Imperial

TECHNICAL REPORT

NUMBER

462-1-81

TITLE
REVISION
DESIGN BASIS ACCIDENT TEST RESULTS -NUTEC 11S OVER CLEAN-N-STRIP AND ABRASIVE BLASTED STEEL

FOR

GENERAL USE

CUSTOMER

Submitted by: GERALD ARNOLD

Approved: ROBERT R. TAYLOR 2/19/82

Date: JANUARY 22, 1982

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

SCOPE: The purpose of this test was to evaluate the feasibility of applying Nutec #11S surfacer to steel imbedded in concrete (i.e. Richmond inserts, Steel Imbeds) in Service Level I areas of nuclear power plants.

SUMMARY: Design Basis Accident test results from Oak Ridge National Laboratories indicate loss of adhesion on 11S coated specimens and #2 few blisters on 11S/1201 coated specimens which had previously been cleaned to bright metal with a 3M Clean-n-Strip cup wheel.

On the other hand no defects were observed on the 11S surfacer over abrasive blasted steel. Mixed results were obtained on 11S/1201 specimens which had been abrasive blasted. Two of four faces looked excellent; whereas the two remaining faces exhibited some blistering.

Of the eight 11S/abrasive blasted steel interfaces, five exhibited no defects and one contained very few #6 blisters (75% passing). Of the two faces which Oak Ridge National Laboratories reported as #2M, one appears marginal.

PROCEDURES: Eight 2" x 4" x ¼" carbon steel panels were prepared for coating:

a. Four were cleaned to bright metal with a 3M Clean-n-Strip cup wheel.

b. Four were abrasive blasted per SSPC-SP-10, near white blast, with a working mix of G-80, G-50, G-40 steel grit to achieve a surface profile of 2.0 mils.

Nutec #11S was applied to all eight panels over a two day period (one face of each panel a day). Nutec 1201 was then applied to two Clean-n-Strip panels and two blasted panels. Details of the application and curing are outlined on the attached panel preparation sheets.

The coated panels were then submitted to Oak Ridge National Laboratories for Design Basis Accident testing, with maximum 385°F. and 70 psig parameters.

The tested panels were evaluated by ORNL personnel immediately upon removal from the autoclave and reinspected by Imperial following shipment of the panels back to New Orleans.

CONCLUSIONS:

Based on the test results, application of Nutec 11S is not recommended (for surfaces greater than two square inches) over clean-n'-strip prepared steel in containment areas which would be exposed to the temperature and pressure conditions observed in this test.

Application of Nutec 11S is recommended for overlap on steel imbeds (maximum 2 inches overlap) and over imbedded steel objects (up to six square inches), which have been abrasive blasted or prepared with power tools which impart a surface profile (i.e., roto peen).

Of the eight abrasive blasted faces coated with Nutec 11S, five exhibited no defects and one contained only very few #6 size blisters. Oak Ridge also reported one face of panel 7829 (rear) as having #2 medium blisters. Imperial evaluated the panels thoroughly and believes that ORNL mistakenly evaluated the same face (front side) twice. Imperial has reevaluated the rear of panel 7829 to only few #4 blisters. The front side of panel 7829 was borderline.

Therefore, of the eight abrasive blasted faces tested, Imperial finds that seven comply with the ANSI N101.2 acceptance criteria (no larger than #4 few blisters) and the eight face is borderline. This amounts to an 87.5% success rate.

NOTE: Technical reports #353-80 and #413-80 relate Elcometer adhesion test data of Nutec 11S over abrasive blasted and power tool cleaned steel surfaces. These reports are recommended for review, especially for Service Level II and Balance of Plant service, when DBA testing is not required, that is, where the coating system will not be subjected to Loss of Coolant Accident conditions.

PANEL PREPARATION SHEETS

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: NUTEC #11S
2. TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2" x 4" x ¼"
3. SURFACE PREPARATION (Describe): Clean-n-Strip cleaned to bright metal
4. PRODUCT DATA: SAMPLE NO.(s): 7822
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
Front	NUTEC	#11S	2417 2102 2103	Squeegee	86/73	.022-.027	9/25/80
Back	NUTEC	#11S	2417 2102 2103	Squeegee	84/76	.021-.027	9/26/80

6. CURING CONDITIONS: AMBIENT TEMP. 80-90 °F REL. HUMIDITY 70-80 %
   MINIMUM CURE 17 DAYS
7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED 10/13/80

APPROVED: Harold C. Arnold

TEST REPORT NO. 462-81

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

PRODUCT TO BE TESTED: Nutec #11S

TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2 x 4 x ¼"

SURFACE PREPARATION (Describe): Clean-n-Strip cleaned to bright metal

PRODUCT DATA: SAMPLE NO.(s): 7823

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
Front	NUTEC	#11S	2417 2102 2103	Squeegee	86/73	.022-.027	9/25/80
Back	NUTEC	#11S	2417 2102 2103	Squeegee	84/76	.021-.027	9/26/80

CURING CONDITIONS: AMBIENT TEMP. 80-90 °F REL. HUMIDITY 70-80

MINIMUM CURE 17 DAYS

TEST PROCEDURE: DBA

TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED 10/13/80

APPROVED BY:

DATE: 1/22/82

PREPARED BY: Maurine Lee

DATE: 1/16/81

TEST REPORT NO.: 462-1-81

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: NUTEC #11S
2. TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2" x 4" x ¼"
3. SURFACE PREPARATION (Describe): Clean-n-Strip cleaned to bright metal.
4. PRODUCT DATA: SAMPLE NO.(s): 7824
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
Front	NUTEC	#11S	2417 2102 2103	Suqeegee	86/73	.018-.026	9/25/80
Back	NUTEC	#11S	2417 2102 2103	Squeegee	84/76	.018-.025	9/26/80
	NUTEC	#1201	1958/1959	Spray	74/78	F- .003-.004 B- .006-.007	10/1/80

Total Dry Film Thickness Range - Front .021 -.030
Back .024 -.032

6. CURING CONDITIONS: AMBIENT TEMP. 80-90 °F REL. HUMIDITY 70-80 %
MINIMUM CURE 17 DAYS
7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED 10/13/80

APPROVED: Harold E. Annis

TEST REPORT NO. 462-81

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: NUTEC #11S
2. TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2" x 4" x ¼"
3. SURFACE PREPARATION (Describe): Clean-n-Strip cleaned to bright metal
4. PRODUCT DATA: SAMPLE NO.(s): 7825
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
Front	NUTEC	#11S	2417 2102 2103	Squeegee	86/73	.021-.026	9/25/8(
Back	NUTEC	#11S	2417 2102 2103	Squeegee	84/76	.018-.024	9/26/8(
	NUTEC	#1201	1958/1959	Spray	74/78	F- .003-.004 B- .004-.006	10/1/8(

Total Dry Film Thickness Range - Front .024-.030
Back .022-.030

5. CURING CONDITIONS: AMBIENT TEMP. 80-90 °F REL. HUMIDITY 70-80
MINIMUM CURE 17 DAYS

7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED 10/13/80

APPROVED: Harold E. Arnold

TEST REPORT NO. 462-81

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: NUTEC #11S
2. TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2" x 4" x¼"
3. SURFACE PREPARATION (Describe): Abrasive blasted per SSPC-SP-10, near white blast, with a surface profile of 2.0 mils as read on a Keane-Tator Profile Comparator Disc.
4. PRODUCT DATA: SAMPLE NO.(s): 7826
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
Front	NUTEC	#11S	2417 2102 2103	Squeegee	86/73	.020-.050	9/25/80
Back	NUTEC	#11S	2417 2102 2103	Squeegee	84/76	.024-.030	9/26/80

6. CURING CONDITIONS: AMBIENT TEMP. 80-90 °F REL. HUMIDITY 70-80
   MINIMUM CURE 17 DAYS
7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED 10/13/80

APPROVED: Harold E. Ansold

TEST REPORT NO. 462-81

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: NUTEC #11S
2. TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2" x 4" x ¼"
3. SURFACE PREPARATION (Describe): Abrasive blast per SSPC-10, near white blast, with a surface profile of 2.0 mils as read on a [illegible] Profile Comparator Disc.
4. PRODUCT DATA: SAMPLE NO.(s): 7827
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
Front	NUTEC	#11S	2417 2102 2103	Squeegee	86/72	.018-.026	9/25/80
Back	NUTEC	#11S	2417 2102 2103	Squeegee	84/76	.021-.027	9/26/80

6. CURING CONDITIONS: AMBIENT TEMP. 80-90 °F REL. HUMIDITY 70-80 %
   MINIMUM CURE 17 DAYS
7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED 10/13/80

APPROVED: Harold E Arnold

TEST REPORT NO. 462-81

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: NUTEC #11S
2. TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2" x 4" x¼"
3. SURFACE PREPARATION (Describe): Abrasive blasted per SSPC-SP-10, near white blast, with surface profile of 2.0 mils as read on a Keane-Tator Profile Comparator Disc.
4. PRODUCT DATA: SAMPLE NO.(s): 7828
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
Front	NUTEC	#11S	2417 2102 2103	Squeegee	86/73	.022-.027	9/25/80
Back	NUTEC	#11S	2417 2102 2103	Squeegee	84/76	.015-.020	9/26/80
	NUTEC	#1201	1958 1959	Spray	74/78	F- .003-.004 B- .006-.007	10/1/80

Total Dry Film Thickness Range - Front .025-.031
Back .021-.027

6. CURING CONDITIONS: AMBIENT TEMP. 80-90 °F REL. HUMIDITY 70-80 %
MINIMUM CURE 17 DAYS
7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED 10/13/80

APPROVED: Harold E Arnold

TEST REPORT NO. 462-81

DBA AND RADIATION TOLERANCE

TEST PANEL PREPARATION DATA

1. PRODUCT TO BE TESTED: NUTEC #11S
2. TYPE SUBSTRATE: ASTM A-36 Carbon Steel SIZE: 2" x 4" x ¼"
3. SURFACE PREPARATION (Describe): Abrasive blasted per SSPC-SP-10, near white blast, with a surface profile of 2.0 mils as read on a Keane-Tator Surface Profile Comparator Disc.
4. PRODUCT DATA: SAMPLE NO.(s): 7829
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
Front	NUTEC	#11S	2417 2102 2103	Squeegee	86/73	.022-.027	9/25/80
Back	NUTEC	11S	2417 2102 2103	Squeegee	84/76	.020-.050	9/26/80
	NUTEC	#1201	1958 1959	Spray	74/78	F- .002-.003 B- .006-.007	10/1/80

Total Dry Film Thickness Range - Front .024-.030
Back .026-.057

6. CURING CONDITIONS: AMBIENT TEMP. 80-90 °F REL. HUMIDITY 70-80 %
MINIMUM CURE 17 DAYS
7. TEST PROCEDURE: DBA
8. TESTING PERFORMED BY: Oak Ridge National Laboratories DATE SUBMITTED 10/13/80

APPROVED: Harold E. Arnold

TEST REPORT NO. 462-81

ORNL PROCEDURES

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 11/13/80

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 Ralph F. Hyde

Approved L. T. Corbin

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 11/13/80

ORNL Log Book No. A 7562; A10-29-80

Table 1. DBA solution composition, distilled water

Reagent	Concentration
Boric acid, H_3BO_3	6200 ppm
Hydrazine, NH_2NH_2	50 ppm
Trisodium phosphate, $Na_3PO_4 \cdot 12H_2O$	Required to adjust pH to 9.7

Table 2. DBA test conditions

Time	Temperature (°F)	Pressure (psig)	Comments
Start	214		Autoclave preheated.
58 s	385	68	Steam injected.
10 min	385	70	Pressure maintained by relief valve.
4 min	385–340	70	
6 h	340	70	
20 s	220	30	Spray solution added at 75°F.
20 min	220–250	30	Adjusted pressure with N_2.
4 days	250	30	
20 s	170	–15	Fresh spray solution added after draining autoclave.
25 min	170–200	10	
3 days	200	10	

Evaluated Robert F. Apple

Approved W. T. Carlson

TEST RESULTS

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

November 13, 1980

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

Dear Jerry:

The enclosed report contains test results recently obtained on the Imperial protective coatings. This test was designed to encompass the 385 and the 340°F envelope curves.

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

Sincerely,

L. T. Corbin

L. T. Corbin, Section Head
Analytical Chemistry Division

LTC:dmw

Enclosures

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 11/13/80

System Identification

x Steel panel ___ Concrete block

11S (clean n'strip)

DBA Test Results

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A 7562; A10-29-80

Sample No.	DBA phase	Comments
7822	spray	Front: loss of adhesion. Rear: loss of adhesion.
7823	spray --	Front: blisters, #2 few. * Rear: blisters, #2 few.

* Following shipment back to Imperial, inspection revealed areas of delamination on both sides. GEA

Evaluated Ralph L. Ripple

Approved L. T. Corbin

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 11/13/80

System Identification

x Steel panel ___ Concrete block

11S/1201 (clean n'strip)

DBA Test Results

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A 7562; A10-29-80

Sample No.	DBA phase	Comments
7824	spray	Front: blisters, #2 few. Rear: blisters, #2 few.
7825	spray	Front: blisters, #2 few. Rear: blisters, #2 few.

