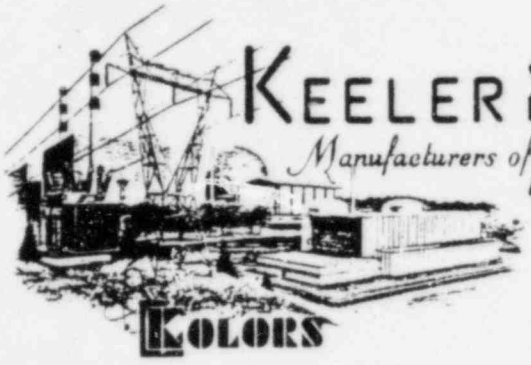
Received 7/6/84
Mailed 12/6/83



KEELER & LONG, INC.
Manufacturers of PAINTS FOR NUCLEAR, UTILITY AND INDUSTRIAL FACILITIES
P. O. BOX 460, WATERTOWN, CONN. 06795 • (203) 274-6701

December 6, 1983

Mr. Tom Kelly
Texas Utilities Gen. Co.
P. O. Box 1002
Glen Rose, Texas 76043

Dear Tom:

Relative to your telephone inquiry, I have enclosed a copy of Keeler & Long's Test Report No. 82-0701 which verifies the acceptability of hand and/or power tool cleaning with the following K&L Coating System:

Primer:	No. 6548/7107 EPOXY WHITE PRIMER	@ 4.0-14.0 mils DFT
Finish:	No. E-1-7475 EPOXY WHITE ENAMEL	@ 2.5- 6.0 mils DFT

This is a different report than I originally said that I would send to you but after looking in our file, I feel that this report is more appropriate.

If you have any further questions, please let me know.

Very truly yours,

David J. Long
Vice President

DJL/as
enc.
cc: Jack Brady

Keeler & Long, Inc.

BOX 460, WATERTOWN, CONN. 06795

TEL: (203) 274-6701

DESIGN BASIS ACCIDENT TESTING
OF
SSPC SP1 & SP2 PREPARED PANELS
(1982A ORNL TEST SERIES)

KOLORS

Paints and Coatings
for
Nuclear, Utility and Industrial Facilities

KOLORS

Final Report #82-0701
July 1, 1982

DESIGN BASIS ACCIDENT TESTING OF SSPC SP1 & SP2 PREPARED PANELS (1982A ORNL TEST SERIES)

Conducted For: Bechtel Power Corporation/SMUD
Requested By: P. L. Goodman, Project Engineer/Manager
Conducted By: Oak Ridge National Laboratory
ORNL Log Book No. A9675, A6-14-2

Conducted in Compliance with: ANSI N101.2 - 1972
ANSI N512 - 1974

Submitted By:

John F. DeBarba
John F. DeBarba
Laboratory Technician

Approved By:

David J. Long
David J. Long
Vice President

KOLORS

TABLE OF CONTENTS

KOLORS

A. PURPOSE:

A proposal was written and dated April 27, 1982 by P. L. Goodman, (See Appendix A) requesting a DBA Test of SSPC SP1 and SP2 prepared panels.

The purpose of this test was to determine any adverse effects between Mobil 78-D-6 Buff Epoxy which has been rusted then cleaned with Oakite #31 and topcoated with Keeler & Long's System S-3.

This DBA Test was prepared for the Rancho Seco Nuclear Generating Station, Unit #1, Bechtel Job 12334, SMUD Task 938.

B. PREPARATION OF TEST SPECIMENS:

Eight (8) A36 carbon steel panels size 3"x5"x1/4" used to evaluate the coating system listed in Table II, Section 1, were prepared by Keeler & Long Laboratory personnel. Table II specifies the number of panels required for each test, the coating system tested, and the minimum and maximum coating system thickness. All eight (8) panels were first blasted with abrasive to an SSPC SP10, with a 1.5-2.5 mil blast profile, both sides. Then, by spray, a coating of Mobil Chemical's 78-D-6 Buff Epoxy @ 1.0-1.5 mils DFT was applied to four (4) panels, both sides. At this point, all eight (8) panels were placed in a weatherometer for fourteen (14) days to promote "Salt and Pepper" rusting on the coated panels, and a full rust bloom on the uncoated panels. After removal from the weatherometer, a working solution of Oakite #31 (1 part Oakite #31 to 1 part water) was applied to the panels with a 3M "Scotch Brite Pad". A scrubbing action was necessary to lightly abrade and remove any contamination and loose rust from the steel/coated steel surfaces. The panels were then rinsed with clean water on a clean sponge and dried using compressed air. An application of Keeler & Long's System S-3 was then applied to all eight (8) panels at recommended coating thicknesses. The coating materials used in the preparation of these test specimens were manufactured in accordance with Keeler & Long's written Quality Assurance Manual (Revision #9, dated March, 1977).

IDENTIFICATION - The panels are identified with stainless steel tags attached with stainless steel wire. These tags identify the coating system, the Oakite wash, the Mobil undercoat, and the specimen number.

EXAMPLE - S-3 OAK.MOB-1 (S-3 is the system number, OAK is the Oakite wash, MOB is the designation for the four (4) panels coated first with Mobil's product, and the 1 is the panel number).

KEELER & LONG, INC. Box 480, Watertown, Conn. 06795, Tel. (203) 274-6701

B. PREPARATION OF TEST SPECIMENS - continued:

COATING SYSTEM - The coating system was applied to the steel panels as follows:

PANELS #1-4

Mobil 78-D-6 BUFF EPOXY		@ 1.0 - 1.5 mils DFT
6548/7107 EPOXY WHITE PRIMER		@ 4.0 - 14.0 mils DFT
E-1-7475 EPOXY WHITE ENAMEL		@ 2.5 - 6.0 mils DFT
	TOTAL	7.5 - 21.5 mils DFT

PANELS #5-8

6548/7107 EPOXY WHITE PRIMER		@ 4.0 - 14.0 mils DFT
E-1-7475 EPOXY WHITE ENAMEL		@ 2.5 - 6.0 mils DFT
	TOTAL	6.5 - 20.0 mils DFT

See Specimen Preparation Data Sheets, Section 3, for pertinent data relative to coating systems, batch numbers, temperature and humidity conditions, applied thicknesses, and dates of application.

C. TEST PROCEDURE:

The test procedure for DBA (Design Basis Accident) Testing is reported in Section 2 of this report.

D. RESULTS:

The results are recorded on Oak Ridge National Laboratory Data Sheets in Section 2 of this report.

E. CONCLUSION:

Of the sixteen (16) sides evaluated (8 minimum, 8 maximum) in this DBA Test, nine (9) sides passed with the coating intact, no defects. Six (6) out of eight (8) minimum film thickness sides (6 - 10 mils DFT) passed with the coating intact, no defects. The blistering that occurred during this DBA Test was mostly on the maximum film thickness sides (14 - 20 mils DFT), however, only two (2) of the eight (8) sides were unacceptable. It is concluded from this test that the results are acceptable since all the required film thickness sides (6 - 10 mils DFT) pass the criteria of acceptance per ANSI N101.2.

TABLE II "Coating Systems & Required Number of Specimens"		SUB-STRATE	DRY FILM THICK. (mils)		RAD. TOL.	PHYS. TEST			DBA CONCRETE		DBA CARBON STEEL						CONTROL
											IRRAD			AIR DRY			
SYSTEM IDENT.	1982-A ORNL TEST SERIES		FRONT	BACK		ABRASS	IMPACT	ADHES	IRRAD	AIR	SAND	GRIT	SHOT	SAND	GRIT	SHOT	
S-3 OAK MOB	MOBIL 78 SERIES 6548/7107 EPOXY WHITE PRIMER 6548/7107 EPOXY WHITE PRIMER E-1-7475 EPOXY WHITE ENAMEL	CARBON STEEL	1 2 2 2.5 7.5	1.5 7 7 6 21.5							4						
S-3 OAK KL	6548/7107 EPOXY WHITE PRIMER 6548/7107 EPOXY WHITE PRIMER E-1-7475 EPOXY WHITE ENAMEL	CARBON STEEL	2 2 2.5 6.5	7 7 6 20							4						

Identification No.	TABLE II "Coating Systems & Required Number of Specimens"	Issued	By:
R & D 117		11/15/77	Ch'k:
Origin		Revised	Appr:
R & D		Revision # 0	Sheet 1 of 1

KEELER & LONG BOX 460 WATERTOWN, CONNECTICUT 06795 TEL. (203) 274 6701

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

June 22, 1982

Mr. David J. Long
Vice-President
Keeler & Long, Inc.
P. O. Box 460
Watertown, Connecticut 06795

Dear Dave:

Enclosed are the results of the recent DBA test performed on your samples. Please note that side 1 on the aluminum fan blades had the identification tag. As always side 1 on the concrete blocks had the file mark, and sides 2, 3, and 4 were located by rotating the block clockwise.

