11 (2) Phenoline 305	5.6 mils	10	None	#8F-B at 1 edge and corner, one side (4)	10	Slight coating discoloration (3)	Excellent
11A. Carbo Zinc 11 (1) Phenoline 305	8.0 mils	10	None	10	10	Slight coating discoloration (3)	Excellent
11B. Carbo Zinc 11 (2) Phenoline 305	7.8 mils	10	None	10	10	Slight coating discoloration (3)	Excellent
12A. Carbo Zinc 11 (1) Phenoline 305	9.5 mils	10	None	10	10	Rough topcoat surface and coating discoloration	Excellent
12B. Carbo Zinc 11 (2) Phenoline 305	10.2 mils	10	None	10	10	Slight "Mud-cracking" and coating discoloration (3)	Excellent
Perfect Performance		10	None	#4P to #8MD	#8 (Light)		

- (1) Panels suspended in chamber
(2) Panels set on bottom of chamber
(3) Pin-holes in topcoat from application
(4) Due to edge effect

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TESTING PROJECT: 01377
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RESULTS: (Continued)

Coating System and I.D.	Measured Dry Film Thickness	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
13A. Carbo Zinc 11 (1) Phenoline 305	11.5 mils	10	None	10	10	Slight wrinkling and coating discoloration (3)	Excellent
13B. Carbo Zinc 11 (2) Phenoline 305	12.0 mils	10	None	10	10	Coating discoloration (3) (4)	Excellent
14A. Carbo Zinc 11 (1) Phenoline 305	15 mils	10	None	10	10	Slight coating discoloration (3)	Excellent
14B. Carbo Zinc 11 (2) Phenoline 305	15 mils	10	None	10	10	Slight coating discoloration; Slight "Mud-cracking" (3) (4)	Excellent
Perfect Performance		10	None	#4F to #8MD	#8 (Light)		

- (1) Panels suspended in chamber
(2) Panels set on bottom of chamber
(3) Topcoat is mirroring the heavy CZ11 prime coat
(4) Pin-holes in topcoat from application



LABORATORY TEST REPORT

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DISCUSSION
OF RESULTS:

All panels were evaluated after 96 hours for development of this interim report. The panels have been returned to test and will be re-graded after 100 days.

John F. Montle
Vice President
Research & Development

Patrick D. Fisher
Developmental Engineer
Testing Department

PDF:ph

7750/8391/252/3083/8852/8675/5689/
5377/6665/9517/5470/5471/7197/7196

OR: Testing Department

XC: SLL/HDT/JFM/EWS/JDB/GHD/SLS/DRL/JRL/RJT/CJW/LAB GROUP LEADERS



From the Carboline Research & Development Laboratory

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"VAULT PACKAGE" #4

REC'D FROM TUGCO (TOLSON)
29 AUG 84 @ 1330 NCV
CPPA-22,217

TEXAS UTILITIES SERVICES INC.

Cloned

OFFICE MEMORANDUM

To R.G. Tolson - Site QA Supervisor (TUGCO) Glen Rose, Texas August 13, 1982

Subject COMANCHE PEAK STEAM ELECTRIC STATION
CARBOLINE TEST REPORT NO. SR 80

Please find enclosed Carboline Test Report No. SR 80 , dealing with various tests on carbolines CZ11. Please enter this report in the TUGCO QA permanent records vault.

RMK 158-g
R.M. Kissinger
Project Civil Engineer

RMK/*mw*/sgf
cc: T. Brandt - Technical Support (1L)
ARMS OL, 1A

INFORMATION
COPY
PPRV

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*COLOR PHOTOGRAPHS OF TEST SAMPLES AVAILABLE UPON REQUEST.



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1.

Product Name Carbo Zinc Product Number 11Generic Description Inorganic Zinc Primer

Weight Per Gallon

Part A Base Range From 8.6 To 9.0Part B Zinc Range From N/A To N/APart C N/A Range From N/A To N/AViscosity Brookfield
(list method) at $75 \pm 2^{\circ}\text{F}$ Part A - Range From 100 To 300 cpsPart B - Range From N/A To N/APart C - Range From N/A To N/A

Total Solids

Part A - 35 \pm 3% Weight * % VolumePart B - 100 % Weight 100 % VolumePart C - N/A % Weight N/A % Volume

Flash Point D-93-73 ASTM

Part A - 56 $^{\circ}\text{F}$ Part B - Powder $^{\circ}\text{F}$ Part C - N/A $^{\circ}\text{F}$ Mixed Components - 58 $^{\circ}\text{F}$

Mixing Ratio

Part A 100 By Weight N/A By VolumePart B 220 By Weight N/A By VolumePart C N/A By Weight N/A By Volume

(Minimum) Hrs.

Recoat Time 36 at 40°F
at 70% R.H.24 hrs. at 50°F 12 hrs. at 70°F 8 hrs. at 90°F Full Cure Time 36 hrs. At 40 $^{\circ}\text{F}$ 24 hrs. At 50 $^{\circ}\text{F}$ 12 hrs. At 70 $^{\circ}\text{F}$ 8 hrs. At 90 $^{\circ}\text{F}$

Service Temperature Limits

Maximum 110** $^{\circ}\text{F}$ Wet 750 $^{\circ}\text{F}$ DryMinimum -60 $^{\circ}\text{F}$ Wet -60 $^{\circ}\text{F}$ DryStorage Life 6 MonthsPot 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

Mixed, sprayed, cured material yields 1000 mil sq. ft./gal.

