

Manufacturer: Carboline  
St. Louis, MO

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

### Report of Irradiation, Decontamination, and DBA Testing

The irradiation, decontamination, and design basis accident (DBA) tests are conducted, respectively, in accordance with Bechtel Corp. Standard Specification Coatings for Nuclear Power Plants, spec. Nos. CP-951, CP-952, and CP-956 (or with modifications as noted in Table 2, DBA test conditions). 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  $1 \times 10^8$  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 to the bottom of the cable and lowered into the

Evaluated *J. J. Gelling*

Approved *L. J. Gelling*

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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 J. H. Helling

Approved L. T. Helling

Manufacturer: Carboline  
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Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

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; A7-17-8-I

Sample Number	Contaminant	Decontamination Factor (DF)				Percent of Total Activity Removed <sup>1</sup>
		Water @25°C	Acid @25°C	Acid @80°C	Overall	
S3-200 (193LF/191HB)	Ce-144	50	2.1	6.9	710	99.4
	Ru-106	16	1.7	1.5	40	
	Cs-137	>2300	>1.5	>1.2	>4100	
	Zr-95	17	1.8	1.1	34	
	TOTAL	40	1.9	2.4	180	
S5-203 (CZ11/288HB)	Ce-144	82	3.8	4.2	1300	99.7
	Ru-106	31	1.9	1.8	110	
	Cs-137	4200	>1.0	>1.5	>6400	
	Zr-95	14	2.7	1.4	51	
	TOTAL	57	2.7	2.0	300	
S7-204 (CZ11/305HB)	Ce-144	660	1.9	1.0	1300	99.6
	Ru-106	18	3.3	3.6	210	
	Cs-137	>3000	>1.6	>1.0	>4800	
	Zr-95	7.1	2.3	1.4	23	
	TOTAL	61	2.7	1.7	280	
	Ce-144					
	Ru-106					
	Cs-137					
	Zr-95					
	TOTAL					
	Ce-144					
	Ru-106					
	Cs-137					
	Zr-95					
	TOTAL					

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

Approved

L. T. [Signature]  
J. [Signature]

Manufacturer: Carboline  
St. Louis, MO

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

Table 1. DBA solution composition, distilled water

0.28 M boric acid (3,000 ppm boron)  
0.064 M sodium thiosulfate  
Adjusted to pH 9.5 with sodium hydroxide

Table 2. DBA test conditions\*

Time	Temperature (°F)	Pressure (psig)	Comments
Start			
10 seconds	307	60	Steam injection.
2 hrs 47 min	307	60	
5 minutes	307-280	60-30	Injected cold spray.
20 minutes	280-250	30	Adjusted pressure.
4 days	250	30	
3 minutes	250-230	10	Drained; injected cold spray.
15 minutes	230-200	10	Adjusted pressure.
3 days	200	10	
End of test			

\*These data are taken from recorder charts on permanent file at ORNL.

ORNL Log Book No. A7562; A7-17-8

Evaluated J. G. Gellberg  
Approved L. T. Gellberg

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

CZ11/191HB

### Radiation Tolerance Test Results:

Test Conducted In:   x   air        water

Cumulative Dose Rate:	Comments

Sample No.	$1 \times 10^8$ rads	$1 \times 10^9$ rads
S1-1		Coatings intact, no defects, sides A, B.
S1-2		Coatings intact, no defects, sides A, B.

Additional Comments:

Evaluated J. J. [Signature]  
Approved L. T. [Signature]

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

SP81/191HB

ORNL Master Analytical Manual Method No. 2 0921;  
Bechtel Corp. Spec. No. CP-951;  
ORNL Log Book No. A 7562; A7-17-8

Test Conducted In: x air water

Sample No.	$1 \times 10^8$ rads	$1 \times 10^8$ rads
S2-23		Coatings intact, no defects, sides A, B.
S2-24		Coatings intact, no defects, sides A, B.

Additional Comments:

Evaluated [Signature]  
Approved [Signature]

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

System Identification:   x Steel Panel          Concrete Block

193LF/191HB

#### Radiation Tolerance Test Results:

ORNL Master Analytical Manual Method No. 2 0921;  
Bechtel Corp. Spec. No. CP-951;  
ORNL Log Book No. A 7562; A7-17-8

Initial Dose Rate:  $1.5 \times 10^7$  rads/hr

Test Conducted In:      x      air      water

Cumulative Dose Rate:	Comments

Sample No.	$1 \times 10^8$ rads	$1 \times 10^9$ rads
S3-43		Coatings intact, no defects, sides A, B.
S3-44		Coatings intact, no defects, sides A, B.

