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TECHNICAL SPECIFICATION

PAINTING OF EQUIPMENT IN CONTAINMENT

KRŠKO NUCLEAR POWER PLANT

SP-A501A

September 2018

Revision 1

Safety Related

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RECORD OF CHANGE
for
PAINTING OF EQUIPMENT IN CONTAINMENT
REVISION 1

Sheet 1 of 1

September 2018

The latest change is referenced in the right-hand margin of the updated pages.

2.0 DEFINITIONS

Items 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 and 2.8 were added to definitions.

3.0 REFERENCES

Reference 3.6 was updated to revision ASTM D4060-14.

Reference 3.9 was updated to revision ASTM D4286-08 (Reapproved 2015).

Reference 3.11 was updated to revision ASTM D4538-15.

Reference 3.17 (ASTM D7108-12) was added.

Reference 3.32 was updated to revision RG 1.54, Revision 2.

4.0 DOCUMENT SUBMITTAL

In Chapter 4.3.1 text was added:

Qualification Test Reports shall provide reasonable assurance that properly applied surface protective system will provide proper performance within Coating Technology.

In Chapter 4.3.7 Training program, qualification and certification of application personnel of Service Level I coating work (in accordance with ref. 3.8, 3.9 and 3.13 – not applicable for coating material delivery) additional text was added.

In Chapter 4.3.8 Training program, qualification and certification of inspectors of Service Level I coating work (in accordance with ref. 3.14 and 3.20 – not applicable for coating material delivery) additional text was added.

In Chapter 4.3.9 Temporary facilities and enclosures used in field coating – not applicable for coating material delivery additional text was added.

In Chapter 4.3.13 Deviations or Exceptions to this Specification listed on the Material and Equipment Specification Exceptions Form – if applicable additional text was added.

9.0 SURFACE PREPARATION AND COATING APPLICATION

In Chapter 9.2.13 Carboline's coating system: new equipment items Carbozinc 11 SG was added.

11.0 APPROVED MATERIALS

In Chapter 11.1.2 Carboline Company, St. Louis, Missouri Carbozinc 11 SG was added.

1.0 SCOPE

1.1. Scope of work

This Specification compiles information on the WORK required to apply nuclear grade protective coating systems to the equipment to be installed inside Containment of the Nuclear Power Plant Krsko. It covers the following areas related to coating work: Manufacturing, Preparation of substrates, Application of the coating system, Equipment to be used, Testing and Inspection Requirements, Receipt and Storage of nuclear grade protective coating systems for the equipment to be installed inside Containment.

1.2. Work included

The WORK includes the furnishing of all labor, supervision, facilities and equipment, and the performance of all operations and incidentals necessary for the complete shop or field coating of the carbon steel surfaces of the equipment inside the containment.

NPP KRSKO shall be responsible for ordering, purchasing, receiving, storage and control of all nuclear coating materials. No change in material selection will be permitted after submittal of the Proposal without written approval of NPP Krsko.

The work shall include but not necessarily be limited to the following:

- Manufacturing,
- Preparation of substrates,
- Protection of surfaces not to be coated,
- Cleaning of the equipment prior to painting,
- Coating application:
 - mixing and applying coating to bare surfaces - priming,
 - touch up previously primed equipment steel surfaces prior to finish coating,
 - repair or replacement of damaged coatings,
 - finish coating,
- Humidity and temperature control (as required by the Material Manufacturer's Product Data Sheets to meet application and curing criteria),
- Testing and Inspection,
- Receipt,
- Storage and

- Stenciling

of nuclear coatings for concrete and structural steel surfaces in Service Level I Nuclear Areas.

1.3. Work not included

Coatings for the following Service Levels and material surfaces are not included in this specification:

- Service Level II coatings.
- Service Level III coatings.
- Balance of Plant coatings.
- Painting of concrete, steel floor and wall surfaces in the Containment.
- Galvanized metal items.
- Stainless steel items.
- Nonferrous metal items.
- Prefinished equipment such as control panels, instrumentation panels and gages, and switchgear.

1.4. Touch up and repair

For areas less than two square feet (0.19 square meter) a touch up and repair should be performed by Civil Maintenance (TO.VZGR) and their Subcontractors. Surveillance inspection for touch up and repair should be performed by SKV.QC.

2.0 DEFINITIONS

- 2.1. Service Level I (SL I) coatings are used in areas inside the reactor containment where the coating failure could adversely affect the operation of post-accident fluid systems and thereby impair safe shutdown. Service Level I coatings are Safety Related at NEK site.
- 2.2. **Coating and/or lining** is a protective, decorative and/or anyway different functional on surface adhered, one or multi layer film of polymer, inorganic, metal and/or composite material in solid or semisolid (viscoelastic) aggregate state.
- 2.3. **Coating material** is liquid, melt or dust, which is applied on surface to form coating due to means of solvent evaporation, chemical reaction, cooling or melting. Coating

material is raw material or semi finished product which applied to the surface with proper technology.

