

TECHNICAL REPORT

NUMBER

756-84

TITLE

ORNL COMPARATIVE DBA TESTING OF VARIOUS
IMPERIAL SYSTEMS USING 7 MINUTE AND 6 HOUR STEAM TESTS

FOR

Company Knowledge

CUSTOMER

Submitted by: G. E. Arnold *GA*
Accepted by: S. Brunnenkant *S.B.*
Approved: M. Lee *M.L.*
Date: January 13, 1984

SOUTHERN IMPERIAL COATINGS CORPORATION, INC.
P. O. Box 200 • New Orleans, Louisiana 70179
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PDR FOIA
GARDEE5-59 PDR

SCOPE: To evaluate the effect of two different steam exposure intervals during DBA testing on Nutec coating system.

BACKGROUND: A controversy has arisen in the last few years in the nuclear industry about the interval of steam injection into the autoclave during DBA tests. There are two trends of thought:

1. Steam injection is only required to reach the maximum pressure (70 PSIG) required for the DBA test - usually this takes about 7 minutes. This pressure remains unchanged during the next 6 hours.
2. Steam injection should be continuous for the entire 6 hour period at 70 PSIG. Venting is required to maintain the pressure at the 70 PSIG level.

ORNL proposed two series of testing using two methods of steam injection. Manufacturers sent coated specimens to ORNL which were placed in both tests to evaluate the effect of different steam injection intervals.

PROCEDURE: Imperial prepared test specimens of steel and concrete coating systems to ORNL for including in the two test series. Identical systems were included in both test series to evaluate the effect of the two different test methods used.

The following systems were tested:

System	Substrate	Description
1244/1245	Steel	Waterborne Epoxy Primer and Topcoat
1440/1201	Steel	Aluminum-Filled Epoxy Mastic/Topcoat
6/1201	Steel	Epoxy Primer/Topcoat
11S/11/1201	Concrete	Nutec 8 -- 100% Solids Epoxy Patch Compound Nutec 10 - Primer/Sealer Nutec 11S - Sand Filled Waterborne Epoxy Surfacer Nutec 11 - Intermediate Epoxy Surfacer (Waterborne) Nutec 1201 - Epoxy Polyamide Topcoat
10/11S/11/1201	Concrete	
8/1201	Concrete	
8/11S/1201	Concrete	

CONCLUSIONS: ORNL felt that overall, the test results were "inconclusive".

As for Imperial systems, the 7 minute steam test exhibited slightly more defects than did the 6 hour steam tests. Defects were very few and isolated with exception of some of the irradiated specimens and the epoxy system over power tool cleaned (SSPC-SP-03) steel.

ORNL COMPARATIVE DBA TESTING OF VARIOUS

IMPERIAL SYSTEMS USING 7 MINUTE AND 6 HOUR STEAM TESTS

Date: September 29, 1983 7 Minute Steam				Date: September 19, 1983 6 Hour Steam			
Panel No.	System	Pass/ Fail	Test Results	Panel No.	System	Pass/ Fail	Test Results
1054*	1244/1245	P	Single #6, ND	1053*	1244/1245	P	ND
1056	1244/1245	P	ND	1055	1244/1245	P	ND
1047*	1440/1201	F	#2D	1048	1440/1201	P	#6F
1049	1440/1201	P	Single #6, ND	1050	1440/1201	P	ND
1042*	6/1201 (SP-03)	F	Large(F) #6F(R)	1041*	6/1201 (SP-03)	P	#8F
1044	6/1201 (SP-03)	F	#4F(F) #4M(R)	1043	6/1201 (SP-03)	F	#4M(F) #4F(R)
1030*	11S/11/1201	F	Large All sides	1029	11S/11/1201	P	ND
1032	11S/11/1201	P	ND, Single crack	1031	11S/11/1201	P	ND
1036*	6/1201	P	#6F, #4f	1035	6/1201	P	ND
1038	6/1201	P	Single #6, ND	1037	6/1201	P	#6F
1024	8/1201, 8/11S/1201	P	Single #4, ND	1023*	8/1201, 8/11S/1201	F	(1/4)#4M** (2/3)#4F
1026	8/1201/8/11S/1201	P	#6F, #4F, ND	1025	8/1201, 8/11S/1201	P	(1/3)ND (2/4) Single #2, #6
1018	10/11S/11/1201	P	#6F	1017	10/11S/11/1201	P	#6F
1020	10/11S/11/1201	P	#6F	1019	10/11S/11/1201	P	#6F, #4F, ND
1012	11S/11/1201	P	Single #2, #4F, #6F	1011	11S/11/1201	P	#4F, ND
1014	11S/11/1201	F	Single #2, #4F	1013	11S/11/1201	P	#6F