Additional Comments:

Evaluated

Approved

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

CZ11/305Fin

ORNL Master Analytical Manual Method No. 2 0921;  
Bechtel Corp. Spec. No. CP-951;  
ORNL Log Book No. A 7562; A7-17-8

Test Conducted In: x air water

<u>Sample No.</u>	<u><math>1 \times 10^8</math> rads</u>	<u><math>1 \times 10^9</math> rads</u>
<u>S6-101</u>		<u>Coatings intact, no defects,</u> <u>sides A, B.</u>
<u>S6-102</u>		<u>Coatings intact, no defects,</u> <u>sides A, B.</u>

Additional Comments:

Evaluated [Signature]  
Approved [Signature]



Manufacturer: Carboline  
St. Louis, MO

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

System Identification: x Steel Panel      Concrete Block

CZ11/305HB

Radiation Tolerance Test Results:

ORNL Master Analytical Manual Method No. 2 0921;  
Bechtel Corp. Spec. No. CP-951;  
ORNL Log Book No. A 7562; A7-17-8

Initial Dose Rate: 1.5 x 10<sup>7</sup> rads/hr

Test Conducted In: x air      water

Cumulative Dose Rate: Comments

<u>Sample No.</u>	<u>1 x 10<sup>8</sup> rads</u>	<u>1 x 10<sup>9</sup> rads</u>
<u>S7-122</u>	<u>                                </u>	<u>Coatings intact, no defects,</u>
	<u>                                </u>	<u>sides A, B.</u>
<u>S7-123</u>	<u>                                </u>	<u>Coatings intact, no defects,</u>
	<u>                                </u>	<u>sides A, B.</u>
<u>          </u>	<u>                                </u>	<u>                                </u>
<u>          </u>	<u>                                </u>	<u>                                </u>
<u>          </u>	<u>                                </u>	<u>                                </u>

Additional Comments:

Evaluated *P. G. G. G.*  
Approved *L. T. G. G.*

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

CZ11/191HB

ORNL Master Analytical Manual Method No. 2 0922;

[illegible]

\*\* (SA) = sand blast; (SH) = shot blast; (GR) = grit blast.

Approved *L. T. Robinson*

**carboline**

DBA AND RADIATION TOLERANCE

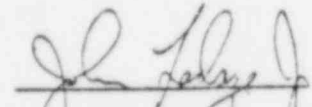
TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED Carbo Zinc 11/Carbo Zinc 11 (repair)/ Carboline 191 HB
2. TYPE SUBSTRATE Steel SIZE 2" x 5" x 1/8"
3. SURFACE PREPARATION (describe) Gritblasted to SSPC-SP10-63 with a 1-3 mil blast profile  
Damaged area: 3M "Strip & Clean" followed by light needle gun impactment
4. PRODUCT DATA: SAMPLE NO.(s) S10-180A, S10-184A
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	7M5123M 7L0980Z	Spray	75°/45%	180A) .0021/.0023 184A) .0024/.0022	4-15-78
1c	Carbo Zinc	11	7M5123M 7L0980Z	Brush	72°/45%	180A) .0017 184A) .0013	4-21-78
1c	Carboline	191 HB	7E1181M 7J2147M	Spray	78°/36%	180A) .0041/.0044 184A) .0039/.0040	5-1-78

5. CURING CONDITIONS: AMBIENT TEMP 66-78°F Primer 40-87%  
Primer 73-78°F °F REL. HUMIDITY 33-56%  
MINIMUM CURE 16 DAYS  
7

6. TEST PROCEDURE ORNL Master Analytical Manual Method No. 2 0922
7. TESTING PERFORMED BY Analytical Chemistry Division DATE SUBMITTED 5-8-78  
Oak Ridge National Laboratory

  
TEST REPORT NO. 01629

**boline**

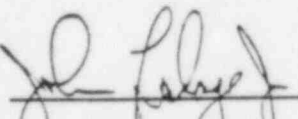
DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED Carboline 193 LF Primer/Carboline 191 HB
2. TYPE SUBSTRATE Certified ASTM A36 Steel SIZE 2" x 4" x 1/4"
3. SURFACE PREPARATION (describe) SSPC-SP3-63 Power Tool Clean with 3M  
"Strip n Clean"
4. PRODUCT DATA: SAMPLE NO.(s) S3-160, S3-163
5. DATE AND TIME CURING COMPOUND OR PRIMER APPLIED ---

<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>TIME &amp; DATE APPLIED</u>
	Carboline	193 LF Primer	7H1949M	Spray	74°F/42% S3-160)	.0026/.0026	3-10-78
			7L2868M		S3-163)	.0026/.002	
	Carboline	191 HB	7E1181M	Spray	80°F/28% S3-160)	.0043/.0035	3-16-78
			7J2147M		S3-163)	.0038/.0035	

5. CURING CONDITIONS: Primer 68-80°F  
AMBIENT TEMP 73-78 °F REL. HUMIDITY 24-42%  
Primer 6  
MINIMUM CURE 53 DAYS
6. TEST PROCEDURE ORNL Master Analytical Manual Method No. 2 0922
7. TESTING PERFORMED BY Analytical Chemistry DATE SUBMITTED 5-8-78  
Division  
Oak Ridge National Laboratory

  
TEST REPORT NO. SR119

DBA TEST RESULTS

Test Report No.