Continuous Immersion Service

Date 8/24/81

Approved

Richard H. StewartTest Report No. SR-80

TS- 06376-2

Report of Irradiation, Decontamination, and DBA Testing
Carboline, St. Louis, Missouri

The Irradiation, Decontamination, and Design Basis Accident (DBA) tests are conducted, respectively, in accordance with Bechtel Corporation Standard Specification Coatings for Nuclear Power Plants, Spec. Nos. CP-951, CP-952, and CP-956. The tests are designed also to meet the specifications set in both A.N.S.I. Report N 101.2-1972, Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities, and N 5.12-1974, Protective Coatings (Paints) for the Nuclear Industry. The DBA test spray solution and the test conditions are listed in Tables 1 and 2. After both the DBA and the irradiation tests, the coatings are examined for signs of chalking, blistering, cracking, peeling, delamination, and flaking, according to ASTM standards where applicable. All except the decontamination 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 (HFIR) at ORNL, as the source of radiation. These fuel assemblies are stored under 20 feet of demineralized water. The fuel is 93% enriched U^{235} as U_3O_8 combined with aluminum. The spent fuel assemblies are removed after each 23-megawatt day period. Irradiation is done using the gamma energy from the 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 1×10^6 rads/hour.

The fuel assembly is 20 inches high. A 20-foot long, 3 1/2-inch diameter pipe, with one end capped, is used for the air irradiation tests. The capped end is lowered into the four-inch opening of the center of the fuel assembly. The open end, above the 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. The test specimens are connected

Evaluated L. Goldberg

Approved W. T. Corbin

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.

The decontamination procedure is as follows: a mixture of fission product nuclides (aged greater than 90 days and less than three years) is neutralized to pH 4 and immediately applied to the test specimens. The specimens are previously degreased in alcohol. After the contaminated spot is air dried, the activities of four of the nuclides are measured by counting with a Ge(Li) detector and a multichannel pulse height analyzer. The specimens are then suspended in a beaker of water at 25°C and washed by stirring for 10 minutes. The specimens are removed, the backs rinsed in water, air dried, and counted as above. The ratios of the activities before, to those after the decontamination are reported as decontamination factors for water. The decontamination and counting steps in 25°C and 80°C acids are repeated, and the respective decontamination factors calculated. The "total overall D. F." is calculated as the ratio of the total activity at the beginning of the test to the total activity at the completion of the three washing steps. All activities are corrected for decay between counts. A computer has been programmed to do all the calculations.



Evaluated

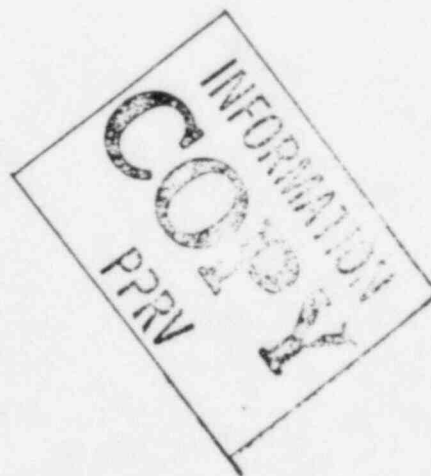
B. G. Lohberg

Approved

L. T. Goff

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA



Test Report No. SR-80

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DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED Carbo Zinc 11
2. TYPE SUBSTRATE Sandblasted Steel SIZE 2" x 4" x 1/4"
3. SURFACE PREPARATION (describe) SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NO.(s) 130, 131
5. DATE AND TIME CURING COMPOUND OR PRIMER APPLIED --

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)±R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
1 c	Carbo Zinc	11	6H5937M 6G6100Z	Spray	68°/28%	130).002/.003 131).0035/.0035	11/12/76

5. CURING CONDITIONS: AMBIENT TEMP 68-79 °F REL. HUMIDITY 20-38
- MINIMUM CURE 17 DAYS
6. TEST PROCEDURE ORNL Master Analytical Manual Methods No. 2 0922
7. TESTING PERFORMED BY Analytical Chemistry Div. DATE SUBMITTED 11/29/76
Oak Ridge National Lab.

[Signature]
TEST REPORT NO. SR-80

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DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED Carbo Zinc 11
2. TYPE SUBSTRATE Sandblasted Steel SIZE 2" x 4" x 1/4"
3. SURFACE PREPARATION (describe) SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NO.(s) 132, 133, 134, 135
5. DATE AND TIME CURING COMPOUND OR PRIMER APPLIED --

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) %R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
1	Carbo Zinc	11	6H5937M 6G6100Z	Spray	68°/28%	132).002/.003 133).002/.0022 134).0047/.0057 135).0037/.0042	11/12/76

5. CURING CONDITIONS: AMBIENT TEMP 68-79 °F REL. HUMIDITY 20-38
MINIMUM CURE 17 DAYS
6. TEST PROCEDURE ORNL Master Analytical Manual Method No. 2 0922
7. TESTING PERFORMED BY Analytical Chemistry Div DATE SUBMITTED 11/29/76
Oak Ridge National Lab.

TEST REPORT NO. SR-80

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DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED Carbo Zinc 11
2. TYPE SUBSTRATE Grit Blasted Steel SIZE 2"x4"x1/4"
3. SURFACE PREPARATION (describe) SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NO.(s) 136, 137
5. DATE AND TIME CURING COMPOUND OR PRIMER APPLIED --

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)%R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
1c	Carbo Zinc	11	6H5937M 6G6100Z	Spray	68°/28%	136).003/.003 137).003/.003	11/12/76

5. CURING CONDITIONS: AMBIENT TEMP 68-79 °F REL. HUMIDITY 20-38
MINIMUM CURE 7 DAYS
6. TEST PROCEDURE ORNL Master Analytical Manual Method No. 270922
7. TESTING PERFORMED BY Analytical Chemistry Div. DATE SUBMITTED 11/29/76
Oak Ridge National Lab.