* Irradiated

** Imperial's Evaluation is #4F All Sides

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION



POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

December 22, 1983

Mr. Henry L. Lomasney
President
Imperial
P. O. Box 29077
New Orleans, Louisiana 70189

Dear Hank:

Enclosed are the DBA test results on your samples submitted in June.
If there are any questions or we can be of further service, please call on
us.

Sincerely,

R.D. Brooksbank

R. D. Brooksbank
Chemist

RDB:lp

Enclosure

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION



POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

October 7, 1983

Mr. Jerry Arnold
Nuclear Technical Representative
Imperial Professional Coatings
P. O. Box 29077
New Orleans, LA 70189

Dear Jerry:-

Enclosed are the DBA results on your samples submitted in June. To review, two separate DBS tests were performed: (1) using six hours of steam during initial heat up (Report data 9/19/83) and (2) using 7 minutes of steam (Report date 9/29/83). Several of your specimens were irradiated prior to your letter of July 29, 1983. These results are included. The results from the tests are inconclusive. While a majority of your specimens performed similarly or better with the short time of steam, some actually did better with the long period of steam. This was seen in some other systems tested from others participating in the experiment, which indicates that results from the two testing techniques are not as clear cut as we thought.

If it is agreeable, I would like to share these results with other interested parties involved with ASTM Committee D-33. I will of course delete the system identifications and use only sample numbers. Please inform me in writing if this is agreeable. Thank you for your participation.

If there are any questions, please call on us.

Sincerely,

A handwritten signature in cursive script, appearing to read "R. D. Brooksbank".

R. D. Brooksbank

RDB:daf

Enclosure

Manufacturer: Imperial

New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

REPORT OF IRRADIATION AND DBA TESTING

The irradiation test is conducted in accordance with American Society for Testing and Materials (ASTM) Standard Method D4082-83. The design basis accident (DBA) test is performed in accordance with ASTM Standard Method D3911-80. The tests are designed to meet specifications set in both ANSI report N101.2-1972, Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities, and N5.12-1974, 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 PD B. L. Bach

Approved W. R. L. L. L. L.

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

ORNL Log Book No. A9675, A9-12-3

Table 1. DBA solution composition, distilled water

Reagent	Concentration
Boric acid, H_3BO_3	0.28 <u>M</u>
Sodium hydroxide, NaOH	Required to adjust pH to 9.5

Table 2. DBA test conditions

Time	Temperature (°F)	Pressure (psig)	Comments
Start	170	-	Autoclave preheated.
20 s	340	70 (10 s)	Steam injected.
6 h	340	70	Pressure maintained by relief valve.
20 s	220	30	Spray solution added at 75°F.
15 min	220-250	30	Pressure adjusted with Ar.
4 d	250	30	
20 s	180	-15	Fresh spray solution added at 75°F after draining autoclave.
10 min	180-200	10	
3 d	200	10	
End of test			

Evaluated

R. H. Smith

Approved

W. L. Luning

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

X Steel panel

Concrete block

1244/1245

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-12-3.

Sample No.

DBA phase

Test results

*1053

Interphase

Coatings intact, no defects, front
and rear.

1055

Spray

Coatings intact, no defects, front
and rear.

*Irradiated

Evaluated

P. B. [Signature]

Approved

W. R. [Signature]

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

x Steel panel

Concrete block

1440/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-12-3.

