

10/4/83 @ CP #10

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| INSPECTION OF STEEL<br>SUBSTRATE PRIMER<br>REPAIR AND SEAL AND<br>FINISH COAT APPLICATION<br>AND REPAIR | PREPARED BY: | <i>[Signature]</i> | 8/23/83<br>DATE |
|   | APPROVED BY: | <i>[Signature]</i> | 8/23/83<br>DATE |
|   | APPROVED BY: | <i>[Signature]</i> | 8/25/83<br>DATE |

1.0 REFERENCES

- 1-A QI-QP-11.4-1, "Inspection of Steel Substrate Surface Preparation and Primer Application and Repair"
- 1-B CCP-30, "Coating Steel Substrates Inside Reactor Buildings and Radiation Areas"
- 1-C CCP-30A, "Coating Steel Substrates Inside Reactor Buildings and Radiation Areas"
- 1-D CP-QP-18.0, "Inspection Reports"
- 1-E QI-QP-11.4-22, "QC Verification of Protective Coatings Unique Identification Number Verification"
- 1-F CP-QP-15.0, "Tagging System"

2.0 GENERAL

2.1 PURPOSE AND SCOPE

The purpose of this instruction is to outline methods utilized by Quality Control personnel in inspection of primer repair and seal and finish coat application and repair.

3.0 INSTRUCTION

Visual inspection of painted surfaces as addressed by this instruction shall be made at approximately an arms 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) cell battery flashlight.

**FOR INFORMATION ONLY**

**HISTORICAL FILE**

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### 3.1 INSPECTION OF PRIMER

#### 3.1.1 Primer Inspections Prior to Application of Seal or Finish Coat

- a) QC shall verify that construction has identified each piece with a unique number in accordance with References 1-A, 1-B and 1-C. The QC Inspector shall maintain a Protective Coating Unique Identification Number Log, Attachment 1 for all protective coatings application on all steel designated for use in the Reactor Building. Subsequent subdivision of coating steel in the field or shop shall be witnessed by QC in accordance with Reference 1-E.

#### NOTE:

- A. Unique number may be assigned to a lot of material to be prime coated at the same time. For example, six pieces steel to be coated at same time may all have same unique number.
- B. Liner plate is excluded from QP numbers.

Equipment which is identified with permanent plant identification number need not be identified with a Protective Coatings unique identification number.

#### NOTE:

Conduit supports that the unique number is not readily visible will be documented and identified in the following manner on the IR:

- 1) Beginning of the run in the area to be coated by Junction box number, unique elevation, major equipment spin number.
- 2) The conduit identification number.
- 3) The number of supports on the run in the area as defined. The unique number of supports on which it is readily visible.
- 4) The termination of the run or the boundary of the area to be coated.

Implementation of this note shall be as directed by the QC Supervisor and may be unique for different areas of inspection.

- b) For all areas of liner plate which do not have adequate documentation, the Inspector shall perform an Adhesion (patch) test. A calibrated Elcometer 106 Adhesion Tester shall be used to verify that the minimum acceptable tensile of adhesion to the steel substrate has been attained. Each test shall consist of three individual dollies tested to failure.

Criteria: The minimum acceptable strength per dolly shall be 200 psi. If any one of the three dollies should test below the minimum acceptable strength, the prime coat shall be removed to the steel substrate over the entire item.

- c) Verify the primer has cured required amount of time per Reference 1-B or 1-C, as applicable.
- d) Perform a visual inspection of the primed surface in accordance with the following:

1. Runs/sags - A DFT measurement shall be made with the Elcometer DFT gage. Runs/sags 7.0 mils or less thick (DFT) which show no evidence of mudcracking (See NOTE) are acceptable. Refer to References 1-B and 1-C for repair of runs/sags exceeding 7.0 mils.

NOTE: Mudcracking is defined as irregular cracking as in a dried mud puddle.

2. Dry Spray - Must be removed by screening or abrading before overcoating.
3. Over Spray - Must be removed before overcoating.
4. Contamination

Oil and grease - unacceptable

Embedded foreign materials - unacceptable

Stains - rust (red) and zinc oxide (white) stains are acceptable provided loose particles are removed prior to application of finish coat.

5. Skips/damaged areas/gross discontinuities such as holidays or voids - unacceptable.

- e) The inspector shall perform a DFT inspection of the cured primer film. A calibrated 0-25 Elcometer

Inspector DFT gage Model III/1E, or equivalent, shall be used. A minimum of five separate spot measurements (See Note 1) spaced evenly over the structure (See Note 2) shall be taken. Since the magnetic gage is sensitive to geometric discontinuities in the steel, measurements less than 1 inch from the edge or a hole shall be avoided where possible. (See Note 3)

Dry Film Thickness shall be as follows:

|                   | Min. (mils) | Max. (mils) |
|-------------------|-------------|-------------|
| CZ-II spot test   | 1.5         | 7.0         |
| D6 spot test      | 1.5         | 5.5         |
| D6 average DFT    | 2.0         | 5.0         |
| CZ-II average DFT | 2.0         | 6.0         |

NOTE 1: A spot measurement is a series of three measurements in the same general area. The probe 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 small areas of coating, 5 separate spot measurements shall be taken. For larger areas, 5 spot measurements shall be taken for every 100 square feet of coating.

NOTE 3: Items with appreciable surface curvature and other geometrical discontinuities, such as handrails, gratings, stairs, sway struts, etc., shall be exempt from dry film thickness measurement per Reference 1-B and 1-C.

### 3.2 PRIMER REPAIRS

#### 3.2.1 Sags and Runs Over 7.0 Mils DFT

Sags and runs over 7.0 mils DFT may be abraded by sanding or aluminum screening. If surface is acceptable per Section 3.1, document such on Attachment 3. If surface is unacceptable refer to Section 3.2.2 or 3.2.3 as applicable.

#### 3.2.2 Primer Touch-up Repair (Primer Damaged to Steel Surface)

The coating inspector shall conduct the following inspections to document primer touch-up repair operations when the damage is to the steel surface and spot

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sandblasting or power tool abrading is required for surface preparation.

a) Ambient Conditions

The inspector shall determine air temperature, surface temperature, relative humidity and dew point of substrate structures. A calibrated non-mercury filled dry bulb thermometer or calibrated temperature recorder (Bristol 4069TH or equivalent) shall be used for air temperature determination. A calibrated non-mercury wet bulb thermometer or a calibrated humidity recorder (Bristol 4069TH or equivalent) shall be used to determine relative humidity. The dew point shall be determined by the difference in dry and wet bulb temperatures using the U.S. Department of Commerce Weather Bureau Psychrometric Tables, WB No. 235. When dry bulb readings are greater than 100°F, the dew point should be determined using the 100°F dry bulb reading, and relative humidity shall be determined by subtracting wet bulb from the surface temperature or ambient temperature, whichever is greater. If the dry bulb thermometer exceeds 100°F, the instrument shall be returned to the calibration lab for recalibration. The surface temperature shall be determined by placing a calibrated surface temperature thermometer (Omega-Amprobe fast temp. range of 10°-250°F) in contact with the substrate surface until the temperature reading stabilizes.

