

Manufacturer: Bechtel/3M  
Saint Paul, Minnesota

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: October 10, 1979

### Report of Irradiation and DBA Testing

The irradiation and design basis accident (DBA) tests are conducted, respectively, in accordance with Bechtel Corp. *Standard Specification Coatings for Nuclear Power Plants*, specs. CP-951 and CP-956 (or with modifications as noted in Table 2, DBA test conditions). The tests are designed 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 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  $1 \times 10^6$  rads/hr.

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 radiation field. Also at the center of the fuel assembly is a stainless steel clad cadmium tube used as a neutron absorber. This prevents contamination of the test specimens by induced radiation.

Evaluated Ralph F. Apple

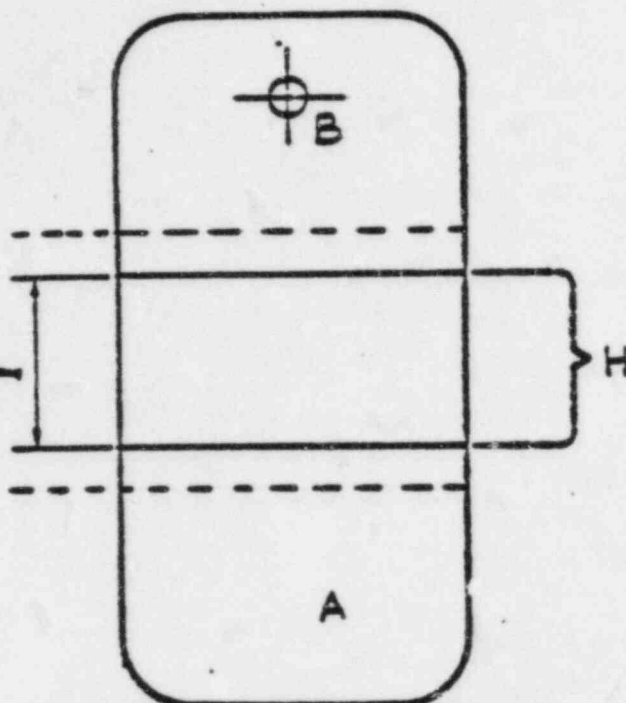
Approved L. T. Cochran

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

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PANEL ID# 811



	COATING MATERIAL	DFT*
A.	Ameron D6N	4.0
B.	Ameron D6N	4.0
T. U.	Ameron D6N	3.1
F.	None	—

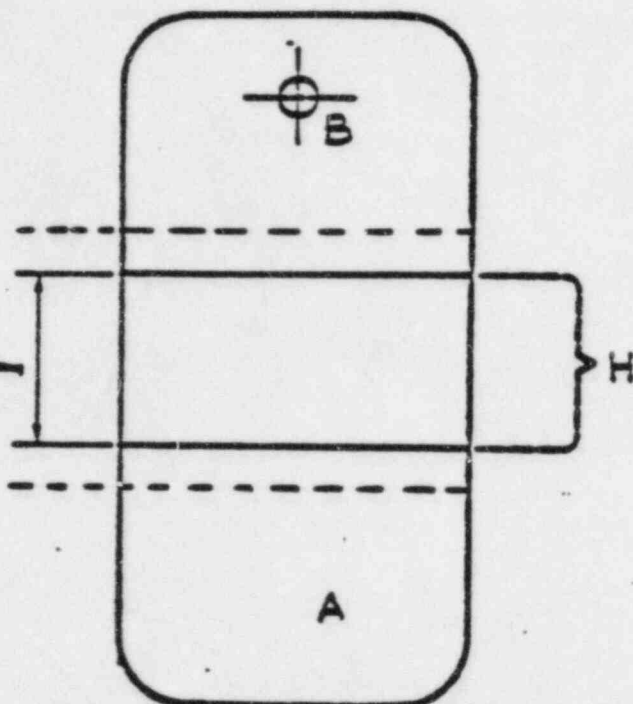
1. ABRASIVE BLAST TO SSPC-SP10 WITH A PROFILE FROM 1.5 TO 3.0 MILS.
2. APPLY THE INDICATED PRIMER TO DESIGNATED AREA OF PANEL. (NO PRIMER IS TO BE APPLIED TO CENTER SECTION H.)
3. ALLOW BARE AREA H TO RUST.
4. PHOTOGRAPH PANEL AT THIS POINT.
5. POWER TOOL CLEAN RUSTED AREA OF PANEL USING THE CLEAN AND STRIP WHEEL AND/OR DISC FOLLOWED BY THE ROTO PEEN WHEEL (MANUFACTURED BY 3M COMPANY.)
6. PHOTOGRAPH PANEL AT THIS POINT.
7. COAT THE PREPARED AREA WITH THE INDICATED TOUCH-UP COATING MATERIAL (TU).
8. PHOTOGRAPH PANEL AT THIS POINT.
9. APPLY INDICATED FINISH COAT ONTO AREAS A, B AND H.
10. PHOTOGRAPH PANEL AT THIS POINT.

\* ACTUAL - AVERAGE OF TWO OR MORE READINGS

				<b>BECHTEL</b> LOS ANGELES			
				GEORGIA POWER COMPANY MELVIN W. VOSSLE NUCLEAR PLANT			
				DBA REPAIRABILITY TEST PANELS			
				DATE	SCALE	DRAWING NO.	REV.
						811	

PANEL ID#

831



COATING MATERIAL

DFT\*

A.	Amerton D6N	3.8
B.	Amerton D6N	3.8
T. U.	Amerton D6N	3.2
F.	None	—

1. ABRASIVE BLAST TO SSPC-SP10 WITH A PROFILE FROM 1.5 TO 3.0 MILS.
2. APPLY THE INDICATED PRIMER TO DESIGNATED AREA OF PANEL. (NO PRIMER IS TO BE APPLIED TO CENTER SECTION H.)
3. ALLOW BARE AREA H TO RUST.
4. PHOTOGRAPH PANEL AT THIS POINT.
5. POWER TOOL CLEAN RUSTED AREA OF PANEL USING THE CLEAN AND STRIP WHEEL AND/OR DISC FOLLOWED BY THE ROTO PEEN WHEEL (MANUFACTURED BY 3M COMPANY.)
6. PHOTOGRAPH PANEL AT THIS POINT.
7. COAT THE PREPARED AREA WITH THE INDICATED TOUCH-UP COATING MATERIAL (TU).
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10. PHOTOGRAPH PANEL AT THIS POINT.

\* ACTUAL - AVERAGE OF TWO OR MORE READINGS

						BECHTEL LOS ANGELES			
						GEORGIA POWER COMPANY MILYN W. FOSTLE NUCLEAR PLANT			
						DBA REPAIRABILITY TEST PANELS			
						DATE	SCALE	DRAWING NO.	REV.