Manufacturer: Carboline  
St. Louis, MO

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

Table 1. DBA solution composition, distilled water

0.28 M boric acid (3,000 ppm boron)  
0.064 M sodium thiosulfate  
Adjusted to pH 9.5 with sodium hydroxide

Table 2. DBA test conditions\*

Time	Temperature (°F)	Pressure (psig)	Comments
Start			
10 seconds	307	60	Steam injection.
2 hrs 47 min	307	60	
5 minutes	307-280	60-30	Injected cold spray.
20 minutes	280-250	30	Adjusted pressure.
4 days	250	30	
3 minutes	250-230	10	Drained; injected cold spray.
15 minutes	230-200	10	Adjusted pressure.
3 days	200	10	
End of test			

\*These data are taken from recorder charts on permanent file at ORNL.

ORNL Log Book No. A7562; A7-17-8

Evaluated

Approved

J. Gellberg

W. T. Cochran

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: Aug. 16, 1978

DBA Test Results:

ORNL Master Analytical Manual Method No. 2 0922;

ORNL Log Book No. A 7562; A7-17-8

[illegible]

\*Irradiated.

\*\* (SA) = sand blast; (SH) = shot blast; (GR) = grit blast.

Evaluated

Approved

Approved L. T. Griffin

DECONTAMINATION TEST

TEST PANEL PREPARATION DATA

Test Report No.



carboline

TEST NO. 01042

DECONTAMINATION TEST

REC'TEL CP-952 AND A.N.S.I. N-5.12

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED Carboline 193 LF Primer/Carboline 191 HB
2. TYPE SUBSTRATE Certified ASTM A36 Steel SIZE 2" x 4" x 1/4"
3. SURFACE PREPARATION (describe) Sandblasted to SSPC-SP10-63 with a 1-3 mil blast profile
4. PRODUCT DATA: SAMPLE NO. (s) S3-200

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(*F)R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline	193 LF	7H1949M	Spray	74°/42%	S3-200)	3-10-78
		Primer	7L2868M			.0032/.0033	
	Carboline	191 HB	7E1181M	Spray	80°/28%	S3-200)	3-16-78
			7J2147M			.0045/.0046	

5. CURING CONDITIONS: Primer 74-80 Primer 28-42  
AMBIENT TEMP. 73-78 °F REL. HUMIDITY 33-56  
Primer 6  
MINIMUM CURE 53 days DAYS
6. TEST PROCEDURE ORNL Master Analytical Manual Method No. 2 0920
7. TESTING PERFORM BY Analytical Chemistry Div. DATE SUBMITTED 5-8-78  
Oak Ridge National Laboratory

  
TEST REPORT NO. SR-119

DECONTAMINATION TEST RESULTS

Test Report No.

Manufacturer: Carboline  
St. Louis, MO

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date Aug. 16, 1978

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; A7-17-8-I

Sample Number	Contaminant	Decontamination Factor (DF)				Percent of Total Activity Removed <sup>1</sup>
		Water @25°C	Acid @25°C	Acid @80°C	Overall	
S3-200 (193LF/191HB)	Ce-144	50	2.1	6.9	710	99.4
	Ru-106	16	1.7	1.5	40	
	Cs-137	>2300	>1.5	>1.2	>4100	
	Zr-95	17	1.8	1.1	34	
	TOTAL	40	1.9	2.4	180	

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

Approved

L. T. L. L.  
J. R. L. L.

193LF/191 NB

PHYSICAL PROPERTIES

Test Report No. 01720 B

# carboline

## PHYSICAL PROPERTIES

BECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carboline 193 LF/Carboline 191 HB
2. TYPE SUBSTRATE 4"x4"x1/32" steel Taber Abraser Panel
3. SURFACE PREPARATION (describe) Surface roughened with sandpaper.
4. PRODUCT DATA: SAMPLE NOS. 15A, 16A, 17A

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)%R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF		8H1682M 8K2406M	Spray	73°F/26%	15A) .0038/.0035	12/16/
						16A) .0034/.0035	12/16/
						17A) .0036/.0035	12/16/
1c	Carboline 191 HB		8K2286M 8J1828M	Spray	73°F/27%	15A) .0040/.0041	12/26/
						16A) .0041/.0041	12/26/
						17A) .0041/.0040	12/26/

### CURING DATA:

AMBIENT TEMP. 61-79°F °F REL. HUM. 27-60% % CURE TIME 45 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 - 36.6 mg. HIGH - 38.5 mg. AVERAGE - 37.4 mg.