- 2.4. **Surface protection with coatings** is a term which combines all needed activities (design, qualification, material purchasing and storage, surface preparation, material application/curing, inspection, performance monitoring and maintenance) for adequate coatings performance.
- 2.5. **Coating work** is an all-inclusive term to define all operations required to accomplish a complete coating job. The term shall be construed to include materials, equipment, labor, preparation of surfaces, control of ambient conditions, application and repair of coating systems, and inspection (Ref. 3.9).
- 2.6. **Coating work inspection** is a phase of quality control that by way of examination, observation, or measurement determines the conformance of materials, supplies, components, parts, appurtenances, systems, processes, or structures to predetermined quality requirements (Ref. 3.10).
- 2.7. **Coating Technical Specification** is a document which defines quality and qualification requirements for coating materials, coatings/linings, personnel, equipment and coating contractor on basis of NPP Krško specifications and legislation.
- 2.8. **Coating Technology** is a document which defines commercial qualities of coating materials, work activities/phases for surface preparation, coating application/curing and inspection for performance of surface protection with coatings/linings.

3.0 CODES, STANDARDS, REGULATORY

- 3.1. ASTM C177-10: Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- 3.2. ASTM D3359-95, Revision A (09 e2): Standard Test Methods for Measuring Adhesion by Tape Test.
- 3.3. ASTM D3843-00 (Reapproved 2008): Standard Practice for Quality Assurance for Protective Coatings Applied to Nuclear Facilities.
- 3.4. ASTM D3911-95(08): Standard Test Method for Evaluating Coatings Used in Light-Water Nuclear Power Plants at Simulated Design Basis Accident (DBA) Conditions.
- 3.5. ASTM D3912-95(10): Standard Test Method for Chemical Resistance of Coatings and Linings for Use in Nuclear Power Plants.

- 3.6. ASTM D4060-14: Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
- 3.7. ASTM D4082-95(10): Standard Test Method for Effects of Gamma Radiation on Coatings for Use in Light-Water Nuclear Power Plants.
- 3.8. ASTM D4228-05 (Reapproved 2012): Standard Practice for Qualification of Coating Applicators for Application of Coatings to Steel Surfaces.
- 3.9. ASTM D4286-08 (Reapproved 2015): Standard Practice for Determining Coating Contractor Qualifications for Nuclear Powered Electric Generation Facilities.
- 3.10. ASTM D4537-12: Standard Guide for Establishing Procedures to Qualify and Certify Personnel Performing Coating Work Inspection in Nuclear Facilities.
- 3.11. ASTM D4538-15: Standard Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities.
- 3.12. ASTM D4541-09: Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- 3.13. ASTM D5139-12: Standard Specification for Sample Preparation for Qualification Testing of Coatings to be used in Nuclear Power Plants.
- 3.14. ASTM D5144-08: Standard Guide for Use of Protective Coating Standards in Nuclear Power Plants.
- 3.15. ASTM D5163-96(08): Standard Guide for Establishing Procedures to Monitor the Performance of Safety Related Coatings in an Operating Nuclear Power Plant.
- 3.16. ASTM D5498-12a: Standard Guide for Developing a Training Program for Personnel Performing Coating Work Inspection for Nuclear Facilities.
- 3.17. ASTM D7108-12: Standard Guide for Establishing Qualifications for a Nuclear Coatings Specialist.
- 3.18. ASTM D7491-08: Standard Guide for Management of Non Conforming Coatings in Coating Service Level I Areas of Nuclear Power Plants.
- 3.19. ASTM E84-91a(12c): Standard Test Method for Surface Burning Characteristics of Building Materials.
- 3.20. ASTM E1461-11: Standard Test Method for Thermal Diffusivity by the Flash Method.

- 3.21. ASTM E1530-11: Standard Test Method for Evaluating the Resistance to Thermal Transmission of Materials by the Guarded Heat Flow Meter Technique.
- 3.22. Manual of Coating Work for Light-Water Nuclear Power Plant Primary Containment and other Safety-related Facilities (ASTM Subcommittee D01.43; 1979).
- 3.23. Electric Power Research Institute, "Guideline on Nuclear Safety-Related Coatings, Revision 2," EPRI Formerly TR-109937 and 1003102, December 2009.
- 3.24. Electric Power Research Institute, "Plant Support Engineering: Aging and Degradation Survey for Nuclear Service Level I Coatings," EPRI TR-1013465, December 2006.
- 3.25. ANSI N5.12-1974, Protective Coatings (Paints) for the Nuclear Industry.
- 3.26. ANSI N45.2-1972, Quality Assurance Program Requirements for Nuclear Power Plants.
- 3.27. ANSI N45.2.2-1972, Packing, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants.
- 3.28. ANSI N101.2-1972, Protective Coatings (Paints) for Light Water Nuclear Containment Facilities.
- 3.29. ANSI N101.4-1972, Quality Assurance for Protective Coatings Applied to Nuclear Facilities.
- 3.30. 10CFR50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.
- 3.31. 10CFR21, Reporting of Defects and Non-compliance.
- 3.32. RG 1.54, Revision 2, Service Level I, II and III Protective Coatings Applied to Nuclear Power Plants, U.S. Nuclear Regulatory Commission, Washington, DC, July 2010.
- 3.33. Steel Steel Structures Painting Council (SSPC):
 - SSPC-SP 1: Solvent Cleaning,
 - SSPC-SP 3: Power Tool Cleaning,
 - SSPC-SP 10: Near White Blast Cleaning.
- 3.34. FER-ZVNE/SA/EQ-TR06/07-2: Development of NPP KRSKO Environmental Qualification Zone Maps and Conditions (NPP KRSKO DBA Appendix A).
- 3.35. CRAI 3156165.