Final surface preparation shall not begin unless the temperature of the surface is a minimum of 5° above the dew point.

Normal conditions of ambient and surface temperature for application of primer shall be as follows:

|              | <u>Ambient Temp. (°F)</u> | <u>Surface Temp. (°F)</u> |
|--------------|---------------------------|---------------------------|
| Dimetecote 6 | 40-120                    | 40-130                    |
| Carbozinc 11 | 40-95                     | 40-110                    |

In no case shall Carboline and Ameron limits be exceeded (0°-130°F ambient and 0°-200°F surface temperatures). Coating material (if thinned) shall be thinned in accordance with Reference 1-B or 1-C.

Humidity values may vary from 10% to 95%; however, primer shall not be applied to a wet or damp surface.

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The surface temperature shall be a minimum of 5° above the dew point.

- b) Verify abrasive acceptability (if used) by obtaining a sample of the abrasive to be used. The abrasive shall be verified to be dry by feel with no grease, oil or deleterious materials. Particle size must be sufficient to achieve a minimum of 1 mil surface profile.
- c) Verify acceptability of blast cleaning equipment (if used) prior to use by:
  - 1. Verifying that water separators are installed in the air supply system and that separators have been drained of accumulated water and drains left partially open.
  - 2. Air supply contamination shall be checked at the nozzle prior to use by exposing a sheet of white paper or cloth to the blast of air (no sand) for approximately 30 seconds. The paper or cloth shall be examined for evidence of contamination (oil, water, foreign matter, etc.). No evidence of contamination is acceptable.
- d) Verify that the blasted or power tooled surface has been brushed or vacuumed to the extent required for final surface inspection. The adjacent areas shall be cleaned to the extent necessary to avoid contamination during subsequent coating applications.
- e) Verify acceptability of the blast cleaned or power tooled surfaces by performing the following inspections:
  - 1. Absence of Foreign Matter -- A visual inspection shall be performed to determine that all oil and grease, dirt, millscale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface except for light shadows, very slight streaks or slight discolorations caused by rust stains, mill scale, oxides, or slight, tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all residues, and the remainder shall be limited to light discolorations as mentioned above.

NOTE: If coating removal is required from an area or item which has been coated in



accordance with this instruction, shadows or tight residues of primer which may remain in the profile of the previously prepared substrate is acceptable.

2. Removal of Sharp Projections -- A reinspection for sharp projections that were not blended (rounded) during blast cleaning or power tooling shall be performed.

Weld splatter on structural steel shall be removed by either grinding or sand blasting. However, if the weld splatter should remain after the above operation, the weld splatter will be acceptable.

Sharp projections are not acceptable.

Protrusions and peaks shall be ground to a rounded contour.

NOTE: Any mechanical surface preparation other than sandblasting or hand or power tooling of sharp edges or weld spatter will require a visual welding inspector's acceptance of the work performed.

3. Anchor Pattern Depth -- The anchor pattern depth of the blasted surface shall be inspected at random locations using a Keane-Tator Surface Profile Comparator (model 373) or equivalent.

The anchor pattern depth for a blasted surface shall be a minimum of 1.0 mils.

Surfaces that have been power tooled with "3M Clean-N-Strip", 80 grit or coarser "flapper wheels", sanding discs, "roto peans" or equivalent provide acceptable surface profile.

No maximum profile will be specified, providing that correct millage and surface uniformity requirements can be obtained after primer application.

- f) Verify applicator qualifications per Section 3.3.1.
- g) Verify air supply acceptability per Section 3.3.4.
- h) 1. Coating Materials Identification

The inspector shall inspect the coating material containers prior to mixing contents for product

identification and verify that all materials are correct for coating application.

Approved materials are:

CZ-11

Carbo Zinc base (gray or green)

Carbo Zinc filler

Carboline #21 or 33 Thinner

Dimetcote

Dimetcote 6 base

Dimetcote filler

Amercoat #65 or 101  
Thinner

He shall also verify that each component container is identified by batch number and that the shelf life has not expired. Carbo Zinc 11 base has a shelf life of 12 months. Carbo Zinc filler and Dimetcote 6 base and filler have a shelf life of 24 months.

## 2. Mixing Operations

An inspector shall witness each mixing/thinning operation. The inspector shall verify that mixing operations are performed in accordance with Reference 1-A and 1-B.

## 3. Thinning Operation

An inspector shall verify that primer thinning complies with thinning requirements established in References 1-A and 1-B.

## 4. When coating materials are mixed/thinned in locations other than the field, the inspector verifying the mixing operation shall fill out the Paint Mixing Slip, Attachment 5. The inspector performing the pre-application inspection shall record the information from the Paint Mixing Slip on the Inspection Report, Attachment 3. The Paint Mixing Slip need not be retained.

i) Verify that primer is applied and pot life is not exceeded in accordance with Reference 1-B and 1-C. If a brush technique is used, the inspector shall verify that a short bristle brush is used and rebrushing is avoided.

j) Verify that hose length is less than 75 feet.



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3.2.3 Primer Touch-up Repair (Primer Damage Does Not Extend to Steel Surface)

The coating inspector shall conduct the following inspections for primer touch-up repair operations when the damage is within the primer coat and sandblasting to the steel substrate is not required.

- a) Verify surface is abraded lightly then wiped clean per Reference 1-B and 1-C.
- b) Perform inspections (e) through (j) in paragraph 3.2.2.

3.2.4 Repair of Primer by Recoating

The coating inspector shall conduct the following inspections for primer recoating repair. Only two (2) overcoats shall be applied.

- a) Verify that the surface has been solvent cleaned or cleansed in accordance with Reference 1-B and 1-C. A clean white cloth shall be used to check primed surface cleanliness. Contamination, other than rust (red) and zinc oxide (white) stains, is unacceptable and require further cleaning.
- b) Perform inspections (e) through (j) in Section 3.2.2.
- c) Minor defects (mechanical damage such as construction damage or exposing substrate during surface preparation operations, etc.) perform inspection (a) through (c) in Section 3.7.2.
- d) Major defects (mechanical damage such as construction damage or exposing substrate during surface preparation operations, etc.) perform inspection (a) through (c) in Section 3.7.3.

3.2.5 Complete Primer Repair (Primer Damage to Steel Surface Extends Over Entire Item)

The coating inspector shall conduct the following inspections to document primer repair when the damage is to the steel surface and requires surface preparation to steel substrate over entire item:

- a) Verify ambient conditions per Section 3.2.2(a) prior to surface preparation.

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b) Perform inspections (a) through (j) in Section 3.2.2.

### 3.2.6 Documentation of Primer Repair Inspections

All inspections required by Section 3.2 shall be documented on an IR, Attachment 3, in accordance with Reference 1-D. The completed IR shall be forwarded to the PPRV for retention.