7.2 ADHESION: Determined by use of the ELCOMETER ADHESION TESTER

AVERAGE OF 5 TESTS \_\_\_\_\_ psi

DESCRIBE FAILURE \_\_\_\_\_

### 7.3 DIRECT-IMPACT RESISTANCE:

\*Curing Data - First Coat:

72-81°F 24-60% R.H. 10 days

IS- 06376-4

Approved: \_\_\_\_\_

*[Signature]*

## PHYSICAL PROPERTIES

BECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carboline 193 LF/Carboline 191 HB
2. TYPE SUBSTRATE Certified ASTM A36 - 2"x4"x1/4" steel panel
3. SURFACE PREPARATION (describe) Gritblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.
4. PRODUCT DATA: SAMPLE NOS. 15B, 16B, 17B, 18B, 19B

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(*F)2R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF		8H1682M 8K2406M	Spray	73°F/26%	15B) .0039/.0038 16B) .0038/.0039 17B) .0038/.0039 18B) .0038/.0038 19B) .0038/.0039	12/16 12/16 12/16 12/16 12/16
1c	Carboline 191 HB		8K2286M 8J1828M	Spray	73°F/27%	15B) .0048/.0047 16B) .0040/.0040 17B) .0051/.0043 18B) .0048/.0049 19B) .0055/.0048	12/26 12/26 12/26 12/26 12/26

## CURING DATA:

AMBIENT TEMP. 61-79°F °F. REL. HUM. 22-60% % CURE TIME 52 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 630 psi

DESCRIBE FAILURE Cohesion of Carboline 193 LF

7.3 DIRECT-IMPACT RESISTANCE:

\*Curing Data - First Coat:

64-81°F 56-77% 10 days

Approved: John Talley

## PHYSICAL PROPERTIES

BECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carboline 193 LF/Carboline 191 HB
2. TYPE SUBSTRATE Certified ASTM A36 - 2"x4"x1/4" steel panel
3. SURFACE PREPARATION (describe) Sandblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.
4. PRODUCT DATA: SAMPLE NOS. 15P, 16P, 17P, 18P, 19P

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)%R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF		8H1682M 8K2406M	Spray	73°F/26%	15P) .0038/.0037	12/16/77
						16P) .0039/.0036	12/16/77
						17P) .0039/.0038	12/16/77
						18P) .0037/.0038	12/16/77
						19P) .0037/.0038	12/16/77
1c	Carboline 191 HB		8K2286M 8J1828M	Spray	73°F/27%	15P) .0040/.0042	12/26/77
						16P) .0043/.0043	12/26/77
						17P) .0044/.0041	12/26/77
						18P) .0041/.0042	12/26/77
						19P) .0041/.0042	12/26/77

## CURING DATA:

 AMBIENT TEMP. 61-79°F °F REL. HUM. 22-60% CURE TIME 52 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 665 psiDESCRIBE FAILURE Cohesion of Carboline 193 LF

## 7.3 DIRECT-IMPACT RESISTANCE:

\*Curing Data - First Coat:

64-81°F 56-77% R.H. 10 days

Approved: John F. Fudge

carboline

PHYSICAL PROPERTIES

BECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carboline 193 LF/Carboline 191 HB
2. TYPE SUBSTRATE Certified ASTM A36 - 2"x4"x1/4" steel panel
3. SURFACE PREPARATION (describe) Shotblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.
4. PRODUCT DATA: SAMPLE NOS. 15Q, 16Q, 17Q, 18Q, 19Q

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF		8H1682M 8K2406M	Spray	73°F/26%	15Q) .0037/.0034 16Q) .0039/.0034 17Q) .0035/.0036 18Q) .0036/.0035 19Q) .0038/.0038	12/16/7 12/16/7 12/16/7 12/16/7 12/16/7
1c	Carboline 191 HB		8K2286M 8J1828M	Spray	73°F/27%	15Q) .0046/.0041 16Q) .0041/.0042 17Q) .0042/.0040 18Q) .0044/.0041 19Q) .0047/.0044	12/26/7 12/26/7 12/26/7 12/26/7 12/26/7

CURING DATA: \*

AMBIENT TEMP. 61-79°F °F REL. HUM. 22-60% % CURE TIME 52 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 670 psi

DESCRIBE FAILURE Cohesion of Carboline 193 LF

7.3 DIRECT-IMPACT RESISTANCE:

\*Curing Data - First Coat:

64-81°F 36-77% R.H. 10 days

S- 06376-4

Approved: 



carboline

PHYSICAL PROPERTIES

BECHTEL CP-954 AND A.N.S.I. N-5.12

1. PRODUCT TESTED Carboline 193 LF/Carboline 191 HB
2. TYPE SUBSTRATE Schedule 40 pipe, 16" long, 2.375" O.D.
3. SURFACE PREPARATION (describe) Gritblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.
4. PRODUCT DATA: SAMPLE NOS. 15C, 16C, 17C, 18C, 19C, 20C, 21C