- 3.36. ADP-1.4.810: Načrtovanje, priprava in izvedba vzdrževanja premazov v NE Krško.
- 3.37. ADP-1.4.811: Spremljanje stanja in vzdrževanje površinske zaščite v razredu I in II.
- 3.38. ADP-1.4.812: Spremljanje stanja in vzdrževanje neustreznih Safety Related premaznih sistemov.
- 3.39. ADP-1.4.815: Obvladovanje kvalitete izvajanja površinske zaščite.

4.0 DOCUMENT SUBMITTAL

- 4.1. Select Materials and corresponding Manufacturer from Section 11.0 (Approved Materials).
- 4.2. Supplier shall be on the NEK ASL (Approved Supplier List).
- 4.3. Information and documentation to be supplied with the Proposal shall include but not be limited to the following:
 - 4.3.1 A copy of the Qualification Test Report. Qualification Test Reports shall be in accordance with the requirements of ANSI N5.12, ANSI N101.2, ASTM E84 and/or ASTM D5144 and shall include but not be limited to the following tests:
For Service Level I Coatings (for detailed description and acceptance criteria, see Section 7.0):
 - Sample preparation.
 - Design Basis Accident Test (use specific NPP Krško DBA curve; see Section 12.1.4 or ref. 3.33).
 - Radiation Resistance.
 - Physical properties:
 - Abrasion resistance,
 - Adhesion.
 - Chemical Resistance.
 - Flame Spread Test.
 - Thermal Conductivity.

Qualification Test Reports shall provide reasonable assurance that properly applied surface protective system will provide proper performance within Coating Technology.

NOTE: SUBMITTAL OF THE QUALIFICATION TEST REPORT IS NOT NECESSARY FOR THE QUALIFIED COATING SYSTEMS ALREADY USED AND APPROVED BY NPP KRSKO. TRACEABILITY TO TECHNICAL REPORT SHALL BE NOTIFIED.

4.3.2 Coating Performance Data

- Name of product.
- Generic type.
- Specific weight or density.
- Percentage of solids by volume.
- Viscosity.
- Flash point.
- Mixing ratio (in case of a multi component material).
- Pot life.
- Thinner.
- Shelf life.
- Recommended dry film thickness.
- Maximum and minimum inter-coat application times.
- Application procedure along with all required data for:
 - surface preparation and coating application technology,
 - acceptance criteria and
 - field testing and inspection.

4.3.3 Batch Attest Data (minimal requirements):

- Name of product.
- Batch number.
- Specific weight or density.
- Percentage of solids by volume.
- Viscosity.
- Date of manufacture.

- 4.3.4 Material Safety Data Sheet (MSDS).
 - 4.3.5 Product Data Sheet PDS (Manufacturer's guidelines for Surface Preparation, Application, Curing and Storage of Coating Material).
 - 4.3.6 Equipment list for:
 - Surface preparation and coating application.
 - Temperature and humidity control.
 - Testing and inspection.
 - Lighting.
 - 4.3.7 Training program, qualification and certification of application personnel of Service Level I coating work (in accordance with ref. 3.8, 3.9 and 3.10 – not applicable for coating material delivery).
 - 4.3.8 Training program, qualification and certification of inspectors of Service Level I coating work (in accordance with ref. 3.10 and 3.16 – not applicable for coating material delivery).
 - 4.3.9 Temporary facilities and enclosures used in field coating – not applicable for coating material delivery.
 - 4.3.10 Quality Assurance (QA) Program Manual, in effect at the time of Proposal.
 - 4.3.11 Statement of Guarantee.
 - 4.3.12 Reference List.
 - 4.3.13 Deviations or Exceptions to this Specification listed on the Material and Equipment Specification Exceptions Form – if applicable.
 - 4.3.14 Statement of Compatibility of a new Coating with previously used Coating System (in case of ordering of a new Coating – different Product or/and Producer).
- 4.4. Information and Documentation to be supplied with the Shipment
- 4.4.1 Certificate of Conformance.
 - 4.4.2 Certificate of Qualification which certifies that Coating Material was manufactured to the same Qualification Standards in place for the Prototype Coating Materials which underwent Qualification Tests as stated in the Qualification Test Report.
 - 4.4.3 Coating Material – Manufacturing Product Identity Certificate Record.

