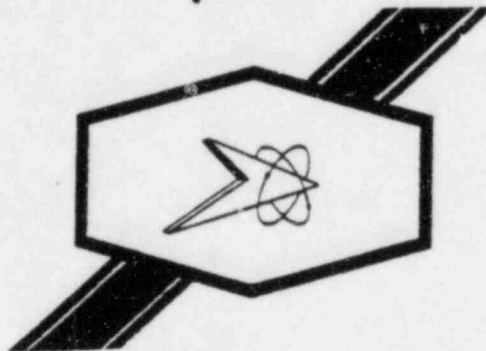


Imperial



TECHNICAL REPORT

NUMBER

549-81

TITLE

RADIATION TOLERANCE/DBA RESULTS
11S/11/1201/1201
HIGH FILM THICKNESSES OF NUTEC 1201 TOPCOAT
FOR
GENERAL USE

CUSTOMER

Submitted by: Gerald E. Arnold *SEA*

Approved: Robert R. Taylor *RRT 2/2/82*

Date: December 9, 1981

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

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PDR FOIA
GARDE85-59 PDR

SCOPE:

The purpose of this test was to evaluate the performance of the Nutec concrete coating system with multicoats and high film thicknesses of Nutec 1201 topcoat.

BACKGROUND:

In many cases, additional coats of Nutec 1201 are applied to the original Nutec concrete coating system. Such instances are:

1. Film building to achieve designated minimum thickness requirements;
2. Repair of pinholes;
3. Repair of damaged areas, with resultant overlap;
4. Overlapping adjacent previously coated areas;
5. Recoating for aesthetics (usually a fresh coat is applied to the system just prior to the contractor releasing the area to the client).

When the 11S/11/1201 system is recoated there is the potential for exceeding the specified maximum dry film thickness of 12 mils for Nutec 1201. This test was designed to evaluate the higher film thicknesses of 1201 both in a single coat application and in a two coat application.

SUMMARY:

Four specimens coated with 11S/11/1201/1201 were submitted to Oak Ridge National Laboratories for radiation tolerance testing at exposure levels of 3×10^6 and 1×10^9 rads, and design basis accident testing per the pressurized water reactor (PWR) parameters of 285°F and 48 PSI. Due to equipment malfunctions, the actual maximum temperature and pressure experienced was 340°F and 70 PSI respectively. The results comply with the acceptance criteria of ANSI N101.2 for DBA testing.

PROCEDURE:

Four concrete specimens were coated with the Nutec 11S/Nutec 11/Nutec 1201 system as described in the attached panel preparation sheets.

PROCEDURE (Con't):

Coupons A79 and A81 were first topcoated with the 11S/11/1201 system, weathered in an Atlas Weather-o-meter for 300 hours, used in an Elcometer adhesion test, repaired, and then re-topcoated with Nutec 1201.

All specimens were submitted to ORNL for irradiation at 3×10^8 and 1×10^9 rads and then design basis accident tested. The critical portion of the DBA test (first 28 hours) was performed in the autoclave; the remaining 10 days was conducted in a constant temperature and pressure chamber with 100% relative humidity.

RESULTS:

See attached ORNL results and result summary.

CONCLUSIONS:

The results comply with the requirements of ANSI N5.12 (radiation tolerance) and ANSI N101.2 (DBA), indicating that the higher film thickness of 1201 had no adverse effects on the performance of the Nutec system.

It should be noted that higher film thicknesses of 1201 may result in a slower evaporation rate (of solvent) and a correspondingly longer full cure time.

PANEL PREPARATION
SHEETS

TEST PANEL PREP/ION DATA

1. PRODUCT TO BE TESTED: Nutec 11S/Nutec 11/Nutec 1201
2. TYPE SUBSTRATE: Concrete 2x4x2"
3. SURFACE PREPARATION (Describe): All faces given rough abrasive blast using G-50 steel grit
4. PRODUCT DATA: SAMPLE NO. (s): A282, A284

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) %R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
1	Nutec	11S	2782/2778/2526	Squeegee	85/71	.025-.045	6/16/81
2	Nutec	11S	2782/2778/2526	Squeegee	86/78	.020-.030	6/17/81
3	Nutec	11	2782/2778/2444	Squeegee	82/75	.004-.008	6/19/81
4	Nutec	1201	2067/2068	Spray	89/81	.008-.012	6/22/81
5	Nutec	1201	2067/2068	Spray	86/65	.008-.010	6/23/81

Side 1 .065-.105
 2 .065-.105
 3 .065-.105
 4 .065-.105

CURING CONDITIONS: AMBIENT TEMP. 65-95 °F REL. HUMIDITY 65-100 % MINIMUM CURE 7 DAYS
 TEST PROCEDURE: DBA
 TEST PERFORMED BY: ORNL DATE SUBMITTED: 9/25/81
 APPROVED BY: *Charles C. Arnold* REPORT NUMBER: 549-81