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(*F)%R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF		8H1682M 8K2406M	Spray	73°F/26%	15C) .0040/.0035 16C) .0040/.0038 17C) .0039/.0036 18C) .0040/.0035 19C) .0036/.0032 20C) .0040/.0034 21C) .0039/.0036	12/16/ 12/16/ 12/16/ 12/16/ 12/16/ 12/16/ 12/16/
1c	Carboline 191 HB		8K2286M 8J1828M	Spray	73°F/27%	15C) .0055/.0050 16C) .0050/.0045 17C) .0046/.0056 18C) .0042/.0045 19C) .0052/.0058 20C) .0051/.0051 21C) .0051/.0051	12/26/ 12/26/ 12/26/ 12/26/ 12/26/ 12/26/ 12/26/

CURING DATA:

AMBIENT TEMP. 61-79°F \*F REL. HUM. 24-60% % CURE TIME 10 days

6. \*Curing Data - First Coat - 72-81°F 28-49% 36 days  
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: 1/31/79

Pipe Number	Effect of 100 psi impact
15C	No Effect
16C	3/8" delamination paint separated from pipe
17C	No Effect
18C	No Effect
19C	1/4" delamination paint separated from pipe
20C	No Effect
21C	1/4" delamination paint separated from pipe

RESULTS REVIEWED BY

*[Signature]*

CHEMICAL EXPOSURE TEST  
PANEL PREPARATION AND INDIVIDUAL  
CHEMICAL RESISTANCE TEST RESULTS

Test Report No.

TEST NO. 01720

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

1. TYPE SUBSTRATE: SIZE 2"x4"x1/2" CONCRETE STEELASTM A36 OTHER \_\_\_\_\_
2. SURFACE PREPARATION (describe): Gritblasted to SSPC-SP10-63 with a 1.0-2.0  
mil blast profile
3. PRODUCT TESTED: Carboline 193 LF/ SAMPLE NO.: 15E  
Carboline 191 HB

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) & R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline	193 LF	8H1682M 8K2406M	Spray	73°F/26%	.0038/.0037	12/16-
1c	Carboline	191 HB	8K2286M 8J1828M	Spray	73°F/27%	.0043/.0041	12-26-

4. CURING CONDITIONS:

	AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1ST coat	72°F-81°F	28-49%	10 days
2ND coat	61°F-79°F	24-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° ± 5° °F SOLUTION 75° ± 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 5% Nitric Acid (ph =0.25)
8. TEST OBSERVATIONS: DATE STARTED 2-5-79

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	106B in LP	NC	#4FBS in LP #4MBS on E	NC
8.4 OTHER EFFECTS	NE	NE	NE	NE	NE

NE= No Effect      NC= No Change  
LP= Liquid phase    B= Blisters  
E= Edge            F= Few  
C= Substrate

RESULTS REVIEWED BY *[Signature]*TEST REPORT NO. *[Signature]*

## CHEMICAL RESISTANCE TEST RESULTS

BECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4"x1/2" CONCRETE STEELASTM A36 OTHER \_\_\_\_\_
2. SURFACE PREPARATION (describe): Gritblast to SSPC-SP10-63 with a 1.0-2.0 mil blast profile
3. PRODUCT TESTED: Carboline 193 LF/  
Carboline 191 HB SAMPLE NO.: 15F

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline	193 LF	8H1682M 8K2406M	Spray	73°F/26%	.0038/.0038	12-16-
1c	Carboline	191 HB	8K2286M 8J1828M	Spray	73°F/27%	.0050/.0048	12-26-

## 4. CURING CONDITIONS:

	AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1ST coat	72°-81°F	28-49%	10 days
2ND coat	61°-79°F	24-60%	6 weeks

## 5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° ± 5° °F SOLUTION 75° ± 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 5% Sulfuric Acid (ph= 0.8)
8. TEST OBSERVATIONS: DATE STARTED 2-5-79

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	0.4F B on E in LP	0.1MB on face in LP	NC
8.4 OTHER EFFECTS	NE	NE	NE	NE	NE

NE= No Effect  
F= Few  
LP= Liquid Phase  
MB= Moderate

NC= No Change  
E= Edge  
B= Blister

RESULTS REVIEWED BY

TEST REPORT NO.

TEST NO. 01720CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4"x1/4" CONCRETE STEEL ASTM A36 OTHER
2. SURFACE PREPARATION (describe): Gritblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.