5.0 GENERAL REQUIREMENTS

- 5.1. Prior to the start of the coating work there shall be a field PRE-JOB meeting with Owner and Supplier/Subcontractor. Each specific phase of the work shall be reviewed to assure complete understanding of all applicable Contract specifications and procedural requirements. In addition the Supplier/Subcontractor shall demonstrate the surface preparation and coating procedures for steel and concrete to assure his compliance with the requirements of the contract documents.
- 5.2. ASTM D01.43 shall be used as a guide for all coating work performed under this Specification.
- 5.3. The areas, hereinafter specified as Service Level I, shall be the steel surfaces of equipment items installed inside reactor containment.

6.0 DESIGN REQUIREMENTS

- 6.1. Environmental Conditions:
 - 6.1.1 For Service Level I Nuclear Areas:
Normal and Design Basis Accident Conditions as defined in ASTM D3911 (see Specific NPP Krsko DBA curve in Section 12.1.4 or ref. 3.33) and Chemical and Physical Requirements as defined in ANSI N5.12/ASTM D5144.
- 6.2. For Service Level I Nuclear Areas Fire Resistance as defined in ASTM E84 is required.

7.0 PERFORMANCE REQUIREMENTS

- 7.1. Coating performance shall be in accordance with ANSI N101.2, ANSI N5.12, ASTM E84 and/or ASTM D5144 Standards and Requirements:
 - 7.1.1 DBA test: coatings shall withstand specific NPP Krsko Normal and Design Basis Accident Conditions stated in Section 12.1.4 (specific NPP Krsko DBA curve).

- Conditions

Parameter	Normal conditions	DBA conditions
Peak Temperature (°C)	49	160

- Acceptance criteria (minimum requirements):
 - Peeling shall not be permitted.
 - Delamination shall not be permitted.
 - Cracking is not considered a failure unless accompanied by delamination or loss of adhesion.
 - Blisters shall be limited to intact blisters that are completely surrounded by sound coating bonded to the surface.

7.1.2 Radiation resistance test shall be implemented in accordance with ANSI N5.12 or ASTM D4082.

- Acceptance criteria:
Coatings shall not exhibit (minimum requirements):
 - cracking (ASTM D661),
 - flaking (ASTM D772),
 - delamination,
 - checking,
 - peeling and
 - blistering (ASTM D714).

7.1.3 Thermal conductivity determination shall be implemented in accordance with one of the listed Standards below:

- ASTM C177,
- ASTM E1461 or
- ASTM E1530.

7.1.4 Chemical resistance test shall be implemented in accordance with requirements stated in ASTM D3912.

Exception: if coating system is tested according to ANSI N5.12 requirements the following chemical Service Reagents shall be excluded from test solutions because they are not used in NPP Krsko:

- Methyl Isobutyl Ketone,
- Tributyl Phosphate 30% + Kerosene 70% and
- Carbon Tetrachloride.

7.1.5 Flame spread test shall be implemented and evaluated in accordance with requirements stated in ASTM E84.

- Acceptance criteria:
 - Flame spread rating values shall be below 50.

7.1.6 Physical properties:

- Abrasion:
 - Abrasion resistance test shall be implemented in accordance with requirements stated in ASTM D4060.
 - Acceptance criteria: weight loss shall not exceed 175 mg/1000 cycles when a CS-17 wheel is used with a 1000g load.
- Adhesion:
 - Adhesion test shall be implemented in accordance with requirements stated in ASTM D4541.
 - Acceptance criteria: the minimum coating adhesion shall be 200 psi.

8.0 MIXING AND PREPARATION OF PAINT

8.1. Mixing

- 8.1.1 Use mixing equipment recommended by the paint Manufacturer.
- 8.1.2 Catalysts, thinners and other components shall be added only in the exact quantities specified by the paint Manufacturer.
- 8.1.3 Materials that are mixed and not used prior to expiration of Pot Life of the coating shall be discarded.

8.2. Thinners and Solvents

- 8.2.1 Thinners shall NOT be used except as specified, recommended by the paint Manufacturer.
- 8.2.2 Use of thinners shall not affect the final quality of protective coatings.

9.0 SURFACE PREPARATION AND COATING APPLICATION

9.1. General

- 9.1.1 It shall be the responsibility of the Supplier/Subcontractor to examine the equipment to determine their acceptability to be prepared and coated as herein specified. Application of coatings by the Supplier/Subcontractor shall signify acceptance of the surfaces and responsibility for the performance of coatings applied.