For the sample identification, coating systems, and dry film thickness, we have included Table II from your letter of June 9, 1982, as an appendix. We hope this is satisfactory for your records.

If we can be of further assistance, please call.

Sincerely,

L. T. Corbin

L. T. Corbin, Section Head
Analytical Chemistry Division

LTC:dmw

Enclosures

Manufacturer: Keeler and Long

Watertown, Connecticut

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: June 22, 1982

REPORT OF DBA TESTING

The design basis accident (DBA) test is conducted in accordance with Bechtel Corporation specification CP-956 in Standard Specification Coatings for Nuclear Power Plants (or with modifications as noted in Table 2, DBA test conditions). The test is also 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 DBA and irradiation tests, 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.

Evaluated P. D. Goodstone

Approved L. T. Corbin

Manufacturer: Keeler and Long
Watertown, Connecticut

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: June 22, 1982

ORNL Log Book No. A9675, A6-14-2

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			Autoclave preheated.
10 s	307	60 (10 s)	Steam injected.
2 h 47 min	307	60	Pressure maintained by relief valve.
4.5 min	307-270	30	Spray solution added at 75°F.
25 min	270-250	30	
4 d	250	30	
3 min	250-230	0	Fresh spray solution added at 75°F after draining autoclave.
10 min	230-200	10	
3 d	200	10	
End of test			

Evaluated P. D. Bowles

Approved L. T. Corbin

Manufacturer: Keeler and Long
Watertown, Connecticut

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: June 22, 1982

SYSTEM IDENTIFICATION

x Steel panel ___ Concrete block

S-3 Oak.MOB-1
S-3 Oak.MOB-2
S-3 Oak.MOB-3
S-3 Oak.MOB-4

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A6-14-2 .

Sample No.	DBA phase	Test results: Minimum thickness side	Test results: Maximum thickness side
S-3 Oak.MOB-1	spray	Coatings intact, no defects.	Coatings intact, no defects.
S-3 Oak.MOB-2	spray	Coatings intact, no defects.	Single blister, #2.
S-3 Oak.MOB-3	spray	Coatings intact, no defects.	Single blister, #6.
S-3 Oak.MOB-4	spray	Coatings intact, no defects.	Blisters, #2 medium.

Evaluated [signature]

Approved [signature]

Manufacturer: Keeler and Long
Watertown, Connecticut

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: June 22, 1982

SYSTEM IDENTIFICATION

x Steel panel ___Concrete block

S-3 Oak.KL-5
S-3 Oak.KL-6
S-3 Oak.KL-7
S-3 Oak.KL-8 **

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A6-14-2 .

Sample No.	DBA phase	Test results: Minimum thickness side	Test results: Maximum thickness side
S-3 Oak.KL-5	spray	Blisters, #6 few.	Blisters, #8 few.
S-3 Oak.KL-6	spray	Blisters, #6 few.	Single blister, #6.
S-3 Oak.KL-7	spray	Coatings intact, no defects.	Coatings intact, no defects.
S-3 Oak.KL-8	spray	Coatings intact, no defects.	Coatings intact, no defects.

** Evaluated J. T. Bramblett
Approved L. T. Corbin

KOLORS

Coating System Mobil 78 + S-3 Date 5-3-82 Test Report # 82-0701
Substrate Type 3"x5"x1/4" A36 Carbon Steel Side All Surface Prep. *(See Below)

For: X DBA ___ Radiation ___ Decon. ___ Physical ___ Chemical ___ Other: ___

I. COATING SYSTEM

Curing Compound: ___ at ___ mils DFT

Primer: MOBIL 78-D-6 BUFF EPOXY at 1-1.5 mils DFT

Primer: 6548/7107 EPOXY WHITE PRIMER at 4-14 mils DFT

Finish: E-1-7475 EPOXY WHITE ENAMEL at 2.5-6 mils DFT

TOTAL at 7.5-21.5 mils DFT

II. BATCH NUMBERS

Product Mobil 78-D-6 Part A ___ Part B ___

Product 6548/7107 Part A 52-555 Part B 52-0435

Product E-1-7475 Part A 52-272 Part B 52-0435

Product ___ Part A ___ Part B ___

III. APPLICATION CRITERIA

Specimen#	Product	Side	Date Applied	Method Applied	°F. Temp.	% Rel.Hum	Actual Dry Film Thickness DFT/Coat	Total DFT
1	Mobil 78	F	5-3-82	SPRAY	72	40	1.5	1.5
2	Mobil 78	F	5-3-82	SPRAY	72	40	1.5-2.0	1.5-2.0
3	Mobil 78	F	5-3-82	SPRAY	72	40	1.5-2.0	1.5-2.0
4	Mobil 78	F	5-3-82	SPRAY	72	40	1.5-2.0	1.5-2.0
1	Mobil 78	B	5-3-82	SPRAY	72	40	1.0-1.5	1.0-1.5
2	Mobil 78	B	5-3-82	SPRAY	72	40	1.5	1.5
3	Mobil 78	B	5-3-82	SPRAY	72	40	1.5	1.5
4	Mobil 78	B	5-3-82	SPRAY	72	40	1.5	1.5
1	6548/7107	F	6-2-82	SPRAY	75	58	3-3.5	4.5-5
2	6548/7107	F	6-2-82	SPRAY	75	58	4	5.5-6
3	6548/7107	F	6-2-82	SPRAY	75	58	3	4.5-5
4	6548/7107	F	6-2-82	SPRAY	75	58	2.5-3	4-5
1	6548/7107	B	6-3-82	SPRAY	74	58	4.0-4.5	5-6
2	6548/7107	B	6-3-82	SPRAY	74	58	3.5-4.5	5-6
3	6548/7107	B	6-3-82	SPRAY	74	58	3.5-4.5	5-6
4	6548/7107	B	6-3-82	SPRAY	74	58	3.5-4.5	5-6

*Blasted to SSPC-SP-10, Coated with Mobil 78-D-6 then scrubbed with 3M "Scotch-brite" pad and Oakite #31.

Submitted By: John F. DeBarbe

Title: Lab Technician

Identification No.		Issued	By:
R & D 118	SPECIMEN PREPARATION DATA SHEET (LABORATORY)	12-7-77	Chk:
Origin		Revised 7-12-80	Appr:
R & D		Revision No.	Sheet 1 of 2

KOLORS

APPLICATION CRITERIA

Specimen#	Product	Side	Date Applied	Method Applied	°F. Temp.	% Rel. Hum	Actual Dry Film Thickness DFT/Coat	Total DF
1	6548/7107	B	6-4-82	SPRAY	74	53	6.5-7.5	11.5-13.5
2	6548/7107	B	6-4-82	SPRAY	74	53	6-8	11-14
3	6548/7107	B	6-4-82	SPRAY	74	53	6-7	11-13
4	6548/7107	B	6-4-82	SPRAY	74	53	7-8	12-14
1	E-1-7475	F	6-4-82	SPRAY	74	53	2.0	6.5-7
2	E-1-7475	F	6-4-82	SPRAY	74	53	2.5	8-8.5
3	E-1-7475	F	6-4-82	SPRAY	74	53	1.5-2.0	6-7
4	E-1-7475	F	6-4-82	SPRAY	74	53	3.0	7-8
1	E-1-7475	B	6-4-82	SPRAY	74	53	3.5-4.5	16-17.0
2	E-1-7475	B	6-4-82	SPRAY	74	53	4.0	15-18.0
3	E-1-7475	B	6-4-82	SPRAY	74	53	4.0	15-17.0
4	E-1-7475	B	6-4-82	SPRAY	74	53	3.0-4.0	15-17.0

Submitted By: John F. DeBarbe

Title: Lab Technician

Identification No.	SPECIMEN PREPARATION DATA SHEET (LABORATORY)	Issued 12-7-77	By:
R & D 128			Chk:
		Revised 7-12-80	Appr:
Origin			
R & D		Revision No. 1	Sheet 2 of 2

KOLORS

Coating System S-3 Date 5-2-82 Test Report # 82-0701
Substrate Type 3"x5"x1/4" A36 Carbon Steel Side All Surface Prep. *(See Below)