NOTE 1: If the repair is on an item which is fabricated out of several pieces of steel bearing different QP numbers, all QP numbers will be recorded in the "Remarks" section of the IR.

NOTE 2: All items within the scope of each inspection which are determined by the Inspector to be satisfactory may be documented on a single IR.

NOTE 3: A reject tag will be applied to any unsat area, with the inspection report, inspector's name and phone extension listed per Reference 1-F.

## 3.3 PRE-APPLICATION INSPECTIONS

The QC inspector shall verify the following items prior to applying coatings:

### 3.3.1 Coating Applicator Qualifications

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

### 3.3.2 Ambient Conditions

The inspector shall determine air temperature, surface temperature, relative humidity and dew point of substrate structures. A calibrated non-mercury filled dry bulb thermometer or calibrated temperature recorder (Bristol 4069TH or equivalent) shall be used for air temperature determination. A calibrated non-mercury wet bulb thermometer or a calibrated humidity recorder (Bristol 4069TH or equivalent) shall be used to determine relative humidity. The dew point shall be determined by the difference in dry and wet bulb temperatures using the U.S. Department of Commerce Weather Bureau Psychrometric Tables, WB No. 235. When dry bulb readings are greater than 100°F, the dew point should be determined using the 100°F dry bulb reading, and relative humidity shall be determined by subtracting wet bulb from the surface temperature or ambient

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temperature, whichever is greater. If the dry bulb thermometer exceeds 100°F, the instrument shall be returned to the calibration lab for recalibration. The surface temperature shall be determined by placing a calibrated surface temperature thermometer (Omega-Amprobe fast temp. range of 10°-250°F) in contact with the substrate surface until the temperature reading stabilizes.

The permissible range of surface and ambient temperature for application of finish coat shall be 50-120°F.

Maximum values of relative humidity shall be 85%.

The surface temperature shall be a minimum of 5°F above the dew point.

### 3.3.3 Coated Surface Acceptability

The Inspector shall visually reinspect the previously coated surface just prior to finish coat application for evidence of contamination (oil, grease, foreign matter) and stains.

Contamination is unacceptable. All contamination must be removed per Reference 1-B or 1-C prior to finish coating.

Rust (red) and zinc oxide (white) stains are acceptable provided all loose particles have been removed (as evidenced by existence of no stain on cloth) from the coated surface by approved cleaning operations. Phenoline Thinner or Xylol are approved cleaners for seal coat. Thinner wiping is not recommended for Dimetcoat primer. Use Carboline #33 cleaner for CZ11 Primer.

### 3.3.4 Air Supply Acceptability

The Inspector shall inspect the air supply system (pressure pots and spray guns) for the existence of suitable filters/traps/separators.

The effectiveness of these items shall be verified by placing a clean piece of cheesecloth (or white fabric) over the exit of the air lines and allowing air to flow for 30 seconds minimum. The cloth shall show no evidence of moisture, oil or foreign matter when examined.

### 3.3.5 Finish Coat Mixing Operations

- 3.3.5.1 Prior to mixing, the inspector shall verify that each component is identified by batch numbers and that the 24 month shelf life has not been exceeded.

3.3.5.2 The inspector shall verify that mixing/thinner operations are performed in accordance with References 1-B and 1-C. Thinning may be done up to two quarts of Phenoline Thinner per gallon of Phenoline 305.

3.3.5.3 The inspector shall verify that the pot life has not expired per References 1-B and 1-C.

3.3.5.4. When coating materials are mixed/thinned in locations other than the field, the inspector verifying the mixing operation shall fill out the Paint Mixing Slip, Attachment 5. The inspector performing the pre-application inspection shall record the information from the Paint Mixing Slip on the Inspection Report, Attachment 1. The Paint Mixing Slip need not be retained.

#### 3.4 SURVEILLANCE OF SEAL OR FINISH COAT APPLICATION

The Inspector shall verify that hose length is less than 75 feet. If a brush technique is used, the inspector shall verify that a short bristle brush is used and rebrushing is avoided.

The inspector shall also verify that the seal coat (if present) is solvent wiped with Phenoline 305 thinner or Xylol prior to finish coat application.

#### 3.5 DOCUMENTATION OF PRIMER INSPECTION AND FINISH COAT PRE-APPLICATION/APPLICATION INSPECTIONS

Results of inspections described in Sections 3.1, 3.3, and 3.4 shall be documented on an Inspection Report (IR), Attachment 1, in accordance with Reference 1-D. The completed IR shall be forwarded to the PPRV for retention.

NOTE 1: All items within the scope of each inspection which are determined by the Inspector to be satisfactory may be documented on a single IR.

#### 3.6 FINISH COAT FINAL ACCEPTANCE INSPECTION

The inspector shall perform a final acceptance inspection of each finish coated item in accordance with Paragraphs 3.6.1 through 3.6.5. For finish coated containment liner plate surfaces, the final acceptance inspection shall be performed at the completion of the curing period. For all other finish coated items, the final acceptance inspection

shall be performed immediately prior to turnover of each area within the containment building and should be coordinated with Area Management. In addition, finish coated containment liner surfaces shall be visually reinspected in accordance with Paragraph 3.6.2 immediately prior to turnover of each containment area.

### 3.6.1 Finish Coat Cure

The QC Inspector may perform a final acceptance inspection after a minimum topcoat cure of 24 hours or minimum cure for recoat as stated in Reference 1-B or 1-C, Section 4.4.21 Paragraph 4, which ever is greater. A calibrated non-mercury filled dry bulb thermometer, a calibrated temperature recorder, or local weather station may be used.

### 3.6.2 Visual Defects Inspection

The Inspector shall perform a visual inspection of the cured finish coated substrate surface in accordance with the following:

- a) Runs/sags - Runs or sags in which the DFT of the total coating system is 15.0 mils or less thick, which show no evidence of mudcracking, are acceptable. Those greater than 15.0 mils shall be repaired in accordance with Reference 1-B or 1-C.
- b) Skips/ damaged areas/ dry spray/ over spray/ gross discontinuities such as holidays, voids, and bubbles are not acceptable.
- c) Pinholes - acceptable to the extent allowed by Attachment 2.
- d) Contamination - Embedded foreign materials unacceptable.

### 3.6.3 Dry Film Thickness (DFT)

The Inspector shall perform a DFT of the cured coating system. A calibrated 0-25 Elcometer Inspector DFT Gage Model III/1E, or equivalent, shall be used. A minimum of five separate spot measurements (See Note 1) spaced evenly over the structure (See Note 2) shall be taken. Since the magnetic gage is sensitive to geometric discontinuities in the steel, measurements less than 1 inch from an edge or a hole shall be avoided where possible.



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The average DFT of the total coating system shall be a minimum of 6.0 mils and a maximum of 13.0 mils. The spot test DFT of the total coating system shall be a minimum of 6.0 mils and a maximum of 15.0 mils.

The finish coated system shall exhibit full "hiding" properties of the primecoat.