TEST REPORT NO. SR-80

TS- 06376-3

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DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED Carbo Zinc 11
2. TYPE SUBSTRATE Shot Blasted Steel SIZE 2"x4"x1/4"
3. SURFACE PREPARATION (describe) SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NO.(s) 138, 139
5. DATE AND TIME CURING COMPOUND OR PRIMER APPLIED ---

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
1c	Carbo Zinc	11	6H5937M 6G6100Z	Spray	68°/28%	138).003/.003 139).003/.003	11/12/76

5. CURING CONDITIONS: AMBIENT TEMP 68-79 REL. HUMIDITY 20-38
MINIMUM CURE 17 DAYS
6. TEST PROCEDURE ORNL Master Analytical Manual Method No.2 0922
7. TESTING PERFORMED BY Analytical Chemistry Div. DATE SUBMITTED 11/29/76
Oak Ridge National Lab.


 TEST REPORT NO: SR-20

TS- 06376-3

DBA TEST RESULTS



Test Report No. SR-80

Manufacturer: Carboline
St. Louis, Missouri

Analytical Chemistry Division
 Oak Ridge National Laboratory
 Date: July 23, 1980

ORNL Log Book No. A 7562; 11-29-6

Table 1. DBA solution composition, distilled water

Reagent	Concentration
Boric acid, H_3BO_3	0.28 M
Sodium thiosulfate, $Na_2S_2O_3 \cdot 5H_2O$	0.064 M
Sodium hydroxide, NaOH	Required to adjust pH to 9.5

Table 2. DBA test conditions^a

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

^aTaken from charts on permanent file at ORNL.

Original signed by:

Evaluated G. Goldberg

Approved L. T. Corbin

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: December 17, 1976

System Identification: X Steel Concrete Block

CBCS-22
CZ11

DBA Test Results:

ORNL Master Analytical Manual Method No. 2 0922;
Bechtel Corp. Spec. No. CP-956;
ORNL Log Book No. A 7562; 11-29-6

<u>Sample No.</u>	<u>DBA Phase</u>	<u>Comments**</u>
<u>*130</u>	<u>spray</u>	<u>(SA) Some loss of film thickness, front and back.</u>
<u>*131</u>	<u>spray</u>	<u>(SA) Some loss of film thickness, front and back.</u>
<u>132</u>	<u>spray</u>	<u>(SA) Some loss of film thickness, front and back.</u>
<u>133</u>	<u>spray</u>	<u>(SA) Some loss of film thickness, front and back.</u>
<u>134</u>	<u>spray</u>	<u>(SA) Some loss of film thickness, front and back.</u>
<u>135</u>	<u>spray</u>	<u>(SA) Some loss of film thickness, front and back.</u>
<u>136</u>	<u>spray</u>	<u>(GR) Some loss of film thickness, front and back.</u>
<u>137</u>	<u>spray</u>	<u>(GR) Some loss of film thickness, front and back.</u>
<u>*138</u>	<u>spray</u>	<u>(SH) Some loss of film thickness, front and back.</u>
<u>139</u>	<u>spray</u>	<u>(SH) Some loss of film thickness, front and back.</u>

*Irradiated.

** (SA) = sand blast; (SH) = shot blast; (GR) = grit blast.
No other defects, all panels.

Evaluated J. J. Gellera

Approved L. T. Corbin

RADIATION TOLERANCE TEST RESULTS

Report No. SR-80

Evaluated G. H. Hargis
Approved L. T. Gish

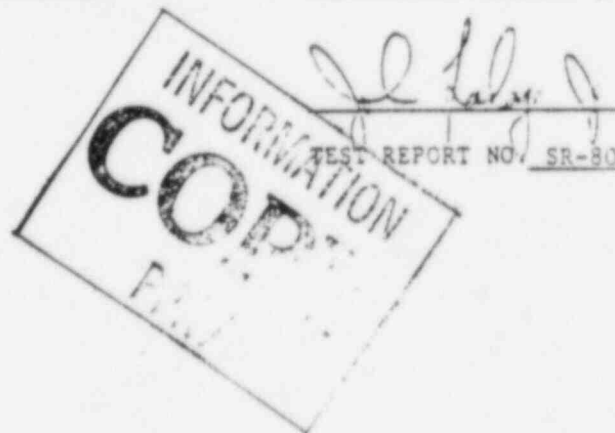
DECONTAMINATION TESTTEST PANEL PREPARATION DATATest Report No. SR-80

DECONTAMINATION TESTBECHTEL CP-952 AND A.N.S.I. N-5.12TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED Carbo Zinc 11
2. TYPE SUBSTRATE Sandblasted Steel SIZE 2"x4"x1/4"
3. SURFACE PREPARATION (describe) SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NO. (s) #140

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(*F) & R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	6H5937M 6G6100Z	Spray	68*/28%	.003/.003	11/12/76

5. CURING CONDITIONS: AMBIENT TEMP. 68-79 °F REL. HUMIDITY 20-38 %
MINIMUM CURE 17 DAYS
6. TEST PROCEDURE ORNL Master Analytical Method No.2 0920
7. TESTING PERFORM BY Analytical Chemistry Div. DATE SUBMITTED 11/29/76
Oak Ridge National Lab.



DECONTAMINATION TEST RESULTS

Manufacturer: Carboline
St. Louis, MO

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: December 3, 1976

Decontamination Test Results:

These tests performed according to ORNL Master Analytical Manual
Method No. 2 0920 and Bechtel Corp. Spec. CP-952.

ORNL Log Book No. A 7562; 11-29-6.

Sample Number	Contaminant	Decontamination Factor (DF)				Percent of Total Activity Removed ¹
		Water @25°C	Acid @25°C	Acid @80°C	Overall	
#51 (SP-81)	Ce-144	4.8	4.5	1.9	41	97.0
	Ru-106	6.4	2.4	1.5	23	
	Cs-137	54	2.6	1.5	210	
	Zr-95	2.1	2.7	1.2	6.6	
	TOTAL	5.8	3.5	1.6	33	
#140 (CZ-11)	Ce-144	5.4	1.2	1.1	7.4	90.0
	Ru-106	7.8	1.3	1.2	12	
	Cs-137	76	1.9	2.0	290	
	Zr-95	3.0	1.4	1.2	5.1	
	TOTAL	6.9	1.3	1.1	10	
	Ce-144					
	Ru-106					
	Cs-137					
	Zr-95					
	TOTAL					
	Ce-144					
	Ru-106					
	Cs-137					
	Zr-95					
	TOTAL					



¹Percent of total activity removed = $(1 - \frac{1}{DF}) \times 100$.