Sample No.

DBA phase

Test results

1048

Immersion

Blisters, #6 few, front and rear.

1050

Immersion

Coatings intact, no defects, front and rear.

Evaluated

ROB [Signature]

Approved

WR [Signature]



Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

X Steel panel

Concrete block

6/1201(SP-3)

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-12-3.

Sample No.

DBA phase

Test results

*1041

Spray

Blisters, #8 few; front and rear.

1043

Spray

Blisters, #4 medium, front;
blisters, #4 few, rear.

*Irradiated

Evaluated

LD Bickelshaus

Approved

WR Lundy

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

Steel panel

X Concrete block

11s/11/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-12-3.

Sample No.

DBA phase

Test results

1029

Spray

Coatings intact, no defects, all
sides

2031

Spray

Coatings intact, no defects, all
sides

Evaluated

R.D. Brookshier

Approved

W.R. Lundy

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

x Steel panel

 Concrete block

6/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.

ORNL Log Book No. A9675, A9-12-3.

Sample No.

DBA phase

Test results

1035

Spray

Coatings intact, no defects, front
& back.

1037

Spray

Blisters, #6 few, front; single
blister, #6, back.

Evaluated

L.D.F. [Signature]

Approved

W.R. [Signature]

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

8/1201, 8/11s/1201

Steel panel

X Concrete block

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-12-3.

Sample No.

DBA phase

Test results

*1023

Spray

Blisters, #4 medium, sides 1 and 4;
single large blister, blisters #4
few, side 2; single large blister,
side 3

1025

Spray

Coatings intact, no defects, sides 1
and 3; single blister, #6, side 2;
single blister, #2, side 4

*Irradiated

Evaluated R.D. Bendish

Approved W.R. Lamm

Manufacturer: Imperial

New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory

Date: 9/19/83

SYSTEM IDENTIFICATION

Steel panel

X Concrete block

10/11s/11/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.

ORNL Log Book No. A9675, A9-12-3.

Sample No.

DBA phase

Test results

1017

Spray

Blisters, #6 few, all sides

1019

Spray

Blisters, #6 few, side 1; Blisters,
#4 few, side 4; Coatings intact, no
defects, sides 2 and 3

Evaluated

RDF [Signature]

Approved

WR [Signature]

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

Steel panel

X Concrete block

11s/11/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-12-3.

Sample No.

DBA phase

Test results

1011

Spray

Coatings intact, no defects, side
1; Single blister, #4, Sides 2 and
4; Blisters, #4 few, side 3

1013

Interphase

Blisters, #6 few, side 1, 3 and 4;
Single blister, #6 side 2

Evaluated

R. B. Smith

Approved

W. R. Lacey

Manufacturer: Imperial

New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

X Steel panel

Concrete block

1244/1245

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method D4082-83; ORNL Log Book No. A9675, A7-25-3.

Initial dose rate: 1.07×10^7 rad/h

Test conducted in: x air water

<u>Sample No.</u>	<u>Cumulative dose (rad)</u>	<u>Test results</u>
1053	1.0×10^9 rads	Coatings intact, no defects, slight discoloration
1054	1.0×10^9 rads	Coatings intact, no defects, slight discoloration

Evaluated *RD Bushnell*

Approved *WR Loring*

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

X Steel panel Concrete block

1440/1201

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method D4082-83; ORNL Log Book No. A9675, A7-25-3.

Initial dose rate: 1.07×10^7 rad/h

Test conducted in: X air water

<u>Sample No.</u>	<u>Cumulative dose (rad)</u>	<u>Test results</u>
1047	1.0×10^9 rads	Coatings intact, no defects, slight discoloration

Evaluated *E. B. Baskin*

Approved *W. R. Lamm*

Manufacturer: Imperial

New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

X Steel panel

Concrete block

6/1201 (SP-3)

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method D4082-83; ORNL Log Book No. A9675, A7-25-3.