TEST PANEL PREPARATION DATA

Page

1. PRODUCT TO BE TESTED: Nutec 11S/Nutec 11/Nutec 1201
2. TYPE SUBSTRATE: Concrete
3. SURFACE PREPARATION (Describe): Broomed surface blast swept to remove efflorescence, remaining surfaces wire brushed and blown with 100 psi compressed air.
4. PRODUCT DATA: SAMPLE NO. (s): A79

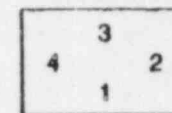
COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) %R.H.	THICKNESS (Ins.)	TIME & DATE APPLIED
1	Nutec	11S*	2519/2086/2516	Squeegee	71/73	See Below	3/27/81
2	Nutec	11*	2519/2086/2444	Squeegee	73/64	" "	4/02/81
3	Nutec	1201	2606/2607	Spray	71/54	" "	4/06/81
4	Nutec	1201 (1)	2067/2068	Spray	85/81	" "	7/10/81

Coupon stored until June 14, 1981 at which time coupon was placed in WOM for 300 hrs. exposure.

* Hand mixed

FILM THICKNESS (Ins.)	11S	11	1201	1201 (1)	Total
Side 1	.025-.035	.005-.008	.006-.010		.036-.053
Side 2	.025-.035	-	.006-.010	.020-.030	.051-.075
Side 3	.025-.035	.005-.008	.006-.010	.015-.020	.051-.075
Side 4	.025-.035	.005-.008	.006-.010	.010-.015	.046-.068

TOP VIEW OF COUPON



Numbered and broomed surface

TOTAL DRY FIL THICKNESSES RANGE — Side 1. See above totals
Side 2.

Side 3. See above totals
Side 4.

CURING CONDITIONS: AMBIENT TEMP. 65-95 °F REL. HUMIDITY 65-100 % MINIMUM CURE 7 DAYS

TEST PROCEDURE: Adhesion, Weathering, Repair, Topcoatability, DBA

TEST PERFORMED BY: Imperial/Testing, ORNL

DATE SUBMITTED: 9/25/81

APPROVED BY:

Gerald E. Arnold

REPORT NUMBER: 549-81

TEST PANEL PREPARATION DATA

Page 6

1. PRODUCT TO BE TESTED: Nutec 11S/Nutec 11/Nutec 1201
2. TYPE SUBSTRATE: Concrete
3. SURFACE PREPARATION (Describe): Broomed surface blast swept to remove efflorescence, remaining surfaces wire brushed and blown down with 100 psi compressed air.
4. PRODUCT DATA: SAMPLE NO. (s): A81

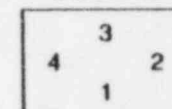
COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) %R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
1	Nutec	11S*	2519/2086/2516	Squeegee	71/73	See below	3/27/81
2	Nutec	11*	2519/2086/2444	Squeegee	73/64	" "	4/02/81
3	Nutec	1201	2606/2607	Spray	71/54	" "	4/06/81
4	Nutec	1201 (1)	2067/2068	Spray	85/81	" "	7/10/81

Coupon stored until June 14, 1981, at which time coupon was placed in WOM for 300 hrs. exposure.

* Drill mixed

FILM THICKNESS (ins.)	11S	11	1201	1201 (1)	Total
Side 1	.025-.035	.005-.008	.006-.010		.036-.053
Side 2	.025-.035	-	.006-.010	.020-.030	.051-.075
Side 3	.025-.035	.005-.008	.006-.010	.015-.020	.051-.075
Side 4	.025-.035	.005-.008	.006-.010	.010-.015	.046-.068

TOP VIEW OF COUPON



Numbered and broomed surface

TOTAL DRY FIL THICKNESSES RANGE — Side 1. See above totals Side 3. See above totals
Side 2. Side 4.

CURING CONDITIONS: AMBIENT TEMP. 65-95 °F REL. HUMIDITY 65-100 % MINIMUM CURE 7 DAYS

TEST PROCEDURE: Adhesion, Weathering, Repair, Topcoatability, DBA

TEST PERFORMED BY: Imperial/Testing ORNL DATE SUBMITTED: 9/25/81

APPROVED BY: Donald E. Arnold REPORT NUMBER: 549-81

ORNL
PROCEDURES

Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: October 29, 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 1×10^6 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 Ray L. Apple

Approved L. T. Corbin

Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division ^{Page 9}
Oak Ridge National Laboratory
Date: October 29, 1981

ORNL Log Book No. A9675, A10-8-1

Table 1. DBA solution composition, distilled water

Reagent	Concentration
Boric acid, H_3BO_3	2000 ppm
Sodium hydroxide, NaOH	Required to adjust pH to 9.5

Table 2. DBA test conditions

Time	Temperature (°F)	Pressure (psig)	Comments
Start	164	—	Autoclave preheated.
20 s	285	48	Solution added at 200°F.
1.5 min	340	70	*
1.5-5 min	285	48	Pressure maintained by relief valve.
5-7 min	285-267	48	Pressure adjusted with N_2 .
13 min	267	48	
13-53 min	267-220	48	Pressure adjusted with N_2 .
53-58 min	220-210	48-0	Pressure released at 0.15 psig/s.
58-167 min	210-150	0	
2.8-27.8 h	150-135	0	End of first part of test.
11 d	135	0	Specimens immersed in a constant-temperature bath.