For: X DBA ___ Radiation ___ Decon. ___ Physical ___ Chemical ___ Other: ___

I. COATING SYSTEM

Curing Compound: ___ at ___ mils DFT

Primer: 6548/7107 EPOXY WHITE PRIMER at 4 -14 mils DFT

Intermediate: ___ at ___ mils DFT

Finish: E-1-7475 EPOXY WHITE ENAMEL at 2.5-6 mils DFT

TOTAL at 6.5-20 mils DFT

II. BATCH NUMBERS

Product 6548/7107 Part A 52-555 Part B 52-0435

Product E-1-7475 Part A 52-272 Part B 52-0435

Product ___ Part A ___ Part B ___

Product ___ Part A ___ Part B ___

III. APPLICATION CRITERIA

Specimen#	Product	Side	Date Applied	Method Applied	°F. Temp.	% Rel.Hum	Actual Dry Film Thickness DFT/Coat	Total DFT
5	6548/7107	F	6-2-82	SPRAY	75	58	4-4.5	4-4.5
6	6548/7107	F	6-2-82	SPRAY	75	58	4-4.5	4-4.5
7	6548/7107	F	6-2-82	SPRAY	75	58	4.5-5	4.5-5
8	6548/7107	F	6-2-82	SPRAY	75	58	4-4.5	4-4.5
5	6548/7107	B	6-3-82	SPRAY	74	58	5	5
6	6548/7107	B	6-3-82	SPRAY	74	58	5	5
7	6548/7107	B	6-3-82	SPRAY	74	58	5-6	5-6
8	6548/7107	B	6-3-82	SPRAY	74	58	5	5
5	6548/7107	B	6-4-82	SPRAY	74	53	6-8	11-13
6	6548/7107	B	6-4-82	SPRAY	74	53	7-8	12-13
7	6548/7107	B	6-4-82	SPRAY	74	53	6-8	11-14
8	6548/7107	B	6-4-82	SPRAY	74	53	7	12
5	6548/7107	F	6-4-82	SPRAY	74	53	3	7-7.5
6	E-1-7475	F	6-4-82	SPRAY	74	53	3-3.5	7-8
7	E-1-7475	F	6-4-82	SPRAY	74	53	3	7.5-8
8	E-1-7475	F	6-4-82	SPRAY	74	53	3	7-7.5

*Blasted to SSPC-SP10, then rusted to a full rust bloom and scrubbed with 3M "Scotch-brite" pad and Oakite #31.

Submitted By: John F. DeBarba

Title: Lab Technician

Specification No.	SPECIMEN PREPARATION DATA SHEET (LABORATORY)	Issued	By:
6 D 118		12-7-77	Chk:
Orig.		Revised 7-12-80	Appr:
		Revision No.	Sheet 1 of 2

