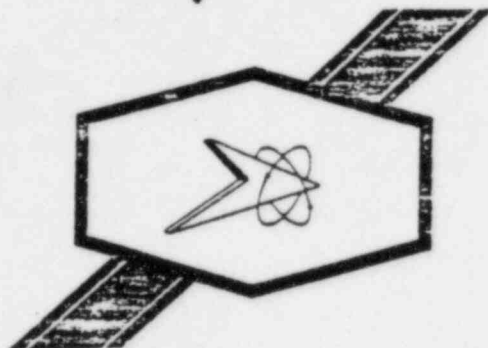


Imperial



TECHNICAL REPORT

NUMBER

550-81

TITLE

RADIATION TOLERANCE AND DBA
NUTEC 1201 ON STEEL AND CONCRETE SUBSTRATES

FOR
GENERAL USE

CUSTOMER

Submitted by: Gerald E. Arnold *GEA*

Approved: Robert R. Taylor *RRT 12/24/81*

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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SCOPE:

The purpose of this test was to evaluate the performance under simulated LOCA conditions of Nutec 1201 applied directly to steel and concrete substrates.

INTRODUCTION:

During the coating of nuclear power plants there may be instances where Nutec 1201 is applied directly to steel without a primer or applied directly to concrete without a surfacer:

1. In mild environments a barrier coat of Nutec 1201 may offer adequate corrosion protection without the need of a primer.
2. On smooth, void-free concrete, a surface may not be necessary; the topcoat may be sufficient in presenting a pin hole free, decontaminable surface.

SUMMARY:

Nutec 1201 was tested directly over steel and concrete substrates. Test specimens were irradiated to as high as 1×10^9 rads, then subjected to design basis accident testing with maximum temperature and pressure of 340°F and 70 PSI. No defects were exhibited by any of the test specimens.

PROCEDURES:

Test specimens were coated as described in the attached panel preparation sheets and then submitted to Oak Ridge National Lab for irradiation and design basis accident testing.

Test Specimen No.	Substrate	Irradiation	Total DFT
A174	Concrete	1×10^9 rad	16-22 mils
A175	Concrete	3×10^8 rad	16-22 mils
A396	Steel	1×10^9 rad	6-10 mils
A397	Steel	1×10^9 rad	6-10 mils
A398	Steel	none	6-10 mils
A399	Steel	none	6-10 mils

RESULTS:

No defects were exhibited. Refer to the attached ORNL results.

CONCLUSIONS:

The tested specimens meet the acceptance criteria for DBA testing as outlined in ANSI N101.2.

PANEL PREPARATION DATA

TEST PANEL PREPARATION DATA

Page 4

1. PRODUCT TO BE TESTED: Nutec 1201 over bare concrete
2. TYPE SUBSTRATE: concrete 2 x 4 x 2"
3. SURFACE PREPARATION (Describe): Broomed surface blast swept to remove efflorescence, edges stoned
and remaining faces wire brushed to remove concrete and dust. All surfaces blown down with 100 PSI
compressed air
4. PRODUCT DATA: SAMPLE NO. (s): A174-A175

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) %R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
1	Nutec	1201	2606/2607	Spray	87/63	.010-.012	5/29/81
2	Nutec	1201	2606/2607	Spray	82/79	.006-.010	6/01/81
Total Side					1. .016-.022	3. .016-.022	
					2. .016-.022	4. .016-.022	

CURING CONDITIONS: AMBIENT TEMP. 65-85 °F REL. HUMIDITY 65-100 % MINIMUM CURE 7 DAYS

TEST PROCEDURE: DBA

TEST PERFORMED BY: ORNL

DATE SUBMITTED: 9/21/81

APPROVED BY: *Arnold E. Arnold*

REPORT NUMBER: 550

ENCLOSURE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: Nutec 1201
2. TYPE SUBSTRATE: Steel 2x4x1/4"
3. SURFACE PREPARATION (Describe): Blasted to SSPC-SP-10 using G-40 steel grit, surface profile 2-3 mils.

4. PRODUCT DATA: SAMPLE NO. (s): 396, 397, 398, 399

COAT	PRODUCT	PRODUCT CODES	BATCH #	APPLICATION METHOD	CONDITIONS R/M(°F) %R.H.	THICKNESS (ins.)	TIME & DATE APPLIED
1	Nutec	1201	2967/1959	Spray	86/81	.006-.010	9/16/81

CURING CONDITIONS: AMBIENT TEMP. 65-85 °F REL. HUMIDITY 65-100 % MINIMUM CURE 7 DAYS

TEST PROCEDURE: DBA, Irradiation

TEST PERFORMED BY: ORNL

DATE SUBMITTED: 9/21/81

APPROVED BY: *Arnold E. Arnold*

REPORT NUMBER: 550

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 1×10^8 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 Ray L. Apple

Approved L. T. Cochran

Manufacturer: Imperial
New Orleans, Louisiana

Page 8
Analytical Chemistry Division
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 290°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. Apple

Approved

L. T. Carlson

RADIATION TOLERANCE
AND
DESIGN BASIS ACCIDENT
RESULTS

RECEIVED

12/4/81
IMPERIAL NUCLEAR

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION



POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

December 1, 1981

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

Nutec 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>
A174	1 x 10 ⁹ rad	Coatings intact, no defects all areas.
A175	3 x 10 ⁸ rad	Coatings intact, no defects all areas.

Evaluated

Ray L. Apple

Approved

L.T. Cochran

Manufacturer: Imperial
New Orleans, Louisiana

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

SYSTEM IDENTIFICATION

 Steel panel x Concrete block

Nutec 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>
A174	spray*	Coatings intact, no defects all areas.
A175	spray*	Coatings intact, no defects all areas.

*Irradiated.

Evaluated

Approved

[Signature]
[Signature]

Manufacturer: Imperial
New Orleans, Louisiana

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

SYSTEM IDENTIFICATION

x Steel panel Concrete block

Nutec 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: 1.2 x 10⁷ rad/h

Test conducted in: x air water

<u>Sample No.</u>	<u>Cumulative dose</u>	<u>Test results</u>
A396	1 x 10 ⁹ rad	Coatings intact, no defects all areas.
A397	1 x 10 ⁹ rad	Coatings intact, no defects all areas.

Evaluated

Ralph F. Apple

Approved

L. T. Corbin

Manufacturer: Imperial
New Orleans, Louisiana

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

SYSTEM IDENTIFICATIONx Steel panelConcrete block

Nutec 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>
A396	spray*	Front: Coatings intact, no defects. Rear: Coatings intact, no defects.
A397	spray*	Front: Coatings intact, no defects. Rear: Coatings intact, no defects.
A398	spray	Front: Coatings intact, no defects. Rear: Coatings intact, no defects.
A399	spray	Front: Coatings intact, no defects. Rear: Coatings intact, no defects.

*Irradiated.

Evaluated

Ralph L. Apple

Approved

L. T. Gorman