Evaluated Ralph F. Ryder

Approved W. T. Corbin

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 11/13/80

System Identification

x Steel panel ___ Concrete block

11S

DBA Test Results

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A 7562; A10-29-80

Sample No.	DBA phase	Comments
7826	spray	Front: coatings intact, no defects. Rear: coatings intact, no defects.
7827	spray	Front: coatings intact, no defects. Rear: coatings intact, no defects.
	--	

Evaluated Ralph F. Apple

Approved L. F. Colwick

Manufacturer: Imperial
New Orleans, LA

Analytical Chemistry Division
Oak Ridge National Laboratory
Date: 11/13/80

System Identification

x Steel panel ___ Concrete block

11S/1201

DBA Test Results

ORNL Master Analytical Manual Method No. 2 0922.
ORNL Log Book No. A 7562; A10-29-80

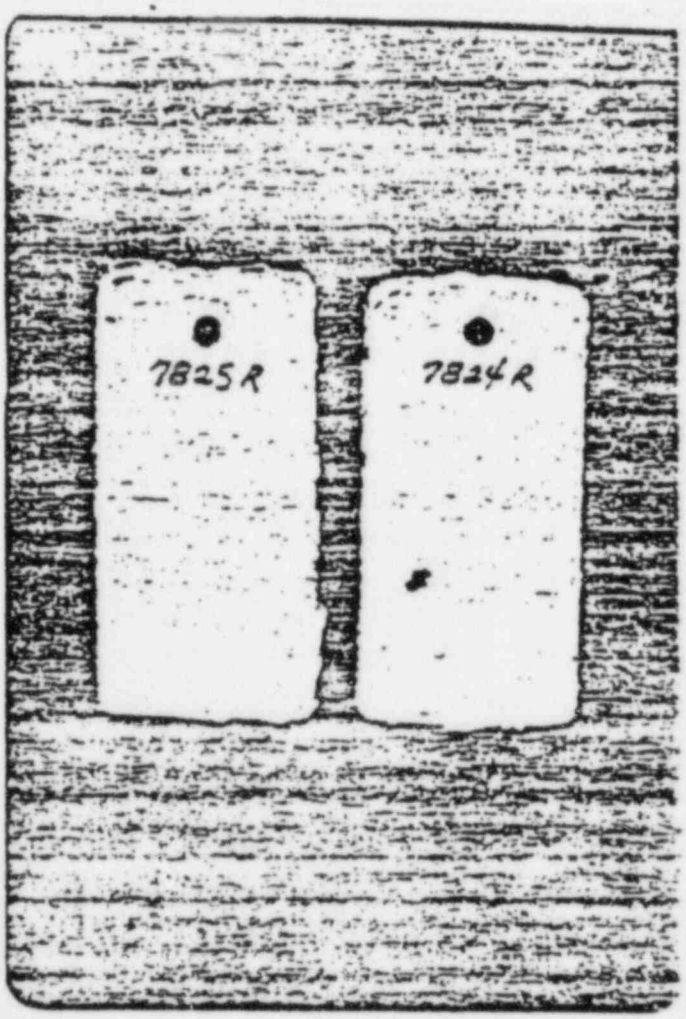
Sample No.	DBA phase	Comments
7828	spray	Front: coatings intact, no defects. Rear: blisters, #6 few.
7829	spray	Front: blisters, #2 medium. * Rear: blisters, #2 medium.

* Imperial inspection of panels
Front: #2-#4, few-medium (borderline)
Rear: #4 few

Evaluated Ralph E. Hyde

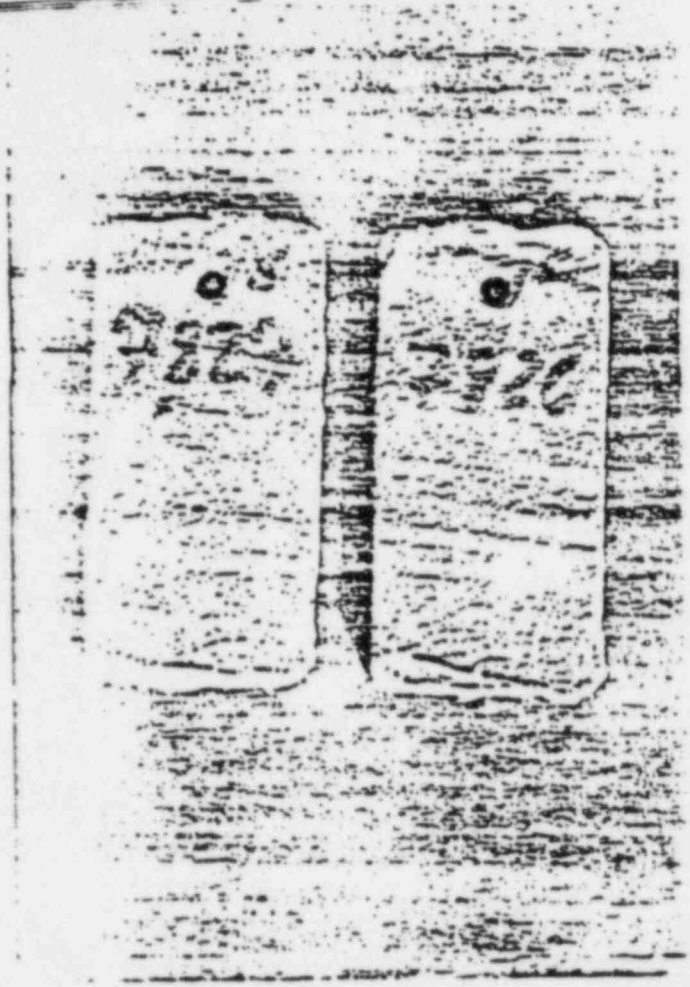
Approved L. E. Corman

7822-7823



7824-7825 R

7824-7825



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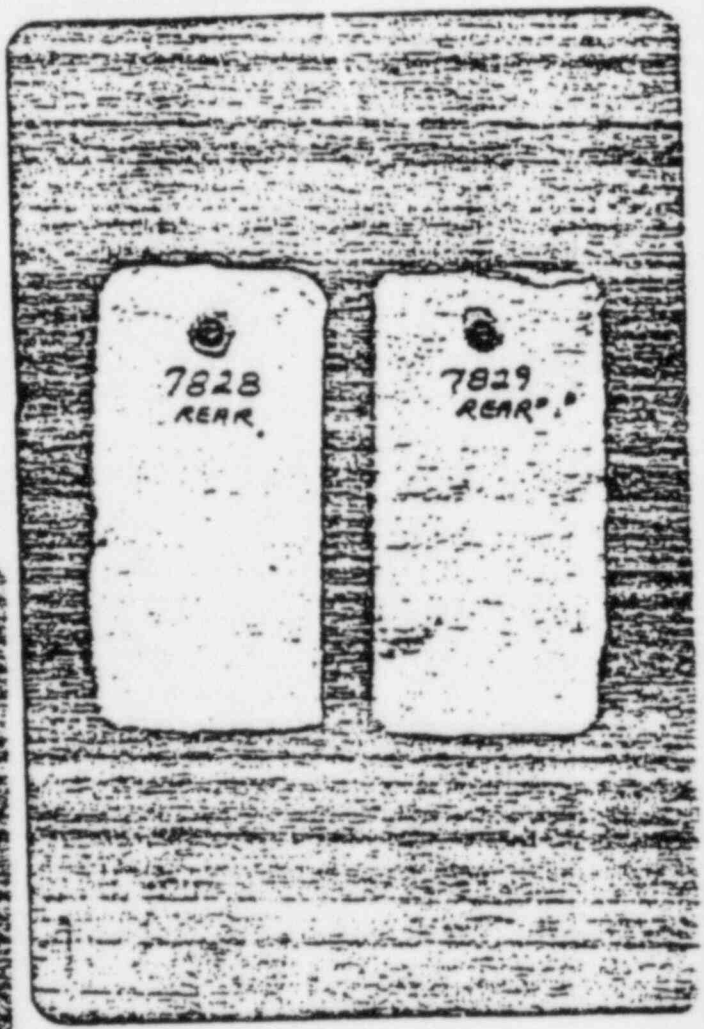

7828-7829 R

7826-7829

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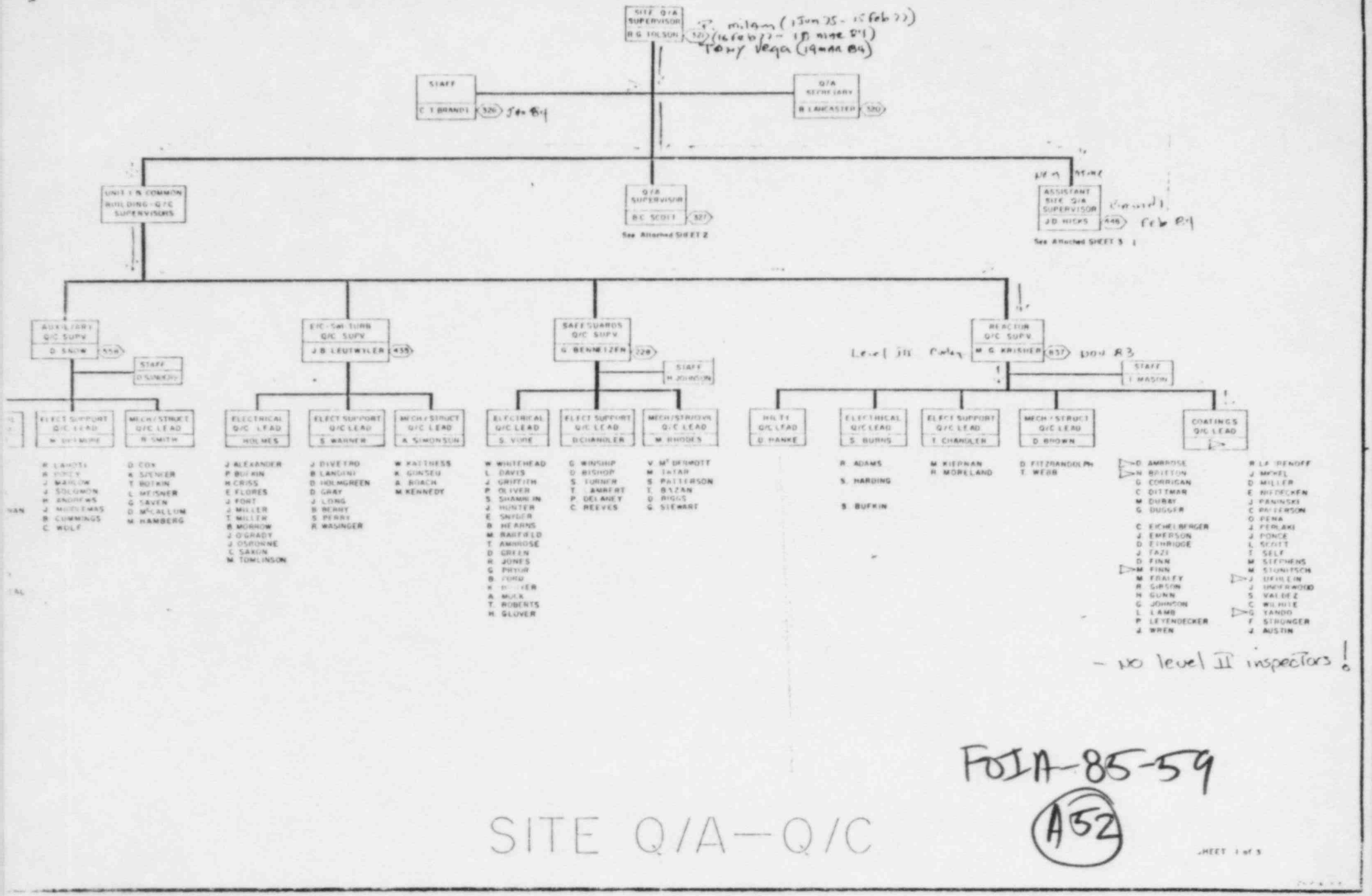
7826-7827

7828-7829 R

7826-7829



Tony Vega (19 mar 84 - 15 feb 85)

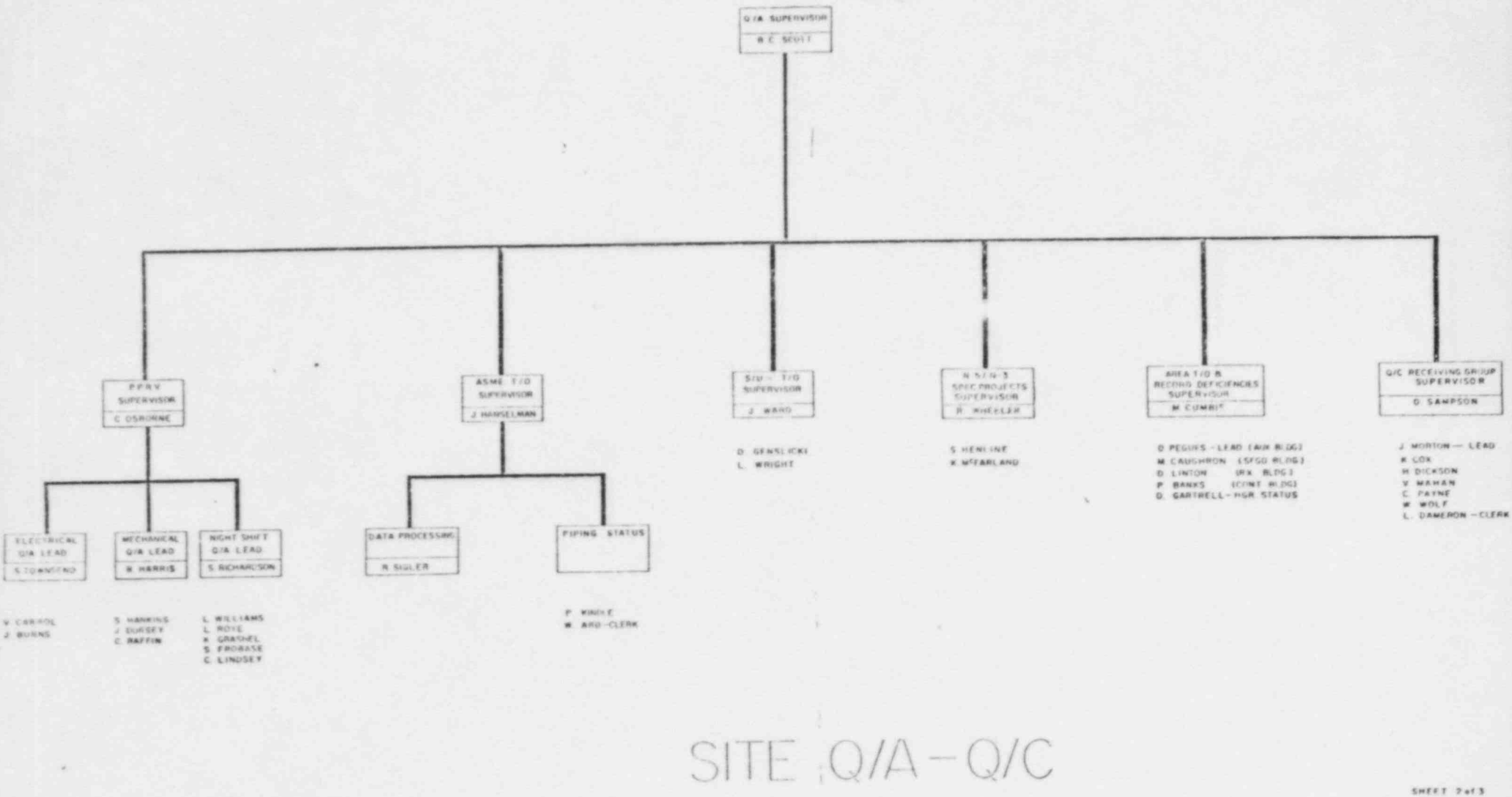
Tony Vega (16 feb 85 - 15 mar 84)

- NO level II inspectors!