KOPPERS COMPANY, INC. BIRMINGHAM, ALABAMA

KOLORS

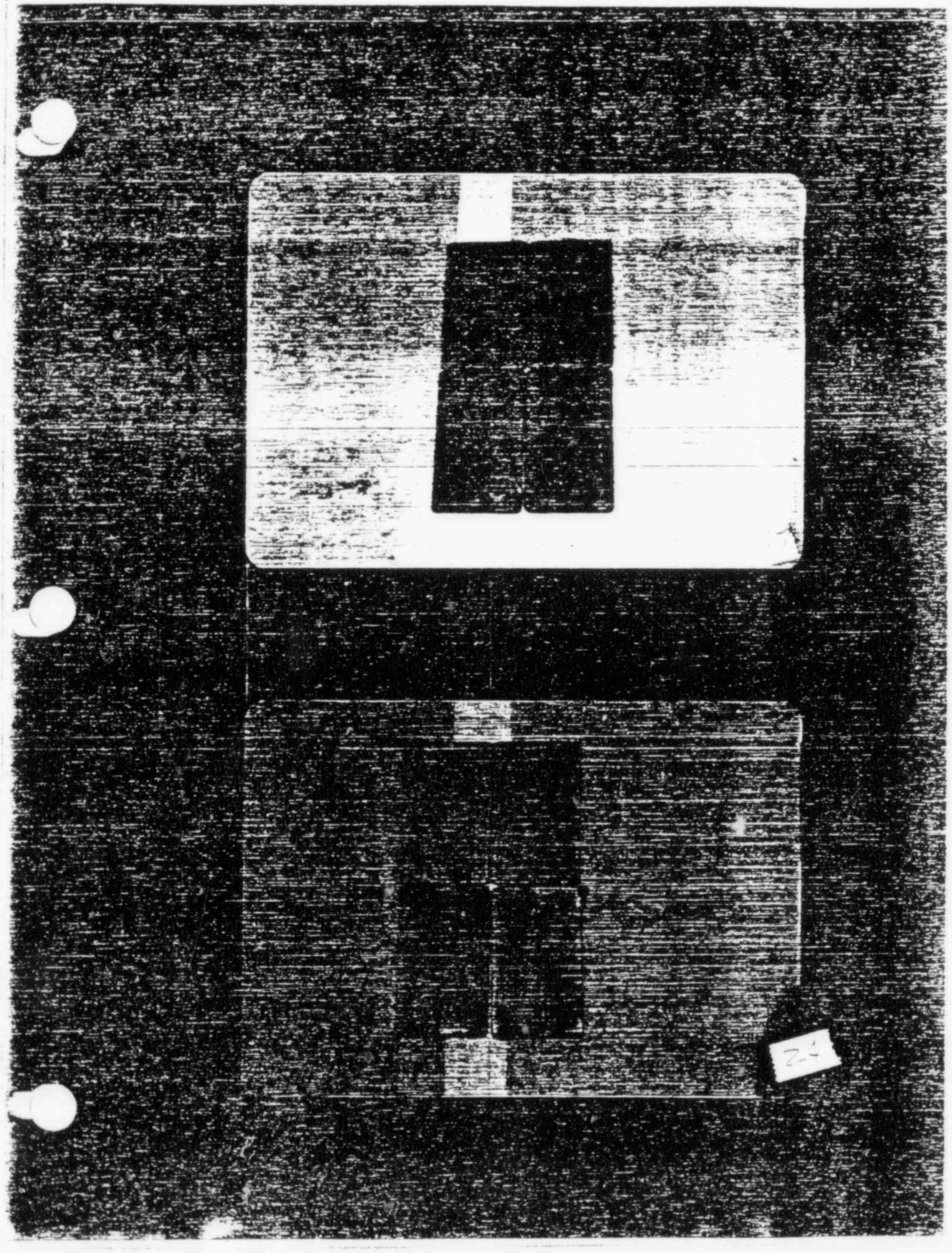
APPLICATION CRITERIA

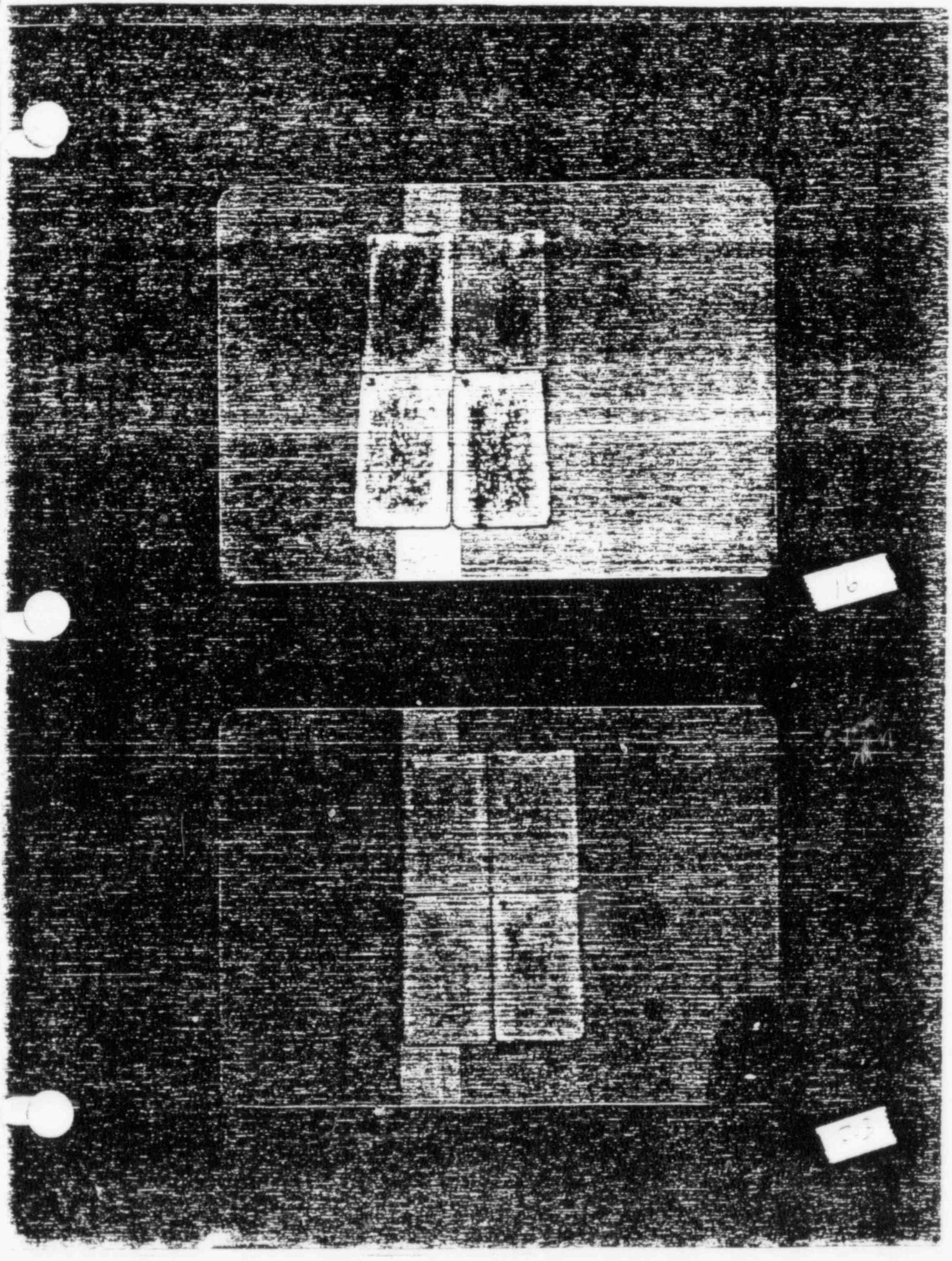
Specimen#	Product	Side	Date Applied	Method Applied	°F. Temp.	% Rel.Hum	Actual Dry Film Thickness	
							DFT/Coat	Total DF
5	E-1-7475	B	6-4-82	SPRAY	74	53	3-4.5	14-17.5
6	E-1-7475	B	6-4-82	SPRAY	74	53	3-5	15-18
7	E-1-7475	B	6-4-82	SPRAY	74	53	5-6	16-20
8	E-1-7475	B	6-4-82	SPRAY	74	53	3-5	15-17

Submitted By: John F. DeBarba

Title: Lab Technician

Identification No.		Issued	By:
R & D 118	SPECIMEN PREPARATION DATA SHEET (LABORATORY)	12-7-77	Ch'k:
		Revised	App'd:
Origin		7-12-80	
R & D		Revision No. 1	Sheet 2 of 2





Bechtel Power Corporation
Engineers - Constructors
12400 East Imperial Highway
Norwalk, California 90650
MAIL ADDRESS
P.O. BOX 60860, TERMINAL ANNEX, LOS ANGELES, CALIFORNIA 90060
TELEPHONE (213) 922-6000

April 27, 1982

Letter No. BVL-245

Dave Long
c/o Keeler & Long, Inc.
Box 460
Watertown, Conneticut 06795

Subject: Rancho Seco Nuclear Generating Station, Unit #1
Bechtel Job 12334, SMUD Task 938
DBA Test of SSPC SP1 & SP2 Prepared Panels
File: D.02 and D.05

Reference: Telecon of April 22, 1982 with M. C. Koch of Bechtel

Dear Mr. Long:

We appreciate your courtesy of including panels in an upcoming DBA test at Oakridge National Laboratories, at no charge to Bechtel Power or SMUD.

The test pressure/temp curve is the P.W.R. curve for ANSI-N-101.2. The surface preparation data is attached. Since the coating has already passed the irradiation test in an acceptable manner, no further irradiation is needed.

We are looking at a August 1, 1982 mobilization start for the continuation of the work at Rancho Seco. Hopefully this will be adequate time.

M. Koch and D. Hill will be coordinating this effort, so if any additional information is needed, please contact either one of them.

Very truly yours,

BECHTEL POWER CORPORATION

P. L. Goodman
Project Engineer/Manager
Los Angeles Power Division

PLG:MK/clc

cc: J. McColligan
A. Alvi
[illegible] Durkovich

PREPARATION OF TEST PANELS FOR
DBA TEST AT OAK RIDGE

Test panel size 3" x 5" x 1/4" A36 Carbon Steel with a 1/4" hole drilled in one end to allow for mounting on test rack.

Number of panels to be preapred - 8.

First surface preparation:

Abrasive blast the 8 panels to an SSPC - SP10, with a 1.5 - 2.5 mil blast profile, both sides

Coating application for 4 panels:

Apply, by spray, to a dry film thickness of 1.0 - 1.5 mils, Mobil Chemical's 78-D-6 Buff Epoxy Coating, both sides

Aging and rusting for the 8 blast prepared panels:

Allow coated panels to cure 7-10 days. Then, place all 8 panels in a weatherometer for 7 to 10 days.

The purpose is to promote "Salt & Pepper" rusting on the coated panels, and a full rust bloom on the uncoated panels.

Second surface preparation:

Using 3M "Scotch Brite" type material as supplied by 3M, apply an application of Oakite #31 to all 8 panels. Apply a scrubbing action to remove any contamination, lightly abrade, and work the solution into the "Salt & Papper" rust on the coated panels. Apply a scrubbing action to the blasted and rusted panels to remove all rust and to thoroughly wet the completed panel with the Oakite #31 solution.

Working solution of Oakite #31 is 1 prt Oakit #31 to 1 part water.

Using clean, clear water on a clean sponge or cloth, rinse the coated panels.

Let the panels air dry, or assist drying by using compressed air.

Coating application - Ambient temperature, between 65°F and 85°F, 40% to 90T humidity. Apply by brush or roller two or more coats of your recommended coating as follows:

The coated panels:

A total dry film thickness of 8-10 mils

The uncoated panels:

A total dry film thickness of 6-10 mils

Let cure your recommended time of cure, then test to ANSI-101.2 PWR pressure/temp curve.

MT-MNA-4578

From METALLURGICAL & NDE ANALYSIS
WIN 284-5238
Date September 27, 1983
Subject DBA Verification for Coating System Used on Refueling Machines of Comanche Peak Units 1 and 2

To E. Allbaugh
Comanche Peak

cc: T. R. Mager
A. E. Satterlee
A. S. Calderwood

Attached please find verification that the Dimetcote 2 (primer)/Amercoat 66 (topcoat) coating system used on the Comanche Peak Units 1 and 2 refueling machines meets DBA requirements, per ANSI N101.2-1972. The attached pages were extracted from a Battelle report of Westinghouse sponsored evaluative testing of various coating systems. Also enclosed, for your information, is the revision of Westinghouse Process Specification 597755, Revision H, to which the refueling machines were coated.

Please call me at WIN-284-5238, if I can be of further assistance.

M. K. Kunka
Metallurgical & NDE Analysis

Attachments

Discard Date

longitudinal to the edge. The edges were struck sufficiently hard to produce bare metal. Ten areas each were struck on all specimens but one using both the flat face and peen end of the hammer. The data from this evaluation are recorded in Table 2. The table also lists the number of photographs which show condition of each specimens after testing. These photographs were supplied in a separate packat.

Low Temperature Cycle Test

The low temperature cycle test was run for 40 cycles. A cycle consisted of 4 hours at 0 F and 4 hours at 100 F. The 4 hours at each temperature was required because of the massiveness of the lattice frame structures. Panels were examined under 10X magnification for any visible signs of coating failure. Results are reported in Table 3. It will be noted from these data that the test caused no noticeable failure in any of the coating systems.

The purpose of the test is to study performance of the coatings under extreme temperatures because the coatings can be subjected to quick temperature changes in service.