SEE A 831



SAMPLE IDENTIFICATION  
AND  
SPECIFIC TEST DESIGNATION

<u>Sample No.</u>	<u>Primer/Touch-Up</u>	<u>Test Designation</u>
811	Dimetcote 6/Dimetcote 6	Radiation & DBA
821	Dimetcote 6/Dimetcote 6	DBA
831	Dimetcote 6/Dimetcote 6	Radiation & DBA
841	Dimetcote 6/Dimetcote 6	DBA

RADIATION TOLERANCE TEST RESULTS

Manufacturer Bechtel/3M  
Saint Paul, Minnesota  
Report Number TRC-089-03

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date October 10, 1979  
Page 41 of 48

System Identification<sup>a</sup>

x Steel panel

Concrete block

GR - Inorganic Zinc D-6  
PT - Inorganic Zinc Touch-Up D-6  
No finish

Radiation Tolerance Test Results

ORNL Master Analytical Manual Method No. 2 0921, Bechtel Corp. Spec. No. CP-951  
ORNL Log Book No. A 7562; A8-23-9

Initial dose rate  $1 \times 10^7$  rad/h

Test conducted in x air water

Sample No.

Cumulative dose rate  $2 \times 10^8$  rads: comments

811

Coatings intact, no defects all areas. 4.0 / 2.1

831

Coatings intact, no defects all areas. 3.1 / 3.2

<sup>a</sup>GR = grit blast cleaning; PT = power tool cleaning; SW = solvent wash cleaning.

Evaluated

Ralph L. Rapp

Approved

L. T. Chin

DBA TEST RESULTS



Manufacturer Bechtel/3M  
Saint Paul, Minnesota  
ORNL Log Book No. A7562; A8-31-9

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date October 10, 1979

Table 1. DBA solution composition, distilled water

Solution A: 0.28 M boric acid (3000 ppm boron)  
Adjusted to pH 10.5 with sodium hydroxide  
Solution B: 0.28 M boric acid (3000 ppm boron)  
Adjusted to pH 8.5 with sodium hydroxide

Table 2. DBA test conditions<sup>a</sup>

Time	Temperature (°F)	Pressure (psig)	Comments
Start			Autoclave preheated.
10 seconds	307	60	Steam injected.
2 minutes	307	60	
20 seconds	310	60	Spray solution A added at 310°F.
5-minute recovery	310-307	62-60	
64 minutes	307	60	
20 seconds	282	52	Spray solution B added at 250°F after draining autoclave.
5-minute recovery	282-307	50	
167 minutes	307	60	
15 minutes	307-250	30	Temperature and pressure reduced via cooling coil.
4 days	250	30	Pressure adjusted with N <sub>2</sub> .
20 seconds	180	-7	Fresh spray solution B added at 75°F after draining autoclave.
15 minutes	180-200	10	Pressure adjusted with N <sub>2</sub> .
3 days	200	10	
End of test			

<sup>a</sup>The above data are taken from recorder charts on permanent file at ORNL.

Evaluated

Approved

*Ralph L. Apple*  
*L. F. Gibson*

Manufacturer Bechtel/3M  
Saint Paul, Minnesota  
Report Number TRC-089-03

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date October 10, 1979  
Page 41 of 48

System Identification<sup>a</sup>

x Steel panel Concrete block

GR - Inorganic Zinc  
PT - Inorganic Zinc Touch-Up  
No finish

DBA Test Results

ORNL Master Analytical Manual Method No. 2 0922  
ORNL Log Book No. A 7562; A8-31-9

<u>Sample No.</u>	<u>DBA phase</u>	<u>Comments</u>
811 <sup>b</sup>	spray	Coatings intact, no defects all areas.
821	spray	Coatings intact, no defects all areas.
831 <sup>b</sup>	spray	Coatings intact, no defects all areas.
841	spray	Coatings intact, no defects all areas.

<sup>a</sup>GR = grit blast cleaning; PT = power tool cleaning; SW = solvent wash cleaning.

<sup>b</sup>Irradiated.

Evaluated

Ralph L. Apple

Approved

L. T. Cochran

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*Signature*

**Ameron**  
Protective Coatings  
Division

Date: March 7, 1984

RADIATION AND OBA TESTING  
OF DIMETCOTE 6 REPAIRED  
AND TOUCHED UP WITH  
DIMETCOTE 6

NAME: \_\_\_\_\_

STATEMENT FROM OAK RIDGE  
ON PROCEDURES USED IN THEIR EVALUATION



TX-4201

06/22/84

Allegation No. 5

Procedure No. CCP-30A, Rev. 2, page 2 of 13, paragraph 1.3.1 allows the application of Carboline 305 over the primer Dimetacote 6 by Ameron. Has this system been DBA qualified?

Evaluation of Validity

We assume the term "Carboline 305" used in the allegation refers to Phenoline 305 manufactured by Carboline.

A coating system of Carboline's Phenoline 305 over Ameron's Dimetacote 6 primer has been specifically qualified for DBA. (See Carboline Testing Project 01684, Final Report, attached).

Safety Significance

None

Generic Implications on Other Systems or Contractors

Not Applicable

# LABORATORY TEST REPORT

August 11, 1978

Testing Project: 01684  
FINAL REPORT

**SUBJECT:** LOCA; Amercoat D-6/Phenoline 305 Finish and the Comanche Peak FSAR LOCA Curve

**REFERENCE:** Comanche Peak Nuclear Station; Mr. Don Sutton; Mr. Keith Falk; Mr. Dan W. McBride; Testing Project 01651

**PURPOSE:** To determine the performance of 1c Amercoat D-6/1c Phenoline 305 Finish when exposed to the Comanche Peak Steam Electric Station, FSAR LOCA curve and evaluated according to ANSI N101.2-1972, Section 4.5 as interpreted by Carboline.

**CONCLUSION:** After the seven days of the Comanche Peak FSAR LOCA curve, the following exhibit an acceptable performance:

	<u>System</u>	<u>Primer Cure</u>
1,2	1c Amercoat D-6 1c Phenoline 305 Finish	17 days at 67-79°F (19-26°C) and 53-88% R.H.
3,4	1c Amercoat D-6 1c Phenoline 305 Finish	17 days at 95-100°F (35-38°C) and 100% R.H.

**PROCEDURE:**

A) Test Coupons

Size: 2" x 4" x 1/4" Certified ASTM A36 Steel  
Surface Prep: Gritblasted to SSPC-SP5-63  
Abrasive Media: GFH #50 grit (Cleveland Metal Abrasives, Inc.)

B)	<u>Systems Tested</u>	<u>Batch Numbers</u>	<u>Dry Film Thickness</u>
1,2	1c Amercoat D-6 (cured in Cure Cabinet*)	1503310 1503210	2.5 - 3.5 mils
	1c Phenoline 305 Finish	7B0427M 6M3959M	6.2 - 8.6 mils
			9.2 - 11.1 mils
3,4	1c Amercoat D-6 (cured in High Humidity Drum**)	1503310 1503210	2.4 - 3.3 mils
	1c Phenoline 305 Finish	7B0427M 6M3959M	4.7 - 5.4 mils
			7.3 - 8.0 mils

\*Cure Cabinet is at ambient temperature but, has humidity controlled from 50% to 90% R.H.