FOIA-85-59

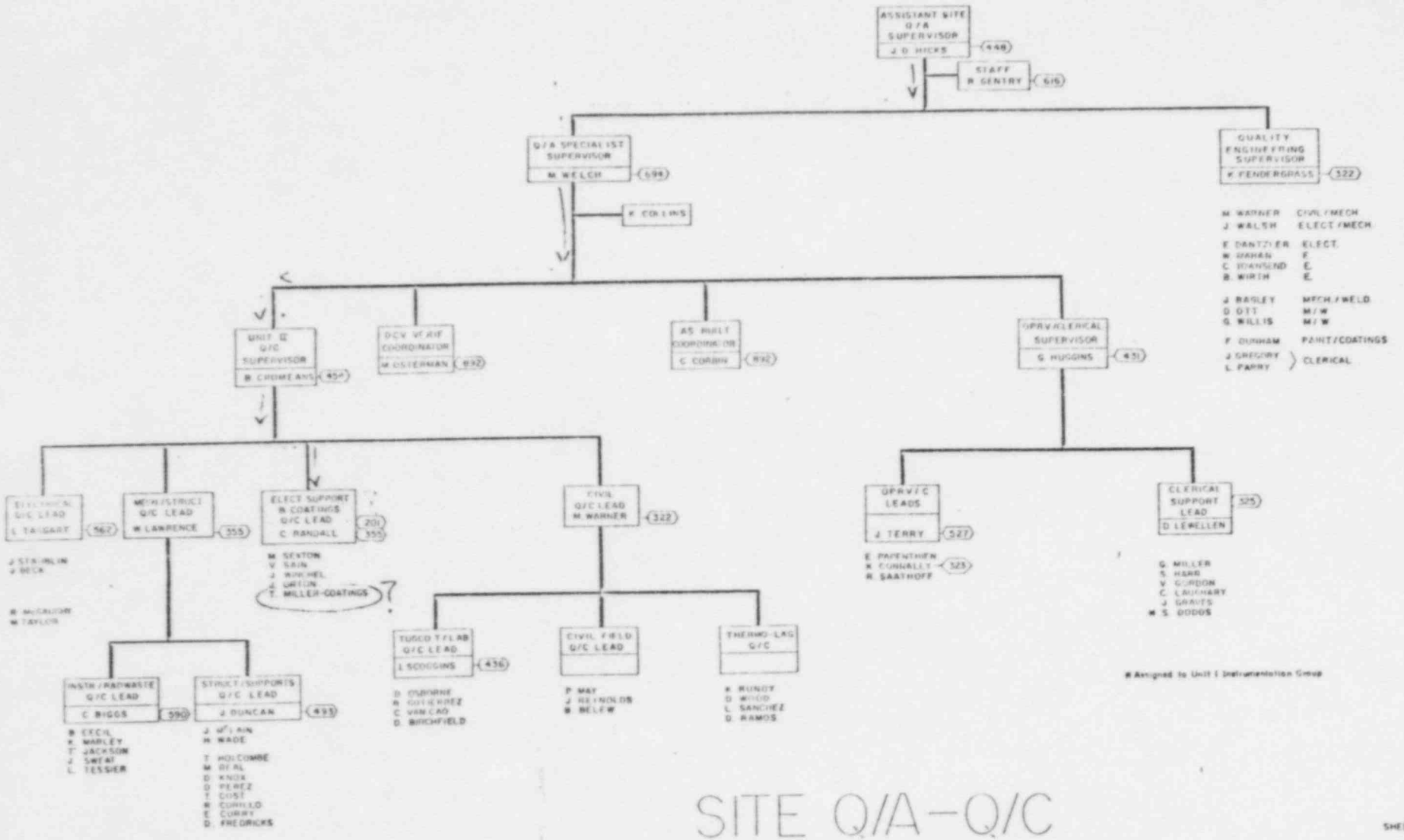
A52

SITE Q/A—Q/C



SITE Q/A - Q/C

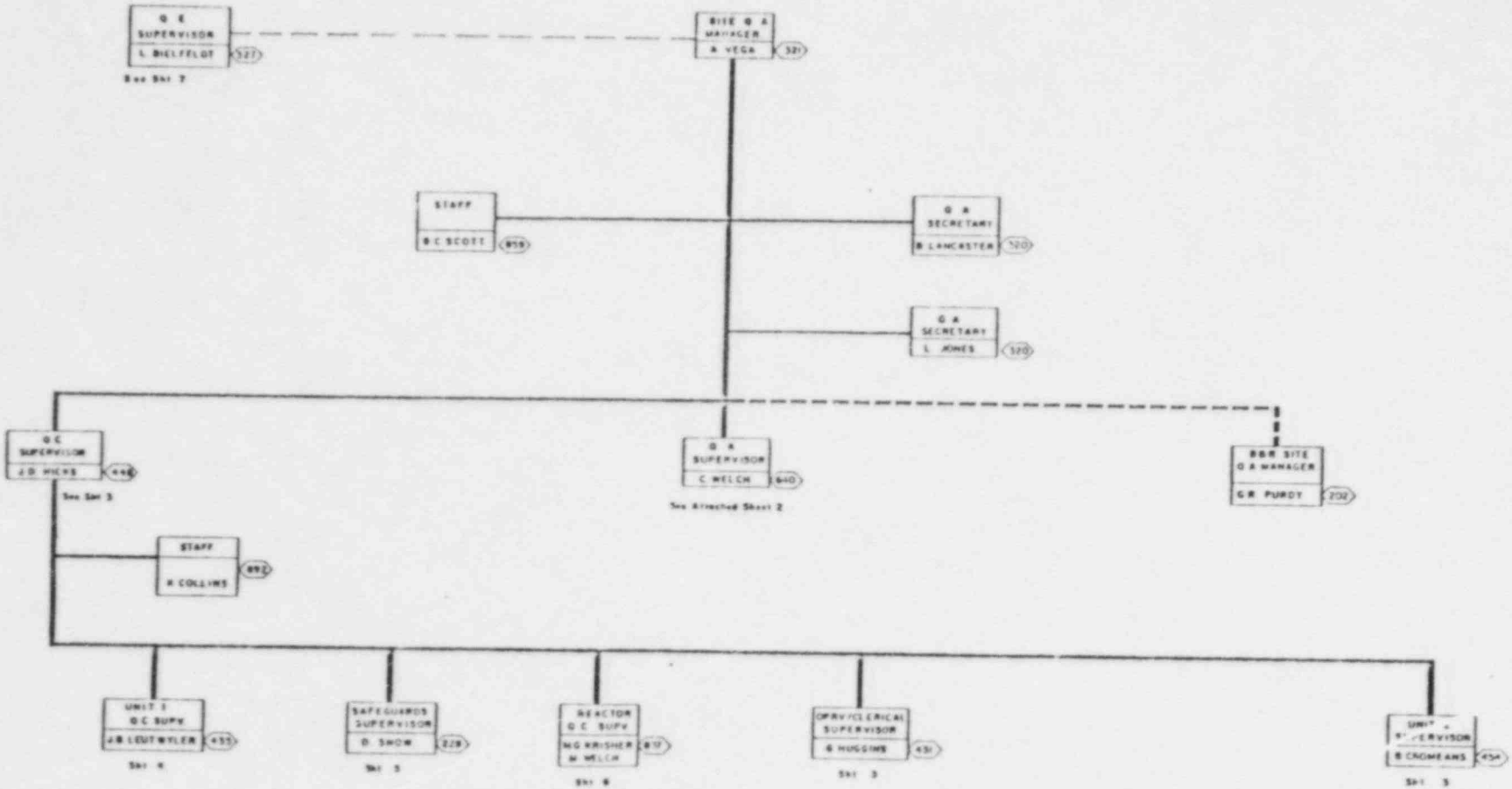
SHEET 2 of 3


ASSISTANT SITE Q/A SUPERVISOR
J D HICKS (448)
STAFF
R GENTRY (616)
Q/A SPECIALIST SUPERVISOR
M WELCH (599)
K COLLINS
QUALITY ENGINEERING SUPERVISOR
K FENDERGRASS (522)
M WARNER CIVIL/MECH
J WALSH ELECT/MECH
E DANTZLER ELECT.
W GAHAN E
C DIANSEND E
B WIRTH E
J BAGLEY MECH./WELD.
D OTT M/W
S WILLIS M/W
F DUNHAM PAINT/COATINGS
J GREGORY
L PARRY
CLERICAL
UNIT II Q/C SUPERVISOR
B CROMEANS (454)
DCN WORK COORDINATOR
M OSTERMAN (932)
AS BUILT COORDINATOR
C CORBIN (932)
OPRV/CLERICAL SUPERVISOR
G HUGGINS (451)
ELECTRICAL Q/C LEAD
L TAIGART (567)
J STRICKLIN
J BECK
B McCALLION
W TAYLOR
MECH/STRUCT Q/C LEAD
W LAWRENCE (355)
ELECT SUPPORT
R COATINGS (201)
Q/C LEAD
C RANDALL (355)
M SEXTON
V SAIN
J WICHEL
J ORTON
T. MILLER-COATINGS
CIVIL Q/C LEAD
M WARNER (322)
OPRV/C LEADS
J TERRY (527)
E PAPENTHIEN
K CONNALLY (525)
R SAATHOFF
CLERICAL SUPPORT LEAD
D LEMELLEN (525)
G MILLER
S HARR
V GORDON
C LAUCHART
J GRANTS
S DODDS
Assigned to Unit 1 Instrumentation Group
PIPE/PIPEWELD Q/C LEAD
C BIGGS (590)
B EXCIL
K MARLEY
T JACKSON
J SWEAT
L TESSIER
STRUCT/SUPPORTS Q/C LEAD
J DUNCAN (435)
J WILLIAMS
H WADE
T HOLCOMBE
M BEAL
D KNOX
D PEREZ
T COST
R CORNILLO
E CURRY
D FREDRICKS
TUSCO T/LAB Q/C LEAD
L SCOGGINS (436)
D OSBORNE
R GUTIERREZ
C VANCAO
D BIRCHFIELD
CIVIL FIELD Q/C LEAD
P MAY
J REYNOLDS
B BELEW
THERMO-LAG Q/C
K RUNDT
D WOOD
L SANCHEZ
D RAMOS