DBA Test

The DBA test was conducted according to Westinghouse specification PS-597755 Rev. E. The test is designed to simulate conditions which can exist in the suppression chamber of a nuclear reactor. The specimens were placed in a special, 70-gallon, glass-lined chamber at BCL on August 11, 1973, at 0615 a.m. Pressurizing of the chamber was started at 0615 a.m. At 0639 a.m. the pressure registered 15 psig and the temperature was 250 F. At 0709 a.m. the pressure was reduced to 0 psig and the cooling cycle was started. At 0918 a.m. the chamber was stabilized at 200 F $\pm$ 5. This temperature was held until 0918 a.m. August 15. At this time the temperature was further reduced to 150 F which was reached at 0943 a.m. This temperature was then held until the completion of the test at 0943 a.m. August 18. The specimens were sprayed throughout the DBA test with a chemical solution containing 3000 ppm of boron as boric acid, buffered with sodium hydroxide to a pH of 9.5.

The panels evaluated for resistance to DBA were evaluated according to ANSI Standard N101.2-1972, Section 4.5 within 2 hours of removal from the

chamber and again after 2 weeks standing in the laboratory on August 31, 1973. Attention was given to any major defects such as flaking, delamination or peeling, blistering, or chalking.

Results of the DBA test are shown in Table 4. The table also lists numbers of photographs which show condition of each specimen after exposure. These photographs were supplied in a separate packet, which accompanied this report.

It will be noted that best overall results in the DBA test were obtained from the coating system comprising Dimetcoat #2 Primer and Amercoat 66 Topcoat. Second best was Dimetcoat #2 Primer and the 305 Topcoat.

FUTURE WORK

All work has been completed on the program as intended.

However, the Sponsor has expressed interest in the possible use of weathering steels (such as COR-TEN®) without a protective coating. BCL will be happy to assist Westinghouse in evaluating the potential of such steels. An important consideration will be the amount of oxide which might be released from the metal surface. This might be determined by modifying the DBA test to collect the washings.

Elimination of coating through the use of other corrosion-preventive measures deserves careful study. While COR-TEN® is one approach, other metal alloys, metal cladding, and perhaps special inhibitors should be studied.

Still other work might be done to search for even better coating systems. This would involve longer term exposure tests designed to show meaningful differences in coatings which will pass the tests used in the current program. The synergistic effects of simultaneous exposure to DBA plus radiation could be a part of this testing procedure.

The current program has been limited to a few coating systems. Many more are available which should be examined for power plant use.

TABLE 4. RESULTS OF DBA CYCLIC TEST

System				
Primer	Topcoat	Spec. Type	Spec. No.	Comments
Dimetcoat #2	Amercoat 66	I-Beam Section (PHOTOGRAPH 7)	DA-2	No blisters--several small rust areas. The topcoat is off on two places. This is where the panel contacted another panel in the DBA test. Very good panel.
		Lattice-Frame Section (PHOTOGRAPH 8)	DA-7	Good panel--two chips along the side where panel rested on another panel in test.
	Phenoline 305	I-Beam Section (PHOTOGRAPH 9)	DP-6	Multiple rust spots showing on surface of coating. No apparent blisters.
		Lattice-Frame Section (PHOTOGRAPH 10)	DP-11	Multiple rust spots. Coating cracked at edge, bottom, and inside 45 degree angle. One blow hole in weld opened up. Cracking and chipping appears in areas where the coating is thick.
Carbozinc 11	Amercoat 66	I-Beam Section (PHOTOGRAPH 11)	ZA-14	Except for rust spots and two areas where panel contacted another panel in the test this is a good panel.
		Lattice-Frame Section (PHOTOGRAPH 12)	Za-19	Very poor panel. Extremely heavy blistering and peeling over surface of panel.
	Phenoline 305	I-Beam Section (PHOTOGRAPH 13)	ZP-17	Several areas where primer appeared to oxidize and break through the topcoat. Several chipped areas also noted.
		Lattice-Frame Section (PHOTOGRAPH 14)	ZP-24	Extremely heavy chipping and flaking inside at 45 degree angle and under flaps. One blister on back of panel cracked open. Poor panel.

APPENDIX A

DETAILS OF PREPARATION OF TEST SPECIMENS, COATINGS APPLICATION, AND COATING THICKNESS MEASUREMENTS

APPENDIX A

DETAILS OF PREPARATION OF TEST SPECIMENS, COATINGS APPLICATION, AND COATING THICKNESS MEASUREMENTS

Preparation of Test Specimens

Sandblasting

As reported in our letter of June 27, 1973, it was mutually agreed between Don Frelin of Westinghouse and Ben Brand of BCL that a 3-mil profile was greater than was needed. Field values of 1.5 to 2.0 mils are typical. Hence, it was agreed to use fine Ottawa sand, -30 to +80 mesh U.S. Sieve Series size for the sandblasting. According to the Steel Structures Painting Manual, this size sand gives a maximum of 2.0 mils profile, using 80 psig air pressure and a 5/16-inch nozzle.

Since difficulties were expected when blasting in the small, enclosed space between horizontal members of the lattice frame weldment simulation, the decision was made to use commercial equipment similar to that expected to be used in the field and skilled professional blasters. All panels were sandblasted at the Alban Equipment Company, 1825 McKinley Avenue, Columbus, Ohio 43222, on July 8, 1973. All panels were stored in 5-gallon lard cans over Drierite desiccant, to prevent rusting during the trip back to BCL.

Surprisingly, better than expected blasting and profile were obtained in the restricted area mentioned above, due to the sand particles bouncing about and ricocheting from one steel surface to the other.

Slightly better blasting than the required SSPC-SP10-63T surface was obtained; a shadow-free white metal surface on all specimens.

Profile measurements were made in at least six places on the I-beam sections and eight places on the lattice frame weldment sections. The minimum profile obtained was 1.5 mils, usually occurring in the restricted area between the horizontal members of the lattice frame weldment. The maximum profile obtained was 2.3 mils. The overall average of all measurements was 1.9 mils.

Careful visual examination was made to insure complete removal of all mill scale and rust.

COATINGS APPLICATION

The specimens to be coated were marked and coated according to the schedule in Figure 1. The primer coats were applied the same day the specimens were sandblasted. They were stored over Drierite from the time they were blasted until they were painted.

Some difficulty was encountered in applying the coating between the horizontal members of the lattice frame weldment section. The spray mist would not penetrate well into the narrow crevice. Some difficulty was also encountered in coating between the top horizontal member and the upright piece close to it, due to eddy currents in the spray pattern.

All specimens were coated to ± 10 percent of the required film thickness of primer, as shown in Figure A-1 and specified in RFQ No. 183224 and Westinghouse Process Specification PS 597 755. Primer film thicknesses were measured in at least six places on the I-beam sections and in at least eight places on the lattice frame weldment section. Those samples coated with 1.5 mils of Carboweld 11 were given a tie-coat of Carbozinc 11, average of 0.8 mils thick, after 3 days of air drying, according to the recommendations in the technical literature of the supplier.

All primed samples were allowed to air-dry 7 days before application of the requisite topcoat.

Even though a full 7 days' air-drying period under laboratory conditions was given to all samples, it was necessary to apply a thin mist coat of topcoat material (about 0.1 mil thick) to Carbozinc primed specimens before applying a standard film of topcoat. Otherwise, attack of the primer film by the topcoat solvents resulted in blistering and swelling of the primer film and loss of adhesion to the steel substrate. This mist coating of primers is usually standard practice with catalysed systems in the field. A mist coat was <u>not</u> necessary on specimens primed with Dimetcoat #2 (for either topcoat) and was not used.

The topcoat materials were applied to the desired thickness in one coat (other than those cases where a mist coat was necessary to prevent blistering). After an overnight dry, the panels were given a rough check for film thickness and completeness of coverage and touched up where necessary; such as around the hole in the I-beam section where the panel was hung during spraying.