NOTE 1: A spot measurement is a series of three measurements in the same general area. The probe 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 small areas of coating, 5 separate spot measurements shall be taken. For larger areas, 5 spot measurements shall be taken for every 100 square feet of coating.

NOTE 3: Items with appreciable surface curvature and other geometrical discontinuities such as handrails, gratings, stairs, sway struts; etc. shall be exempt from DFT measurement (See DCA 11421).

NOTE 4: PCR's from previous DFT inspections that are satisfactory per current requirements of DCA 12145 R.3, do not require additional DFT inspections provided no additional coatings have been applied to the area.

#### 3.6.4 Continuity Inspection

The Inspector shall test the continuity of the cured finish coat using a Tinker and Razor Model M1 (67.5 volt) holiday detector. 100% of the finish coated surface area shall be tested.

The applied film should contain only a minor number of points of discontinuity. No more than two points of discontinuity should occur within an area having a radius of 6 inches as measured from a point of discontinuity (pinholes). No more than 40% of the total number of allowable points of discontinuity should occur within any one area equal to 25% of the total area being coated. The total number of pinhole discontinuities allowed is defined in Attachment 2. No gross discontinuities are allowed.

#### 3.6.5 Documentation of Finish Coat/Seal Coat Acceptance Inspections

Results of inspections described in Sections 3.6 shall be documented on an Inspection Report (IR), Attachment 4, in



accordance with Reference 1-D. The completed IR shall be forwarded to the PPRV for retention.

NOTE 1: All items within the scope of each inspection per Paragraph 3.6, which are determined by the Inspector to be satisfactory, may be documented on a single IR.

NOTE 2: A reject tag will be applied to any unsat area, with the inspection report, inspector's name and phone extension listed per Reference 1-F.

### 3.7 REPAIRS OF FINISH COAT

#### 3.7.1 Repairs of Runs and Sags

The QC inspector shall verify that the area is abraded until the DFT of the total coating system is within 6.0 and 15.0 mils, and examined for mudcracking.

The presence or absence of mudcracking shall dictate the type of repair required per Reference 1-B or 1-C.

#### 3.7.2 Repair of Minor Defects

The QC inspector shall perform the following inspection when repairing minor defects (as defined by Reference 1-B or 1-C):

- a) Verify ambient conditions per Section 3.2.2(a) prior to surface preparation.
- b) Verify that the damaged area is blasted or abraded and any exposed steel is ground per Reference 1-B or 1-C.
- c) Verify damaged area is solvent wiped in accordance with Reference 1-B or 1-C.
- d) Perform inspections described in 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5, and 3.4.

#### 3.7.3 Repair of Major Defects

The QC inspector shall perform the following inspection when repairing major defects (as defined by Reference 1-B or 1-C):

- a) Verify ambient conditions per Section 3.2.2(a) prior to surface preparation.
- b) Verify area is abraded or spot blasted per Reference 1-B or 1-C.

c) Perform inspections in Section 3.2.2.

d) Perform inspections in Section 3.7.2(c).

3.7.4 Repair of Embedded Foreign Particles

The QC inspector shall verify that embedded foreign particles are removed and the surface recoated per Section 3.7.5.

3.7.5 Repair of Pinholes and Discontinuities, Over Spray, Dry Spray and/or Overcoating

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

b) Perform inspections described in 3.7.2, except pinholes and small discontinuities may be repaired at the time of final inspection without a later reinspection of the repair.

3.7.6 Documentation of Repairs

All repairs shall be documented on an Inspection Report, Attachment 1. Repairs involving application of primer will be documented on Attachment 3.

3.8 MAPPING OF LARGE AREAS

For large areas (such as reactor containment liner plate) which have received coatings prior to 10/23/81 (Issuance date of Rev. 5 of this procedure), a unique number shall be assigned to the original inspection checklist. This number will be transferred to the area on a map drawing to provide traceability to the original checklist. For any coatings applied after 10/23/81, the IR number shall be transferred to the area on the map drawing.

The map drawing shall be maintained by the QC Supervisor, or his designee, until the entire surface has been coated. At this time, the completed map shall be transmitted to the Permanent Plant Records Vault.

NOTE 1: Separate maps shall be maintained for the prime, seal and finish coats.

NOTE 2: If the coated area applicable to a given IR is irregular in shape, a sketch should be attached to

the IR to indicate the extent of the area inspected.

NOTE 3: Coating repairs requiring recoating shall be mapped, but repairs only requiring touch-up need not be mapped.

NOTE 4: The following parameters (as necessary) should be considered for description of areas on the sketch:

- a) Bottom and top elevations (vertical and diagonal surfaces) or elevation of surface (horizontal surfaces).
- b) Dimensions in relationship to azimuths, column lines, reactor centerline or other components of known location.
- c) Quadrant, compartment, cavity or room in which inspection is located.
- d) Unit number.
- e) Relation of surface to cardinal directions (i.e., North, South, etc.).

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ATTACHMENT 1

COMANCHE PEAK STEAM ELECTRIC STATION

INSPECTION REPORT

SHEET 1 OF 2  
NO.

|  |   |   |   |   |       |
|--|---|---|---|---|-------|
| ITEM DESCRIPTION<br>PROTECTIVE COATINGS  |   | IDENTIFICATION NO.                                      |   | SYSTEM / STRUCTURE DESIGNATION  |       |
| SPEC. NO.<br>AS-31   | REV.  | REF. Q.C. DOC. & REV. & CHANGE NO.<br>QI-QP-11.4-5 Rev. |   | MEASURE OR TEST EQUIP. IDENT. NO.   |       |
| <input type="checkbox"/> IN PROCESS INSPECTION   | <input type="checkbox"/> PRE-INSTALLATION VERIFICATION  | <input type="checkbox"/> INSTALLATION INSPECTION        | <input type="checkbox"/> FINAL INSPECTION | <input type="checkbox"/> PRE-TEST INSPECTION  |       |
| INSPECTION RESULTS   |   |   |   | DATE  |       |
| <input type="checkbox"/> INSPECTION COMPLETED, ALL APPLICABLE ITEMS SATISFACTORY<br><input type="checkbox"/> INSPECTION COMPLETED, UNSATISFACTORY ITEMS LISTED BELOW |   |   |   | <div style="text-align: center; font-size: 2em; transform: rotate(-10deg); opacity: 0.5;">TYPICAL</div> |       |
| ITEM NO.   | INSPECTION ATTRIBUTES   |   |   | SAT   | UNSAT |
|  | SEAL COAT   | FINISH COAT   |   |   |       |
|  | ORIGINAL  | REPAIR  |   |   |       |
| 1.   | RECORD ALL PROTECTIVE COATINGS UNIQUE QP & ID NO.'s:<br>(FOR MULTIPLE ITEMS INDICATE IN "REMARKS WITH<br>CORRESPONDING DFT READINGS FROM ITEM #3 ABOVE.) PER<br>PARA. 3.1.1.a |   |   |   |       |
| 2.   | VERIFY PRIMER CURE PER PARA. 3.1.1.a  |   |   |   |       |
| 3.   | PERFORM VISUAL INSPECTION OF PRIMED SURFACE PER PARA.<br>3.1.1.d  |   |   |   |       |
| 4.   | PERFORM DFT OF PRIMER COAT PER PARA. 3.1.1.e (FOR<br>MULTIPLE ITEMS INDICATE MIN. SPOT, MAX. SPOT AND AVER-<br>AGE DFT FOR EACH ITEM IN "REMARKS")                            |   |   |   |       |
| 5.   | PERFORM VISUAL INSPECTIONS OF PREVIOUSLY COATED SURFACE<br>PER PARA. 3.3.3  |   |   |   |       |
| 6.   | VERIFY SURFACE PREPARATION ACCEPTABLE PER CCP30 OR<br>CCP30A  |   |   |   |       |
| 7.   | AMBIENT CONDITIONS CHECKED PER PARA. 3.3.2 PRIOR TO<br>COATING APPLICATION<br>RECORD:<br>DATE: _____ TIME: _____ W.B. _____<br>D.B. _____ S.T. _____ D.P. _____ R.H. _____    |   |   |   |       |
| (CONTINUED ON SHEET 2 of 2)  |   |   |   |   |       |
| REMARKS (DWGS, SPECS, ETC.)  |   |   |   |   |       |
|  |   |   |   |   |       |
| RELATED QCR NO.  |   | I.R. CLOSED <input type="checkbox"/>                    |   | DATE  |       |
|  |   |   |   | SIGNATURE _____<br>QC INSPECTOR   |       |