SITE Q/A–Q/C

Revised 9/20/87

QCP

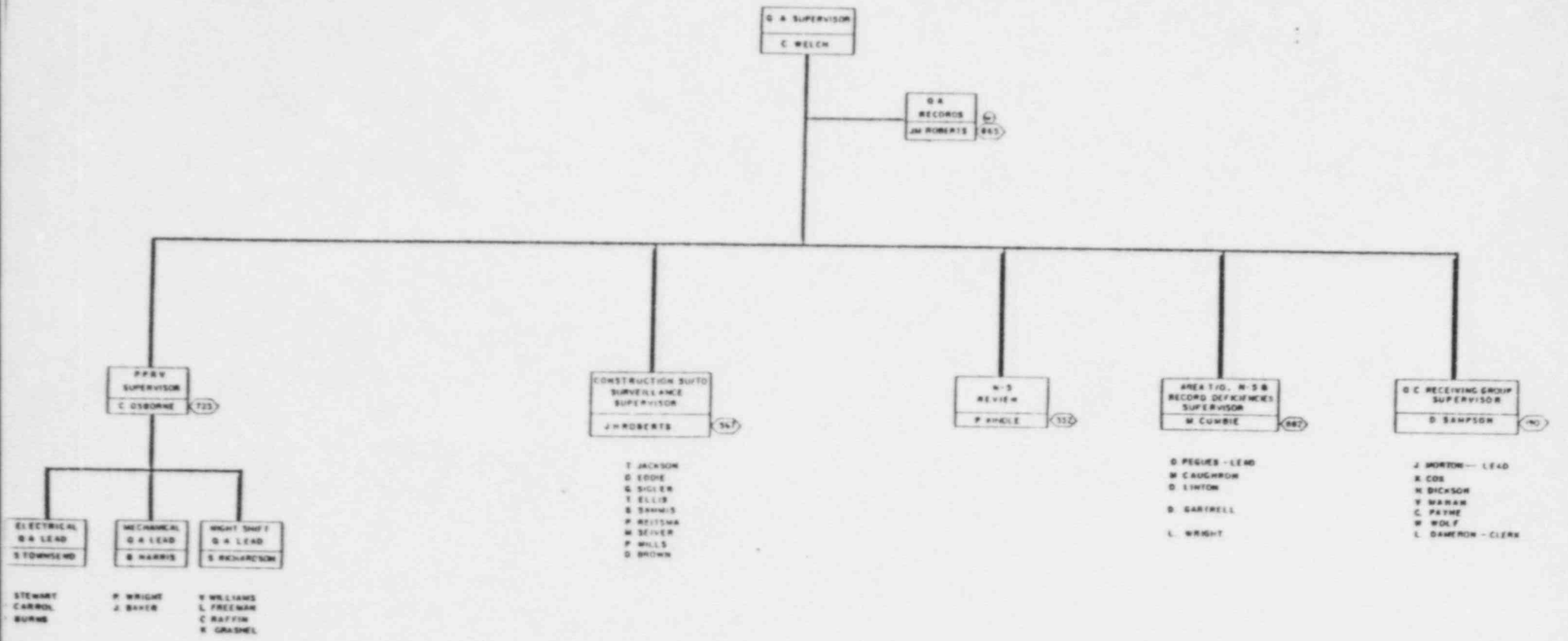


SITE QA / QC

APPROVED DATE

SHEET 1 of 2

7/11/87

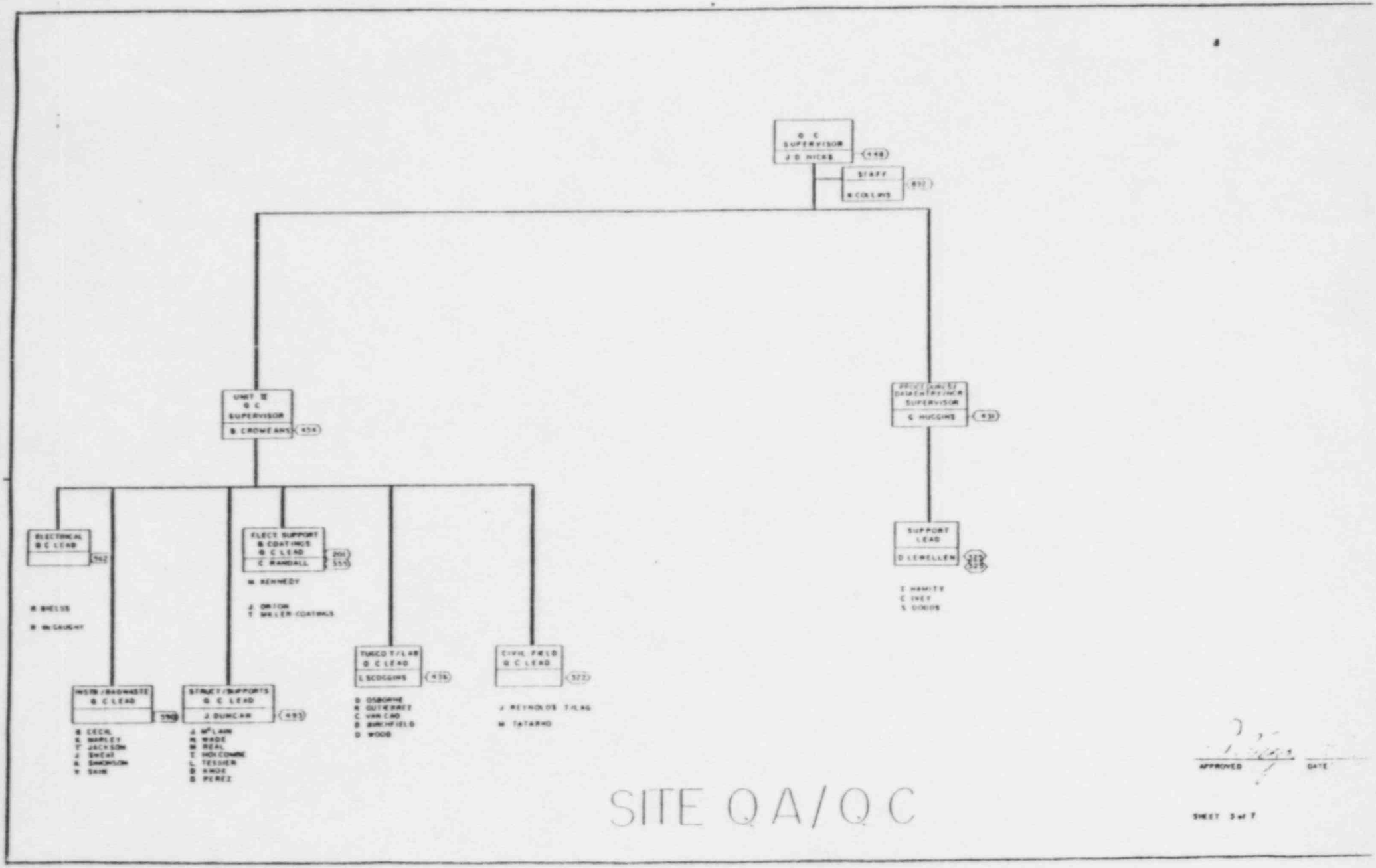


SITE Q A / Q C

APPROVED

DATE

SHEET 1 of 1



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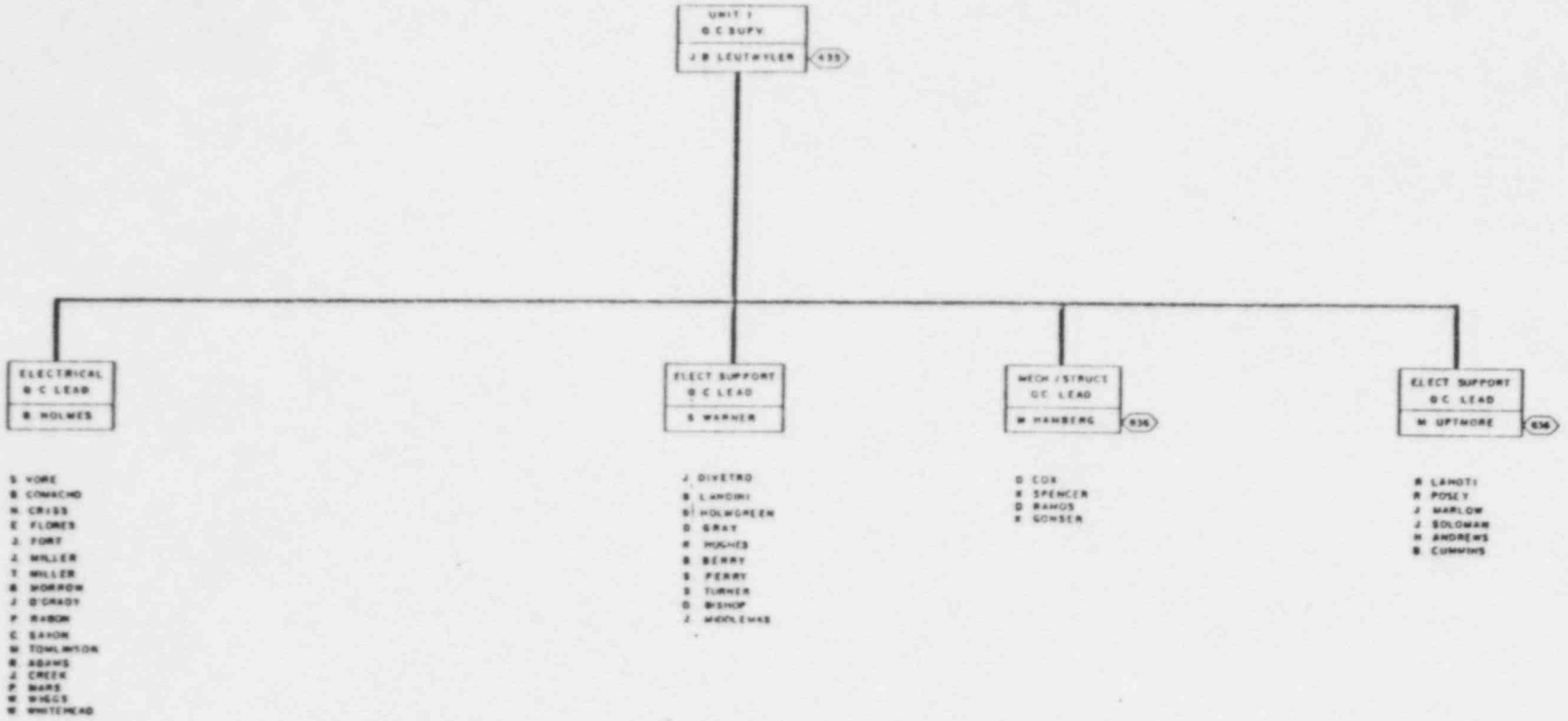

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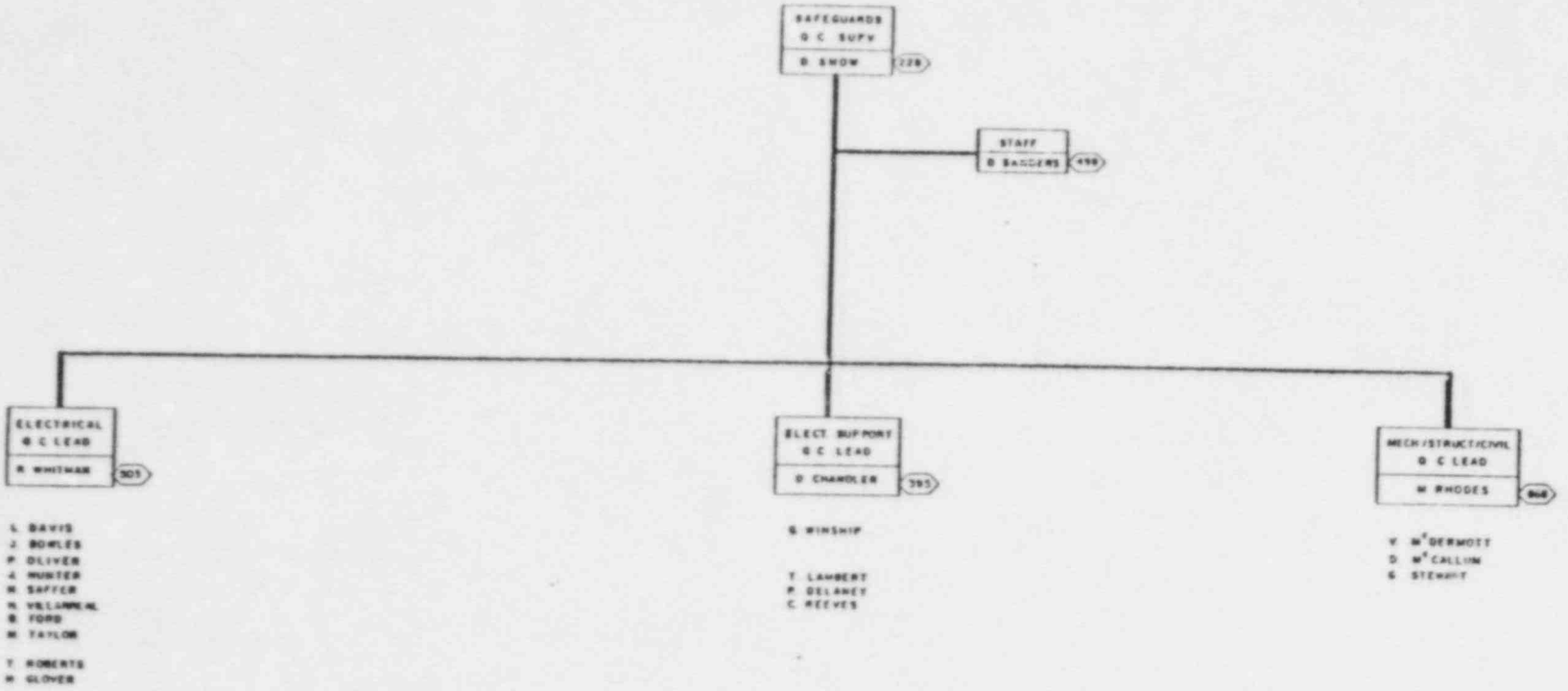