3. PRODUCT TESTED: Carboline 193 LF/ SAMPLE NO.: 15G  
Carboline 191 HB

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF	8H1682M 8K2406M		Spray	73°F/26%	.0038/.0039	12/16/
1c	Carboline 191 HB	8K2286M 8J1828M		Spray	73°F/27%	.0043/.0041	12/26/

CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1st coat: 72°F-81°F	28%-48%	10 days
2nd coat: 61°F-79°F	24%-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° + 5° °F SOLUTION 75° ± 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 5% Hydrazine (pH = 10.75)
8. TEST OBSERVATIONS: DATE STARTED 2/5/79

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

NE = No Effect

RESULTS REVIEWED BY [Signature]

• TEST REPORT NO.

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

1. TYPE SUBSTRATE: SIZE 2"x4"x4" CONCRETE STEELASTM A36 OTHER
2. SURFACE PREPARATION (describe): Gritblast to SSPC-SP10-63 with a 1.0-2.0 mil blast profile
3. PRODUCT TESTED: Carboline 193 LF/ SAMPLE NO.: 15H  
Carboline 191 HB

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline	193 LF	8H1682M 8K2406M	Spray	73°F/26%	.0037/.0033	12-16-
1c	Carboline	191 HB	8K2286M 8J1828M	Spray	73°F/27%	.0045/.0040	12-26-

4. CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1ST coat 72°-81°F	28-49%	10 days
2ND coat 61°-79°F	24-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° ± 5° °F SOLUTION 75° ± 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 5% Sodium Hydroxide (ph=11.75)
8. TEST OBSERVATIONS: DATE STARTED 2-5-79

ACCEPTANCE CRITERIA	CHEMICAL EXPOSURE RESULTS				
	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS
8.1 FLAKING/PEELING	NE	NL	NE	NE	NE
8.2 DELAMINATION	NE	NE	NE	NE	NE
8.3 BLISTERING	NE	NE 5 on E 102+6b on BA	NC	NC	NC
8.4 OTHER EFFECTS	NE	NE	NE	NE	NE

NE= No Effect  
 NC= No Change  
 E= Edge

B= Blister  
 BA= Back  
 F= Few

RESULTS REVIEWED BY J. L. LongTEST REPORT NO. 01720

TEST NO. 01720CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4"x1/2" CONCRETE STEEL ASTM A36 OTHER
2. SURFACE PREPARATION (describe): Gritblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.
3. PRODUCT TESTED: Carboline 193 LF/ SAMPLE NO.: 15-I  
Carboline 191 HB

<u>COAT</u>	<u>PRODUCT</u>	<u>PRODUCT CODES</u>	<u>BATCH #</u>	<u>APPLICATION METHOD</u>	<u>CONDITIONS R/M(°F)&amp;R.H.</u>	<u>THICKNESS (ins.)</u>	<u>DATE APPLIED</u>
1c	Carboline 193 LF	8H1682M 8K2406M		Spray	73°F/26%	.0033/.0035	12/16/
1c	Carboline 191 HB	8K2286M 8J1828M		Spray	73°F/27%	.0042/.0041	12/26/

4. CURING CONDITIONS:

<u>AMBIENT TEMP. (°F)</u>	<u>% REL. HUMIDITY</u>	<u>LENGTH OF CURE</u>
1st coat: 72°-81°F	28-49%	10 d s
2nd coat: 61°-79°F	24-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° + 5° °F SOLUTION 75° + 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 5% Ammonium Hydroxide (pH = 11.6)
8. TEST OBSERVATIONS: DATE STARTED 2/5/79

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

NE = No Effect

RESULTS REVIEWED BY J. L. Lohr• TEST REPORT NO.



TEST NO. 01/20

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

1. TYPE SUBSTRATE: SIZE 2"x4"x1/2" CONCRETE STEEL ASTM A36 OTHER
2. SURFACE PREPARATION (describe): Gritblast to SSPC-SP10-63 with a 1.0-2.0  
mil blast profile
3. PRODUCT TESTED: Carboline 193LF/ SAMPLE NO.: 15J  
Carboline 191 HB

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) & R.H.	THICKNESS (ins)	DATE APPLIED
1c	Carboline	193 LF	8H1682M 8K2406M	Spray	73°F/26%	.0037/.0038	12-16-
1c	Carboline 191 HB		8K2286M 8J1828M	Spray	73°F/27%	.0043/.0043	12-26-

4. CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1ST coat 72°-81°F	28-49%	10 days
2ND coat 61°-79°F	24-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° ± 5° °F SOLUTION 75° ± 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 5% Sodium Borate (ph= 9.7)
8. TEST OBSERVATIONS: DATE STARTED 2-5-79

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

NE= No Effect

RESULTS REVIEWED BY J. L. [Signature]TEST REPORT NO.



TEST NO. 01720

CHEMICAL RESISTANCE TEST RESULTS

BECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4"x1/4" CONCRETE STEEL ASTM A36 OTHER
2. SURFACE PREPARATION (describe): Gritblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.