|   |                       |          |               |          |
|---|-----------------------|----------|---------------|----------|
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Attachment 2

TOTAL NUMBER OF ALLOWABLE POINTS OF DISCONTINUITY

| SURFACE AREA<br>BEING COATED<br>(SQ. FT.) | COND. "C"<br>COMMERCIALY<br>CONTINUOUS |
|---|--|
| 10  | 5                                      |
| 10-50                                     | 10                                     |
| 50-100                                    | 20                                     |
| 100-500                                   | 30                                     |
| 500-1000                                  | 50                                     |
| 1000-5000                                 | 75                                     |

Gross Discontinuities - None Allowed.



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### ATTACHMENT 3

#### COMANCHE PEAK STEAM ELECTRIC STATION INSPECTION REPORT

|  |  |  |   |  |
|--|--|--|---|--|
| ITEM DESCRIPTION<br>PROTECTIVE COATINGS  |  | IDENTIFICATION NO.<br>21                         | SYSTEM STRUCTURE DESIGNATION              |  |
| SPEC. NO.<br>AS-31   | REV.<br>5  | REF. QI-QP-11.4-5, Rev. 5                        | DESIGNER OR TEST ENGINEER NO.             |  |
| <input type="checkbox"/> IN PROCESS INSPECTION                                   | <input type="checkbox"/> PRE-INSTALLATION VERIFICATION   | <input type="checkbox"/> INSTALLATION INSPECTION | <input type="checkbox"/> FINAL INSPECTION | <input type="checkbox"/> PRE-TEST INSPECTION |
| INSPECTION RESULTS   |  |  |   |  |
| <input type="checkbox"/> INSPECTION COMPLETED, ALL APPLICABLE ITEMS SATISFACTORY |  |  |   |  |
| <input type="checkbox"/> INSPECTION COMPLETED, UNSATISFACTORY ITEMS LISTED BELOW |  |  |   |  |
| ITEM NO.   | INSPECTION ATTRIBUTES  |  |   | QC SIGNATURE                                 |
| 1.   | For repair of sags and runs over 5.5 mils DFT, perform DFT of Primer Coat in areas which have been sanded or screened per Para. 3.2.1. (For multiple items, indicate Min. Spot, Max. Spot and Average DFT with corresponding QP & ID No's for each item in "Remarks.") |  |   |  |
|  | RECORD: Minimum Spot Test:   |  |   |  |
|  | Maximum Spot Test:   |  |   |  |
|  | Average DFT:   |  |   |  |
| 2.   | Abrasive acceptable per Para. 3.2.2.b.   |  |   |  |
| 3.   | Separators installed, drained, and drains left partially open.   |  |   |  |
| 4.   | Air supply free of contamination.  |  |   |  |
| 5.   | Blasted or power-tooled surface and profile:   |  |   |  |
|  | a. Surface and surrounding areas cleaned per Para. 3.2.2.d.  |  |   |  |
|  | b. Surface free of foreign matter incl. grease & oil   |  |   |  |
|  | c. Sharp (non-rounded) projections removed   |  |   |  |
|  | d. Anchor pattern depth 1.0 mil, minimum 3.2.2.e.3   |  |   |  |
|  | e. Surface lightly abraded per Para. 3.2.3   |  |   |  |
|  | f. Surface wiped clean per Para. 3.2.3 or 3.2.4 (Repairs Only)   |  |   |  |
| 6.   | Unique Number stamped on piece(s). Record Unique Number(s) in "Remarks" below.   |  |   |  |
| 7.   | Ambient conditions checked per Para. 3.3.2 prior to primer application and record below:   |  |   |  |
|  | DATE:  | TIME:  | WET BULB TEMP:                            |  |
|  | DRY BULB TEMP:   | RELATIVE HUMIDITY:                               |   |  |
|  | DEW POINT:   | SURFACE TEMP:                                    |   |  |
| 8.   | Substrate surface free of contaminants and less than 24 hours elapsed since blasting.  |  |   |  |
| (Continued on Next Sheet)  |  |  |   |  |



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Attachment 4

## COMANCHE PEAK STEAM ELECTRIC STATION

## INSPECTION REPORT

SHEET 1 OF 1  
NO.