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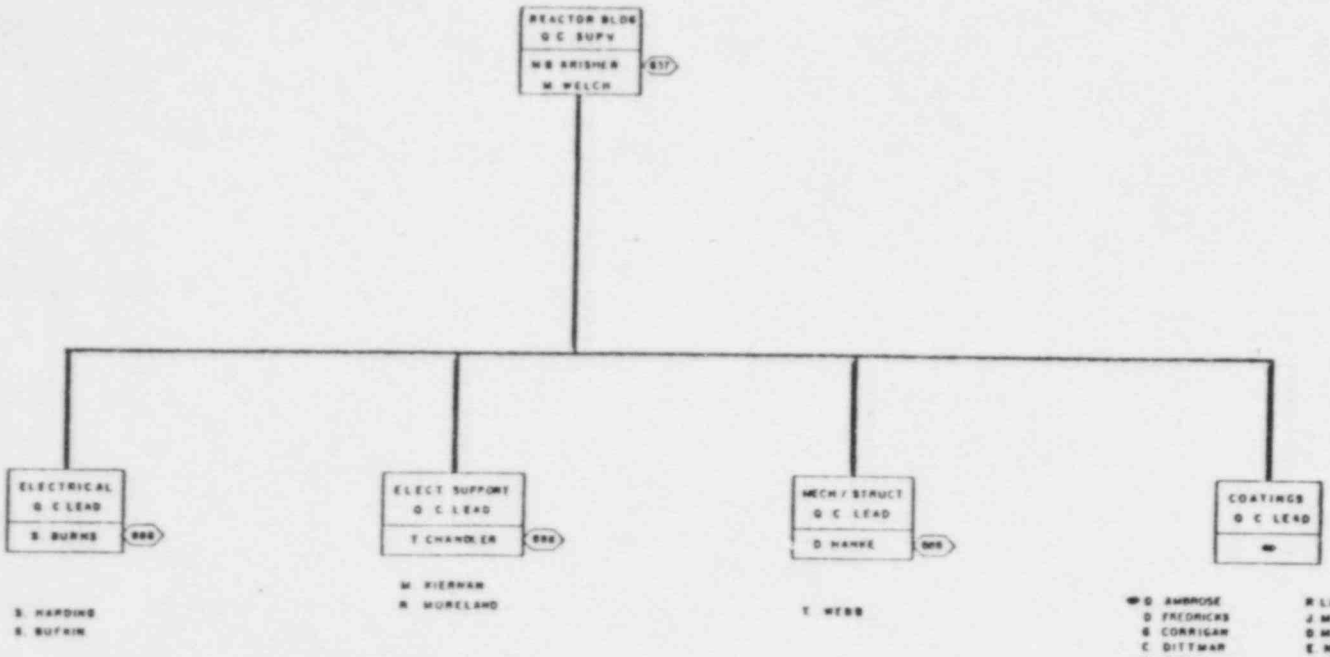
SITE QA / QC

SHEET 5 of 7



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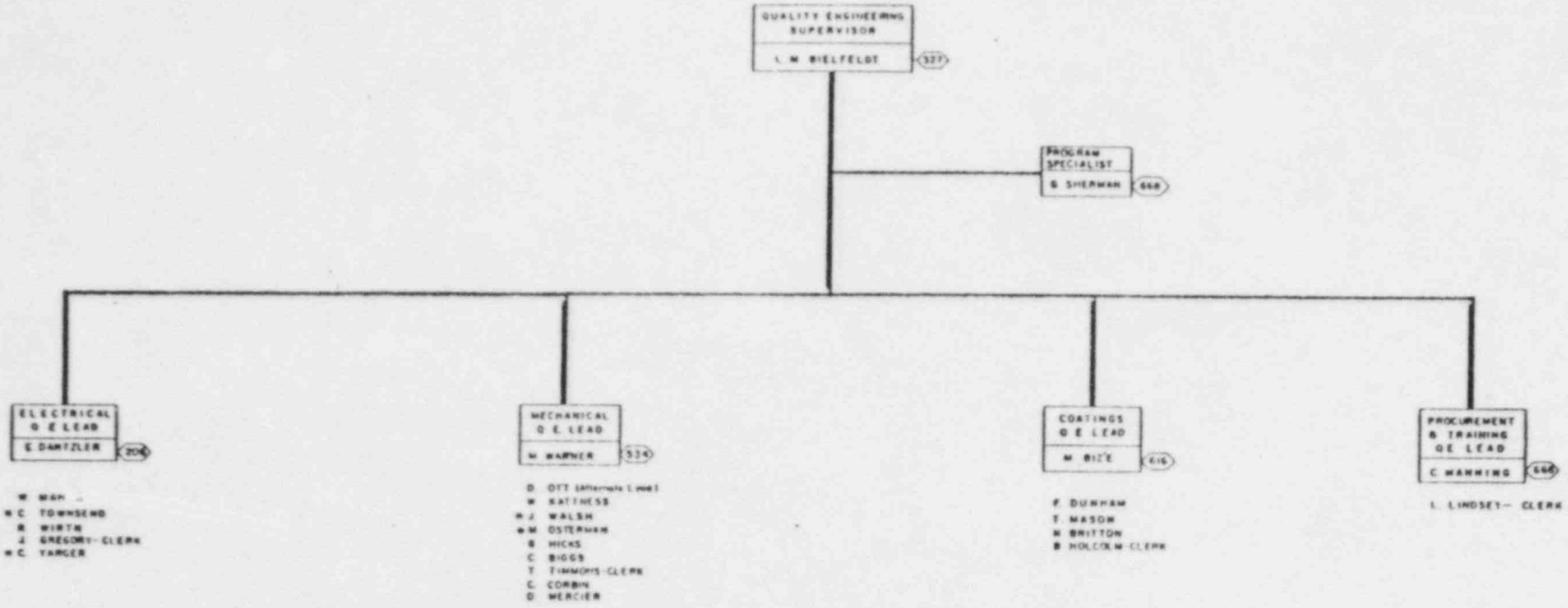
SHEET 6 of 7



APPROVED DATE

SITE Q E

* Assigned to Unit 1 Task Force

SHEET 7 of 7

DEC 20 1983

MEMORANDUM FOR: John W. Clark, Chief
Management Analysis Branch
Division of Budget and Analysis, RM

FROM: Lee Abramson, Statistical Advisor
Dan Lurie, Mathematical Statistician
Management Analysis Branch, RM/B

SUBJECT: TRIP REPORT ON COMANCHE PEAK BACKFIT INSPECTION

On November 29-30, we met with Frank Hawkins (RIII), Claude Johnson (RIV) and Lisa Bielfeldt (Texas Utilities Generating Company (TUGC)) in the TUGC offices in Dallas. We also conferred by telephone with TUGC and plant staff located at Comanche Peak. The purpose of the meeting was to review the statistical analysis of the backfit inspection program at Comanche Peak Units 1 and 2, with the intention of providing an estimate of the total amount of coating which might flake off in the event of an accident.

The backfit inspection program is required to verify that the containment coatings were properly applied, both to the steel and concrete liners and to the miscellaneous items (miscellaneous steel, pipe hangers, conduit supports and cable tray supports). The liners were divided into test areas of approximately 100 square feet and three adhesion tests and five scratch tests (to measure coating thickness) were performed in each test area. Miscellaneous items were divided into test areas of between 5 and 100 square feet, whenever possible, and three adhesion and five scratch tests were performed in each test area. If a test area was less than 5 square feet, only one adhesion test and five scratch tests were performed.

If any adhesion or scratch test indicated a defect, the extent of the defective area was delineated with additional tests and the entire defective area was repaired. However, since the actual area tested was a very small fraction of the total area of the coating (the adhesion test covers a circle about one inch in diameter and the scratch test is only a few inches long), the possibility exists that defective sections of coating, not sampled by the test procedure, still remain.

In order to estimate the total amount of coating which might flake off in the event of an accident, it is necessary to estimate the total area of the defective coating still remaining after the backfit inspection has identified and repaired the defective areas which it happens to have tested. The residual defective area can be estimated from the observed failure rates for the adhesion and scratch tests as performed, along with an estimate of the average size of the defective areas which were repaired. With this information for the various liners and miscellaneous items, it is possible to calculate a confidence interval for the residual defective area.

At the meeting, we requested Ms. Bielfeldt to provide us with the data described above. Since the analyses performed to date by TUGC were designed to confirm that the average thickness of the coating met the technical specifications rather than to estimate the percentage of defective coating, it will be necessary for TUGC to analyze the backfit inspection records to provide us with the requested data. Furthermore, in order to ascertain that the data we will receive is appropriate for making the required estimates, we asked Ms. Bielfeldt to send us a sample of the data as soon as she collects it. We expect to receive this sample data by the end of the year.

Lee Abramson, Statistical Advisor

Dan Lurie, Mathematical Statistician
Management Analysis Branch, RM/B

cc: F. Hawkins, RIII
C. Johnson, RIV
E. Triner, RM/B

bcc: L. Abramson, RM/BMA
D. Lurie, RM/BMA
RM/BMA Subj/Chron

OFFICE ▶	RM/BMA	RM/BMA			
NAME ▶	Abramson:bb	Lurie			
DATE ▶	12/ /83	12/ /83			

TEXAS UTILITIES GENERATING CO. CPSES	INSTRUCTION NUMBER	REVISION	ISSUE DATE	PAGE
	QI-QP-11.4-27	6	JUL 11 1984	1 of 32

INSPECTION OF CONCRETE SUBSTRATE SURFACE PREPARATION AND COATINGS APPLICATION AND REPAIR

PREPARED BY: Fred L Dunham 7-10-84 DATE

APPROVED BY: C D Mason 7-10-84 DATE

APPROVED BY: G R Bischoff 7-10-84 DATE

1.0 REFERENCES

1-A Gibbs and Hill Specification 2323-AS-31, "Protective Coatings"

1-B QI-QP-11.4-28, "Protective Coatings Inspection Travelers"

1-C CP-QP-16.0, "Nonconformances"

2.0 GENERAL

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2.1 PURPOSE AND SCOPE

This instruction shall describe the methods used by Quality Control personnel while performing inspections of application of coatings on a concrete substrate inside the Reactor Containment Building, Unit 1.

3.0 INSTRUCTIONS

Visual inspection of surfaces as addressed by this instruction shall be made at approximately an arm's length from the surface being inspected. The area of inspection shall be adequately lighted during the inspection activity. Adequate lighting is defined as the minimum light produced by a two (2) D-cell battery flashlight.

Visual aids fabricated on site and approved by Quality Assurance and Engineering may be used by Inspectors as an aid in the performance of their inspections.

For definitions reference Attachment 6.

If a conflict arises between the requirements of this procedure and the requirements of the site specification, Ref. 1-A, the requirements of the site specification shall prevail.

3.1 SURFACE PREPARATION

Under normal conditions, the concrete surface shall be allowed to cure a minimum of 28 days prior to application of protective coatings. However, if the coatings are to be applied to pour backs, grouting, or patching to which NUTEC 10 has been applied as a curing compound, coating application may be performed after a minimum of 6 days has elapsed from NUTEC 10 application time. Repaired abandoned Hilti bolt holes, tie holes, unacceptable spalled concrete, grout under base plates which have 3 square feet or less of exposed grouted surface to be coated, may be coated if Nutec 10 is applied as a curing compound and the Nutec 10 has cured in accordance with Section 3.1.1.7. Abandoned Hilti Bolt holes and tie holes may be coated after initial setting of the patch if no curing membrane is used. If other curing methods are utilized for cosmetic patches or grout under base plates as stated above, coating shall not proceed until 7 days cure has elapsed.

3.1.1 Application of NUTEC 10 Curing Compound (if applicable)

3.1.1.1 The QC Inspector shall verify that the green concrete has been cleaned.

3.1.1.2 The QC Inspector shall verify the coating applicator is qualified per Section 3.3.5.

3.1.1.3 The QC Inspector shall verify that NUTEC 10 is not applied under inclement conditions and that the surface temperatures are above 50°F. Ambient conditions shall be verified per Section 3.3.1. Areas of visible moisture or standing water are unacceptable (Reference Attachment 6).

3.1.1.4 NUTEC 10 shall be mixed per Paragraph 3.2. The NUTEC 10 has a pot life of (1) one hour at 75°F. If the NUTEC 10 gives the appearance of crawling and does not penetrate the concrete, the material shall be removed from the concrete by solvent and a clean cloth. All the expired material shall be discarded.

3.1.1.5 Pot life above is the recommended time and should be utilized as a guideline for coating time, actual pot life is determined by the applicability of the coating. This applies to thinned and unthinned coatings.

3.1.1.6 Nutec 10 may be applied by spray, brush, or roller. If spray application is used, the QC Inspector shall verify that the NUTEC 10 air supply shall be in accordance with Section 3.3.3.

3.1.1.7 Cure times for Nutec 10 is as follows:

ST - 50°F - 69°F -- 72 hours
70°F - 89°F -- 24 hours
90°F and above 18 hours

3.1.2 Preblast Cleaning Operations

Prior to surface preparation, the QC inspector shall visually examine the surface to be water blasted for heavy deposits of oil and grease. Any heavy oil or grease deposits shall be removed.

The QC inspector shall also verify that any detrimental surface irregularities such as projections, fins or ridges are removed.

NOTE: The preblast visual inspection is required only when surface preparation is by one of the following methods:
a. Water blasting
b. Water blasting with sand injection
c. Dry sandblasting
d. Bush hammering

3.1.3 Methods of Surface Preparation

Water blasting, water blasting with sand injection, acid etching, sand blasting, and power tooling are all acceptable methods of surface preparation. If NUTEC 10 curing membrane has been applied and gives a "glossy" appearance, the NUTEC 10 shall be abraded to remove the glossy appearance.

If chemical cleaning is performed on the concrete substrate, the QC Inspector shall verify that the surface is flushed clean with water.

3.1.4 Post Surface Preparation Operations

After surface preparation, the QC inspector shall visually examine the surface to verify the following:

a) The surface shall be free of construction dust, laitance, and loose deposits, and all adjacent areas cleaned to avoid contamination.

b) All holes greater than 1/2 inch in depth or greater than 2" diameter and cracks greater than 1/32" width are repaired prior to surfacer application.

c) All sharp projections removed.

d) Markings (ink, pencil, chalk, felt tip marker, etc.) solvent wiped.

e) Marking paint removed.

f) Objects protruding from surface are ground or cut smooth until object is flush.

g) All loosely adhering embedded objects are removed.

h) Embedded steel objects less than 4 square inches shall be power tool roughened and solvent wiped.

i) Metal objects larger than 4 square inches are primed.

j) Surface is free of grease, oil, and nonapproved curing membranes.

3.2 MIXING OPERATIONS

3.2.1 Materials

A QC inspector shall verify on Attachment 5 that the shelf life has not expired.

3.2.2 Mixing/Thinning

An inspector shall witness all mixing/thinning operations Per Attachment 7. Induction times for finish mixes are shown in Attachment 2.