Approved: L. T. Kline

PHYSICAL PROPERTIES

Test Report No. SR-80

PHYSICAL PROPERTIESBECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carbo Zinc 11
2. TYPE SUBSTRATE 4" x 4" x 1/8" Aluminum
3. SURFACE PREPARATION (describe) Grit blasted to SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NOS. 1000, 1001, 1002

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)%R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	6J5954M 6G6100Z	Spray	70°/36%	1000) .003 1001) .003 1002) .003	1/6/77

5. CURING DATA:AMBIENT TEMP. 64-71 °F REL. HUM. 25-36 % MIN. CURE TIME 10 Days6. TEST PROCEDURE: Bechtel Standard CP-954 and A.N.S.I. N-5.127. TEST RESULTS:7.1 ABRASION: Federal Test Method Standard 141 Test Method 6192,
1000 cycles with a CS-17 wheel and a 1000 gram load.LOW - 1065 mg HIGH - 1205 mg AVERAGE - 11557.2 ADHESION: Determined by use of the ELCOMETER ADHESION TESTER

AVERAGE OF 5 TESTS _____ psi

DESCRIBE FAILURE _____

7.3 DIRECT-IMPACT RESISTANCE:

TS- 06376-4

Approved: 

PHYSICAL PROPERTIESBECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carbo Zinc 11
2. TYPE SUBSTRATE Shot Blasted Steel
3. SURFACE PREPARATION (describe) SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NOS. 26, 27, 28, 29, 30

<u>COAT</u>	<u>PRODUCT</u>	<u>PRODUCT CODES</u>	<u>BATCH #</u>	<u>APPLICATION METHOD</u>	<u>CONDITIONS R/M(°F)%R.H.</u>	<u>THICKNESS (ins.)</u>	<u>DATE APPLIED</u>
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°/30%	26).0028/.0035 27).003/.0038 28).0034/.0040 29).0030/.0035 30).0028/.0035	12/10/75

5. CURING DATA:
- AMBIENT TEMP. 65-77 °F REL. HUM. 30-100 MIN. CURE TIME 134 Days

6. TEST PROCEDURE: Bechtel Standard CP-954 and A.N.S.I. N-5.12

7. TEST RESULTS:

- 7.1 ABRASION: Federal Test Method Standard 141 Test Method 6192,
1000 cycles with a CS-17 wheel and a 1000 gram load.

LOW -HIGH -AVERAGE -

- 7.2 ADHESION: Determined by use of the ELCOMETER ADHESION TEST

AVERAGE OF 5 TESTS 475 (500, 450, 625, 550, 250)

DESCRIBE FAILURE Cohesive failure of the coating

- 7.3 DIRECT-IMPACT RESISTANCE:

INFORMATION
COPY
PPRV

Approved: Petrucci & Fisher

PHYSICAL PROPERTIESBECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carbo Zinc 11
2. TYPE SUBSTRATE Grit Blasted Steel
3. SURFACE PREPARATION (describe) SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NOS. 32, 33, 34, 35, 3

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc 11	5J5818M XA5094M		Spray	70°/40%	32).0036/.0040 33).0026/.0032 34).0026/.0031 35).0026/.0034 3).0030/.0032	12/10/75

CURING DATA:

AMBIENT TEMP. 65-77 °F REL. HUM. 30-70 % MIN. CURE TIME 134 Days

6. TEST PROCEDURE: Bechtel Standard CP-954 and A.N.S.I. N-5.12

7. TEST RESULTS:

- 7.1 ABRASION: Federal Test Method Standard 141 Test Method 6192, 1000 cycles with a CS-17 wheel and a 1000 gram load.

LOW -

HIGH -

AVERAGE -

- 7.2 ADHESION: Determined by use of the ELCOMETER ADHESION TESTER

AVERAGE OF 5 TESTS 460 (650,500,500,250,400) psi

DESCRIBE FAILURE Cohesive failure of the coating

- 7.3 DIRECT-IMPACT RESISTANCE:

Approved: Patricia D. Fisher

S- 06376-4

PHYSICAL PROPERTIESBECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carbo Zinc 11
2. TYPE SUBSTRATE Schedule 40 Steel Pipe: 60.3 mm OD by 406 mm long
3. SURFACE PREPARATION (describe) Sandblasted to SSPC-SP10-63
4. PRODUCT DATA: SAMPLE NOS. P15, P16, P17, P18, P19, P20, P21

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)%R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°/70%	P15).0028/.0034 P16).0026/.0028 P17).0028/.0032 P18).003/.0034 P19).0026/.0032 P20).003/.0032 P21).0029/.0033	3/12/76

5. CURING DATA:
- AMBIENT TEMP. 65-77 °F REL. HUM. 30-70 % MIN. CURE TIME 101 Days

6. TEST PROCEDURE: Bechtel Standard CP-954 and A.N.S.I. N-5.12

7. TEST RESULTS:

7.1 ABRASION: Federal Test Method Standard 141 Test Method 6192, 1000 cycles with a CS-17 wheel and a 1000 gram load.

LOW -

HIGH -

AVERAGE -

7.2 ADHESION: Determined by use of the ELCOMETER ADHESION TESTER

AVERAGE OF 5 TESTS _____

psi

DESCRIBE FAILURE _____

7.3 DIRECT-IMPACT RESISTANCE: No effect at 100 inch pounds.

P15) 100 inch pounds

P19) 100 inch pounds

P16) 100 inch pounds

P20) 100 inch pounds

P17) 100 inch pounds

P21) 100 inch pounds

P18) 100 inch pounds

TS- 06376-4

Approved: _____

CHEMICAL EXPOSURE TEST
PANEL PREPARATION AND INDIVIDUAL
CHEMICAL RESISTANCE TEST RESULTS



Test Report No. SR-80

TEST NO. I - ICHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4" CONCRETE STEEL OTHER 2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-633. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 15

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH	.0035/.0040	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F7. CHEMICAL SOLUTION (pH and Concentration): 5% Nitric Acid (pH = 0.8)8. TEST OBSERVATIONS: DATE STARTED 4/26/76
OOT 4/27/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING					
8.2 DELAMINATION					
8.3 BLISTERING					
8.4 OTHER EFFECTS	Coating dissolved in liquid area down to substrate				

RESULTS REVIEWED BY P.D.F.