End of test

*Gas that evolved from the specimens upon addition of the hot chemical solution resulted in a pressure and subsequent temperature increase exceeding the specifications of the designed temperature-pressure curves.

Evaluated

Ralph L. Dwyer

Approved

L. T. Carlson

ORNL
RADIATION/DBA
RESULTS

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION



POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

December 1, 1981

RECEIVED

12/4/81
IMPERIAL NUCLEAR

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

Dear Jerry:

Enclosed are combined reports describing test results recently obtained on Imperial protective coatings. Your attention is called to the temperature-pressure anomalies of A9675, A10-8-1.

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

Sincerely,

L. T. Corbin, Section Head
Analytical Chemistry Division

LTC:dmw

Enclosures

Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: October 29, 1981

SYSTEM IDENTIFICATION

 Steel panel x Concrete block

11S/11/1201/1201

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; Bechtel Corporation
Specification No. CP-951; ORNL Log Book No. A9675, A10-2-1.

Initial dose rate: 0.9 x 10⁷ rad/h

Test conducted in: x air water

<u>Sample No.</u>	<u>Cumulative dose</u>	<u>Test results</u>
A79	3×10^8 rad	Coatings intact, no defects all areas.
A81	1×10^9 rad	Coatings intact, no defects all areas.

Evaluated

Raymond L. Apple

Approved

L. T. Collins

Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: October 29, 1981

SYSTEM IDENTIFICATIONSteel panelx Concrete block

115/11/1201/1201

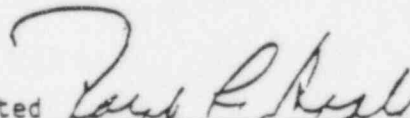
DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A10-8-1.

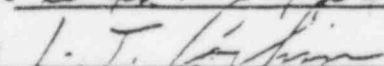
<u>Sample No.</u>	<u>DBA phase</u>	<u>Test results</u>
A79	spray*	Coatings intact, no defects after one day. Blisters, #4 few, sides B and C at end of test.
A81	spray*	Coatings intact, no defects after one day. Blisters, #4 few, sides B, C, and D at end of test.

*Irradiated.

Evaluated



Approved



Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: October 29, 1981

SYSTEM IDENTIFICATION

 Steel panel x Concrete block

11S/11/1201/1201

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; Bechtel Corporation
Specification No. CP-951; ORNL Log Book No. A9675, A10-1-1.

Initial dose rate: 1.3 x 10⁷ rad/h

Test conducted in: x air water

<u>Sample No.</u>	<u>Cumulative dose</u>	<u>Test results</u>
A282	3 x 10 ⁸ rad	Coatings intact, no defects all areas.
A284	1 x 10 ⁹ rad	Coatings intact, no defects all areas.

Evaluated

Ralph L. Apple

Approved

L. T. Berlin

Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: October 29, 1981

SYSTEM IDENTIFICATION

Steel panel x Concrete block

11S/11/1201/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A10-8-1.

<u>Sample No.</u>	<u>DBA phase</u>	<u>Test results</u>
A282	spray*	Coatings intact, no defects after one day. Blisters, #4 few, sides A and B at end of test. No other defects.
A284	spray*	Coatings intact, no defects after one day. Single blister, #4, sides A and B at end of test. No other defects.

*Irradiated.

Evaluated

Ray L. Apple

Approved

L. T. Carlson

SUMMARY OF RESULTS

Panel No.	DRY FILM THICKNESSES (In Mils)					DBA RESULTS	
	Maximum Single Coat 11S	Maximum Total 11S	Maximum 11	Maximum Single Coat 1201	Maximum Total 1201	After Day 1	After Day 11
A79	35	35	8	30	40	No Defect	#4 few Sides 2 & 3 N/D Side 1 & 4
A81	35	35	8	20	40	No Defect	#4 few Sides 2,3,4 N/D Side 1
A282	45	75	8	12	22	No Defect	#4 few Sides 1,2 N/D Side 3 & 4
A284	45	75	8	12	22	No Defect	One #4 on Side 1, 2 N/D Side 3 & 4

Panel No.	Radiation Exposure	Results
A79	3×10^8 rads	No Defects
A81	1×10^9 rads	No Defects
A282	3×10^8 rads	No Defects
A284	1×10^9 rads	No Defects

N/D = No Defect