|  |   |  |  |  |              |
|--|---|--|--|--|--------------|
| ITEM DESCRIPTION<br>PROTECTIVE COATINGS  |   | IDENTIFICATION NO.                                       |  | SYSTEM / STRUCTURE DESIGNATION                   |              |
| SPEC. NO.<br>AS-31   | REV.<br>5   | REF. Q.C. DOC. & REV. & CHANGE NO.<br>QI-QP-11.4-5, Rev. |  | MEASURE OR TEST EQUIP. IDENT. NO.                |              |
| <input type="checkbox"/> IN PROCESS INSPECTION                                   |   | <input type="checkbox"/> PRE-INSTALLATION VERIFICATION   |  | <input type="checkbox"/> INSTALLATION INSPECTION |              |
| <input type="checkbox"/> FINAL INSPECTION  |   | <input type="checkbox"/> POST-TEST INSPECTION            |  |  |              |
| INSPECTION RESULTS   |   |  |  |  |              |
| <input type="checkbox"/> INSPECTION COMPLETED, ALL APPLICABLE ITEMS SATISFACTORY |   |  |  |  |              |
| <input type="checkbox"/> INSPECTION COMPLETED, UNSATISFACTORY ITEMS LISTED BELOW |   |  |  |  |              |
| ITEM NO.   | INSPECTION ATTRIBUTES   |  |  | SAT  | UNSAT        |
|  | FINISH COAT FINAL ACCEPTANCE  |  |  | DATE   | QC SIGNATURE |
| 1.   | Verify curing is per CCP-30 or 30A and para. 3.6.1.   |  |  |  |              |
| 2.   | Perform Visual Inspection of Coated Surface per para. 3.6.2.  |  |  |  |              |
| 3.   | Perform DFT on coated surface as per para. 3.6.3 (For multiple items indicate Min. Spot, Max. Spot and Average DFT with corresponding QP & ID No's for each item in "Remarks"). |  |  |  |              |
|  | Coating System Spot Test Minimum:   |  |  |  |              |
|  | Coating System Spot Test Maximum:   |  |  |  |              |
|  | Average DFT Coating System:   |  |  |  |              |
| 4.   | Perform continuity inspection per para. 3.6.4.  |  |  |  |              |
| REMARKS (DWGS, SPECS, ETC.)  |   |  |  |  |              |
|  |   |  |  |  |              |
| RELATED NCR NO.  |   | I.R. CLOSED <input type="checkbox"/>                     |  | DATE   | SIGNATURE    |
|  |   |  |  |  | QC INSPECTOR |

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ATTACHMENT 5

| PAINT MIXING SLIP |                    |
|-------------------|--------------------|
|                   | DATE: _____        |
| BLDG. _____       | ELEV. _____        |
| COATING: _____    | COLOR. _____       |
| TIME MIXED: _____ | TEMP. _____        |
| BATCH #           | BASE (A) _____     |
|                   | CAT./FLR (B) _____ |
|                   | THINNER (C) _____  |
|                   | GAL. _____         |
| M&TE #'s _____    |                    |
| INSP _____        | DATE: _____        |

Recd 11/31/84



# LABORATORY TEST REPORT

Testing Project Number: 01931

Date: February 10, 1981

Report # Final Time 7 days

Date of Grading: 2-3-81

Total Design Test Duration: 7 days

Requested by: Mr. D. W. McBride

TITLE: LOCA Testing of Carbo Zinc 11/Phenoline 305 Finish repairability

PURPOSE: To determine the performance of 1c Carboline 191 Primer/1c Phenoline 305 Finish as a repair system for Carbo Zinc 11/Phenoline 305 Finish over a surface preparation of 3M "Clean 'n Strip" and 3M "Rotapeen" when exposed to the PWR 307°F. LOCA Curve and evaluated according to ANSI N101.2-1972, Section 4.5, as interpreted by Carboline. This is a proposed repair procedure for the Waterford Nuclear Station Unit #3 which is being engineered by Ebasco Services, Inc.

CONCLUSIONS: After 7 days of the LOCA Curve, the 1c Carboline 191 Primer/1c Phenoline 305 Finish system over a surface preparation of 3M "Clean 'n Strip" and 3M "Rotapeen" exhibits an acceptable performance when evaluated according to ANSI N101.2-1972, Section, 4.5, as interpreted by Carboline.

DISCUSSION:

Ampe 851100236

From the Carboline Research & Development Laboratory

The technical data furnished are true and accurate to the best of our knowledge. However, no guarantee of accuracy is given or implied.

carboline

100 HUNTER ROAD, ST. LOUIS, MO 63104

PROCEDURE:

A. Test Coupons

Description: 2"x4"x1/4" steel certified Carboline ST1 (See Appendix 1)

Surface Preparation: Gritblasted to SSPC-SP5-63 with a 2.0-3.0 mil blast profile.

Abrasive Medium: 50/50 mix of GFH #40 grit and S230 shot.

B. Systems Tested

| System                  | Batch Number | Color | Thinner   | Thinning Ratio | DFT Range    |
|-------------------------|--------------|-------|-----------|----------------|--------------|
| 1c Carbo Zinc 11        | A) OE5477M   | Green | #33       |                |              |
|                         | B) OE1981Z   | 0300  | 9L1818M   | 12%            | 3.0-3.5 mils |
| 1c Phenoline 305 Finish | A) OH1395M   | Gray  | Phenoline |                |              |
|                         | B) OH1491M   | C705  | 9M2285M   | 10%            | 4.0-4.5 mils |

Carbo Zinc 11/Phenoline 305 Finish was removed by SSPC-SP3-63, power tool cleaning method. Detailed procedure is outlined in Section C; Repair Procedure.

|                         |            |      |           |     |              |
|-------------------------|------------|------|-----------|-----|--------------|
| 1c Carboline 191 Primer | A) OC3362M | Red  | #15       |     |              |
|                         | B) OC3361M | 0500 | 9L0859M   | 15% | 4.0-4.5 mils |
| 1c Phenoline 305 Finish | A) OH1395M | Gray | Phenoline |     |              |
|                         | B) OH1491M | C705 | 9M2285M   | 10% | 3.0-3.5 mils |

C. Repair Procedure

1. Remove Carbo Zinc 11/Phenoline 305 Finish with 3M's "Clean 'n Strip" wheel
  - a. A residual amount of Carbo Zinc 11 is left on substrate.
2. Restore surface profile with 3M's "Rotapeen"
  - a. Operate power tool in two directions over substrate.
3. Solvent wipe substrate to remove grease and oil which may be present from power tool cleaning.

D. Cure Schedule

Carbo Zinc 11: Seven days at 100°F and 100% RH. Phenoline 305 Finish: 48 hours at 72-76°F and 27-32% RH. Carboline 191 Primer: 24 hours at 73-77°F and 29-32% RH. Phenoline 305 Finish: 72 hours at 72-78°F and 28-34% RH and a final cure at 150°F for 24 hours.



E. Exposure

PWR 307°F LOCA Curve

1. Time-Temperature-Pressure Curve

| <u>Time</u>                      | <u>Temperature**</u> | <u>Pressure**</u> |
|----------------------------------|----------------------|-------------------|
| Initial                          | Ambient              | Ambient           |
| Initial to 2 hours, 47 minutes   | 307°F (153°C)        | 60 psig           |
| 2 hours, 47 minutes to 96 hours* | 250°F (121°C)        | 30 psig           |
| 96 hours to 7 days               | 200°F (93°C)         | 10 psig           |

2. Water Chemistry

0.28 Molar  $H_3BO_3$  (3000 ppm Boron)

0.064 Molar  $Na_2S_2O_3$

NaOH added to adjust to a pH of 9.5 at 77°F (25°C) in deionized water

\*After 2 hours and 47 minutes of exposure, temperature of the test environment was reduced by spraying test solution at 200°F (93°C) into the test chamber which was at 307°F (153°C), giving a final temperature of 250°F (121°C).

\*\*These are theoretical values. The next page contains graphs of the theoretical and actual LOCA temperature and pressure curves. The data for the actual LOCA curves are taken from the chart recording for this test, which is stored in lab book #230, page 57

Note: Test was interrupted to place spray nozzle in LOCA chamber. Time was added to test to make up for interruption.