TEST.42276

TEST REPORT NO. SR-80

TEST NO. I - IICHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4" CONCRETE _____ STEEL X OTHER _____2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-633. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 21

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) & R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH	.0026/.0028	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F7. CHEMICAL SOLUTION (pH and Concentration): 5% Sulfuric Acid (pH = 1.3)8. TEST OBSERVATIONS: DATE STARTED 4/26/76OOT 4/27/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE				
8.2 DELAMINATION	NE				
8.3 BLISTERING	NE				
8.4 OTHER EFFECTS	Sev. Surface Attacks Down to Substrate				

RESULTS REVIEWED BY P.D.F.

TEST.42276

TEST REPORT NO. SR-80

CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4" CONCRETE _____ STEEL X OTHER _____2. SURFACE PREPARATION (describe): Sandblasted to SSP-SP10-633. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 16

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	SJ5818M XA5094M	Spray	70°F/40% RH	.0031/.0035	12/10/75

4. CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F7. CHEMICAL SOLUTION (pH and Concentration): 5% Hydrazine (pH = 9.6)8. TEST OBSERVATIONS: DATE STARTED 4/26/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE	NE	NE	NE
8.2 DELAMINATION	NE	NE	NE	NE	NE
8.3 BLISTERING	NE	NE	NE	NE	NE
8.4 OTHER EFFECTS	NE	NE	NE	NE	NE

RESULTS REVIEWED BY P.O.F.

TEST.42276

TEST REPORT NO. 52-80

TEST NO. I - IVCHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4" CONCRETE STEEL OTHER 2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-633. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 14

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH	.0028/.0032	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F7. CHEMICAL SOLUTION (pH and Concentration): 5% Sodium Hydroxide (pH - 13.1)8. TEST OBSERVATIONS: DATE STARTED 4/26/76OOT 4/28/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE			
8.2 DELAMINATION	NE	NE			
8.3 BLISTERING	NE	NE			
8.4 OTHER EFFECTS	SA in LP	SA in LP down to substrate			

RESULTS REVIEWED BY P.D.F.

TEST.42276

TEST REPORT NO. SR-80

CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4" CONCRETE STEEL X OTHER 2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-633. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 24

<u>COAT</u>	<u>PRODUCT</u>	<u>PRODUCT</u> <u>CODES</u>	<u>BATCH #</u>	<u>APPLICATION</u> <u>METHOD</u>	<u>CONDITIONS</u> <u>R/M(°F) & R.H.</u>	<u>THICKNESS</u> <u>(ins.)</u>	<u>DATE</u> <u>APPLIED</u>
1c	Carbo Zinc	11	SJ5818M XA5094M	Spray	70°F/40% RH	.0026/.0036	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F7. CHEMICAL SOLUTION (pH and Concentration): 5% Ammonium Hydroxide (pH = 11.3)8. TEST OBSERVATIONS: DATE STARTED 4/26/76
4/28/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE			
8.2 DELAMINATION	NE	NE			
8.3 BLISTERING	NE	NE			
8.4 OTHER EFFECTS	SA, S in LP	SA down to Substrate			

RESULTS REVIEWED BY P.O.F.

TEST.42276

TEST REPORT NO. SR-80

CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4" CONCRETE _____ STEEL X OTHER _____2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-633. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 21

<u>COAT</u>	<u>PRODUCT</u>	<u>PRODUCT CODES</u>	<u>BATCH #</u>	<u>APPLICATION METHOD</u>	<u>CONDITIONS R/M(°F)&R.H.</u>	<u>THICKNESS (ins.)</u>	<u>DATE APPLIED</u>
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH	.0036/.0039	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F7. CHEMICAL SOLUTION (pH and Concentration): 5% Sodium Borate (pH = 11.4)8. TEST OBSERVATIONS: DATE STARTED 4/26/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE	NE	NE	NE
8.2 DELAMINATION	NE	NE	NE	NE	NE
8.3 BLISTERING	NE	NE	NE	NE	NE
8.4 OTHER EFFECTS	NE	NE	NE	NE	NE

RESULTS REVIEWED BY P.D.F.

TEST.42276

TEST REPORT NO. SR-80

TEST NO. I - VIICHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4" CONCRETE STEEL X OTHER 2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-633. PRODUCT TESTED: Carbo Zinc 11SAMPLE NO.: 22

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH	.0026/.0030	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F7. CHEMICAL SOLUTION (pH and Concentration): 0.5M Sodium Fluoride (pH = 7.6)8. TEST OBSERVATIONS: DATE STARTED 4/26/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE	NE	NE	NE
8.2 DELAMINATION	NE	NE	NE	NE	NE
8.3 BLISTERING	NE	NE	NE	NE	NE
8.4 OTHER EFFECTS	NE	NE	CD @ LVP	CD @ LVP	CD @ LVP

RESULTS REVIEWED BY P.D.F.