3.3 SURFACER APPLICATION

The coating system will consist of a surfacer Nutec 11S, touch-up with Nutec 11 surfacer as required and a finish coat of Nutec 1201. In areas where the concrete surface to be coated exhibits only minor amounts of "bug holes" and surface imperfections, Nutec 11 and Nutec 1201 may be used without the use of Nutec 11S as primary surfacer.

3.3.1 Ambient Conditions

The inspector shall monitor the ambient conditions being recorded on the Environmental Log (Attachment 4) at the "paint distribution point" inside Reactor Unit I. A calibrated non-mercury filled dry bulb thermometer or a calibrated temperature recorder (Bristol 4069 TH or equivalent) shall be used for air temperature determination. A calibrated non-mercury filled wet bulb thermometer or a calibrated humidity recorder (Bristol 4069 TH or equivalent) shall be used to determine relative humidity. The dew point shall be determined by the difference in dry and wet bulb temperature using the U.S. Department of Commerce Weather Bureau Psychrometric Tables, W.B. No. 235. When dry bulb readings are greater than 100°F, the dew point and relative humidity should be determined using the 100°F reading (note in Remarks Section). The surface temperature shall be determined by placing a calibrated Range 0-250°F thermometer or equivalent in contact with the surface to be coated. The thermometer probe shall remain in contact with the surface until the temperature reading stabilizes.

Minimum and maximum values of surface and ambient temperatures shall be 50°F and 100°F respectively. Infrequent dips in temperature to 40°F is permissible during application and/or cure; however, the elapsed time the temperature is below 50°F shall be added to the cure time. Application of the coating shall not begin unless the surface temperature is 5°F above the dew point.

Humidity may vary as high as 100%; however, free standing water shall be removed. Coating application over a damp surface is permissible. Under no conditions shall NUTEC 11S or Nutec 11 be applied to a surface containing free standing water. (Reference Attachment 6).

3.3.1.1 Documentation of Environmental Conditions

a. The Inspector assigned to the "paint distribution point" in the Reactor Building shall, as a minimum, take a complete set of readings (air temperature, relative humidity, dew point and surface temperature) on each floor elevation at least three (3) times each shift (preferably, the beginning, mid point, and just prior to the end of each shift). More readings may be taken when necessary (i.e., noticeable change in air temperature, request by field inspector to take readings in a specific area, etc.).

b. The Inspector at the "paint distribution point" shall document these readings on Attachment 4 as follows:

1. The Inspector shall fill in the applicable information as delineated on the form, except for the "Report No. _____". (The Report No. will be filled in by the Paper Flow Group when they assign numbers, prior to transmitting to the QA vault.)

2. Upon completion of the shift, the inspector shall turn all of the Environmental Log Sheets for that shift into the lead inspector(s).

c. The lead inspector(s) shall review the log sheets for completeness and correctness, sign and date the "QC Review" block, obtain copies for QC reference and transmit the originals to the Paper Flow Group.

d. If at any time the inspector determines readings which do not comply with the parameters set forth in this procedure, he shall proceed in the following manner:

1. Immediately take an additional set of readings in the immediate area of the first set of unacceptable readings and record them on the Environmental Log.

2. If the additional set of readings are acceptable, take a third set of readings for referee purposes and record them. If the referee set of readings are acceptable, then the area in question is acceptable but should be closely monitored with readings as necessary.

3. If the additional set of readings is unacceptable and/or the referee set of readings is unacceptable, the inspector is to notify the coatings inspectors in the areas affected so that coating work may be stopped at that time. Coating work shall not continue until the ambient conditions resume an acceptable status.

4. When unacceptable ambient conditions occur and are verified by Step 3 above, the Inspector shall document it on a Nonconformance Report (NCR) in accordance with Reference 1-C, and adequately identify the affected areas/elevations.

3.3.2 Surface Acceptability

The QC inspector shall visually examine the substrate surface immediately prior to surfacer application to verify that it is free of contamination (dust, laitance, loose deposits and markings).

3.3.3 Air Supply Acceptability

The inspector shall inspect the air supply system for suitable filters/traps/separators. The effectiveness of these items shall be verified by exposing a piece of white cloth to a blast of air for approximately 30 seconds. The cloth shall show no evidence of moisture, oil or foreign matter when examined.

3.3.4 Pot Life

The QC inspector shall verify that the pot life as shown in Attachment 2 is not exceeded.

3.3.5 Qualification of Applicator(s)

The Inspector shall verify (by Qualification Record or list of qualified applicators from QA file) that the coating applicators on each shift are qualified for safety-related coating work.

3.3.6 Dry Film Thickness

The QC inspector shall determine the DFT of the applied surfacer by taking wet film thickness spot measurements and multiplying each reading by the % volume solids (taking in account any thinner used). A minimum of five (5) separate spot wet film thickness (WFT) measurements (See Note 1) spaced evenly over the coated area shall be taken for every 100 square feet of coated surface. For areas less than 100 square feet, Refer to Note 2 below.

NOTE 1: A spot measurement is a series of three measurements in the same general area. The WFT gage should be moved a short distance for each gage reading. Discard any unusually high or low gage reading that cannot be repeated consistently. Take an average of these three gage readings as one spot measurement.

NOTE 2: Five spot tests shall be taken for every 100 square feet of coated surface. For areas less than 100 square feet, the following shall apply:

Area Sq. Ft.	No. Spots
100-80	5
80-50	4
50-10	3
10-3	2
3-0	1

Thickness of Nutec 11S may vary between 10 and 35 mils. Nutec 11 may vary between 3 - 20 mils. (See Attachment 3 for method of determining percent volume solids.)

NOTE 3: Tack free times shall be as follows:

Temperature °F	#11	#11S
50 - 59	6 hrs.	8 hrs.
60 - 79	4 hrs.	6 hrs.
80 - 99	2 hrs.	4 hrs.
100	1 hr.	2 hrs.

Temperature °F	Full Cure 11, 11S
50 - 59	10 days
60 - 69	8 days
70 - 79	7 days
80 - 89	6 days
90 - 100	5 days

3.3.7 Monitoring of Surfacer Application

Monitor the surfaces where NUTEC 11S or Nutec 11 is being applied to assure that it is not being applied to a surface containing free standing water. (Application of 11S over a damp surface is permissible.) Reference Attachment 6. Verify that the pot life as stated in Paragraph 3.3.4 is not exceeded.

3.3.8 Surfacer Repair Work

3.3.8.1 Repair of Runs and Sags

Runs and sags which show no evidence of mudcracking shall be abraded flush with the surrounding surface. If after

abrading, surfacer is unsatisfactory due to mudcracking remove unsatisfactory coating to substrate and reapply the surfacer. If after abrading the surfacer is satisfactory, no further repair is necessary.

3.3.8.2 Repair of Contamination

Contamination shall be removed by abrading. If unsatisfactory coating still exists, then the area shall be repaired in accordance with Section 3.3.8.3.

NOTE: Rust stains residue, not necessarily the stain, shall be removed with bristle brush and water or Imperial Thinner #DL-54.

3.3.8.3 Repairs When Touch Up or Recoating is Necessary

For repairs that require either touch up or recoating with NUTEC 11S, NUTEC 11 or NUTEC 1201, the QC inspector shall:

a) Verify ambient conditions are acceptable per Section 3.3.1.

b) Verify the surface has been prepared in accordance with Sec. 3.3.8.2 and is free from loose and foreign materials as per Section 3.1.4 and/or Paragraph 3.5.6.

c) Verify acceptable materials are used, and shelf life is not exceeded.

d) Verify that NUTEC 11S, NUTEC 11 or NUTEC 1201 is mixed/thinned in accordance with Section 3.2.

e) Verify pot life is not exceeded per Attachment 2.

f) Verify qualification of applicator(s) per Section 3.3.5.

g) Visually inspect per Section 3.4.2.1.

h) Verify that curing is in accordance with Section 3.4.2.2.

i) Verify dry film thickness in the repair area is in accordance with the following millage requirements:

NUTEC 11S	10 - 35 mils
NUTEC 11	3 - 20 mils
NUTEC 1201	3 - 16 mils

NOTE 1: See Section 3.3.6 and Attachment 3 for DFT calculation using Wet Film Thickness measurement and percent volume solids.

3.3.8.4 In-process repairs shall be documented on the Traveler in accordance with Reference 1-B, (Attachment 1) showing their status and/or completion.

3.4 FINISH COAT PREAPPLICATION

3.4.1 Preapplication Inspection

3.4.1.1 Ambient Conditions

Prior to finish coat application, the QC inspector shall determine ambient conditions in accordance with Section 3.3.1.

3.4.2 Surfacer Post Application Operation

3.4.2.1 Visual Defects Inspection

The inspector shall perform a visual inspection of the surfacer coat NUTEC 11S and NUTEC 11 prior to the finish coat application for the following defects:

a) Runs and sags which show no evidence of mudcracking shall be abraded down to adjoining coating thickness.

b) Stains - rust (red) and zinc oxide (white) stains are acceptable provided loose particles are removed from NUTEC 11S or NUTEC 11 surfaces prior to application of finish coat.

c) Damaged areas, skips, dry spray, holidays, blisters, bubbling, mudcracking, oil and grease, contamination are all unacceptable and shall be removed and repaired in accordance with the applicable subsection of 3.3.8.

NOTE: Hairline cracks appearing in concrete coatings after application are acceptable provided coatings show no loss of adhesion.

3.4.2.2 Surfacer Cure

The inspector shall monitor ambient temperature after the surfacer is applied to determine when cure is adequate for

finish coating operations to commence. A calibrated non-mercury filled dry bulb thermometer or a calibrated temperature recorder (Bristol 4069TH or equivalent) shall be used for air temperature determination.

Curing time shall be as follows:

Temperature 0°F	Curing Time Before Topcoating with 1201
50-59	72 hrs.
60-69	48 hrs.
70-79	24 hrs.
80-89	18 hrs.
90-100	12 hrs.

Temperature durations below 50°F will be added to the cure time on an hour for hour basis.

NUTEC 11S may be touched up or recoated with #11 or #11S as soon as the initial coat has dried such that the paint shall not adhere to the thumb when downward pressure is exerted on the paint film while turning a 90° angle. (This does not refer to the two pass application method.)

3.4.3 Mixing Operations

3.4.3.1 Materials

The QC Inspector shall verify on Attachment 5 that shelf has not expired.

3.4.3.2 Mixing/Thinning

An Inspector shall witness all mixing/thinning operations per Attachment 7. Induction times for finish mixes are shown in Attachment 2.

3.5 FINISH COAT APPLICATION

3.5.1 Air Supply Acceptability

The QC inspector shall verify the air supply is acceptable per Section 3.3.3.

3.5.2 Qualification of Applicator(s)

The Inspector shall verify (by Qualification Record or list of qualified applicators from QA file) that the coating applicators on each shift are qualified for safety-related coating work.

3.5.3 Pot Life

The QC inspector shall verify that the pot life of NUTEC 1201 has not been exceeded. Pot life is shown on Attachment 2.

3.5.4 Dry Film Thickness

The inspector shall determine the DFT of the applied finish coat by taking wet film thickness spot measurements and multiplying each reading by the % volume solids. A minimum of five (5) separate spot wet film thickness (WFT) measurements (See Note 1) spaced evenly over the coated area shall be taken for every 100 square feet of coated surface. For areas less than 100 square feet, refer to Note 2 below.

NOTE 1: A spot measurement is a series of three measurements in the same general area. The WFT gage should be moved a short distance for each gage reading. Discard any unusually high or low gage reading that cannot be repeated consistently. Take an average of these three gage readings as one spot measurement.

NOTE 2: For spot test areas, Ref. Sec. 3.3.6 Note 2.

(See Attachment 3 for method of determining percent volume solids.)

3.5.5 Monitoring of Finish Coat Application

a. During application of finish coat, the inspector shall monitor the wet film to assure no fish eyes appear. If fish eyes occur, the inspector shall notify the paint foreman of their presence. Fish eyes should be removed while the coating is still wet, previous coat (surfacer) cleaned with solvent and finish coat reapplied.

b. If applicable, the inspector shall monitor that the hose length does not exceed 75 feet.

c. Monitor the cure time for recoat of NUTEC 1201. Recoating time of NUTEC 1201 is 24 hours.

The total DFT of NUTEC 1201, recoat and existing coat shall not exceed 16 mils.

3.5.6 Finish Coat Repairs

For repairs in the NUTEC 1201 Finish Coat, the QC Inspector shall verify the following:

a) The inspector shall determine the DFT of the existing coated surface (prior to recoating) by either, or one of the two following methods.

1) Using the DFT readings acquired during the backfit documentation.

2) The scratch test of the NUTEC 1201 finish coat shall be performed using a Mark II Tooke Inspection Gage equipped with a 2x tip. Five separate readings spaced randomly over each finish coated area of 100 square feet shall be taken. For areas less than 100 square feet, Note 2 of Section 3.3.6 shall apply.

b) Repairs of Runs/Sags

Runs/sags showing evidence of mudcracking shall be removed. Runs or sags which exhibit no other coating defect shall be abraded to the thickness of adjoining coatings.

1) Verify that all loose particles and foreign particles are removed from surface.

2) Verify that the surface is solvent wiped.

3) Perform inspections in Sections 3.2, 3.4.1, 3.5, and 3.6.

c) Repair of Scratches and/or Damaged Areas

Any scratches or damaged areas shall be abraded until loosely adherent particles are removed. The following minimum coating requirements shall be maintained for damages extending to concrete:

Damage 1/2" or less regardless of length - no additional surfacer required prior to topcoat.

Damage greater that 1/2" in width - normal coating system required.

When performing surfacer and/or topcoat repair work, and the damaged area is 2 sq/ in. or less in size, or the damage is a scratch 1/4 in. width or less, regardless of length, substantiating or recording wet film thickness of the damaged area repair shall not be required.