Initial dose rate: 1.07×10^7 rad/h

Test conducted in: X air water

<u>Sample No.</u>	<u>Cumulative dose (rad)</u>	<u>Test results</u>
1041	1.0×10^9 rads	Coatings intact, no defects, slight discoloration
1042	1.0×10^9 rads	Coatings intact, no defects, slight discoloration

Evaluated

DDA [Signature]

Approved

WR [Signature]

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

X Steel panel Concrete block

6/1201

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method
D4082-83; ORNL Log Book No. A9675, A7-25-3.

Initial dose rate: 1.07×10^7 rad/h

Test conducted in: X air water

<u>Sample No.</u>	<u>Cumulative dose (rad)</u>	<u>Test results</u>
1036	1.0×10^9 rad's	Coatings intact, no defects, slight discoloration

Evaluated

J. D. H. H. H. H. H.

Approved

W. R. L. L. L.

Manufacturer: Imperial

New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/19/83

SYSTEM IDENTIFICATION

X Steel panel

Concrete block

11s/11/1201

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method D4082-83; ORNL Log Book No. A9675, A7-25-3.

Initial dose rate: 1.07×10^7 rad/h

Test conducted in: x air water

Sample No.

Cumulative dose (rad)

Test results

1030

1.0×10^9 rads

Coatings intact, no defects,
slight discoloration

Evaluated

P. B. ...

Approved

W. R. ...

Manufacturer: Imperial

New Orleans, LA

Analytical Chemistry Division

Oak Ridge National Laboratory

Date: 9/19/83

SYSTEM IDENTIFICATION

X Steel panel

Concrete block

8/1201, 8/11s/1201

RADIATION TOLERANCE TEST

ORNL Master Analytical Manual Method No. 2 0921; ASTM Standard Method D4082-83; ORNL Log Book No. A9675, A7-25-3.

Initial dose rate: 1.07×10^7 rad/h

Test conducted in: X air water

Sample No.

Cumulative dose (rad)

Test results

1023

1.0×10^9 rads

Coatings intact, no defects,
slight discoloration

Evaluated *RD Burt*

Approved *WR Lanning*

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

REPORT OF IRRADIATION AND DBA TESTING

The irradiation test is conducted in accordance with American Society for Testing and Materials (ASTM) Standard Method D4082-83. The design basis accident (DBA) test is performed in accordance with ASTM Standard Method D3911-80. The tests are designed to meet specifications set in both ANSI report N101.2-1972, Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities, and N5.12-1974, 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 L.D. Brookshank
Approved W.R. Lundy

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

ORNL Log Book No. A9675, A9-22-3

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	-170	-	Autoclave preheated.
20 s	340	70 (10 s)	Steam injected.
7 min	340	70	Steam turned off.
6 h	340	70	
20 s	220	30	Spray solution added at 75°F.
15 min	220-250	30	Pressure adjusted with Ar.
4 d	250	30	
20 s	180	-15	Fresh spray solution added at 75°F after draining autoclave.
10 min	180-200	10	
3 d	200	10	
End of test			

Evaluated

P. J. H. H. H.

Approved

W. H. H. H.

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

SYSTEM IDENTIFICATION

X Steel panel

 Concrete block

1244/1245

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-22-3.

<u>Sample No.</u>	<u>DBA phase</u>	<u>Test results</u>
*1054	Spray	Single blister, #6 front; coatings intact, no defects, rear.
1056	Interphase	Coatings intact, no defects, front and rear.

*Irradiated

Evaluated *P. J. B. [signature]*
Approved *W. K. [signature]*

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

SYSTEM IDENTIFICATION

X Steel panel

 Concrete block

1440/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-22-3.

<u>Sample No.</u>	<u>DBA phase</u>	<u>Test results</u>
*1047	Immersion	Blisters, #2 dense, front and rear.
1049	-- Immersion	Single blister, #6, front and rear.

*Irradiated

Evaluated

[Signature]

Approved

[Signature]

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

SYSTEM IDENTIFICATION

X Steel panel

Concrete block

6/1201(SP-3)

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.

ORNL Log Book No. A9675, A9-22-3.

Sample No.