3. PRODUCT TESTED: Carboline 193 LF/ SAMPLE NO.: 15K  
Carboline 191 HB

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) & R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF		8H1682M 8K2406M	Spray	73°F/26%	.0038/.0036	12/16
1c	Carboline 191 HB		8K2286M 8J1828M	Spray	73°F/27%	.0042/.0043	12/26

4. CURING CONDITIONS:

	AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1st coat:	72°-81°F	28-49%	10 days
2nd coat:	61°-79°F	24-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° + 5° °F SOLUTION 75° + 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 0.5M Sodium Fluoride (pH = 6.6)
8. TEST OBSERVATIONS: DATE STARTED 2/5/79

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

NE = No Effect

RESULTS REVIEWED BY John J. [Signature]

TEST REPORT NO. \_\_\_\_\_

TEST NO. 01720CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4"x1/4" CONCRETE STEEL ASTM A36 OTHER
2. SURFACE PREPARATION (describe): Gritblasted to SSPC-SP10-63.
3. PRODUCT TESTED: Carboline 193 LF/ SAMPLE NO.: 15L  
Carboline 191 HB

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) & R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF	8H1682M 8K2406M		Spray	73°F/26%	.0037/.0036	12/16/
1c	Carboline 191 HB	8K2286M 8J1828M		Spray	73°F/27%	.0043/.0041	12/26/

CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1st coat: 72°-81°F	28-49%	10 days
2nd coat: 61°-79°F	24-60%	6 weeks

5. TYPE OF TEST:  
CHEMICAL EXPOSURE TEST PER BECHTEL CP-953 and A.N.S.I. N-5-12
6. TEST TEMPERATURE: AMBIENT 75° ± 5° °F SOLUTION 75° ± 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 3% Citric Acid (pH = 1.65)
8. TEST OBSERVATIONS: DATE STARTED 2/5/79

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

NE = No Effect

RESULTS REVIEWED BY J. L. F. J.

• TEST REPORT NO. \_\_\_\_\_

TEST NO. 01720CHEMICAL RESISTANCE TEST RESULTSBECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4"x1/4" CONCRETE STEEL ASTM A36 OTHER
2. SURFACE PREPARATION (describe): Gritblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.

3. PRODUCT TESTED: Carboline 193 LF/ SAMPLE NO.: 15M  
Carboline 191 HB

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) & R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF	8H1682M 8K2406M		Spray	73°F/26%	.0037/.0038	12/16/
1c	Carboline 191 HB	8K2286M 8J1828M		Spray	73°F/27%	.0042/.0042	12/26/

4. CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1st coat: 72°-81°F	28-49%	10 days
2nd coat: 61°-79°F	24-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° + 5° °F SOLUTION 75° + 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 0.3M Hydrogen Peroxide (pH = 3.5)
8. TEST OBSERVATIONS: DATE STARTED 2/5/79

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

NE = No Effect

RESULTS REVIEWED BY [Signature]TEST REPORT NO. [Signature]

# CHEMICAL RESISTANCE TEST RESULT

BECHTEL CP-953 and A.N.S.I. N-5.12

1. TYPE SUBSTRATE: SIZE 2"x4"x1/2" CONCRETE STEEL/ASTM A36 OTHER
2. SURFACE PREPARATION (describe): Gritblast to SSPC-SP10-63 1.0-2.0

nil blast profile

3. PRODUCT TESTED: Carboline 193 LF/  
Carboline 191 HB SAMPLE NO.: 15 N

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline	193 LF	SH1682M SK2406M	Spray	73°F/26%	.0038/.0037	12-16-
1c	Carboline	191 HB	SK2286M 8J1828M	Spray	73°F/27%	.0041/.0041	12-26-

4. CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1ST coat 72°F-81°F	28-49%	10 days
2ND coat 61°F-79°F	24-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° ± 5° °F SOLUTION 75° ± 5° °F
7. CHEMICAL SOLUTION (pH and Concentration): 0.3M Potassium Permanganate(pH= 5.0)
8. TEST OBSERVATIONS: DATE STARTED 2-5-79

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	SEV CD in LP	NC	NC	NC	NC

NE= No Effect  
NC= No Change  
LP= Liquid phase

SEV= Severe  
CD= Coating discoloration

RESULTS REVIEWED BY

TEST REPORT NO.