TEST.42276

TEST REPORT NO. SS-80

CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4" CONCRETE STEEL X OTHER 2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-633. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 11

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH	.0022/.0032	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F7. CHEMICAL SOLUTION (pH and Concentration): 5% Citric Acid (pH = 2.6)8. TEST OBSERVATIONS: DATE STARTED 4/26/76OOT 4/28/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	Slight peel- ing on edges	Peeling on edges in			
8.2 DELAMINATION	in LP NE	LP NE			
8.3 BLISTERING	NE	NE			
8.4 OTHER EFFECTS	S, CD in LP	SA to sub- strate S.			

RESULTS REVIEWED BY P.P.F.

TEST.42276

TEST REPORT NO. SR-80

TEST NO. I - IX

CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4" CONCRETE STEEL X OTHER
2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-63
3. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 20

COAT	PRODUCT	PRODUCT		APPLICATION METHOD	CONDITIONS		THICKNESS (ins.)	DATE APPLIED
		CODES	BATCH #		R/M(°F)	%R.H.		
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH		.0032/.0038	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION °F
7. CHEMICAL SOLUTION (pH and Concentration): 5% Sodium Phosphate (pH = 9.5)
8. TEST OBSERVATIONS: DATE STARTED 4/26/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE	NE	NE	NE
8.2 DELAMINATION	NE	NE	NE	NE	NE
8.3 BLISTERING	NE	NE	NE	NE	NE
8.4 OTHER EFFECTS	NE	SL. CD in LP	SL. CD in LP	SL. CD in LP	SL. CD in Liquid Phase

RESULTS REVIEWED BY P.D.F.

TEST.42276

TEST REPORT NO. SR-80

TEST NO. I - XCHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4" CONCRETE STEEL X OTHER
2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-63
3. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 17

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH	.0035/.0038	12/10/75

4. CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F
7. CHEMICAL SOLUTION (pH and Concentration): 0.3M Hydrogen Peroxide (pH = 6.8)
8. TEST OBSERVATIONS: DATE STARTED 4/25/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE	NE	NE	NE
8.2 DELAMINATION	NE	NE	NE	NE	NE
8.3 BLISTERING	NE	NE	NE	NE	NE
8.4 OTHER EFFECTS	NE	V. SL CD in LP	V SL CD in LP	SL CD in LP	SL CD in LP

RESULTS REVIEWED BY P.D.F.

TEST.42276

CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4" CONCRETE _____ STEEL x OTHER _____
2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-63
3. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 19

<u>COAT</u>	<u>PRODUCT</u>	<u>PRODUCT</u> <u>CODES</u>	<u>BATCH #</u>	<u>APPLICATION</u> <u>METHOD</u>	<u>CONDITIONS</u> <u>R/M(°F)&R.H.</u>	<u>THICKNESS</u> <u>(ins.)</u>	<u>DATE</u> <u>APPLIED</u>
1c	Carbo Zinc	11	5J5818M XA5094M	Spray	70°F/40% RH	.0035/.0041	12/10/71

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F
7. CHEMICAL SOLUTION (pH and Concentration): 0.3M Potassium Permanganate (pH = 8.0)
8. TEST OBSERVATIONS: DATE STARTED 4/76/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE	NE	NE	NE
8.2 DELAMINATION	NE	NE	NE	NE	NE
8.3 BLISTERING	NE	NE	NE	NE	NE
8.4 OTHER EFFECTS	SL. CD in LP	Mod. CD in LP	Mod. CD in LP	Mod. CD in LP	Mod. CD in LP

TEST.42276

RESULTS REVIEWED BY P.D.F.TEST REPORT NO. SP-80

CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4" CONCRETE STEEL x OTHER
2. SURFACE PREPARATION (describe): Sandblasted to SSPC-SP10-63
3. PRODUCT TESTED: Carbo Zinc 11 SAMPLE NO.: 18

<u>COAT</u>	<u>PRODUCT</u>	<u>PRODUCT CODES</u>	<u>BATCH #</u>	<u>APPLICATION METHOD</u>	<u>CONDITIONS R/M(°F) & R.H.</u>	<u>THICKNESS (ins.)</u>	<u>DATE APPLIED</u>
1c	Carbo Zinc	11	5J5818M LA5094M	Spray	70°F/40% RH	.0038/.0040	12/10/75

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
65-75°	30-100%	138 Days

5. TYPE OF TEST:

CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12

6. TEST TEMPERATURE: AMBIENT 75 °F SOLUTION 75 °F
7. CHEMICAL SOLUTION (pH and Concentration): 1.1% Sodium Phosphate (pH = 12.3)
8. TEST OBSERVATIONS: DATE STARTED 4/26/76

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NE	NE	NE	NE
8.2 DELAMINATION	NE	NE	NE	NE	NE
8.3 BLISTERING	NE	NE	NE	NE	NE
8.4 OTHER EFFECTS	SL. CD in LP	SL. CD in LP	SL. CD in LP	CD in LP	SL CD in LP

RESULTS REVIEWED BY P.D.F.

TEST.42276

TEST REPORT NO. SP-80

SUMMARY OF CHEMICAL EXPOSURE RESULTSTest Report No. SR-80



BECHTEL CP-951 AND A.N.S.I. N-5-12

CHEMICAL RESISTANCE TEST RESULTS

COATING SYSTEMS: Carbo Zinc 11

PRODUCT TESTED	5% CITRIC ACID	5% NITRIC ACID	5% HYDRAZINE	5% SULFURIC ACID	0.30 M HYDROGEN PEROXIDE	5% SODIUM HYDROXIDE
1c Carbo Zinc 11	Fail	Fail	Pass	Fail	Pass	Fail



PRODUCT TESTED	0.5M SODIUM FLUORIDE	5% SODIUM BORATE	5% AMMONIUM HYDROXIDE	0.30M POTASium PERMAN- GANATE	1.0#/gal. TRISODIUM PHOSPHATE	5% DISODIUM PHOSPHATE
1c Carbo Zinc 11	Pass	Pass	Fail	Pass	Pass	Pass

RESULTS APPROVED

Patricia P. Fisher

TEST REPORT NO.