\*\*High Humidity Drum is at 100°F (38°C) and 100% R.H.  
From the Carboline Research & Development Laboratory

8511060295

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# LABORATORY TEST REPORT

August 11, 1978/Page 2

Testing Project: 01684  
FINAL REPORT

PROCEDURE: (Continued)

C. Cure Schedule

- 1,2 Amercoat D-6: 17 days at 67-79°F (19-26°C) and 53-88% Relative Humidity.  
Phenoline 305 Finish: 18 days at 71-80°F (22-27°C) and 55-70% Relative Humidity.
- 3,4 Amercoat D-6: 17 days at 95-100°F (35-38°C) and 100% Relative Humidity.  
Phenoline 305 Finish: 18 days at 71-80°F (22-27°C) and 55-70% Relative Humidity.

D. Exposure

Texas Utilities Generating Company, Comanche Peak Steam Electric Station, FSAR Figures 6.2.1-1 and 6.2.1-2.

1. Time/Temperature/Pressure Profile

<u>Time</u>	<u>Temperature</u>	<u>Pressure</u>	<u>Spray Condition</u>
Initial to 10 seconds	240°F (115°C)	44 psia	Static
10 seconds to 15 mins.	270°F (132°C)	58 psia	Dynamic
15 mins. to 1 hour			
15 mins.	215°F (102°C)	34 psia	Dynamic
1 hour 15 mins. to 7 days	215°F-130°F (102°C-51°C)	34-10 psia	Dynamic

(Note: This is the theoretical curve supplied by Comanche Peak. It was followed as closely as possible with the LOCA apparatus available at Carboline Company. Please refer to the recorder chart (L115-129) for exact conditions of LOCA profile.)

2. Spray Solution

H<sub>2</sub>BO<sub>3</sub> (2000 ppm as Boron) in deionized water.  
pH = 8.5 - 10.0 (NaOH added to adjust pH).

GRADING PROCEDURE:

The test coupons were evaluated for performance in the following areas:

- 1) Material flaking off
- 2) Delamination between coats and/or peeling

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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## LABORATORY TEST REPORT

-August 11, 1978/Page 3

Testing Project: 01684  
FINAL REPORT

### GRADING PROCEDURE: (Continued)

- 3) Blistering of the topcoat
- 4) Chalking of the coating
- 5) Excessive cracking

Grading procedures specified in Report N101.2 - 1972 of the American National Standards Institute-Protective coatings for Light Water Nuclear Reactor Containment Facilities:

#### 4.5 Methods of Examining and Evaluating the Exposed Test Specimens

The dynamic and/or static elevated temperature-pressure and irradiation test panels shall be evaluated within 2 hours and again after 2 weeks after removal from the test chamber for the following surface defects: flaking, delamination and/or peeling, blistering, and chalking. Defects listed in Subsections 4.5.1 through 4.5.4 shall be dealt with as follows:

4.5.1 Flaking. ASTM D772, Evaluating Degree of Resistance to Flaking (Scaling) of Exterior Paints, Part 21, American Society for Testing and Materials, Philadelphia, Pa. 19103. Flaking shall not be permitted.

4.5.2 Delamination and/or Peeling. Delamination and/or peeling shall not be permitted.

4.5.3 Blistering. Blistering shall be limited to a few, intact blisters, Size No. 4, ASTM D714, Standard Method of Evaluating Degree of Blistering of Paints, Part 21, American Society for Testing and Materials, Philadelphia, Pa. 19103. The number and the size of blisters shall be recorded.

4.5.4 Chalking. ASTM D659, Standard Method of Evaluating Degree of Resistance to Chalking of Exterior Paints, Part 21, American Society for Testing and Materials, Philadelphia, Pa. 19103. Heavy chalking shall not be permitted.

Any other changes in coating properties which are not also associated with the separation, or the release, of coating from the substrate shall not be a cause for rejection.

From the Carboline Research & Development Laboratory

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

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# LABORATORY TEST REPORT

August 11, 1978/Page 4

Testing Project: 01684  
FINAL REPORT

ANSI N101.2-1972 Criteria  
(As interpreted by Carboline)

## Maximum Degree of Failure Allowable

Flaking ASTM D772

10 (None)

Delamination or Peeling

None

\*Blistering ASTM D714-56

### Blister Size

### Blister Density

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

#2

None

#4

Few

#6

Medium

#8

Medium-Dense

Chalking ASTM D659

8 (Light)

NOTE: Flaking, blistering and chalking are all evaluated according to ASTM Standards, with a rating of 10 indicating that no failure was observed in the specific grading area.

From the Carboline Research & Development Laboratory

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

carboline

Panel Identification and Coating System	Dry Film Thickness	Flaking	Delamination or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
1A* 1c Amercoat D-6 (Primer Cure 53-88% R.H.) 1c Phenoline 305 Finish	3.5 mils 6.5 mils 10.0 mils	10	None	None	10	----	Acceptable
1B 1c Amercoat D-6 (Primer cure 53-88% R.H.) 1c Phenoline 305 Finish	3.0 mils 6.2 mils 9.2 mils	10	None	#4 Few Intact	10	----	Acceptable
2A* 1c Amercoat D-6 (Primer cure 53-88% R.H.) 1c Phenoline 305 Finish	2.8 mils 7.7 mils 10.5 mils	10	None	None	10	----	Acceptable
2B 1c Amercoat D-6 (Primer cure 53-88% R.H.) 1c Phenoline 305 Finish	2.5 mils 8.6 mils 11.1 mils	10	None	#4 Few Intact	10	----	Acceptable
3A* 1c Amercoat D-6 (Primer cure 100% R.H.) 1c Phenoline 305 Finish	2.4 mils 5.4 mils 7.8 mils	10	None	None	10	----	Acceptable
3B 1c Amercoat D-6 (Primer cure 100% R.H.) 1c Phenoline 305 Finish	3.3 mils 4.7 mils 8.0 mils	10	None	None	10	----	Acceptable
4A* 1c Amercoat D-6 (Primer cure 100% R.H.) 1c Phenoline 305 Finish	2.6 mils 4.7 mils 7.3 mils	10	None	None	10	----	Acceptable
4B 1c Amercoat D-6 (Primer cure 100% R.H.) 1c Phenoline 305 Finish	2.5 mils 4.9 mils 7.4 mils	10	None	None	10	----	Acceptable

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Testing Project: 01684  
FINAL REPORT

RESULTS

Panel Identification and Coating System	Dry Film Thickness	Flaking	Delamina- tion or Peeling	Blistering	Chalking	Other Performance Characteristics	Performance Evaluation
Acceptable Performance ANSI N101.2-1972, Section 4.5, As Interpreted by Carboline		10	None	#4F to #8M	#8 (Light)	*Panel suspended in the vapor phase	

*John J. Ladage, Jr.*

John J. Ladage, Jr.  
Developmental Chemist  
Testing Department

*Michael D. Teller*

Michael D. Teller  
Supervisor  
Research & Development

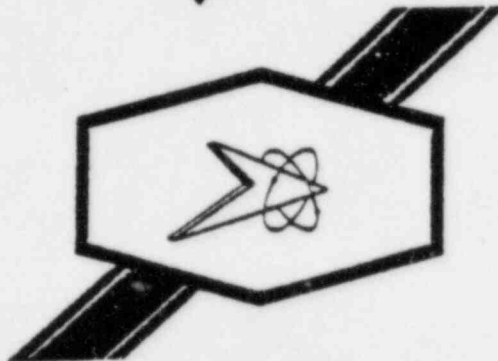
*John F. Montle*

John F. Montle  
Vice President  
Research & Development

/b/  
XC: JFH/CJW/DWI/PDI/NDT

#12

# Imperial



## TECHNICAL REPORT

### NUMBER

#495-81

### TITLE

Nutec 11S/Nutec 1201  
Nutec 11S/Nutec 11/Nutec 1201  
Radiation Tolerance,  
Design Basis Accident Testing (ORNL)  
FOR