9.2. Special Conditions

- 9.2.1 The Supplier/Subcontractor shall be prepared to control temperature and humidity by the use of special equipment (heaters and dehumidifiers) in any area of the plant that is being coated if environmental conditions are not within specified limits and the construction schedule does not permit postponement. In conjunction with environmental control the Supplier/Subcontractor may be required to erect temporary enclosure during the preparation, painting and curing operations.
- 9.2.2 The surface preparation of Service Level I steel equipment surfaces (whether shop or field coated in the workshop) shall be in accordance with SSPC-SP 10.
- 9.2.3 Stainless steel, galvanized and aluminum surfaces shall not be blasted or painted. Such surfaces shall be fully protected when they are in proximity to blasting and painting operations.
- 9.2.4 Machined surfaces such as threads and shafts, nameplates, identification numbers and nonmetallic components shall be fully protected during cleaning, blasting and painting operations.
- 9.2.5 Filters and openings shall be covered to avoid defilement and clogging during cleaning, blasting and painting operations.
- 9.2.6 The application of epoxy coatings is not permitted at temperatures below 10°C.
- 9.2.7 Surface temperature shall be at least 3 degrees above the dew point before painting can proceed.
- 9.2.8 The Supplier/Subcontractor shall be fully responsible for the equipment during entire period of surface preparation and coating application. Responsibility starts when an Item is received and it terminates when that particular Item is released.

9.2.9 Previously primed steel surfaces to be top coated in the field shall be cleaned of oil, grease, dirt, crayon marks, surface deposits or other deleterious material. SSPC-SP 1 shall be used to achieve desired cleanliness.

9.2.10 Steel equipment items shall generally receive a prime coat of inorganic zinc or self-priming epoxy coating. These Items will require solvent cleaning (SSPC-SP 1), touch up of damaged surfaces with like primer and finish coating.

9.2.11 Prime coat might be received in a workshop over SSPC-SP 10 prepared steel surfaces, a repair (required surface preparation: SSPC-SP 3 or SSPC-SP 11) and application of topcoat might be received inside containment.

9.2.12 PPG's coating system: equipment items

- First protection of steel surfaces of equipment items:
 - Steel surfaces shall be cleaned to near white metal SSPC-SP 10.
 - Application of:
 - 1 × Dimetcote 6N primer, 60–120 µm (max. 150 µm),
 - 2 × Amercoat 90N (125–250 µm).
- Maintenance and repair of first protection of steel surfaces of equipment items:
 - Steel surfaces shall be power tool cleaned to SSPC-SP 3 stage.
 - Application of:
 - 1 × Amercoat 71P (60 µm) – damaged areas.
 - 1–2 × Amercoat 66 (60–120 µm).
- Current protection of steel surfaces of equipment items:
 - Steel surfaces shall be cleaned to near white metal SSPC-SP 10.
 - Application of:
 - 1 × Dimetcote 6N primer, 60–90 µm (max. 150 µm),
 - 2 × Amercoat 90N (125–175 µm).
- Maintenance and repair of current protection of steel surfaces of equipment items:
 - Steel surfaces shall be power tool cleaned to SSPC-SP 3 stage.
 - Touch up and repair:

- 1 × Amercoat 90N (60 µm) – damaged areas.
- 1–2 × Amercoat 90N (60–120 µm).

9.2.13 Carboline's coating system: new equipment items

- Protection of steel surfaces of new equipment items:
 - Steel surfaces shall be cleaned to near white metal SSPC-SP 10:
 - 2-3 × Carboguard 890N (240 µm) or
 - 1 × Carbozinc 11 SG (50 - 80 µm, max. 150 µm) + 1-2 × Carboguard 890N (160 - 190 µm), total DFT 240 µm.
- Maintenance and repair of steel surfaces of new equipment items:
 - Steel surfaces shall be power tool cleaned to SSPC- SP 3 or SSPC-SP 11 stage.
 - Touch up and repair:
 - 2-3 × Carboguard 890N (240 µm).

9.2.14 Carboline's coating system over PPG's system on equipment items

- PPG's coating system (Dimetcote 6N + Amercoat 90N) shall not exceed 250 µm DFT.
- Steel surfaces shall be power tool cleaned to SSPC-SP 3 or SSPC-SP 11 stage.
- Touch up and repair:
 - 2–3 × Carboguard 890N (240 µm) on damaged areas.

NOTE: Carboline 890 was renamed to Carboguard 890, which was subsequently changed to Carboguard 890N.

9.2.15 PPG's coating system: air handling units VA101AHU

- First protection of steel surfaces of VA101AHU:
 - Steel surfaces shall be cleaned to near white metal SSPC-SP 10.
 - Application of:
 - 1 × Dimetcote 6N primer,
 - 2 × Amercoat 90N.

- Maintenance and repair of first protection of steel surfaces of VA101AHU:
 - Steel surfaces shall be power tool cleaned to SSPC-SP 3 stage.
 - Application of:
 - 1 × Amercoat 71P (60 µm) – damaged areas .
 - 1–2 × Amercoat 66 (60–120 µm).
- Current protection of steel surfaces of VA101AHU:
 - Steel surfaces shall be cleaned to near white metal SSPC-SP 10.
 - Application of:
 - 1 × Dimetcote 6N primer (60 µm),
 - 2 × Amercoat 90N (140 µm).
- Maintenance and repair of current protection of steel surfaces of VA101AHU:
 - Steel surfaces shall be power tool cleaned to SSPC-SP 3 stage.
 - Touch up and repair:
 - 1 × Dimetcote 6N primer (60 µm).
 - 2 × Amercoat 90N (140 µm).