SR-80



QUALITY ASSURANCE DOCUMENTATION



Test Report No. 80

carbolino

280 HANLEY INDUSTRIAL CT. ST LOUIS, MO 63144

CERTIFICATION RECORD

Product Name and Number

40.

BASE

Component

INORGANIC ZINC

Generic Type

THIS MATERIAL WAS MANUFACTURED AND TESTED IN ACCORDANCE WITH THE CARBOLINE QUALITY ASSURANCE PROGRAM AS DESCRIBED IN THE CARBOLINE QUALITY ASSURANCE MANUAL.

	Formulation Data	Test Data - This Batch
Batch Number	N/A	6H5937M
Date of Manufacture	N/A	8-76
Shelf Life	12 Months	N/A
Weight Per Gallon		8.88 Lbs
by Fed. Std. No. 141, Method 4184	8.6-9.0 Lbs	
Viscosity - Method	Brookfield	BROOKFIELD
Viscosity	100-300	200 CPS
Temperature	75 ± 2°F	75°F
Color - Visual	Green or Gray	GREEN
Number	N/A	0300
This batch tested by--initial and date	8-5-76	AS

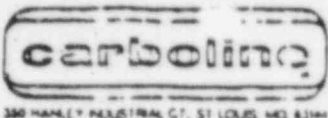
Mixed Material - Formulation Data

		Specified
Volume Solids	1000 mil sq.ft./gal.	Carboline Thinner #33 or #21
Mixing Ratio	Parts Component	Parts Component
By Weight	33 lbs. A (or resin)	To 73 lbs. B (or catalyst)
Pot Life	8 Hours at 75 °F	50 °F
Induction		
Period	Not Required Hours at 75 °F	50 °F
Tack Free Time	1/2 Hours at 75 °F	50 °F
Recoat Time	12 Hours at 75 °F	50 °F
Final Dry Time	12 Hours at 75 °F	50 °F
Flash Point-Pensky-Martens Closed Cup (ASTM D-93) (this comp. only)		56 °F
Recommended Dry Film Thickness Per Coat		2-3 Mils

Verified by Q.A./Q.C. Supervisor
Signature John PetatukDate 1-11-77Purchaser _____
"Ship To" _____
Address _____

Customer P.O. # _____

Release # _____
Carboline _____
Invoice # _____Name of Project _____
Type of Package _____ Number Shipped _____
Total Gallons This Component Shipped _____Production Services
Department _____
Signature _____
Title _____
Date _____



QUALITY ASSURANCE
CERTIFICATION RECORD

CARBO ZINC FILLER
Filler Name and Number

ZINC DUST
Generic Type

41.

THIS MATERIAL WAS TESTED IN ACCORDANCE WITH THE CARBOLINE QUALITY ASSURANCE PROGRAM AS DESCRIBED IN THE CARBOLINE QUALITY ASSURANCE MANUAL.

	Spec. Data	Test Data-This Batch
Batch Number	N/A	6661002
Date of Manufacture	N/A	7-76
Shelf Life	24 Months	N/A
Color - Visual	Metallic Gray	METALLIC GRAY
Sieve Analysis - 325 Mesh	5% Max. Retained	2% RETAINED
100 Mesh	100% Min. Through	100% THROUGH
This Batch Tested by--		
Initial & Date	N/A	7-15-76 DS

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

Verified by Q.C./Q.A. Supervisor
Signature John P. Stetson
Date 1-11-77

Purchaser
"Ship To"
Address

Customer P.O. #

Release #
Carboline
Invoice #

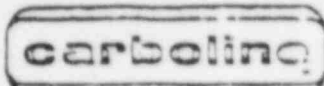
Name of Project

Type of Package

Number Shipped

Product Services
Department
Signature
Title
Date





250 PARKWAY INDUSTRIAL CT. ST. LOUIS, MO 63144

QUALITY ASSURANCE
CERTIFICATION RECORD

Product Name and Number

BASE

Component

INORGANIC ZINC

Generic Type

THIS MATERIAL WAS MANUFACTURED AND TESTED IN ACCORDANCE WITH THE CARBOLINE QUALITY ASSURANCE PROGRAM AS DESCRIBED IN THE CARBOLINE QUALITY ASSURANCE MANUAL.

	Formulation Data	Test Data - This Batch
Batch Number	N/A	6J5954M
Date of Manufacture	N/A	9-76
Shelf Life	12 Months	N/A
Weight Per Gallon		
by Fed. Std. No. 141, Method 4184	8.6-9.0 Lbs	8.89 Lbs
Viscosity - Method	Brookfield	BROOKFIELD
Viscosity	100-300	166 CPS
Temperature	75 ± 2°F	75°F
Color - Visual	Green or Gray	GREEN
Number	N/A	0300
This batch tested by--initial and date		9-27-76 BR

Mixed Material - Formulation Data

		Specified	
		Carboline Thinner #33 or #21	
Volume Solids	1000 mil sq.ft./gal.		
Mixing Ratio	Parts Component		Parts Component
By Weight	33 lbs. A (or resin)	To	73 lbs. B (or catalyst)
Pot Life	6 Hours at 75 °F	50	NR.H.
Induction			
Period	Not Required Hours at 75 °F	50	NR.H.
Tack Free Time	1/2 Hours at 75 °F	50	NR.H.
Recoat Time	12 Hours at 75 °F	50	NR.H.
Final Dry Time	12 Hours at 75 °F	50	NR.H.
Flash Point-Pensky-Martens Closed Cup (ASTM D-93) (this comp. only)		56	°F
Recommended Dry Film Thickness Per Coat		2-3	Mils

Verified by Q.A./Q.C. Supervisor
Signature

John R. Stetzel

Date

1-11-77

Purchaser

"Ship To"