GRADING  
PROCEDURE:

The test coupons were evaluated for performance in the following areas:

- 1) Material flaking off.
- 2) Delamination between coats and/or peeling.
- 3) Blistering of the topcoat.
- 4) Chalking of the topcoat.
- 5) Excessive cracking.

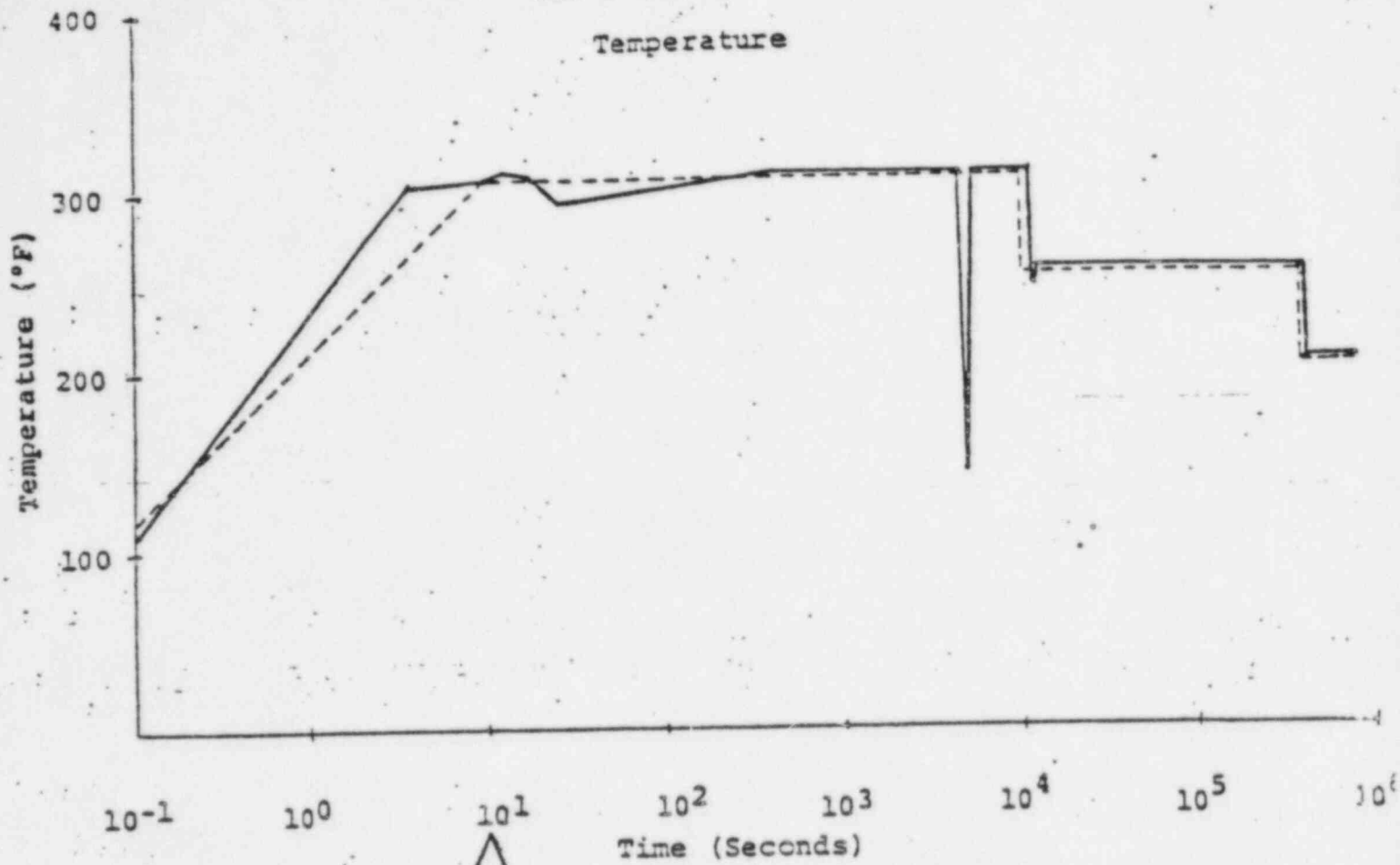
Grading procedures specified in Report N101.2-1972 of the American National Standards Institute - Protective Coatings for Light Water Nuclear Reactor Containment Facilities:

Theoretical

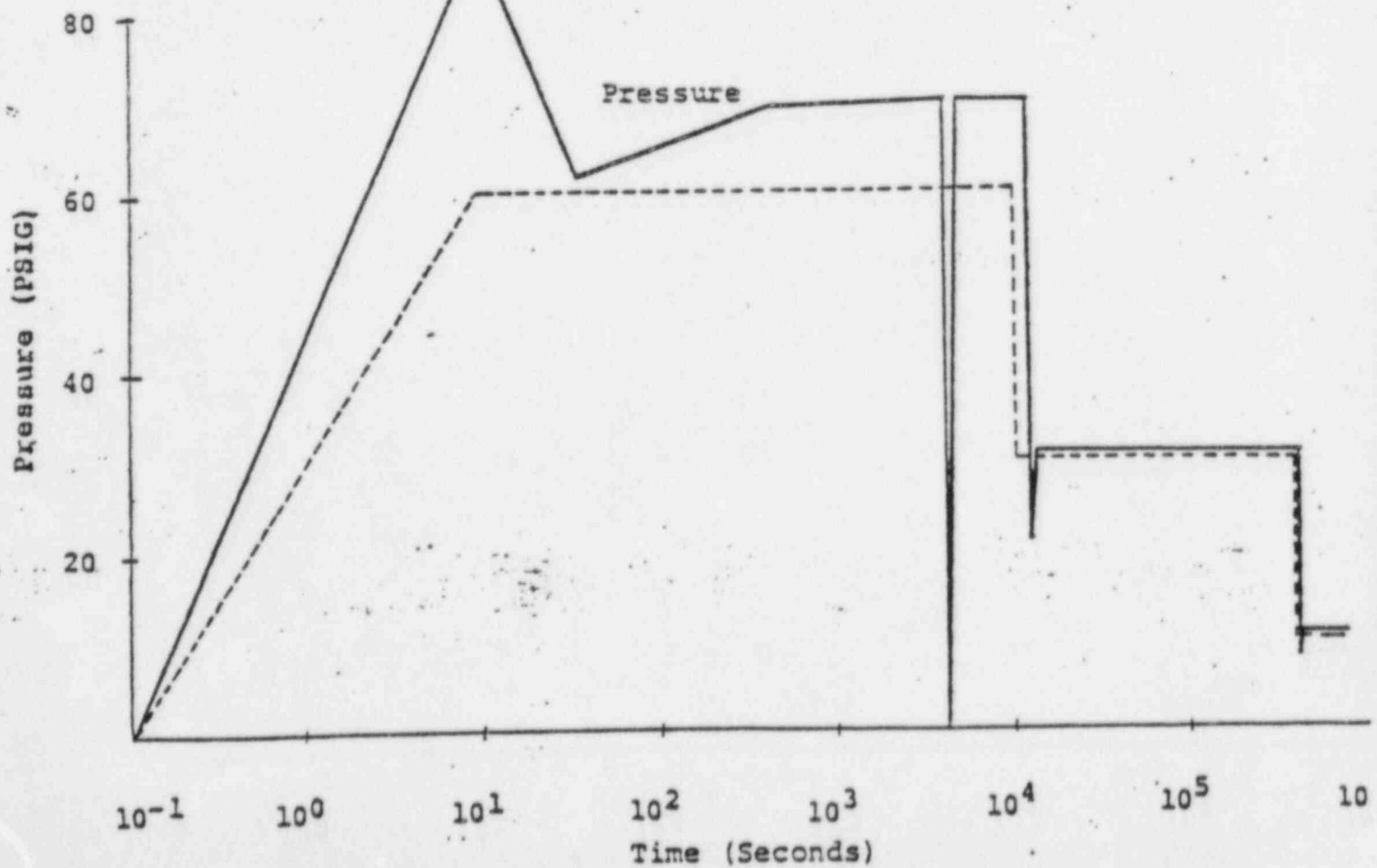
Actual

## 307°F PWR LOCA CURVE

Temperature



Pressure



GRADING  
PROCEDURE: (continued)

4.5 Methods of Examining and Evaluating the Exposed Test Specimens

The dynamic and/or static elevated temperature-pressure and irradiation test panels shall be evaluated within 2 hours and again after two weeks after removal from the test chamber for the following surface defects: flaking, delamination and/or peeling, blistering and chalking. Defects listed in Subsection 4.5.1 through 4.5.4 shall be dealt with as follows:

4.5.1 Flaking. ASTM D772, Evaluating Degree of Resistance to Flaking (Sealing) of Exterior Paints, Part 21, American Society for Testing and Materials, Philadelphia, PA 19103. Flaking shall not be permitted.

4.5.2 Delamination and/or Peeling. Delamination and/or peeling shall not be permitted.

4.5.3 Blistering. Blistering shall be limited to a few, intact blisters, Size No. 4, ASTM D714, Standard Method of Evaluating Degree of Blistering of Paints, Part 21, American Society for Testing and Materials, Philadelphia, PA 19103. The number and the size of blisters shall be recorded.

4.5.4 Chalking. ASTM D659, Standard Method of Evaluating Degree of Resistance to Chalking of Exterior Paints, Part 21, American Society for Testing and Materials, Philadelphia, PA 19103. Heavy chalking shall not be permitted.

Any other changes in coating properties which are not also associated with the separation, or the release, of coating from the substrate shall not be a cause for rejection.

ANSI N101.2-1972 Criteria  
(As interpreted by Carboline)

Maximum Degree of Failure Allowable

|                          |                     |                        |
|--------------------------|---------------------|------------------------|
| Flaking ASTM D772        |                     | 10 (None)              |
| Delamination or Peeling  |                     | None                   |
| *Blistering ASTM D714-56 | <u>Blister Size</u> | <u>Blister Density</u> |
|                          | #2                  | None                   |
|                          | #4                  | Few                    |
|                          | #6                  | Medium                 |
|                          | #8                  | Medium-Dense           |
| Chalking ASTM D659       |                     | 6 (Moderate)           |

Note: Flaking, blistering and chalking are all evaluated according to ASTM Standards, with a rating of 10 indicating that no failure was observed in the specific grading area.

TESTING PROJECT: 01931  
Final Report: 7 days

February 10, 1981  
Page 5

RESULTS: PWR 307°F LOCA Curve

| Panel Identification<br>and<br>Coating System        | Dry<br>Film<br>Thickness         | Flaking | Delamina-<br>tion or<br>Peeling | Blister-<br>ing | Chalking | Other<br>Performance<br>Characteristics | Performance<br>Evaluation |
|--|----------------------------------|---------|---------------------------------|-----------------|----------|---|---------------------------|
| 1A)*<br>Carboline 191 Primer<br>Phenoline 305 Finish | 4.5 mils<br>3.5 mils<br>8.0 mils | 10      | None                            | #4F-B           | None     | --                                      | Acceptable                |
| 2A)<br>Carboline 191 Primer<br>Phenoline 305 Finish  | 4.5 mils<br>3.5 mils<br>8.0 mils | 10      | None                            | #6M-B           | None     | --                                      | Acceptable                |

Acceptable Performance  
ANSI N101.2-1972, Section 4.5,  
As Interpreted By Carboline

10

None

#4F to  
#6M to  
#8MD

#6 (Moderate)

\*Panel suspended in the  
vapor phase.  
LAB/T-21878-1

*Robert M. Reals*

Robert M. Reals  
Lab Technician  
Testing Department

*John J. Ladage Jr.*  
-SCH

John J. Ladage, Jr.  
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jag/t.p. 01931

cc: S. Lopata/D. Porthouse/J. Montle/E. Skiles/S. Steinberg/P. Litzsinger/  
M. Dugan/Group Leaders

# carboline

## Appendix 1

### Carboline Specification CB1

#### Preparation of Concrete Specimens:

##### Concrete Composition

Cement, ASTM C150, Type II. Low alkali  
Gravel, ASTM C33, size 3/8 inch  
Sand, ASTM C33  
Water reducing admixture, ASTM C494  
Air entraining admixture, ASTM C260  
Pozzolans, ASTM C618  
Water - Demineralized or distilled water

NOT APPLICABLE

##### Concrete Proportions

Cement, 7 sacks per cubic yard  
Sand-Gravel ratio, 55 sand, 45 gravel by volume  
Pozzolans, to 15 percent replacement of cement  
Air entraining admixture, 4-7 percent  
Water reducing admixture, as per manufacturer's instructions  
Water, to produce a 3 inch slump

#### Preparation of Test Specimen:

Make and cure the specimen according to ASTM C192, except that no form oils may be used. The face to be tested shall be composed to the form to simulate poured walls and the wood troweled surfaces: Broom finish top surface to simulate floors. No test face shall be saw cut. When applicable, concrete curing agents compatible with the coating system shall be used.

##### Panels:

The size for concrete panels shall be 2 by 4 inches by 2 inches thick  $\pm$  0.2 inches.

##### Curing Time:

Before concrete specimens are coated, they shall be cured a minimum of 28 days in accordance with ACI 301, "Specifications for Structural Concrete for Buildings." If a concrete curing primer is used, it shall be applied on the concrete within 24 hours after removal of the forms.

### Carboline Specification ST1

#### Steel Test Specimens

Panels: The size for carbon steel panels shall be 2 by 4 inches by 1/4 inch thick  $\pm$  0.1 inches with rounded edges and corners. The steel for each specimen shall meet the requirements of ASTM A36, "Standard Specifications for Structural Steel".