Company Knowledge

### CUSTOMER

Submitted by: Gerald E. Arnold

Approved By:

*Gerald E. Arnold*  
*[Signature]*

Date: June 10, 1981

SOUTHERN IMPERIAL COATINGS CORPORATION, INC.  
P. O. Box 29077, \* New Orleans, Louisiana 70189  
Phone: (504) 254-1433

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8611050388



#### SCOPE:

The purpose of this test is to evaluate the performance of Nutec 11S applied at film thicknesses of .020-.115" under design basis accident conditions specified for the South Texas Project. The effects of various mixing techniques and compressed air cleaning are also studied.

#### BACKGROUND:

The six test specimens were included in the South Texas Project test to generate data on Nutec 11S at film thicknesses higher than the currently qualified 35 mil. maximum DFT imposed in Service Level 1 areas, to comply with the newly revised STP test requirements and to provide data on surface preparation other than abrasive blasting.

#### SUMMARY:

All six specimens exhibited no defects when subjected to the STP design basis accident conditions (291°F., 70 PSIG). Two of the specimens were irradiated to  $2 \times 10^8$  rads; radiation tolerance was excellent.

#### PROCEDURES:

Concrete coupons, measuring 2x4x2", were coated as described in the attached panel preparation sheets. On coupons A32, A34, and A38, Nutec 11S was applied at various film thicknesses and in 1-3 coats. Some faces also received a tight coat of Nutec 11.

Coupons A78, A83, and A85 were coated with Nutec 11S and Nutec 11 which had either been hand mixed with a spatula or with a Cowles mixer. One face of each coupon received no Nutec 11. Therefore, the coupons in both sets represent both the Nutec 11S/11/1201 and the Nutec 11S/1201 system.

The test specimens were submitted to Oak Ridge National Laboratories. Coupons A32 and A83 were irradiated to  $2 \times 10^8$  rads; all coupons were DBA tested per the South Texas requirements, with maximum temperature and pressure, of 291°F. and 70 PSIG, respectively. (See attachment summary)

Refer to the attached ORNL statement for a description of the tests performed.

#### RESULTS:

Refer to individual ORNL results sheets.

<u>Coupon No.</u>	<u>Irradiation</u>	<u>DBA Results</u>
A32	Yes	No defects
A34	No	"
A38	No	"
A78	No	"
A83	Yes	"
A85	No	"

CONCLUSION:

At the LOCA conditions simulated in this test, the Nutec concrete system performed satisfactorily:

- A) Without Nutec 11 (Nutec 11S/1201)
- B) At Nutec 11S thicknesses of .020-.070" (one coat)
- C) At Nutec 11S thicknesses of .040-.115" (two-three coats)
- D) At Nutec 11 thicknesses of 1001-.010"
- E) At Nutec 1201 thicknesses of .003-.012"
- F) Regardless of dispersion speed (mixing)
- G) Over various prepared surfaces

The data demonstrates that both the 11S/11/1201 and 11S/1201 systems met the acceptance criteria of ANSI N5.12 and ANSI N101.2, when subjected to a radiation exposure level of  $2 \times 10^8$  rads and DBA conditions of 291°F and 70 PSIG.

This report should be reviewed in conjunction with Imperial's technical report #505-81, which describes the results of a second DBA test series on the Nutec concrete coating system.

# SUMMARY OF TEST PROCEDURES

Coupon #	Surface Prep.	System	Max. DFT (Mils)	Rad. Levels	Comments
A 32	Broomed surface was abrasive blasted; all other surfaces were stoned follow- ed by compressed air cleaning.	11S/1201 11S/11S/1201	70 (11S) 60 (11S)	$2 \times 10^8$ rads	
A 34		11S/1201 11S/11/1201 11S/11S/1201 11S/11S/11S/11/1201	25 (11S) 40 (11S) 115 (11S) 75 (11S)	No radiation	
A 38		11S/11/1201 11S/11S/11/1201 11S/11S/1201	45 (11S) 70 (11S) 70 (11S)	No radiation	
A 78		11S/11/1201	30 (11S) 10 (11) 12 (1201)	No radiation	#11S & #11 were hand mixed.
A 83	Broomed surface was abrasive blasted; all other surfaces were wire brushed follow- ed by compress- ed air cleaning.	11S/11/1201	30 (11S) 10 (11) 12 (1201)	$2 \times 10^8$ rads	#11S & #11 were hand mixed.
A 85		11S/11/1201	30 (11S) 10 (11) 12 (1201)	No radiation	#11S and #11 were mixed on a Cowles dissolver.

TEST PROCEDURES

Manufacturer: Imperial  
New Orleans, Louisiana

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: May 26, 1981

## REPORT OF IRRADIATION AND DBA TESTING

The irradiation and design basis accident (DBA) tests are conducted, respectively, in accordance with Bechtel Corporation specifications CP-951 and CP-956 in Standard Specification Coatings for Nuclear Power Plants (or with modifications as noted in Table 2, DBA test conditions). The tests are designed to meet specifications set in both ANSI 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 irradiation tests, coatings are examined for signs of chalking, blistering, cracking, peeling, delamination, and flaking, according to ASTM standards where applicable. All test panels are returned to the coating manufacturer.

The irradiation tests are run using a spent fuel assembly, removed from the High-Flux Isotope Reactor at ORNL, as the source of radiation. These fuel assemblies are stored under 20 ft of demineralized water. The fuel is 93% enriched U-235 as  $U_3O_8$  combined with aluminum. The spent fuel assemblies are removed after each 23-megawatt-day period. Irradiation is done using the gamma energy from 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  $1 \times 10^8$  rad/h.