Address

Customer P.O. #

Release #

Carboline

Invoice #

Name of Project

Type of Package

Number Shipped

Total Gallons This Component Shipped

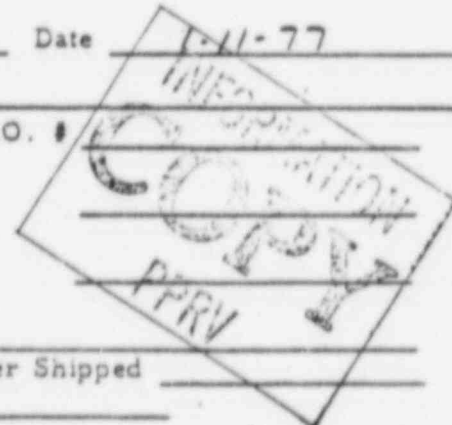
Production Services

Department

Signature

Title

Date



FORM APPROVED JFM DATE 1/3/77



QUALITY ASSURANCE
CERTIFICATION RECORD

Product Name and Number 43.
BASE
Component
INORGANIC ZINC
Generic Type

THIS MATERIAL WAS MANUFACTURED AND TESTED IN ACCORDANCE WITH THE CARBOLINE QUALITY ASSURANCE PROGRAM AS DESCRIBED IN THE CARBOLINE QUALITY ASSURANCE MANUAL.

	Formulation Data	Test Data - This Batch
Batch Number	N/A	5J5818M
Date of Manufacture	N/A	9-75
Shelf Life	12 Months	N/A
Weight Per Gallon		
by Fed. Std. No. 141, Method 4184	8.6-9.0 Lbs	8.92 Lbs
Viscosity - Method	Brookfield	BROOKFIELD
Viscosity	100-300	100 CPS
Temperature	75 ± 2°F	75°F
Color - Visual	Green or Gray	GREEN
Number	N/A	0120
This batch tested by--initial and date		9-17-75 RE

Mixed Material - Formulation Data

	Specified	
	Carboline Thinner #33 or #21	
Volume Solids 1000 mil sq.ft./gal.	Parts Component	Parts Component
Mixing Ratio		
By Weight	33 lbs. A (or resin)	To 73 lbs. B (or catalyst)
Pot Life	8 Hours at 75 °F	50 W.H.
Induction		
Period	Not Required	
Hours at 75 °F	50	W.H.
Tack Free Time	1/2 Hours at 75 °F	50 W.H.
Recoat Time	12 Hours at 75 °F	50 W.H.
Final Dry Time	12 Hours at 75 °F	50 W.H.
Flash Point-Pensky-Martens Closed Cup (ASTM D-93) (this comp. only)	56 °F	
Recommended Dry Film Thickness Per Coat	2-3	Mils

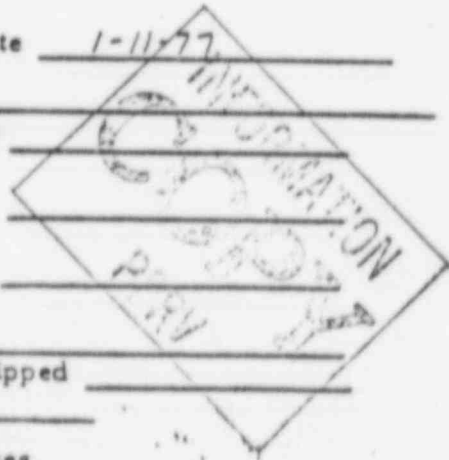
Verified by Q.A./Q.C. Supervisor
Signature John Katush Date 1-11-77

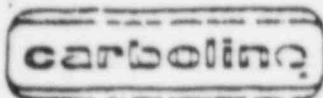
Purchaser _____ Customer P.O. # _____
"Ship To" _____
Address _____
Release # _____
Carboline _____
Invoice # _____

Name of Project _____
Type of Package _____ Number Shipped _____
Total Gallons This Component Shipped _____

Production Services
Department _____
Signature _____
Title _____
Date _____

FORM APPROVED FM DATE 1/11/77





300 HANLEY INDUSTRIAL CT. ST LOUIS MO 63114

QUALITY ASSURANCE
CERTIFICATION RECORD -

CARBO ZINC FILLER
Filler Name and Number

44.

ZINC DUST
Generic Type

THIS MATERIAL WAS TESTED IN ACCORDANCE WITH THE CARBOLINE QUALITY ASSURANCE PROGRAM AS DESCRIBED IN THE CARBOLINE QUALITY ASSURANCE MANUAL.

	Spec. Data	Test Data-This Batch
Batch Number	N/A	XA 5094 M
Date of Manufacture	N/A	9-75
Shelf Life	24 Months	N/A
Color - Visual	Metallic Gray	METALLIC GRAY
Sieve Analysis - 325 Mesh	5% Max. Retained	NA AT TIME RECEIVED
100 Mesh	100% Min. Through	NA AT TIME RECEIVED
This Batch Tested by--		
Initial & Date	N/A	9-8-75 E.S.

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

Verified by Q.C./Q.A. Supervisor
Signature John Petsted
Date 1-12-77

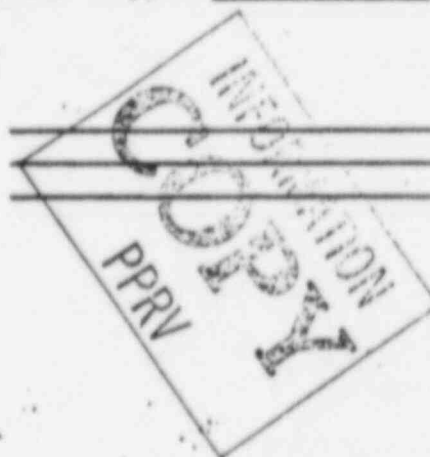
Purchaser _____
"Ship To" _____
Address _____

Customer P.O. # _____
Release # _____
Carboline _____
Invoice # _____

Name of Project _____

Type of Package _____ Number Shipped _____

Product Services
Department _____
Signature _____
Title _____
Date _____



FORM APPROVED JFH DATE 1/3/77