NOTE: Hairline cracks appearing in concrete coatings after application are acceptable provided coatings show no loss of adhesion.

d) Repair of Contamination

The QC inspector shall verify that contamination is removed by abrading and the surface recoated. The inspector shall perform inspections delineated in Sections 3.2, 3.4.1, 3.5 and 3.6.

e) Repair of Pinholes and Small Discontinuities

1) Verify all loose particles are removed and area is solvent wiped.

2) Pinholes and small discontinuities may be repaired at the time of final inspection without a later reinspection of the repair. The inspections in Section 3.2, 3.4.1, 3.5 and 3.6 still apply.

f) Repair of Dry Spray

Repair of dry spray identifiable by visual inspection defined within this procedure shall be removed. (A minor amount of adherent dry spray is acceptable on the final finish coat.)

1) Verify all loose particles are removed.

2) Verify coating film thickness is still within allowable range.

3) If film thickness is not within allowable range perform inspections in Sec. 3.2, 3.4.1, 3.5 and 3.6.

g) Repair of Excessive Orange Peel

1) Verify the affected area is abraded and solvent wiped..

2) Verify the affected area is refinished and perform the inspections delineated in Section 3.2, 3.4.1, 3.5 and 3.6 if required.

h) Repair of Gloss and Color Nonuniformity

1) Verify the affected area is solvent wiped.

2) Verify the affected area is recoated without exceeding the maximum film thickness and perform inspections in Sections 3.2, 3.4.1, 3.5 and 3.6.

3) Top coated areas which have been abraded for various reasons (i.e., runs, sags, high millage, etc.) and are within acceptable procedural thickness, following repairs, do not require recoating for gloss enhancing.

4) For small repair areas such as pinholes, color and gloss uniformity is not required, provided the coating is smooth and continuous.

NOTE 1: If present, the tie in interface between concrete coatings and steel coatings shall be visually inspected during the finish coat final acceptance of both coating systems.

NOTE 2: (If applicable) coating interface - at coating interface for finish and or primer coat, the existing coating shall be "feathered back" a sufficient distance to ensure a smooth final coating system. When performing coating interface the interface of the coating of systems shall be a maximum of 1½ inch in width. Within the interface area overlapping of any materials or systems is acceptable.

NOTE 3: Repair and touch-up - For repair and/or touch-up purposes, Nutec #11S or #11 surfacer may be placed over the initial system as required to complete the required repair or touch-up. Roughen the topcoat, if present, by sanding, or stoning prior to applying repair surfacer.

3.5.6.1 In-process repairs shall be documented on the Traveler (Attachment 1) showing their status and/or completion.

3.6 FINISH COAT FINAL ACCEPTANCE INSPECTION PRIOR TO AREA TURNOVER

A final* visual inspection in accordance with the following subsections shall be performed on exposed finish coated concrete substrates.

3.6.1 Finish Coat Cure

Prior to performing finish coat final acceptance inspections, the inspector shall verify that the finish coat has cured for the minimum of 24 hours.

3.6.2 Finish Coat Continuity Inspection

The QC Inspector shall visually inspect the continuity of the finish coat. The maximum number of permissible pinholes is shown on Attachment 3. No more than 2 points of discontinuity shall occur within an area having a radius of six inches (using a point of discontinuity as the center of the circle). No more than 40% of the total number of allowable points of discontinuity shall occur within any one area equal to 25% of the total area. The pinholes that are beyond the acceptance of Attachment 3 shall be repaired in accordance with Section 3.5.6.

3.6.3 Visual Examination

The QC inspector shall visually examine the finish coated surface for the following defects:

a) Runs and sags which show no evidence of mudcracking are acceptable. Unacceptable runs and sags will be repaired in accordance with Section 3.5.6.

b) At the time of the final inspection, pinholes and small discontinuities may be repaired with no later reinspection required of these areas.

c) Skips, holidays, color and gloss nonuniformity, excessive orange peel, dry spray, damaged areas, blisters, bubbles, and fish eyes will be repaired in accordance with Section 3.5.6.

d) Contamination is unacceptable. Area must be repaired per Section 3.5.6.

NOTE: Minor repairs limited to 4 square inches or less and requiring finish coat only may be performed at the time of final inspection without later reinspection of the repair. Conditions may exist which will warrant reinspection at the inspector's discretion.

3.7 NONCONFORMANCES

3.7.1 Unacceptable conditions which are not readily repaired or corrected per the approved procedures shall be documented as unsatisfactory on the inspection traveler.

3.7.2 Nonconforming conditions such as coating failure due to loss of adhesion or indeterminate/unacceptable conditions which cannot be repaired or corrected as per existing procedures shall be documented on a Nonconformance Report (NCR) in accordance with Reference 1-C. The NCR number shall be referenced on the inspection traveler, if applicable.

3.8 DOCUMENTATION (REFER TO ATTACHMENT 1)

3.8.1 All inspections required by this procedure shall be recorded in the inspection attributes on the back of the travelers (Attachment 1). Preparation and processing of the traveler shall be per Reference 1-B.

3.8.2 When the inspections required by Sections 3.1 through 3.2.2 have been satisfactorily completed, Step 1 shall be signed and dated by the inspector.

3.8.3 When the inspections required by Sections 3.3 through 3.3.7.2 have been satisfactorily completed, Step 2 (for NUTEC 11S) or Step 4 (for NUTEC 11) shall be signed and dated by the inspector and the other Step marked not applicable (N/A), initialled and dated.

3.8.4 When the inspections required by Sections 3.3.8 through 3.4.2.2 have been satisfactorily completed, Step 3 (for NUTEC 11S) or Step 5 (for NUTEC 11) shall be signed and dated by the inspector and the other Step marked not applicable (N/A), initialled and dated.

3.8.5 When the inspections required by Sections 3.5 through 3.5.5 have been satisfactorily completed, Step 6 shall be signed and dated by the inspector.

3.8.6 When the inspections required by Sections 3.5.6 through 3.6.3 have been satisfactorily completed, Step 7 shall be signed and dated by the inspector.

3.9 CLARIFICATION

3.9.1 Repair of Mechanical Damage to Completed Items

3.9.2 Areas that have been completed, inspected, accepted and traveler package closed which incur major damage at a later date may be repaired, inspected and documented on Attachment 8, "Concrete Protective Coating Inspection Repair Traveler". Otherwise, the minor areas of mechanical damage, which occur after completion of an area, will be repaired during the final protective coatings walkdown Reference CP-EI-4.0-51.

3.10 INACCESSIBLE/LIMITED ACCESS AREAS

If questions arise concerning inaccessible or limited access areas per (Reference 1-A) nondeleterious embedded foreign material in the final finish coat, the above condition(s) will be evaluated by the Project Civil Engineer or designee. Clarification and acceptance of the above stated condition(s) shall be so denoted by signature of the Engineer with date and comments as required, in the comments section of the applicable step.

3.11 ATTACHMENTS

3.11.1 Attachment 1, "Concrete Protective Coating Inspection Traveler"

3.11.2 Attachment 2, "Shelf and Pot Life Reference Sheet"

3.11.3 Attachment 3, "Allowed Points of Discontinuity Table" and "DFT Determination"

3.11.4 Attachment 4, "Environmental Log Sheet"

3.11.5 Attachment 5, "Paint Mix Slip"

3.11.6 Attachment 6, "Definitions"

3.11.7 Attachment 7, "Preparation of Coating Materials"

3.11.8 Attachment 7A, "Table for Partial Mixing of NUTEC 11S"

3.11.9 Attachment 7B, "Table for Partial Mixes of NUTEC 1201"

3.11.10 Attachment 8, "Concrete Protective Coating Repair Traveler"

ATTACHMENT 1

CONCRETE PROTECTIVE COATING INSPECTION TRAVELER

WORK PKG. # _____ PCI TRAVELER # _____

ELEVATION: _____ ITEM # / DESCRIPTION _____

REF. DWGS. _____

PREPARED BY: _____ DATE _____

STEP 1	SURFACE PREPARATION INSPECTED AND FOUND ACCEPTABLE PER QI-QP 11.4-27 AND RELEASED FOR NUTEC IIS APPLICATION. INSPECTOR _____ DATE _____ COMMENTS _____
STEP 2	NUTEC IIS SURFACER APPLICATION VERIFIED AND INSPECTED IN ACCORDANCE WITH QI-QP 11.4-27 AND FOUND ACCEPTABLE. INSPECTOR _____ DATE _____ COMMENTS _____
STEP 3	NUTEC IIS SURFACER PREPARATION INSPECTED AND FOUND ACCEPTABLE PER QI-QP 11.4-27 AND RELEASED FOR FURTHER COATING ACTIVITIES. INSPECTOR _____ DATE _____ COMMENTS _____
STEP 4	NUTEC II SURFACER APPLICATION VERIFIED AND INSPECTED IN ACCORDANCE WITH QI-QP 11.4-27 AND FOUND ACCEPTABLE. INSPECTOR _____ DATE _____ COMMENTS _____
STEP 5	NUTEC II SURFACER PREPARATION INSPECTED AND FOUND ACCEPTABLE PER QI-QP 11.4-27 AND RELEASED FOR FURTHER COATING ACTIVITIES. INSPECTOR _____ DATE _____ COMMENTS _____
STEP 6	NUTEC 201 TOPCOAT APPLICATION VERIFIED AND INSPECTED IN ACCORDANCE WITH QI-QP 11.4-27 AND FOUND ACCEPTABLE. INSPECTOR _____ DATE _____ COMMENTS _____
STEP 7	FINISH COAT INSPECTED FOR FINAL ACCEPTANCE AND FOUND ACCEPTABLE IN ACCORDANCE WITH QI-QP 11.4-27 INSPECTOR _____ DATE _____ COMMENTS _____
STEP 8	COMPLETION OF INSPECTION TRAVELER VERIFIED. QC REVIEW _____ DATE _____ COMMENTS _____
NOTES	1) DOCUMENT INSPECTION ATTRIBUTES ON ATTACHED SUPPORTING DOCUMENTATION SHEET(S) 2) DOCUMENT REPAIRS AND ATTRIBUTES, IF REQUIRED, ON ATTACHED SUPPORTING DOCUMENTATION SHEET(S) 3) FOR ENVIRONMENTAL CONDITIONS REFERENCE THE ENVIRONMENTAL LOG. 4) DOCUMENT NUTEC 10 APPLICATION ON ATTACHED SUPPORTING DOCUMENTATION SHEET.

ATTACHMENT 1 (Continued)

PROTECTIVE COATING INSPECTION TRAVELER SUPPORTING DOCUMENTATION

WORK PKG. NO. ______ PCI TRAVELER NO. ______

ENTRY #	STEP	APPLICATORS QUALIFIED	BATCH LOG #	MIN WFT	MAX WFT	AVG WFT	MIN DFT	MAX DFT	AVG DFT	INSTR USED	LOC I D	SAT UNSAT	INSP. SIGNATURE	DATE	TIME	COMMENTS

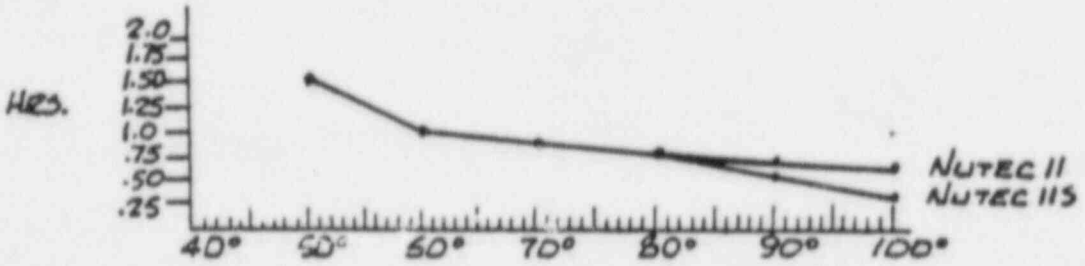
ATTACHMENT 2

SHELF AND POT LIFE REFERENCE SHEET

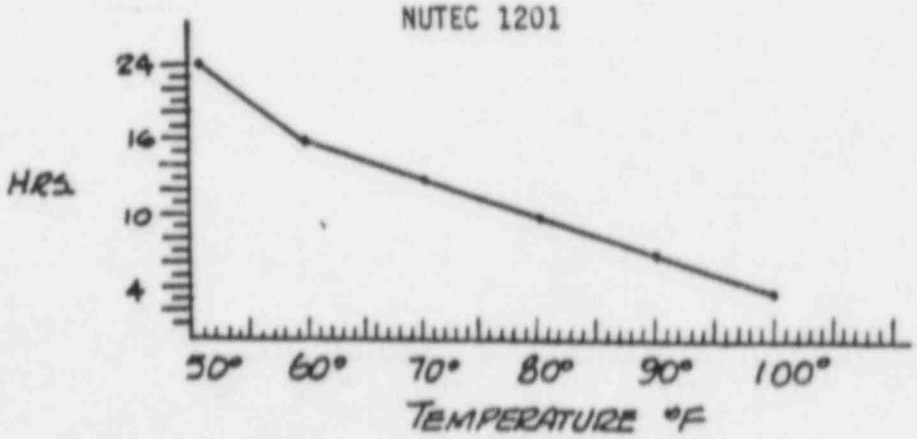
Material	Shelf Life
Nutec 11 Base & Curing Agent	12 months
Nutec 11S Base & Curing Agent	12 months
Nutec 1201 Base & Curing Agent	12 months
Thinners and Sand Filler	Unlimited

POT LIFE

NUTEC 11 AND NUTEC 11S



NUTEC 1201



INDUCTION TIMES FOR NUTEC 1201

Temp. (°F)	
50-59	45 min.
60-69	30 min.
70-79	20 min.
80-90	10 min.
90-100	None

ATTACHMENT 3

PART I Allowed Points of Discontinuity Table

Surface Area (sq. ft.)	Total Allowable Number of Points of Discontinuity
Up to 10	1
10-50	2
50-100	5
100-500	10
500-1000	15
1000-5000	25

No gross discontinuities are acceptable.