DBA phase

Test results

*1042

Spray

Blisters, large, front; blisters,
#6 few, rear.

1044

Spray

Blisters, #4 few, front; blisters,
#4 medium, rear.

*Irradiated

Evaluated

M. B. Burkholder

Approved

W. L. Laine

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

SYSTEM IDENTIFICATION

X Steel panel

Concrete block

6/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.

ORNL Log Book No. A9675, A9-22-3.

Sample No.

'DBA phase'

Test results

*1036

Spray

Blisters, #6 few, front; blisters,
#4 few, rear.

1038

Spray

Single blister, #6 front; coatings
intact, no defects, rear.

*Irradiated

Evaluated

P.D. Bickel

Approved

U.R. Lancy

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

SYSTEM IDENTIFICATION

Steel panel X Concrete block

11s/11/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-22-3.

<u>Sample No.</u>	<u>DBA phase</u>	<u>Test results</u>
*1030	Spray	Blisters, large, all sides.
1032	Spray	Coatings intact, no defects, sides 1, 2, and 4; single crack, side 3.

*Irradiated

Evaluated L.D. Burdick

Approved W. L. Loring

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

SYSTEM IDENTIFICATION

Steel panel

X Concrete block

8/1201, 8/11s/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.

ORNL Log Book No. A9675, A9-22-3.

<u>Sample No.</u>	<u>DBA phase</u>	<u>Test results</u>
1024	Spray	Single blister, #4 side 1; coatings intact, no defects, sides 2, 3, and 4.
1026	Spray	Blisters, #6 few, side 1; coatings intact, no defects side 2; blisters, #4 few, sides 3 and 4.

Evaluated

P. W. Buck's book

Approved

C. R. Laine

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 9/29/83

SYSTEM IDENTIFICATION

Steel panel

X Concrete block

10/11s/11/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A9675, A9-22-3.

Sample No.

DBA phase

Test results

1018

Spray

Blisters, #6 few, all sides.

1020

Spray

Blisters, #6 few, all sides.

Evaluated

R. B. Wood

Approved

W. L. Lanning

Manufacturer: Imperial

New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory

Date: 9/29/83

SYSTEM IDENTIFICATION

Steel panel

X Concrete block

11s/11/1201

DBA TEST

ORNL Master Analytical Manual Method No. 2 0922.

ORNL Log Book No. A9675, A9-22-3.

Sample No.

DBA phase

Test results

1012

Spray

Single blister, #2, blisters, #4
few, side 1; blisters, #6 few,
sides 2, 3, and 4.

1014

Interphase

Blisters, #4 few, sides 1, 2, and 3;
single blister, #2, blisters, #4
few, side 4.

Evaluated

Robt. L. Schmitt

Approved

W. R. Lanning

DECONTAMINATION TEST PANEL PREPARATION DATA

DECONTAMINATION TEST

BECHTEL CP-952 AND A.N.S.I. N-5.12

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: REACTIC #1201
2. TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2" x 4" x 1/4"
3. SURFACE PREPARATION (Describe): Sandblasted per SSPC-SP-10 with Cresblast #4 Blasting Sand. Surface profile between 1S70 and 2S70 as read on a Keane-Tator Profile Comparator Disc.
4. PRODUCT DATA: SAMPLE NO. (s): 688

<u>COAT</u>	<u>PRODUCT</u>	<u>PRODUCT CODES</u>	<u>BATCH #</u>	<u>APPLICATION METHOD</u>	<u>CONDITIONS R/M(°F)%R.H.</u>	<u>THICKNESS (ins)</u>	<u>DATE APPLIED</u>
1	NUTEC	#6	6169/6170	Spray	82°F/63%	.0024- .0033	7/29/76 5:00 p.m.
2	REACTIC	#1201	6171/6172	Spray	92°F/59%	.0056- .0077	8/5/76 12:00 noon

Total Dry Film Thickness - .0080 - .0110

5. CURING CONDITIONS: AMBIENT TEMP: 75 ± 5 °F REL. HUMIDITY 60 ± 10 %
MINIMUM CURE: 7 DAYS
6. TEST PROCEDURE Decontamination
7. TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED: 8/12/76