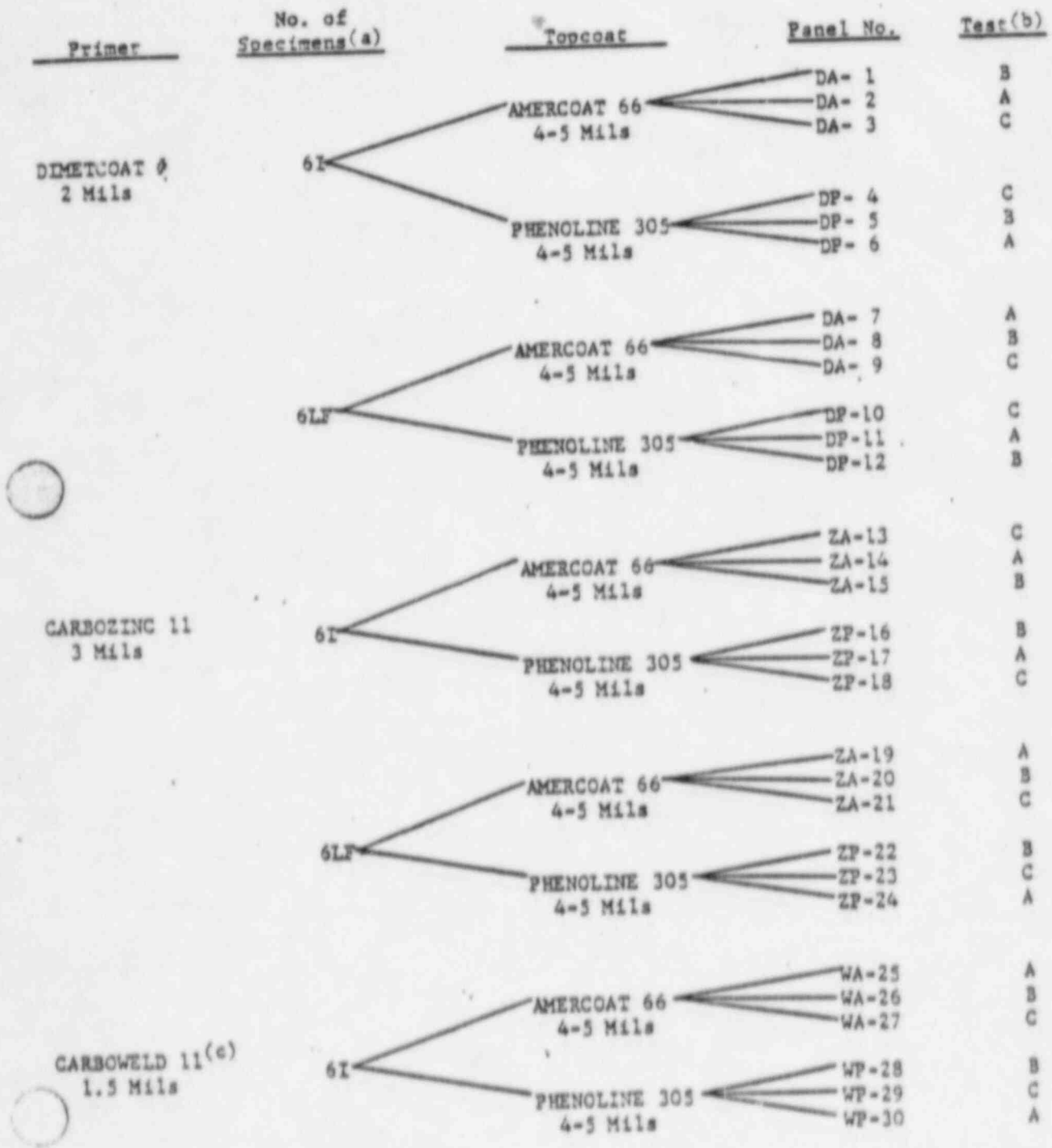


FIGURE A-1. COATING SCHEDULE

After air drying in the laboratory (75 F and 50% relative humidity) for 7 days, the total paint film thickness were measured according to the maps in Figures A-2 and A-3, using an Inspector gauge.* The detailed film thickness data for each sample are recorded in Table A-1.

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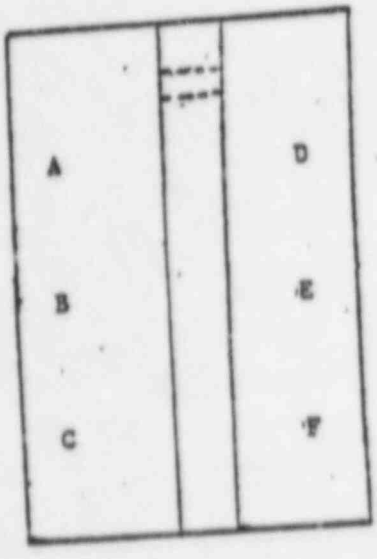
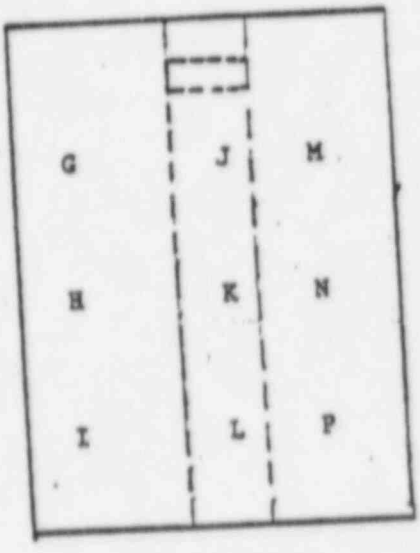
* The Inspector Gauge is available from Gardner Laboratory, Inc., Bethesda, Maryland.