PART II Dry Film Thickness Determination Using Wet Film Thickness Readings and the Percentage (%) Volume Solids

Percent volume solids for unthinned concrete coatings are as follows:

NUTEC 11 - 78%
NUTEC 11S - 88%
NUTEC 1201 - 54%

EXAMPLE: 11 mils WFT X 54% = 5.94 mils DFT

For thinned mixes:

$$\% \text{ Volume Solids} = \frac{\text{Volume of unthinned coating}}{\text{Volume of unthinned coating + Volume thinner}} \times \% \text{ Volume Solids (unthinned)}$$

NOTE: In above equation, volume must be expressed in the same unit of measure.

ATTACHMENT 4

Report No. _____
Sheet _____ of sheet ___

Sheet Number _____

ENVIRONMENTAL LOG SHEET

M&TE #'s _____ Elevation _____ Bldg. _____

Date _____ Shift _____ Unit _____

INSPECTOR	TIME	DRY BULB	WET BULB	SURFACE TEMP. STEEL	SURFACE TEMP. CONCRETE	HUMIDITY	DEW POINT

QC REVIEW _____ _____
Signature Date

ATTACHMENT 5

PAINT MIX SLIP

Report No. _____

Bldg. _____

DATE _____ POT LIFE _____ SHIFT _____ TIME _____

MIX NUBMER _____ ELEVATION _____

MATERIAL _____ GAL. MIXED _____

SHELF LIFE ACCEPATBLE: YES ____ NO ____ M&TE #'S _____

DATE & TIME MIXED _____ BASE _____

CURING AGENT _____ FILLER _____ THINNER _____

ACCEPTED BY _____

DATE _____ POT LIFE _____ SHIFT _____ TIME _____

MIX NUMBER _____ ELEVATION _____

MATERIAL _____ GAL. MIXED _____

SHELF LIFE ACCEPTABLE: YES ____ NO ____ M&TE #'S _____

DATE & TIME MIXED _____ BASE _____

CURING AGENT _____ FILLER _____ THINNER _____

ACCEPTED BY _____

DATE _____ POT LIFE _____ SHIFT _____ TIME _____

MIX NUMBER _____ ELEVATION _____

MATERIAL _____ GAL. MIXED _____

SHELF LIFE ACCEPTABLE: YES ____ NO ____ M&TE #'S _____

DATE & TIME MIXED _____ BASE _____

CURING AGENT _____ FILLER _____ THINNER _____

ACCEPTED BY _____

QC REVIEW & ACCEPTANCE _____
signature date

ATTACHMENT 6

DEFINITIONS

Color and Gloss Nonuniformity: A milky haze or mist in the finish of a recently applied coating.

Contaminant: A foreign substance, inadvertently added to a coating or found on the substrate that adversely affects the application, adhesion, curing and/or subsequent performance of the applied coating.

Dry Spray: A dry powdery primer or finish coat readily removed by light sanding with either sandpaper or a wire screen. A minor amount of adherent dry spray is acceptable on the final finish coat.

Feathering: An area that is roughened and tapered to obtain a smooth and continuous surface with an existing damaged coating.

Fisheyes: Small openings ("fish eyes") in wet film exposing old surface or previous coat.

Free Standing Water: May be identified by:

a. Reduced viscosity of the surfacer during application, and excessive sagging from bug holes.
b. Wet rings around bug holes.
c. Visible signs of surface water.
d. Running hand over the surface resulting in moisture on the hand.
e. Product instability resulting in white streaks.
f. Failure of the surfacer to adhere to the substrate during the sqeegeeing or troweling process.

Full Hiding: The coating provides sufficient coverage so that the preceding coat is not readily visible with an unaided eye.

Holiday: A pinhole, skip, discontinuity or void in coating film.

Laitance: A fine, whitish accumulation on concrete surfaces. It consists mainly of cement particles that were carried by water rising to the surface of freshly placed concrete. The resulting concrete surface is unsuitable for proper adhesion or bond of subsequent fillers or protective coatings.

Monitor: Conformance verification by physically observing a task being performed on a periodic or random basis.

Mudcracking: Irregular cracking as in a dried mud puddle.

Orange Peel: Dents in the surface resembling orange skin. A moderate amount is acceptable.

Over Spray: A deflected spray mist that settles on dry or partially dry coated surfaces.

Pinholes: Minor discontinuities in coating which expose primer or substrate.

Verify: Confirm or make certain.

Visual: To examine with an unaided eye (correctional eye glasses or contact lens are acceptable).

ATTACHMENT 7

PREPARATION OF COATING MATERIALS

Surfacer Coat

The surfacer, NUTEC 11S, is packaged in a three component kit consisting of a base, curing agent, and filler. The base and curing agent shall be thoroughly mixed first. If necessary, box the mixture to assure that all the base and cure has been used. The filler shall then be slowly added under constant agitation and mixed until a smooth blend is achieved. The patching material, NUTEC 11, is prepared the same way. Partial mixes for NUTEC 11S shall be in accordance with Attachment 7A. No provision is given for partial mixes of NUTEC 11.

Finish Coat

The finish coat, NUTEC 1201, is a two component epoxy topcoat consisting of a base and cure. These shall be thoroughly mixed under constant agitation until a homogenous blend is achieved. Partial mixes of NUTEC 1201 shall be in accordance with Attachment 7B. Minimum induction times shall be as per Attachment 2.

SEALER/CURING COMPOUND

The sealer/curing compound, NUTEC 10, is normally a two component material consisting of a base and a curing agent. If applying to surfaces below 60° F, a third component accelerator may be used. Slowly mix by power agitation or by hand the entire volume of the cure component with the entire volume of the base component. If an accelerator is used, add the premeasured portion to the base-cure mixture and agitate slowly. Avoid rapid agitation which may result in air entrapment. Thinning may be performed by adding from 10-40% by volume #DL-56 solvent. Do not vary mixing proportions.

ATTACHMENT 7A

TABLE FOR PARTIAL MIXING OF NUTEC 11s

	NUTEC 11s							
	BASE		CURE		FILLER		PERMISSIBLE THINNER	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	pts.	oz.
0 Gal. - 1 Qt.		10.6	0	6.3	3	0	0	1.6
0 Gal. - 2 Qt.	1	5.1	0	12.6	6	0	0	3.2
0 Gal. - 3 Qt.	1	15.7	1	3	9	0	0	4.8
1 Gal. - 0 Qt.	2	10.2	1	9.3	12	0	0	6.4
1 Gal. - 1 Qt.	3	4.8	1	15.6	15	0	0	8
1 Gal. - 2 Qt.	3	15.4	2	5.9	18	0	0	9.6
1 Gal. - 3 Qt.	4	9.9	2	12.2	21	0	0	11.2
2 Gal. - 0 Qt.	5	4.5	3	2.6	24	0	0	12.8
2 Gal. - 1 Qt.	5	15.0	3	8.9	27	0	0	14.4
2 Gal. - 2 Qt.	6	9.6	3	15.2	30	0	0	16
2 Gal. - 3 Qt.	7	4.2	4	5.5	33	0	1	1.6
3 Gal. - 0 Qt.	7	14.7	4	11.8	36	0	1	3.2
3 Gal. - 1 Qt.	8	9.3	5	2.2	39	0	1	4.8
3 Gal. - 2 Qt.	9	3.8	5	8.5	42	0	1	6.4
3 Gal. - 3 Qt.	9	14	5	14.8	45	0	1	8
4 Gal. - 0 Qt.	10	9	6	5.1	48	0	1	9.6
4 Gal. - 1 Qt.	11	3.5	6	11.4	51	0	1	11.2
4 Gal. - 2 Qt.	11	14.1	7	1.8	54	0	1	12.8
4 Gal. - 3 Qt.	12	8.6	7	8.1	57	0	1	14.4
5 Gal. - 0 Qt.	13	3.2	7	14.4	60	0	2	0

Number: RG-1.54 R0
Date: .6/77
Revision: 1

WESTINGHOUSE CLASS 3

PWR SYSTEMS
NUCLEAR SAFETY POSITION PAPER

Prepared by: J. J. McInerney

Approved: [signature]
R. Schneidingen, Manager
Nuclear Safety Department

Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants (Revision 0, June, 1973)

ISSUE:

Regulatory Guide 1.54 recommends that Quality Assurance programs encompassing all phases of the coating process be applied for surfaces located inside containment. These QA programs are intended to assure application of coatings such that a high degree of confidence will exist that the paint will not decompose or flake off or otherwise perform unsatisfactorily in normal operation or under accident conditions.

NUCLEAR SAFETY POSITION:

The Westinghouse NSSS equipment located in the containment building is separated into four categories to identify the applicability of this regulatory guide to various types of equipment. These categories of equipment are as follows:

Category 1 - Large equipment

Category 2 - Intermediate equipment

Category 3 - Small equipment

Category 4 - Insulated/stainless steel equipment

Category 1 - Large Equipment

The Category 1 equipment consists of the following:

1. Reactor Coolant System Supports
2. Reactor Coolant Pumps (motor and motor stand)
3. Accumulator Tanks
4. Manipulator Crane

The total exposed surface area for these items is approximately 20,830 square feet for a four loop plant.

Since this equipment occupies a large surface area and is procured from only a few vendors, it is possible to implement tight controls over these items.

Westinghouse specifies stringent requirements for protective coatings on this equipment through the use of a painting specification in our procurement documents. This specification defines requirements for:

1. Preparation of vendor procedures.
2. Use of specific coatings systems which are qualified to ANSI N101.2.
3. Surface preparation.
4. Application of the coating systems in accordance with the paint manufacturer's instructions.
5. Inspections and non-destructive examinations.
6. Exclusion of certain materials.
7. Identification of all nonconformances.
8. Certifications of compliance.

The vendors's procedures are subject to review by PWRSD Engineering personnel, and the vendor's implementation of the specification requirements is monitored during the Westinghouse QA Surveillance activities.

This system of controls provides assurance that the protective coatings will properly adhere to the base metal during prolonged exposure to a post-accident environment present within the containment building. No loss of paint is anticipated.

Category 2 - Intermediate Equipment

The Category 2 equipment consists of the following:

1. Seismic Platform and Tie Rods
2. Reactor Internals Lifting Rig
3. Head Lifting Rig
4. Electrical Cabinets

The total exposed surface area of these items is approximately 3450 sq. ft. Since these items are procured from a large number of vendors, and individually occupy very small surface areas, it is not practical to enforce the complete set of stringent requirements which are applied to Category 1 items. However, Westinghouse does implement another specification in our procurement documents. This specification defines to the vendors the requirements for:

1. Use of specific coating systems which are qualified to ANSI N101.2.
2. Surface preparation.
3. Application of the coating systems in accordance with the paint manufacturer's instructions.

The vendor's compliance with the requirements is also checked during the Westinghouse QA Surveillance activities in the vendor's plant. Westinghouse believes that these measures of control provide a high degree of assurance that the protective coatings will adhere properly to the base metal and withstand the postulated accident environment within the containment building. However, to be conservative, Westinghouse has not taken credit for this in calculating the amount of paint which might peel or flake off in the post-accident environment.

Category 3 - Small Equipment

Category 3 equipment consists of the following:

1. Transmitters
2. Alarm Horns
3. Small Instruments
4. Valves
5. Heat Exchanger Supports

These items are procured from several different vendors and are painted by the vendor in accordance with conventional industry practices. Because the total exposed surface area is only 900 sq. ft., Westinghouse does not believe it is necessary to specify further requirements. For purposes of estimating the amount of paint that might peel or flake off, Westinghouse has assumed that all of this material might come off.

Category 4 - Insulated or Stainless Steel Equipment

Category 4 equipment consists of the following:

1. Steam generators - covered with wrapped insulation.
2. Pressurizer - covered with wrapped insulation.
3. Reactor Pressure Vessel - covered with rigid reflective insulation.
4. Reactor Cooling Piping - stainless steel.
5. Reactor Coolant Pump Casings - stainless steel.

The wrapped or rigid insulation captures and retains any paint which might come off the equipment surfaces, thereby preventing the paint from blocking the sump drains or interrupting the water flow in the containment spray system.

APPLICABILITY:

This Nuclear Safety Position Paper is for general guidance only.

To determine the applicability and implementation for an individual plant, refer to that plant's Safety Analysis Report.

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18 JUL 84
1155 HRS.

[redacted]

TEXAS UTILITIES GENERATING COMPANY

OFFICE MEMORANDUM

To Distribution — Glen Rose, Texas February 10, 1984

Subject Backfit Inspection of Protective Coatings In RCB #1

Review and detailed analyses of the quality records generated to date as a part of the reverification of previously applied coatings system in the CPSES Unit 1 Reactor Containment Building have been completed. This review indicates conclusively that the coatings applied prior to January, 1982 are either acceptable, have been reworked as a part of on-going construction, or declassified by Engineering.

Accordingly, effective immediately all routine destructive testing of coating systems shall be discontinued on all surfaces including the liner plate, concrete, hangers, miscellaneous steel, etc. Further NCR's, unsat PC Inspection Reports and other open quality documentation that reference the QI-QP for "backfit" destructive testing shall be reviewed by the Quality Engineer and may be closed on a case basis with concurrence of the Assistant Site QA Supervisor or the undersigned.

Nondestructive testing shall continue as per the established program. Any personnel who express concerns with this decision should be encouraged to express these concerns either to the undersigned or Boyce Grier.

R. G. Tolson
TUGCO Site QA Supervisor

RGT/bll
cc: J. T. Merritt
D. N. Chapman
B. J. Murray
B. H. Grier
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