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

Evaluated

Paul F. Kelly

Approved

L. T. Gibson



Manufacturer: Imperial  
New Orleans, Louisiana

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: May 26, 1981

ORNL Log Book No. A9675, A5-5-1

Table 1. DBA solution composition, distilled water

Reagent	Concentration
Boric acid, $H_3BO_3$	0.28 M
Sodium hydroxide, NaOH	Required to adjust pH to 9.5

Table 2. DBA test conditions

Time	Temperature (°F)	Pressure (psig)	Comments
Start	150		Autoclave preheated.
10 min	150-291		Steam injected at 260°F.
20 min	291	70	Pressure maintained by relief valve.
45 min	291-260		
80 min	260	39	Pressure adjusted with $N_2$ .
120 min	260-220		
180 min	220	20	
210 min	220-160		
21 h	160	5	
10 d	125	2	Placed in fresh spray solution in constant temperature bath.
End of test			

Evaluated

Ralph L. Ryall

Approved

L. T. Liskin

PANEL PREPARATION DATA

# TEST PANEL PREPARATION DATA

PRODUCT TO BE TESTED: Nutec 11S/Nutec 1201

TYPE SUBSTRATE: Concrete Size: 2 x 4 x 2

SURFACE PREPARATION (Describe): Carborundum stone used to remove high lights and loose particles; broomed surface blast swept to remove efflorescence. Cleaned with 100 psi compressed air

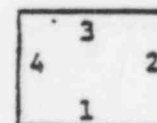
PRODUCT DATA: SAMPLE NO.(s): A-32

DATE AND TIME CURING COMPOUND OR PRIMER APPLIED: N/A

QAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F)R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
	Nutec	11S	2519/2530/2517	Squeegee	66°F/53%	*	2/4/81 3:00 p.m.
	Nutec	11S	2519/2530/2517	Squeegee	60°F/85%	**	2/5/81 9:00 a.m.
	Nutec	11S	2519/2530/2517	Squeegee	64°F/55%	***	2/9/81 9:30 a.m.
	Nutec	1201	9772/1959	Spray	73°F/52%	*****	2/16/81, 3:00

FILM THICKNESS (ins.)		11S *	11S **	11S ***	11 *****	1201 *****
Side 1	max.	.060-.070				.003-.005
Side 2	min.	.040-.050				.003-.005
Side 3			.010-.020	.030-.040		.003-.005
Side 4			.010-.020	.030-.040		.003-.005

TOP VIEW OF COUPON



Numbered and broomed surface

TOTAL DRY FILM THICKNESS RANGE - Side 1 .063-.075 Side 3 .043-.065  
Side 2 .043-.055 Side 4 .044-.074

CURING CONDITIONS: AMBIENT TEMP. 70-80 °F REL. HUMIDITY 45-65 %

MINIMUM CURE 7 DAYS

TEST PROCEDURE: DBA and Rad

TESTING PERFORMED BY: ORNL

DATE SUBMITTED 4-28-81

APPROVED [Signature]

TEST REPORT NO. 495-81

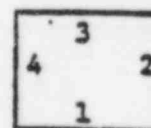
# TEST PANEL PREPARATION DATA

- PRODUCT TO BE TESTED: Nutec 11S/Nutec 11/Nutec 120L Nutec 11S/Nutec 120L
- TYPE SUBSTRATE: Concrete Size: 2 x 4 x 2
- SURFACE PREPARATION (Describe): Carborundum stone used to remove high lights and loose particles; broomed surface blast swept to remove efflorescence. Cleaned with 100 psi compressed air
- PRODUCT DATA: SAMPLE NO.(s): A-34
- DATE AND TIME CURING COMPOUND OR PRIMER APPLIED: N/A

QAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(*F) TR.H.	THICKNESS (ins.)	TIME & DATE APPLIED
	Nutec	11S	2519/2530/2517	Squeegee	66°F/53%	*	2/4/81 3:00 P.M.
	Nutec	11S	2519/2530/2517	Squeegee	60°F/85%	**	2/5/81 9:00 a.m.
	Nutec	11S	2519/2530/2517	Squeegee	62°F/55%	***	2/9/81 9:30 a.m.
	Nutec	11	2476/2102/2444	Squeegee	62°F/43%	****	2/13/81, 2:00
	Nutec	120L	9772/1959	Spray	73°F/52%	*****	2/16/81, 3:00

FILM THICKNESS (ins.)		11S *	11S **	11S ***	11 ****	120L *****
Side 1	Min.	.020-.025				.003-.005
Side 2		.025-.040			.001-.004	.003-.005
Side 3	Max.	.025-.035	.030-.040	.030-.040	.001-.004	.003-.005
Side 4			.020-.035	.030-.040		.003-.005

TOP VIEW OF COUPON



Numbered and broomed surface

TOTAL DRY FILM THICKNESS RANGE - Side 1 .023-.030 Side 3 .086-.124  
Side 2 .029-.049 Side 4 .053-.080

CURING CONDITIONS: AMBIENT TEMP. 70-80 °F REL. HUMIDITY 45-65 %  
MINIMUM CURE 7 DAYS

TEST PROCEDURE: DBA

TESTING PERFORMED BY: ORNL

DATE SUBMITTED 4-28-81

APPROVED Sheld C. Powell

TEST REPORT NO. 495-81

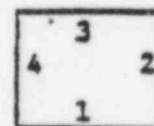
# TEST PANEL PREPARATION DATA

- PRODUCT TO BE TESTED: Nutec 11S/Nutec 11/Nutec 1201, Nutec 11S/Nutec 1201
- TYPE SUBSTRATE: Concrete Size: 2 x 4 x 2
- SURFACE PREPARATION (Describe): Carborundum stone used to remove high lights and loose particles; broomed surface blast swept to remove efflorescence. Cleaned with 100 psi compressed air
- PRODUCT DATA: SAMPLE NO.(s): A- 38
- DATE AND TIME CURING COMPOUND OR PRIMER APPLIED: N/A

DATE	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
	Nutec	11S	2519/2530/2517	Squeegee	66°F/53%	*	2/4/81 3:00 p.m.
	Nutec	11S	2519/2530/2517	Squeegee	60°F/85%	**	2/5/81 9:00 a.m.
	Nutec	11S	2519/2530/2517	Squeegee	62°F/55%	***	2/9/81 9:30 a.m.
	Nutec	11	2476/2102/2444	Squeegee	62°F/43%	****	2/13/81, 2:00
	Nutec	1201	9772/1959	Spray	73°F/52%	*****	2/16/81, 3:00

FILM THICKNESS (ins.)		11S *	11S **	11S ***	11 ****	1201 *****
Side 1	min.		.030-.045		.001-.004	.003-.005
Side 2	max.	.025-.030	.030-.040		.001-.004	.003-.005
Side 3		.025-.030		.030-.040		.003-.005
Side 4		.025-.030	.030-.040			.003-.005

TOP VIEW OF COUPON



Numbered and broomed surface

TOTAL DRY FILM THICKNESS RANGE - Side 1 .034-.054 Side 3 .058-.075  
Side 2 .059-.079 Side 4 .058-.075

CURING CONDITIONS: AMBIENT TEMP. 70-80 °F REL. HUMIDITY 45-65 %

MINIMUM CURE 7 DAYS

TEST PROCEDURE: DBA

TESTING PERFORMED BY: ORNL

DATE SUBMITTED 4-28-81

APPROVED

*[Signature]*

TEST REPORT NO. 495-81



# TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: Nutec 11S/Nutec 11/Nutec 1201, Nutec 11S/Nutec 1201
2. TYPE SUBSTRATE: Concrete SIZE: 2" x 4" x 2"
3. SURFACE PREPARATION (Describe): Blast swept on broomed surface to remove efflorescence; remaining faces wire brushed and blown down with 100 psi compressed air to remove dust and loose concrete.
4. PRODUCT DATA: SAMPLE NO. (s): A-78
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
	Nutec	11S*	2519/2086/2516	squeegee	71/73	See below	3-27-81
	Nutec	11*	2476/2683/2444	squeegee	73/64	"	4-2-81
	Nutec	1201	2606/2607	spray	69/51	"	4-6-81