APPROVED: [Signature]

TEST REPORT NO. 115-3-78

PREPARED BY: Gerald E. Arnold

DATE: 4/5/78

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DECONTAMINATION TEST RESULTS

Manufacturer: Sout on Imperial
New Orleans, LA

Analyt il Chemistry Division
Oak Ridge National Laboratory
Date: September 15, 1976

Decontamination Test Results:

These tests performed according to ORNL Master Analytical Manual
Method No. 2 0920 and Bechtel Corp. Spec. CP-952.

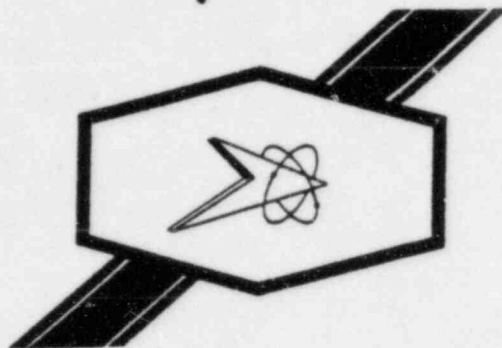
ORNL Log Book No. A 7562; 8-12-6.

Sample Number	Contaminant	Decontamination Factor (DF)				Percent of Total Activity Removed ¹
		Water @25°C	Acid @25°C	Acid @80°C	Overall	
673 (1203)	Ce-144	87	1.9	1.6	270	99.4
	Ru-106	41	1.6	1.6	100	
	Cs-137	680	1.2	1.7	1400	
	Zr-95	20	1.5	1.0	31	
	TOTAL	70	1.6	1.5	170	
688 (1201)	Ce-144	120	2.1	1.0	250	99.4
	Ru-106	68	1.6	1.1	120	
	Cs-137	160	1.3	1.4	280	
	Zr-95	17	1.5	1.1	29	
	TOTAL	85	1.6	1.1	160	
112 (555)	Ce-144	1.7	4.0	1.8	13	90.0
	Ru-106	2.3	1.7	1.4	5.5	
	Cs-137	20	2.6	1.9	98	
	Zr-95	1.1	1.9	2.0	0.3	
	TOTAL	2.7	2.4	1.6	10	
	Ce-144					
	Ru-106					
	Cs-137					
	Zr-95					
	TOTAL					
	Ce-144					
	Ru-106					
	Cs-137					
	Zr-95					
	TOTAL					

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

Approved L.T. Corbin

Imperial



TECHNICAL REPORT

NUMBER

412-80

TITLE

Design Basis Accident Testing
Nutec 1201 and Nutec 1202 over Bare Concrete
FOR

CUSTOMER

Submitted by: Gerald E. Arnold

Accepted by: *Gerald E. Arnold*

Approved: *James J. Bauer*

Date: July 2, 1980

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

The information contained in this report, based upon our experience, is offered without charge as part of our service to customers. It is intended for use by persons having technical skill, at their own discretion and risk. We assume no liability in connection with its use. This information is not intended as a license to operate under, nor a recommendation to infringe, any patent covering this material or use.

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SCOPE - The purpose of this test was to evaluate the DBA performance of Nutec 1201 and Nutec 1202 over bare concrete.

BACKGROUND - During the application of the Nutec 11S/11/1201 system, bare concrete is sometimes exposed due to overworking of the Nutec 11S or Nutec 11, or stoning or abrading of the surfacer to the substrate. In Service Level I and Service Level II areas it is essential that the concrete be shielded from radioactive nuclides and that the surface be easily decontaminable. It is already known, from past testing that Nutec 1201 meets these requirements - that decontamination factor is well within the ANSI N5.12 criteria. However, in addition to the above requirements, the Nutec 1201 (and 1202) must be demonstrated to withstand the rigors of a Loss of Coolant Accident - that is, it must remain intact on the surface, to prevent clogging of the strainers and to facilitate decontamination work.