9.2.16 Carboline's coating system over PPG's coating system: air handling units VA101AHU

- Steel surfaces shall be power tool cleaned to SSPC-SP 3 or SSPC-SP 11 stage.
- Touch up and repair:
 - 3–4 × Carboguard 890N (240 µm) on damaged areas.

9.2.17 Carboline's coating system: new air handling units VA101AHU

- Protection of steel surfaces of new VA101AHU:
 - Steel surfaces shall be cleaned to near white metal SSPC-SP 10.
 - Application of:
 - 3–4 × Carboguard 890N (240 µm).
- Maintenance and repair of new AHUs:

- Steel surfaces shall be power tool cleaned to SSPC-SP 3 or SSPC-SP 11 stage.
- Touch up and repair:
 - 3–4 × Carboguard 890N (240 µm) on damaged areas.

9.2.18 Hot insulated piping may be left unprimed.

10.0 COATING SYSTEMS

10.1. Requirements

- 10.1.1 The dry film thickness (DFT) shall be as recommended by the Manufacturer to meet the design criteria specified under Section 4.3.1 and Section 4.3.2. The film thickness shall be obtained by one or more successive coating applications.
- 10.1.2 WHITE only shall be used within containment.
- 10.1.3 Paint shall be applied only within ambient temperature and humidity ranges specified by the coating Manufacturer.
- 10.1.4 Coatings may be applied by spray, brush or roller; a spray application is recommended. The coating Manufacturer's instructions on type of spray equipment, air pressure, mixing and thinning shall be followed. Successive coats on any surface shall be applied within the time limits established by the coating Manufacturer.
- 10.1.5 Defects of any kind shall be corrected immediately before the coating dries.
- 10.1.6 Do not use any substitute coating material for Service Level I.

10.2. Touch up and repair

- 10.2.1 Destroyed priming shall be cleaned to near white metal SSPC-SP 10 (in the workshop – if applicable) by the use of sandblasting equipment, needle guns, power tools or equivalent means. Loose coating shall be feather edged at least 2 inches (50 mm) onto adjoining firm coating. Inside containment repair and maintenance over SSPC-SP 3 or SSPC-SP 11 prepared steel surfaces is required.
- 10.2.2 Small areas defined as less than 2 square feet (0.19 square meter) of exposed surface area may be touch up painted.

11.0 APPROVED MATERIALS

11.1. Service Level I coatings for structural steel surfaces:

11.1.1 PPG Industries, Inc., One PPG Place, Pittsburgh, Pennsylvania:

- Dimetcote 6N (primer),
- Amercoat 90N, white (topcoat).

11.1.2 Carboline Company, St. Louis, Missouri:

- Carbozinc 11 SG (primer),
- Carboguard 890N, white (topcoat).

NOTE: Carboline 890 was renamed to Carboguard 890, which was subsequently changed to Carboguard 890N.

11.2. Stenciling:

11.2.1 Marsh Shipping Supply Company, LLC, Collinsville, Illinois:

- Marsh Spray Stencil Ink (various color shades).