FIGURE A-2. MAP OF THICKNESS READINGS
I-BEAM SECTION

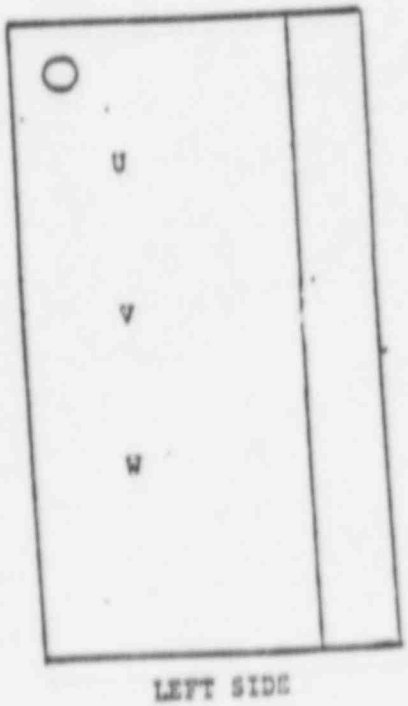


FRONT

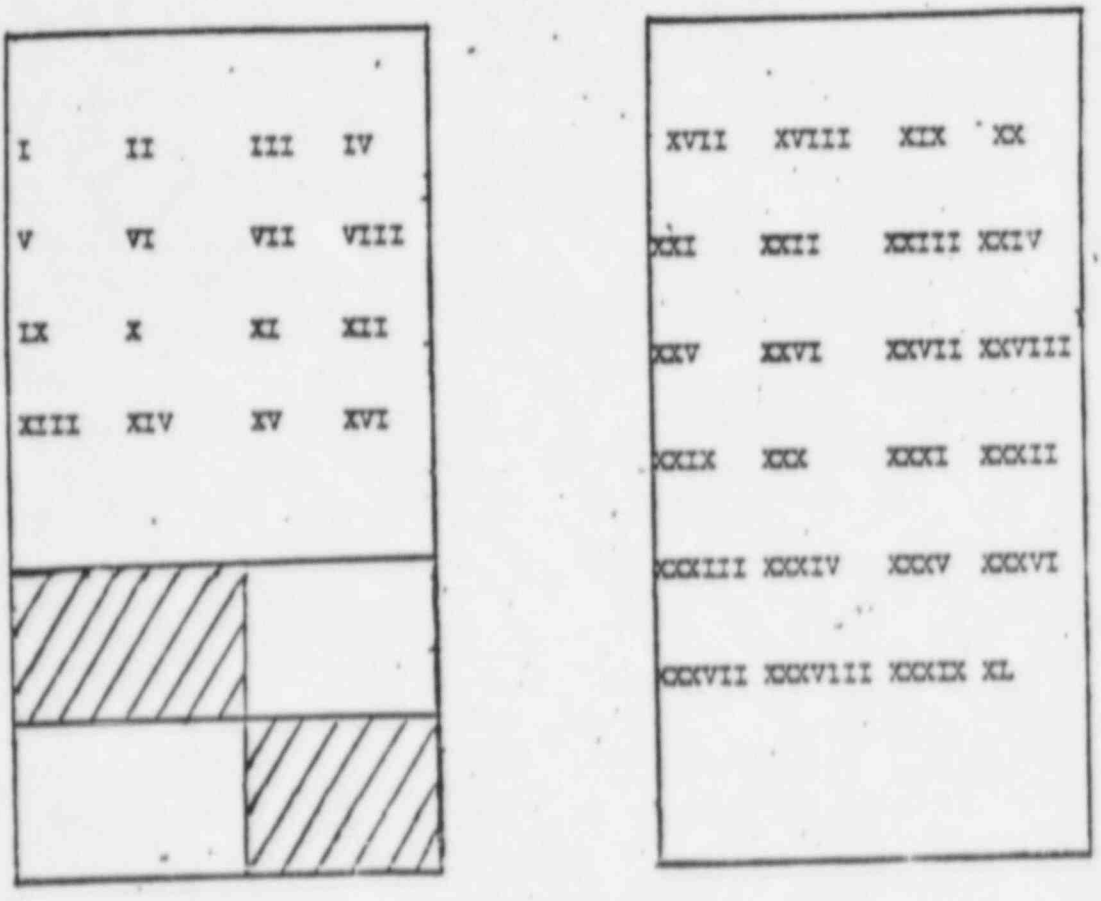


BACK

RIGHT SIDE



LEFT SIDE



SIX READINGS

BOTH TOP AND BOTTOM OF THE TWO WINGS

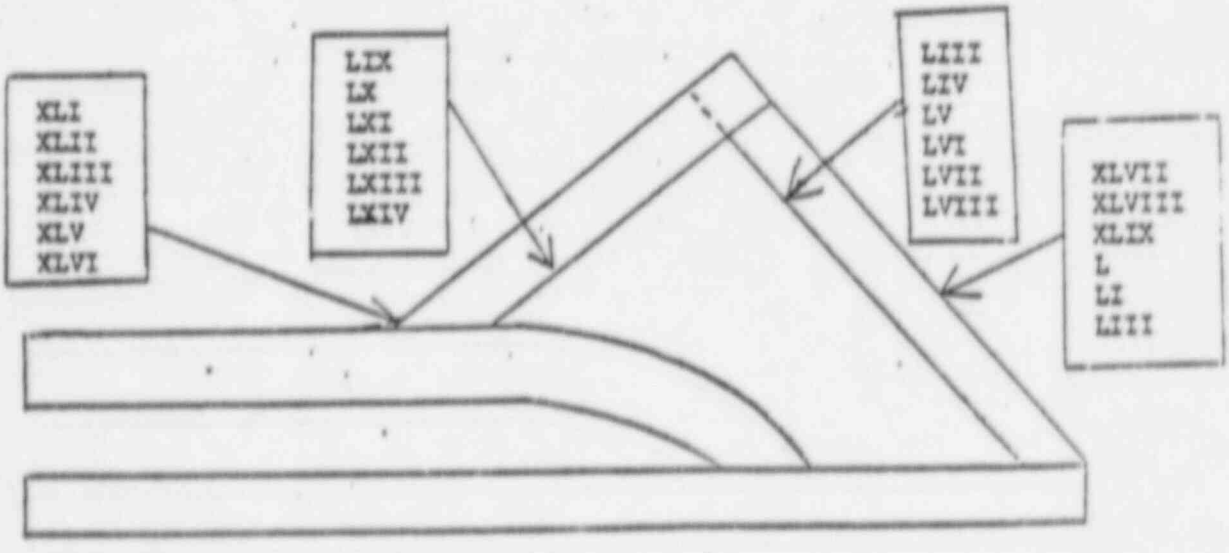


FIGURE A-3. MAP OF THICKNESS READINGS
LATTICE FRAME WELDMENT SECTION

TABLE A-1. FILM THICKNESS MEASUREMENTS

Measurement Location[c]	B[a] DA 1[b]	A DA 2	C DA 3	C DP 4	B DP 5	A DP 6
	Film Thickness, mils					
A	6	8	10	7	5	7
B	6.5	7	10	6.5	6	7.5
C	7	7.5	9	6.	7	8
D	5.5	6	11	4	5	5
E	7	7	10	4	5.5	5
F	8	7.5	11	6	7	6
G	8	7	10	5.5	6	6.5
H	7.5	6.5	9	4.5	5	6
I	6	6	8	4.5	4	4.5
J	7	7	9	5.5	7	7
K	7	7	11	5	5	6
L	5.5	6	12	5.0	4.5	5
M	6	7.5	8	4.5	5	5.5
N	5	5.5	9.5	4.5	4.5	5
P	5.5	5	8.5	4.5	4	7
R	7	6.5	11	5.5	5	8
S	6	6	11	5.5	6	6
T	6	8	9	5.5	6	6
U	7	8	10	5	5	6.5
V	7.5	8	11	4.5	5.5	6.5
W	7.5	7.5	10	5	5	6
Max	8.	8	12	7	7	8
Min	5	5	8	4	4	4.5
Avg	6.5	6.8	9.9	5.1	5.3	6.2

TABLE A-1. (Continued)

Measurement Location	A DA 7	B DA 8	C DA 9	C DP 10	A DP 11	B DP 12
	Film Thickness, mils					
I	7	8	8	7	8	8
II	8	8	7	7	7	8
III	9	8	8	7	8	8
IV	8	8	9	7	7	8
V	9	8	9	7	8	8
VI	9	8	9	7	8	9
VII	9	9	10	7	8	8
VIII	10	9	10	7	8	8
IX	10	9	10	8	10	9
X	11	10	12	8	10	9
XI	11	10	12	8	9	8
XII	9	10	10	7	9	8
XIII	14	10	10	9	10	8
XIV	14	11	12	8	11	9
XV	13	11	14	8	10	9
XVI	12	11	12	7	9	9
XVII	9	8	8	6	6	8
XVIII	8	8	8	6	6	9
XIX	8	9	7	7	7	9
XX	8	9	7	6	7	8
XXI	9	8	8	6	7	8
XXII	10	9	8	7	8	8
XXIII	10	9	8	8	8	9
XXIV	9	9	7	8	8	9
XXV	9	11	9	7	9	8
XXVI	9	10	9	7	9	9
XXVII	10	10	8	8	9	9
XXVIII	9	12	8	8	9	9
XXIX	9	10	9	8	9	8

TABLE A-1. (Continued)

Measurement Location(c)	A(a) DA 7(b)	B DA 8	C DA 9	C DP 10	A DP 11	B DP 12
	Film Thickness, mils					
XXX	10	10	9	8	8	9
XXXI	9	10	9	8	8	9
XXXII	10	10	9	8	9	9
XXXIII	11	10	10	6	8	8
XXXIV	10	9	10	7	9	9
XXXV	10	9	10	8	9	8
XXXVI	10	10	9	7	8	8
XXXVII	11	8	9	7	9	8
XXXVIII	11	8	9	6	8	9
XXXIX	10	8	9	6	8	8
XL	10	9	9	6	8	7
XLI	11	10	12	8	10	8
XLII	13	12	13	9	10	8
XLIII	15	12	11	9	9	9
XLIV	15	13	9	9	9	9
XLV	10	10	9	8	7	7
XLVI	12	10	9	9	8	9
XLVII	10	11	10	8	8	6
XLVIII	14	15	12	8	9	8
XLIX	10	11	13	7	8	8
L	10	10	9	7	8	7
LI	10	10	8	8	7	8
LII	8	8	8	6	7	8
LIII	7	9	7	6	6	8
LIV	7	9	7	7	6	8
LV	8	7	7	6	7	6
LVI	7	6	8	7	6	5
LVII	7	8	9	7	8	6
LVIII	7	9	9	8	8	7
LIX	7	9	13	6	6	8
LX	7	9	10	6	8	8
LXI	8	7	10	6	6	9
LXII	8	7	9	7	8	8
LXIII	9	7	9	6	8	10
LXIV	10	9	12	7	9	9
Max	15	15	14	9	11	10
Min	7	6	7	6	6	5
Avg	9.7	9.4	9.4	7.2	8.1	8.2

Westinghouse Electric Corporation Power Systems

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PROCESS SPECIFICATION PS 597755 or (83342 PA-PE) January 5, 1976
Rev. H

APPLICATION OF PROTECTIVE COATINGS TO STRUCTURES AND SYSTEM COMPONENTS IN THE REACTOR CONTAINMENT

1.0 SCOPE

This specification covers the application of paint systems to structures and components in the reactor containment which may come in contact with the fission product removal and/or containment cooling spray. As used herein, the term Purchaser shall refer to Westinghouse NES and the term Painting Contractor shall refer to the supplier or vendor responsible for applying the protective coating as required by the applicable Purchase Order or Equipment Specification.

Protective coatings, application procedures, and inspection methods will be acceptable provided all requirements of this specification, including the following, are met:

a. All protective coatings shall meet the applicable performance verification tests, as defined by the Purchaser, of ANSI N.101.2-1972, "Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities," and ANSI N.512-1974, "Protective Coatings (Paints) for the Nuclear Industry."

b. Protective coatings are not of the generic aluminum type.

c. Records shall be maintained by the Painting Contractor to assure the traceability of all protective coatings.

d. Prior to applying any coating, the Painting Contractor shall submit to the Purchaser, for approval, a Coating Procedure. This procedure shall define, as a minimum, the following:

1. the generic type and name of all coatings to be used.