PROCEDURE - Two concrete coupons, measuring 2 x 4 x 2" and prepared in accordance with the proposed ASTM D01.43 concrete procedure, were topcoated with Nutec 1201 and Nutec 1202 epoxy polyamide topcoats. Each topcoat was applied to two faces on each concrete specimen. Details of the application and curing of the coatings are outlined in the attached panel preparation sheets.

The panels were then submitted to Oak Ridge National Laboratories for Design Basis Accident Testing at the ASTM D01.43 proposed PWR curve (307°F., 60 psig). Refer to the attached ORNL procedures.

RESULTS - No defects were noted on either coupon. Refer to the attached ORNL results sheet.

CONCLUSION - In those instances where the concrete remains exposed, application of Nutec 1201 or 1202 is satisfactory provided the application is pinhole free.

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: Nutec 1201 and Nutec 1202
2. TYPE SUBSTRATE: Concrete SIZE: 2 x 4 x 2"
3. SURFACE PREPARATION (Describe): Wire brush cleaned to remove efflorescence from coupon.
4. PRODUCT DATA: SAMPLE NO.(s): 6163
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
1	Epoxy	*1202	8353/7939	Spray	44° 71%	.005 - .006	02/07/80 02/80/80
2	Nutec	**1201	6637/6333	Spray	44° 71%	.005 - .006	02/07/80 02/80/80

*Sides 1 & 2 coated with 1202

**Sides 3 & 4 coated with 1201

6. CURING CONDITIONS: AMBIENT TEMP. 40 - 45 °F REL. HUMIDITY 70 - 75 %
MINIMUM CURE 35 DAYS
7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge DATE SUBMITTED 03/15/80

APPROVED: Paul E. Arnold
TEST REPORT NO. _____

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: Nutec 1201 and Nutec 1202
2. TYPE SUBSTRATE: Concrete SIZE: 2 x 4 x 2"
3. SURFACE PREPARATION (Describe): Wire brush cleaned to remove efflorescence from
coupon.
4. PRODUCT DATA: SAMPLE NO.(s): 6165
5. DATE AND TIME CURING COMPOUND OR PRIMER APPLIED: N/A

<u>COAT</u>	<u>PRODUCT</u>	<u>PRODUCT CODES</u>	<u>BATCH #</u>	<u>APPLICATION METHOD</u>	<u>CONDITIONS R/M(°F)%R.H.</u>	<u>THICKNESS (ins.)</u>	<u>TIME & DATE APPLIED</u>
1	Epoxy	*1202	8353/7939	Spray	44° 71%	.005 - .006	02/07/80 02/08/80
2	Nutec	**1201	5637/6333	Spray	44° 71%	.005 - .006	02/07/80 02/08/80

*Sides 1 & 2 coated with 1202

**Sides 3 & 4 coated with 1201

6. CURING CONDITIONS: AMBIENT TEMP. 40 - 45 °F REL. HUMIDITY 70 - 75
MINIMUM CURE 35 DAYS
7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge DATE SUBMITTED 03/15/80

APPROVED: *Donald E. Arnold*
TEST REPORT NO. _____

Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: May 14, 1980

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 1×10^8 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

Approved

R. P. Apple
L. T. Corbin

Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division
Oak Ridge National Laboratory
May 14, 1980

ORNL Log Book No. A 7562; A5-5-80

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 days	250	30	
3 min	250-230	0	Fresh spray solution added at 75°F after draining autoclave.
10 min	230-200	10	
3 days	200	10	
End of test			

Evaluated

R. P. Apple

Approved

L. T. Cochran

Manufacturer: Imperial
New Orleans, Louisiana

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: May 14, 1980

System Identification

Steel panel x Concrete block

1201/1202

DBA Test Results

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A 7562; A5-5-80

<u>Sample No.</u>	<u>DBA phase</u>	<u>Comments</u>
6163	spray	Coatings intact, no defects, sides 1, 2, 3, and 4.
6165	spray	Coatings intact, no defects, sides 1, 2, 3, and 4.

Evaluated

R. L. Apple

Approved

L. T. Cochran