FILM THICKNESS (ins.)	Nutec 11S	Nutec 11	Nutec 1201	TOTAL DFT RANGE
Side 1	.020-.030	.006-.010	.008-.012	.034-.052
Side 2 Min.	.020-.030		.008-.012	.028-.042
Side 3	.020-.030	.006-.010	.008-.012	.034-.052
Side 4	.020-.030	.006-.010	.008-.012	.034-.052

TOP VIEW OF COUPON



Numbered and broomed surface

CURING CONDITIONS: AMBIENT TEMP. 65-80 °F REL. HUMIDITY 45-90  
MINIMUM CURE 7 DAYS

TEST PROCEDURE: DBA

TESTING PERFORMED BY: ORNL DATE SUBMITTED 4-28-81

\*Hand mixed

APPROVED: Donald C. Arnold

TEST REPORT NO: 495-81

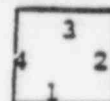
# TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: Nutec 11S/Nutec 11/Nutec 1201, Nutec 11S/Nutec 1201
2. TYPE SUBSTRATE: Concrete SIZE: 2" x 4" x 2"
3. SURFACE PREPARATION (Describe): Blast swept on broomed surface to remove efflorescence; remaining faces wire brushed and blown down with 100 psi compressed air to remove dust and loose concrete.
4. PRODUCT DATA: SAMPLE NO.(s): A-83
5. DATE AND TIME CURING COMPOUND OR PRIMER APPLIED N/A

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) & R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
	Nutec	11S*	2519/2086/2516	squeegee	71/73	See below	3-27-81
	Nutec	11*	2476/2683/2444	squeegee	73/64	"	4-2-81
	Nutec	1201	2606/2607	spray	69/51	"	4-6-81

FILM THICKNESS (ins.)	Nutec 11S	Nutec 11	Nutec 1201	TOTAL DFT RANGE
Side 1	.020-.030	.006-.010	.008-.012	.034-.052
Side 2 min.	.020-.030		.008-.012	.028-.042
Side 3	.020-.030	.006-.010	.008-.012	.034-.052
Side 4	.020-.030	.006-.010	.008-.012	.034-.052

TOP VIEW OF COUPON



Numbered and broomed surface.

CURING CONDITIONS: AMBIENT TEMP. 65-80 °F REL. HUMIDITY 45-90  
 MINIMUM CURE 7 DAYS

TEST PROCEDURE: DBA / Radiation Tolerance

TESTING PERFORMED BY: ORNL DATE SUBMITTED 4-28-81

\*Hand mixed

APPROVED: Arthur E. Arnold

TEST REPORT NO: 495-81

# TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: Nutec 11S/Nutec 11/Nutec 1201, Nutec 11S/Nutec 1201
2. TYPE SUBSTRATE: Concrete SIZE: 2"x4"x2"
3. SURFACE PREPARATION (Describe): Blast swept on broomed surface to remove efflorescence; remaining faces wire brushed and blown down with 100 psi compressed air to remove dust and loose concrete.
4. PRODUCT DATA: SAMPLE NO.(s): A-85
5. DATE AND TIME CURING COMPOUND OR PRIMER APPLIED

<u>DATE</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>TIME &amp; DATE APPLIED</u>
	Nutec	11S*	2519/LN138-17-2	squeegee	71/73	See below	3-27-81
	Nutec	11*	2476/LN138-17-1	squeegee	73/64	"	4-2-81
	Nutec	1201	2606/2607	spray	69/51	"	4-6-81

<u>FILM THICKNESS (ins.)</u>	<u>Nutec 11S</u>	<u>Nutec 11</u>	<u>Nutec 1201</u>	<u>TOTAL DFT RANGE</u>
<u>Side 1</u>	.020-.030	.006-.010	.008-.012	.034-.052
<u>Side 2</u> min.	.020-.030		.008-.012	.028-.042
<u>Side 3</u>	.020-.030	.006-.010	.008-.012	.034-.052
<u>Side 4</u>	.020-.030	.006-.010	.008-.012	.034-.052

TOP VIEW OF COUPON



Numbered and broomed surface.

1. CURING CONDITIONS: AMBIENT TEMP. 65-80 °F REL. HUMIDITY 45-90
- MINIMUM CURE 7 DAYS

2. TEST PROCEDURE: DBA
3. TESTING PERFORMED BY: ORNL DATE SUBMITTED 4-28-81

\*Cowles Mixed

APPROVED: Shall E. Arnold

TEST REPORT NO: 495-81

RESULTS

OAK RIDGE NATIONAL LABORATORY

OPERATED BY  
UNION CARBIDE CORPORATION  
NUCLEAR DIVISION



POST OFFICE BOX X  
OAK RIDGE, TENNESSEE 37830

May 26, 1981

Mr. Gerald E. Arnold  
Technical Representative  
Imperial Professional Coatings  
P.O. Box 29077  
New Orleans, Louisiana 70189

Dear Jerry:

Enclosed are the test results on your recently submitted specimens.

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

Sincerely yours,

A handwritten signature in dark ink, appearing to read 'L. T. Corbin', written in a cursive style.

L. T. Corbin, Section Head  
Analytical Chemistry Division

LTC:dmw

Enclosures



Manufacturer: Imperial  
New Orleans, Louisiana

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: May 26, 1981

SYSTEM IDENTIFICATION

11S/1201

Steel panel x Concrete block

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; Bechtel Corporation  
Specification No. CP-951; ORNL Log Book No. A9675, A5-5-1.

Initial dose rate:  $1.0 \times 10^7$  rad  
Test conducted in: x air water

Sample No.

Cumulative dose

Test results

A-32

$2 \times 10^8$  rad

Coatings intact, no defects.

Evaluated

Paul F. Apple

Approved

L. T. Gish

Manufacturer: Imperial  
New Orleans, Louisiana

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: May 26, 1981

SYSTEM IDENTIFICATION

11S/1201

Steel panel x Concrete block

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.  
ORNL Log Book No. A9675, A5-5-1

<u>Sample No.</u>	<u>DBA phase</u>	<u>Test results</u>
A-32	spray*	Coatings intact, no defects, all areas.
A-34	spray	Coatings intact, no defects, all areas.
A-38	spray	Coatings intact, no defects, all areas.

\*Irradiated.

Evaluated

Ralph F. Apple

Approved

L. T. Collins

Manufacturer: Imperial  
New Orleans, Louisiana

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: May 26, 1981

SYSTEM IDENTIFICATION

11S/11/1201

Steel panel x Concrete block

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; Bechtel Corporation  
Specification No. CP-951; ORNL Log Book No. A9675, A5-5-1.

Initial dose rate:  $1.0 \times 10^7$  rad  
Test conducted in: x air        water

Sample No.

Cumulative dose

Test results

A-83

$2 \times 10^8$  rad

Coatings intact, no defects.