2. the time and temperature storage limitations of coatings to be used

3. the method of surface preparation, including the media used.

4. the method of application.

5. the time, temperature, and moisture limitations during coating application.

6. the inspection procedures, including equipment used and frequency of examination.

7. the repair procedures.

8. the documentation procedures.

e. After completion of all work, the Painting Contractor shall submit to the Purchaser certification that all operations were performed in accordance with the approved Coating Procedure and that all applicable requirements of this Specification were either met or all deviations were reported and approved by the Purchaser.

f. The requirements of (d) and (e) above may be waived, if, in the judgment of the Purchaser, the total surface area to be coated is insignificant, i.e. less than approximately 1 sq. ft. to justify the additional quality assurance. The waiver must be formally granted and all other applicable requirements of this specification must be met.

2.0 COATING SYSTEM

The coating system to be used shall be selected from one of the following, as applicable. The Purchase Order or Equipment Specification shall indicate which dash number is to be used.

597755-1 (83342 PA) Application to metal surfaces for normal operation to 200°F, with topcoat.

597755-11(83342 PB) Application to metal surfaces for normal operation to 200°F, without topcoat.

597755-2 (83342 PC) Application to metal surfaces for normal operation between 200°F and 685°F which are not thermally insulated.

597755-3 (83342 PD) Condition A: Application to concrete surfaces not requiring wear resistance.

Condition B: Application to concrete surfaces which require wear resistance.

597755-4 (83342 PE) Application to metal surfaces for operation between 200°F and 685°F which are covered with thermal insulation (such as: pressure vessel, reactor vessel, steam generator). Coating of these surfaces is not considered necessary and is not recommended.

SAFETY PRECAUTIONS: USE OF SOME OF THE COMPOUNDS AND MATERIALS MAY REQUIRE SPECIAL PRECAUTIONS. FOLLOW MANUFACTURER'S INSTRUCTIONS WHEN USING.

NOTE: Any deviations to this specification necessitated by special or unusual circumstances shall be submitted in writing to UNES for written disposition.

3.0 SURFACE PREPARATION:

CAUTION: COMPONENTS, PIPING AND EQUIPMENT IN THE VICINITY OF ITEMS BEING SURFACE PREPARED SHALL BE PROTECTED FROM BLAST AND BLAST MEDIA.

3.1 Metal Surface Preparation

3.1.1 (For -1, -11, and -2)

a. Blast clean all surfaces in accordance with SSPC-SP10-63T* to remove all rust, mill scale, rust scale, paint and other foreign matter. No iron blast shot is permitted. Only blast media which complies with Westinghouse PS 292722 shall be used.

b. Remove all blasting dust and residue by brushing or vacuum cleaning.

*Issued by Steel Structures Painting Council, "Surface Preparation Specification."

NOTE: When abrasive blast cleaning is impossible due to part configuration (such as motors), surface preparation shall be as recommended by paint manufacturer.

3.1.2 (For -4)

a. Carbon steel surfaces which are subsequently painted and covered with permanent drip proof metallic insulation shall be cleaned consistent with recommendations of the paint manufacturer. Only cleaning agents which conform to PS 292722 are permitted.

3.2 Concrete Surface Preparation

NOTE: HYDROCHLORIC ACID CLEANING IS NOT ACCEPTABLE.

3.2.1 All concrete surfaces shall be clean, dry, and free of disintegrated or chalky material (laitence). Unless the concrete curing or form release agent has been chosen to be compatible with the subsequent epoxy surfacer (3.2.2), the surface must be free of all previously applied coatings. This may be performed by either of the following methods:

a. Sand blast surfaces using a 16-30 mesh (recommended) silica or equal. Surface shall have a profile that feels like medium sandpaper to the

touch. Dust shall be removed from the blasted surface by vacuuming or by blowing with dry, oil-free air. In lieu of sandblasting, water blasting may be used.

NOTE: IT IS IMPORTANT THAT THE DEGREE OF SAND OR WATER BLASTING BE CONTROLLED TO AVOID EXCESSIVE OPENING OF THE CONCRETE SURFACE. THE INTENT OF THIS PREPARATION IS TO REMOVE ONLY LOOSELY BOUND MATERIAL AND HENCE A LIGHT BRUSH-OFF TYPE BLAST IS THE ONLY REQUIREMENT.

3.2.2 If surfacing agents are required to smooth rough concrete or to fill small surface voids in the concrete, only epoxy base agents shall be used.

These materials must be applied in strict accordance with manufacturers recommendations.

4.0 MIXING AND APPLICATION

4.1 General

The mixing and application (spray, brush or otherwise) of paints shall be in accordance with the manufacturer's instructions. When brushing is permitted, the surface shall be covered uniformly, brushing the paint on with overlapped strokes, avoiding brush marks as much as possible.

Regardless of the type of equipment used, uniform films should be applied which are continuous and unbroken at any point and which have a glossy-wet appearance. Sprayed material shall be sufficiently wet to flow out smoothly. Use a cone-shaped spray for painting small parts, pipes, angle irons, and small or narrow surfaces, and a fan-shaped spray for painting larger areas. Move the spray gun with a steady motion and at such speed over the entire surface as will produce a wet, glossy film and avoid a variation in film thickness. Each stroke of the gun as in brushing shall overlap the previous stroke approximately 50%, so as to produce a uniformly and completely covered surface. Best results are obtained with the gun held 10" - 12" from surface so that the material strikes the work at an angle of approximately 90°.

4.1.1 Prime and Finish Coating

4.1.1.1 Apply the number of coatings and the appropriate thickness/coating in accordance with Table I.

4.1.1.2 Only those thinners specified by the paint manufacturer, and defined in the approved painting procedure, shall be used.

4.1.1.3 No application shall be made when the temperature of the component or of the paint is below the paint manufacturers recommended limit, or if the surface temperature is expected to drop below this limit before the paint has dried.

4.1.1.4 Paint shall not be applied to wet or moist surfaces.

4.1.1.5 Paint shall not be applied to stainless steel components or surfaces.

NOTE: EXTREME CARE MUST BE EXERCISED TO PREVENT SPRAY, SPLASHING OR SEEPAGE OF ANY PAINTS ONTO STAINLESS STEEL SURFACES OR COMPONENTS. IF SUCH SURFACES ARE INADVERTENTLY COATED, THE PAINT MUST BE REMOVED, USING AN APPROVED PROCEDURE AND USING MATERIALS ACCEPTABLE PER WESTINGHOUSE PS 292722.

5.0 INSPECTION

5.1 The inspection operations shall be performed, as identified in the approved painting procedure, to assure compliance with the procedure. Deviations to any of the requirements shall be submitted to the Purchaser for disposition.

5.2 Dry film thicknesses shall be verified by means of a dry film thickness gauge (Elcometer or Mikro-Test or equivalent).

5.3 Because the D.F.T. (dry film thickness) is a function of the application rate, the use of wet film thickness measurements, which permits an adjustment of the film thickness during application, is recommended. Acceptable gauges are Nordson or equivalent.

TABLE I

SPECIFICATION DESIGNATION	PRIMER			TOP COAT		
	D.F.T.*	NO. COATS	GENERIC TYPE	D.F.T.*	NO. COATS	GENERIC TYPE
597755-1	1.5-3	1	Self-curing zinc rich/ silicate based primer.	4-5	1	Chemically-cured epoxy or Epoxy-modified Phenolic
597755-2	2-4	1	Self curing zinc rich/silicate or epoxy based primer.	N/A	N/A	N/A
597755-3A	N/A	N/A	N/A	4-5	1	Same as 597755-1
597755-3B	N/A	N/A	N/A	4-5	1	Same as 597755-1
597755-4	1 min.	1	Carbon filled low chloride high temperature/ silicate based primer.	N/A	N/A	N/A
597755-11	1.5-3	1	Same as 597755-2	N/A	N/A	N/A

*Dry film thickness in mils. (Per coat)

NOTE 1 - No portion of the paint film shall be less than the minimum specified D.F.T. Local areas may exceed the maximum D.F.T. specified provided the average of all readings do not exceed the maximum D.F.T. specified.

NOTE 2 - The generic type shown does not preclude use of other types providing ALL OTHER REQUIREMENTS of this specification are met.

NOTE 3 - Application rate to be such to produce D.F.T. required.