TEST NO. 01720

CHEM AL RESISTANCE TEST RESULTBECHTEL CP-953 and A.N.S.I. N-5.12TYPE SUBSTRATE: SIZE 2"x4"x1/4" CONCRETE STEEL ASTM A36 OTHER         2. SURFACE PREPARATION (describe): Gritblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.3. PRODUCT TESTED: Carboline 193 LF/ SAMPLE NO.: 15-0  
Carboline 191 HB

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(*F) & R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF	8H1682M 8K2406M		Spray	73°F/26%	.0039/.0037	12/16/
1c	Carboline 191 HB	8K1286M 8J1828M		Spray	73°F/27%	.0048/.0042	12/26/

4. CURING CONDITIONS:

	AMBIENT TEMP. (*F)	% REL. HUMIDITY	LENGTH OF CURE
1st coat:	72°-81°F	28-49%	10 days
2nd coat:	61°-79°F	24-60%	6 weeks

5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° ± 5° °F SOLUTION 75° ± 5° °F7. CHEMICAL SOLUTION (pH and Concentration): 1.0 lb/l gal. Trisodium Phosphate  
(pH = 11.5)8. TEST OBSERVATIONS: DATE STARTED 2/5/79

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

NE = No Effect

RESULTS REVIEWED BY J. L. FeltzTEST REPORT NO.

TEST NO. 01720

## CHEM AL RESISTANCE TEST RESULT

BECHTEL CP-953 and A.N.S.I. N-5.12

TYPE SUBSTRATE: SIZE 2"x4"x1/4" CONCRETE STEEL <sup>ASTM</sup> A36 OTHER \_\_\_\_\_2. SURFACE PREPARATION (describe): Gritblasted to SSPC-SP10-63 with a 1.0-2.0 mil blast profile.3. PRODUCT TESTED: Carboline 193 LF/ Carboline 191 HB SAMPLE NO.: 15 R

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)&R.H.	THICKNESS (ins.)	DATE APPLIED
1c	Carboline 193 LF		8H1682M 8K2406M	Spray	73°F/26%	.0039/.0038	12/16
1c	Carboline 191 HB		8K2286M 8J1828M	Spray	73°F/27%	.0044/.0042	12/26

## 4. CURING CONDITIONS:

AMBIENT TEMP. (°F)	% REL. HUMIDITY	LENGTH OF CURE
1st coat: 72°-81°F	28-49%	10 days
2nd coat: 61°-79°F	24-60%	6 weeks

## 5. TYPE OF TEST:

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

6. TEST TEMPERATURE: AMBIENT 75° ± 5° °F SOLUTION 75° ± 5° °F7. CHEMICAL SOLUTION (pH and Concentration): 5% Disodium Phosphate (pH = 8.5)8. TEST OBSERVATIONS: DATE STARTED 2/5/79

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

NE = No Effect

RESULTS REVIEWED BY John F. [Signature]

TEST REPORT NO. \_\_\_\_\_

SUMMARY OF CHEMICAL EXPOSURE RESULTS

Test Report No.

CARBOLINE

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

CHEMICAL RESISTANCE TEST RESULTS

COATING SYSTEMS: Carboline 193LF/ Carboline 191 HB

PRODUCT TESTED	5% CITRIC ACID	5% NITRIC ACID	5% HYDRAZINE	5% SULFURIC ACID	0.30 M HYDROGEN PEROXIDE	5% SODIUM HYDROXIDE
	pass	fail	pass	fail	pass	pass

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
	pass	pass	pass	pass	pass	pass

RESULTS APPROVED

TEST REPORT NO.

D1720

CS-06376-6



OAK RIDGE NATIONAL LABORATORY

OPERATED BY  
UNION CARBIDE CORPORATION  
NUCLEAR DIVISION



POST OFFICE BOX X  
OAK RIDGE, TENNESSEE 37830

September 28, 1978

615-576-5454  
Carboline Division  
374-0255

Mr. Charles Wiegiers  
Power Industry Manager  
Carboline  
350 Hanley Industrial Court  
St. Louis, MO 63144

Dear Mr. Wiegiers:

As you requested, enclosed is the revised format copy of  
Carboline report dated August 16, 1978.

Please call on us if we can be of additional help.

Sincerely yours,

*L. T. Corbin*

L. T. Corbin, Section Head  
Analytical Chemistry Division

LTC:dmw

Enclosures

16272

OAK RIDGE NATIONAL LABORATORY

OPERATED BY  
UNION CARBIDE CORPORATION  
NUCLEAR DIVISION



POST OFFICE BOX X  
OAK RIDGE, TENNESSEE 37830

AUG 21 1978

August 17, 1973

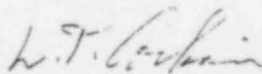
Mr. Dan W. McBride  
Nuclear Market Specialist  
Carboline  
350 Hanley Industrial Court  
St. Louis, MO 63144

Dear Mr. McBride:

Enclosed are the results of the irradiation, decontamination,  
and DBA tests you requested. The conditions of the two DBA  
tests were identical and are listed in Table 2.

If we can be of further assistance, please feel free to call on  
us.

Sincerely yours,



L. T. Corbin, Section Head  
Analytical Chemistry Division

LTC:dmw

Enclosures