Evaluated

Ray L. F. Hays

Approved

L. T. Lin

Manufacturer: Imperial  
New Orleans, Louisiana

Analytical Chemistry Division  
Oak Ridge National Laboratory  
Date: May 26, 1981

SYSTEM IDENTIFICATION

Steel panel x Concrete block

115/11/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.  
ORNL Log Book No. A9675, A5-5-1

<u>Sample No.</u>	<u>DBA phase</u>	<u>Test results</u>
A-78	spray	Coatings intact, no defects, all areas.
A-83	spray*	Coatings intact, no defects, all areas.
A-85	spray	Coatings intact, no defects, all areas.

\*Irradiated.

Evaluated

Approved

R. E. Apple  
L. T. Collins



## LABORATORY TEST REPORT

TESTING PROJECT: 02040

DATE: August 24, 1982

REPORT #: First

TIME: Final

DATE OF GRADING: 7/19/82

TOTAL DESIGN TEST DURATION: Seven Days REQUESTED BY: Dan McBride

TITLE: LOCA Testing of Carbo Zinc 11 over an SSPC-SP6 Blast

PURPOSE:

To determine the performance of Carbo Zinc 11 over a SSPC-SP6 "Commercial Blast" when subjected to a 340°F BWR (ASTM D3911-80) LOCA condition.

CONCLUSIONS:

Please refer to results.



PROCEDURE:

A. Test Coupons:

2"x4"x 1/4" steel, certified  
Carboline ST-1 (See Appendix 1)  
Surface Preparation: Gritblasted to SSPC-SP6-63,  
"Commercial Blast Cleaning".  
Abrasive Medium: 50/50 mix of GFH #40 grit on S230 shot.  
Panels were degreased before priming.

B. System Tested:

System Tested	Batch No.	Color	Thinner	Thinning Ratio	DFT Range (Mils)
1c Carbo Zinc 11	Part A: 2B5754M Part B: 2A2678M	Green #300	Thinner #33 1E0964M	12%	1.8-2.0

C. Cure Schedule:

System Tested	Time Cure	Temp °F	Temp °C	Relative Humidity Range
1c Carbo Zinc 11	2 days ambient	69°-76°	21°-24°	56% - 91%
	6 weeks, 3 days (roof)	50°-90°	10°-32°	33% - 97%
	3 days ambient	70°-76°	21°-24°	60% - 70%

D. Exposure:

1. Time-Temperature-Pressure Curve

Time	Temperature*	Pressure*
Initial	Ambient	Ambient
Initial to 6 hours	340°F (171°C)	70 psig
6 hours to 96 hours	250°F (121°C)	30 psig
96 hours to 7 days	200°F (93°C)	10 psig

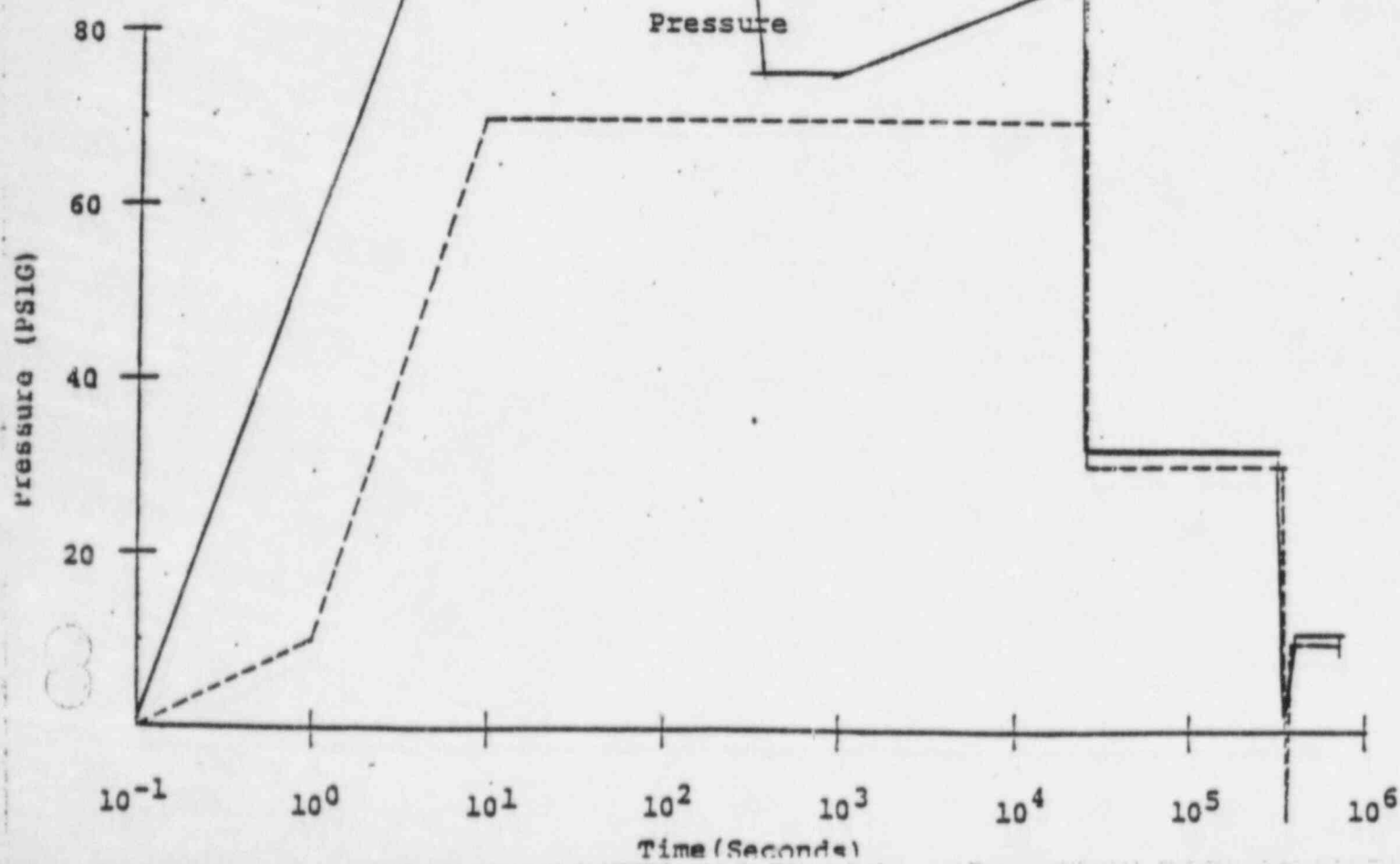
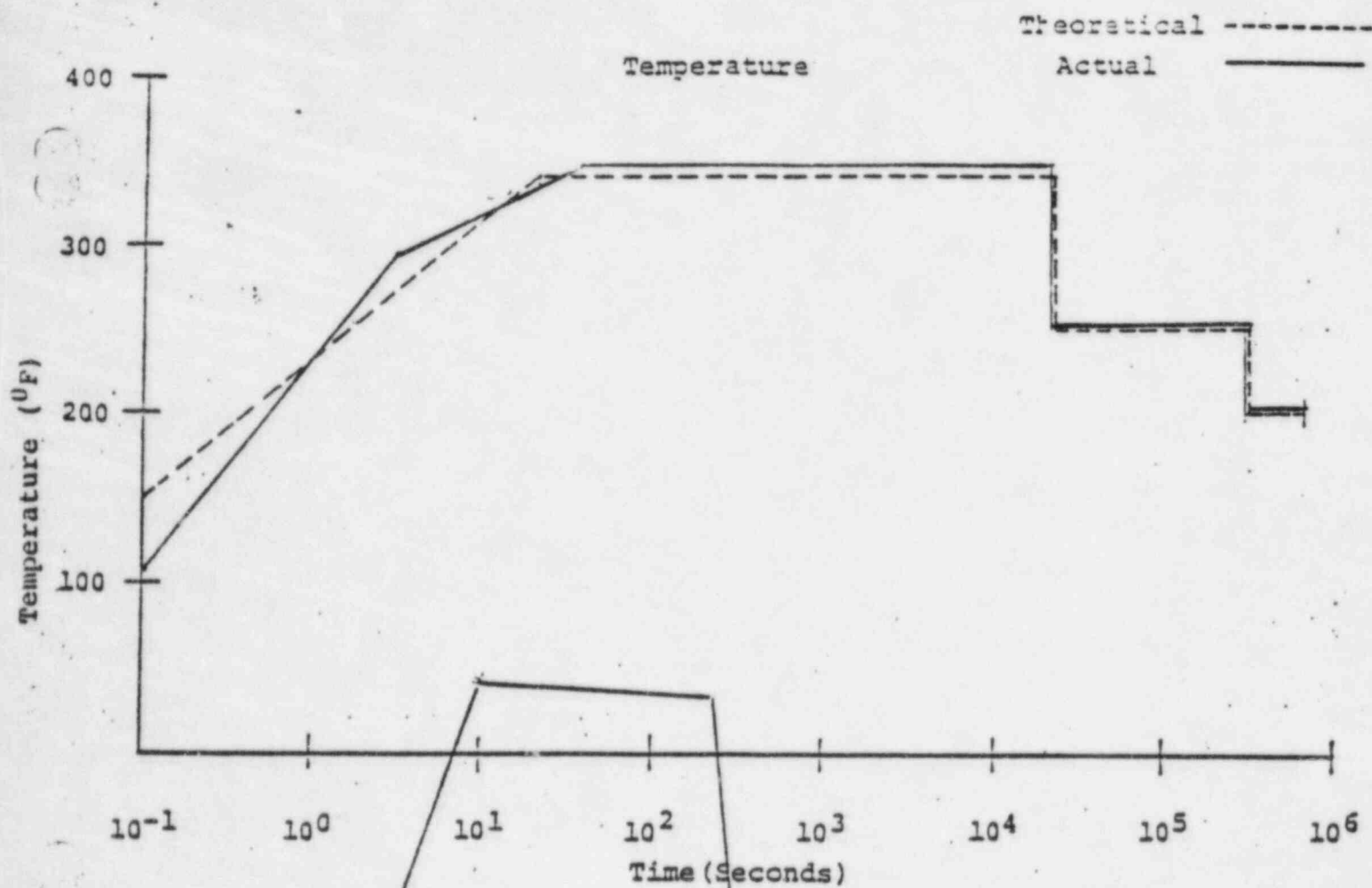
\*These are theoretical values. The next page includes graphs of theoretical and actual LOCA temperature and pressure curves. The data for the actual LOCA curves are from the chart recording for this test are found on page 131, Lab Book #230.