12.0 MATERIAL REQUIREMENTS

12.1. Service Level I coatings:

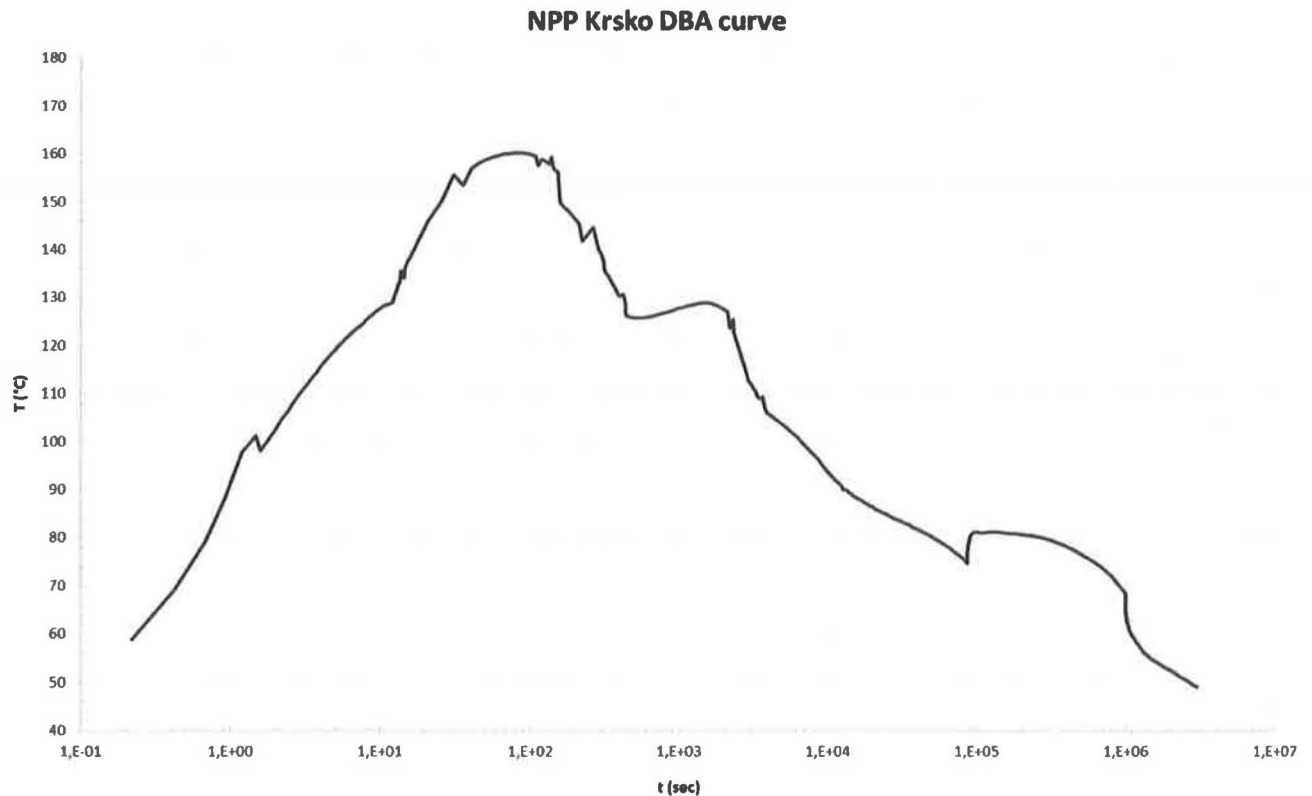
12.1.1 Epoxy coatings shall not be applied when the surface temperature is below 10°C (50°F). No primer shall be applied to wet or damp surfaces or when relative humidity exceeds 95%. Other coatings including epoxy topcoats shall not be applied when the relative humidity is above 80%.

12.1.2 NPP KRSKO shall require the Material Supplier to have and implement a QA program which meets the requirements of the referenced Codes and Standards in Section 3.0. The QA program shall include all relevant manufacturing, QC and documentation procedures which are necessary to assure traceability, material certification, formulation, conformance and compliance with specified requirements. Material used under this Specification shall be purchased, received and inventoried on a Service Level I basis.

12.1.3 NPP KRSKO shall require certification from the Material Supplier that his coating systems as listed in Section 11.0 of this Specification meet or exceed the requirements for severe radiation exposure as specified in ANSI N5.9, Section

2.2.2 and ANSI N101.2 or ASTM D5144. These tests shall be performed by independent accredited testing facility.

12.1.4 The coating systems shall meet the criteria and intent pertinent to PWR containments specified in ASTM D3911 and the following Time - Temperature profile (specific NPP Krsko DBA curve, ref. 3.33):



12.2. Stenciling

12.2.1 Stenciling is NOT considered as a Service Level I coating according to the reference 3.34. Stenciling is an activity which does not require Qualified Coatings Applicator and corresponding QA procedures. The only purpose of stenciling is to identify various areas of structural steel or concrete surfaces. Spray stencil ink does not provide corrosion protection and it is not tested under DBA conditions, therefore the use of spray stencil ink is limited for the identification purposes only.

13.0 INSPECTIONS AND TESTS

- 13.1. Factory Quality Control (QC) production inspection, testing and acceptance criteria shall be in accordance with in-house QA Program, consistent with the requirements of Codes and Standards defined in Section 3.0. The scope shall cover at least the requirements of ASTM D3843, Paragraph 7.
- 13.2. Gauges and equipment for tests shall be furnished by the Supplier/Subcontractor and calibrated and certified during the course of the WORK. The Supplier/Subcontractor shall have at the jobsite the following test equipment (or equal) which includes but is not limited to the following:
 - Surface profile Comparator with magnifier.
 - Elcometer or Mikrotester (0–25 or 0–40 mils).
 - Humidity sensors (psychrometer).
 - Surface thermometers or pyrometers.
 - Air temperature thermometer.
 - Took Gauge.
 - Elcometer adhesion tester.
- 13.3. The Supplier/Subcontractor shall perform his own inspection for QC by using test equipment and visual inspection to check for the following:
 - Presence of rust.
 - Anchor pattern.
 - Air pressure.
 - Relative humidity.
 - Ambient and surface temperatures.
 - Wet and dry film thickness.
 - Sags, runs, cracks, delaminations, overspray, holidays and so forth.
- 13.4. Inspection personnel, inspection techniques, extent of inspection and the procedure for qualification of coating inspectors shall conform to the referenced Codes and Standards in Section 3.0.
- 13.5. The procedure for qualification of coating inspectors is found in ASTM D01.43 (proposed) and ASTM D4537.