2. Water Chemistry  
Deionized Water pH=6.1

LOCA GRADING PROCEDURE (ASTM-D3911-80)

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

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



Testing Unit: 02040  
Final Report: Seven Days  
RESULTS

Aug 24, 1982  
Page 4

340°F LOCA VAPOR PHASE

COATING SYSTEM	DFT RANGE	FLAKING	DELAMINATION OR PEELING	BLISTERING	CRACKING	OTHER PERFORMANCE CHARACTERISTICS
1A Front						
1c Carbo Zinc 11	1.8	10	None	None	None	None
1A Back						
1c Carbo Zinc 11	1.8	10	None	None	None	None
2A Front						
1c Carbo Zinc 11	1.9	10	None	None	None	None
2A Back						
1c Carbo Zinc 11	1.9	10	None	None	None	None
3A Front						
1c Carbo Zinc 11	2.0	10	None	None	None	None
3A Back						
1c Carbo Zinc 11	1.8	10	None	None	None	None

Testing: 02040  
Final Report: Seven Days  
RESULTS

August 24, 1982  
Page 5

340°F LOCA LIQUID PHASE

COATING SYSTEM	DFT RANGE	FLAKING	DELAMINATION OR PEELING	BLISTERING	CRACKING	OTHER PERFORMANCE CHARACTERISTICS
1B Front						
1c Carbo Zinc 11	1.9	10	None	None	None	None
1B Back						
1c Carbo Zinc 11	1.8	10	None	None	None	None
2B Front						
1c Carbo Zinc 11	2.1	10	None	None	None	None
2B Back						
1c Carbo Zinc 11	2.1	10	None	None	None	None
3B Front						
1c Carbo Zinc 11	1.8	10	None	None	None	None
3B Back						
1c Carbo Zinc 11	2.0	10	None	None	None	None

*Maria R. Bumiller*

Maria R. Bumiller  
Laboratory Technician  
Testing Department

*Yuly Korobov*

Yuly Korobov  
Supervisor  
Testing Department

*John F. Montle*

John F. Montle  
Vice President  
Technology

nt/082482/  
T.P. 02040

## APPENDIX 1

### Carboline Specification CB1

#### Preparation of Concrete Specimens:

##### Concrete Composition

Cement, ASTM C150, Type II. Low alkali  
Gravel, ASTM C33, size 3/8 inch  
Sand, ASTM C33  
Water reducing admixture, ASTM C494  
Air entraining admixture, ASTM C260  
Pozzolans, ASTM C618  
Water - Demineralized or distilled water

##### Concrete Proportions

Cement, 7 sacks per cubic yard  
Sand-Gravel ratio, 55 sand, 45 gravel by volume  
Pozzolans, to 15 percent replacement of cement  
Air entraining admixture, 4-7 percent  
Water reducing admixture, as per manufacturer's instructions  
Water, to produce a 3 inch slump

#### Preparation of Test Specimen:

Make and cure the specimen according to ASTM C192, except that no form oils may be used. The face to be tested shall be composed to the form to simulate poured walls and the wood troweled surfaces: Broom finish top surface to simulate floors. No test face shall be saw cut. When applicable, concrete curing agents compatible with the coating system shall be used.

#### Panels:

The size for concrete panels shall be 2 by 4 inches by 2 inches thick  $\pm$  0.2 inches.

#### Curing Time:

Before concrete specimens are coated, they shall be cured a minimum of 28 days in accordance with ACI 301, "Specifications for Structural Concrete for Buildings." If a concrete curing primer is used, it shall be applied on the concrete within 24 hours after removal of the forms.

### Carboline Specification ST1

#### Steel Test Specimens

Panels: The size for carbon steel panels shall be 2 by 4 inches by  $\frac{1}{4}$  inch thick  $\pm$  0.1 inches with rounded edges and corners. The steel for each specimen shall meet the requirements of ASTM A36, "Standard Specifications for Structural Steel".