- 13.6. Inspection personnel in NEK shall have completed EPRI's Comprehensive Coatings Course.

14.0 QUALIFICATION

- 14.1. Coatings for Service Level I Nuclear Areas shall be qualified in accordance with ANSI N101.2, ANSI N5.12 and/or ASTM D5144 Standards. Coatings shall hold out Normal and Accident environments in Containment and they are classified as **Safety Related**.
- 14.2. Only Qualification Test Reports issued by Independent Accredited Laboratories are acceptable for qualification purposes.

15.0 MARKING AND IDENTIFICATION

On coating package it shall be clearly visible:

- 15.1. Intention of coating application:
 - Service Level I Nuclear Areas.
- 15.2. Coating Shelf Life expiration data.
- 15.3. Batch Number.
- 15.4. Purchase Order Number.
- 15.5. Identification marks shall connect coating with associated documentation.

16.0 RECEIVING, HANDLING AND STORAGE

- 16.1. Receiving, Handling and Storage of Coating Materials shall be in accordance with the requirements of ANSI N45.2.2, Level B.
- 16.2. Shelf Life data shall be provided by the Expiration Date.
- 16.3. No paint shall be used past the Shelf Life recommended by the Manufacturer.
- 16.4. Only originally sealed, intact, identified and undamaged material containers shall be used. Containers shall remain unopened until needed for use and then be kept covered when not in use.

17.0 NON-CONFORMING MATERIALS

- 17.1. Non-conformances of any kind related to product are not acceptable and shall be in remedied at expense of Manufacturer prior to final release of product.
- 17.2. Non-conforming coatings are coatings which:
- are physically degraded,
 - do not meet requirements specified in Standards of Section 7.0 (Performance requirements),
 - have incomplete testing documentation according to Section 7.0,
 - have incomplete documentation regarding the application process, applicator or inspector documentation,
 - are shop coated with inadequate coatings,
 - are applied over improperly prepared surface (surface preparation is not in accordance with SSPC-SP Standards for steel),
 - have inadequate specification of technical and quality procurement requirements,
 - have improper Cross-DBA test results in case of alternate coating.
- 17.3. Non-conforming coatings shall be documented in “Unqualified Coatings Log” (ref. 3.37) – surface type and type, location and quantity of certain non-conforming coating, including a reason for non-conforming condition shall be recorded (ref. 3.37). “Unqualified Coatings Log” shall be updated whenever an inadequate coating is being added to or removed from containment. Additional support and guidelines regarding unqualified coatings can be found in references 3.18 (American Society for Testing and Materials, “Standard Guide for Management of Non Conforming Coatings in Coating Service Level I Areas of Nuclear Power Plants,” ASTM D7491-08) and 3.23 (Electric Power Research Institute, “Guideline on Nuclear Safety-Related Coatings, Revision 2,” EPRI Formerly TR-109937 and 1003102, December 2009).

18.0 RECORDS

- 18.1. A Record System shall be established and maintained by the Manufacturer that provides documentary evidence of the Quality of the Coatings and activities affecting Quality. These QA Records shall include Results of Reviews, Inspections, Tests, Audits, Monitoring of Work Performance and Material Analysis. The classification

and retention time of lifetime and non-permanent records shall be in compliance with the requirements of USNRC Regulatory Guide 2.28, Revision 3-1985.

19.0 OTHER REQUIREMENTS

- 19.1. Specification of Guarantee Conditions.
- 19.2. Special Instructions.

20.0 RIGHT OF ACCESS

- 20.1. NPP KRSKO shall have a right of access to the Manufacturer's Facilities and records of Inspections or Audits by NPP KRSKO and/or their designated representatives. This shall include but not be limited to the:
 - right to Audit Material, Test, Inspection, Services and Quality Records,
 - arrange Surveillance Visit during manufacturing and
 - Witness Tests to the extent NPP KRSKO deems necessary to assure that work is being performed in accordance with all product design and manufacturing requirements.

21.0 QA REQUIREMENTS

- 21.1. All Coating Materials shall be performed/provided in accordance with a Quality Assurance Program that complies with 10CFR50, Appendix B and ANSI N101.4, ANSI N45.2 or ASTM D3843.
- 21.2. This Technical Specification is subject to the provision of Title 10 of the US Code of Federal Regulations Part 21. Reporting of Defects and Noncompliance Reporting pursuant to 10CFR21 shall be made to NPP KRSKO.

22.0 ATTACHMENTS

- 22.1. Material and Equipment Specification Exceptions Form.

MATERIAL AND EQUIPMENT SPECIFICATION EXCEPTIONS

The Bidder certifies that the Proposal is in complete and absolute agreement with this Specification, except as specifically stated below (use additional sheet if required).

Bidder's Name:

Manufacturer's Name:

Quotation Number:

Signature:

Date: