AMPP

AMPP-Nuclear

Nuclear Coatings Inspection Specialty (NCIS)

Product Version

- ✓ Up to Date products, reliable and verified.
- ✓ Questions and Answers in PDF Format.

Latest Version: 6.0

Question: 1

Safety-related coatings must remain effective after a design basis fire event. Which test or criterion best evaluates this according to EPRI guidelines?

A. ASTM D5163 adhesion test after thermal aging at rated temperatures
B. Visual inspection for discoloration only
C. Smoke toxicity and flammability testing under ASTM E162 and ASTM E662
D. Chemical resistance to inorganic acids

Answer: C

Explanation:
Fire safety evaluation includes smoke toxicity and flammability per ASTM E162 and E662 to ensure coatings do not contribute to fire hazards, essential under design basis fire conditions. Adhesion and aging tests are important but secondary to fire safety.

Question: 2

High-complexity: Nuclear shield wall steel to SSPC-SP 10, D4417 2.5 mils; D4228 demo with 10% overspray. Formula for efficiency = (applied volume / total sprayed) x100 >90%. Mitigations?

A. Adjust gun distance to 12 inches, re-measure efficiency
B. Peak density 220 peaks/inch^2 min
C. Bake panels at 200°F for 1 hour post-apply
D. Oil extraction per D7393 on abrasive <50 mg/kg

Answer: A, D

Explanation:
Distance adjustment boosts transfer efficiency per D4228. Oil limit per D7393 prevents defects in shields.

Question: 3

At a BWR Mark I containment during a 2024 steam dryer replacement outage, the inspector assesses a degraded vinyl ester coating on the torus suppression pool baffle after exposure to two-phase flow at 120°C and 0.3 MPa, revealing intercoat delamination per ASTM D5179 tape test rated 1. Holiday testing shows 15 defects/m^2. Using the delamination propagation model $\delta = \sigma \times t \times (1 - \nu) / E$, where σ=stress 20 MPa, t=thickness 15 mils, ν=Poisson 0.35, E=modulus 3 GPa, compute δ=0.08 mm. Identify all mandatory repair sequences and quality control metrics per ANSI/ANS-56.8 for hydrodynamic loading resistance.

A. Remove delaminated areas via needle gun to Sa 2.5 per ISO 8501-1, then spot-repair with 100% solids epoxy at 10 mils DFT, curing via IR lamp at 150°C for 2 hours.
B. Verify repair adhesion with X-cut test per ASTM D3359 Method A, requiring 5B rating, and perform pull-off to 800 psi minimum per ASTM D4541 on 5-grid pattern.
C. Simulate hydrodynamic impulse with water jet at 200 psi, 30° angle, 1 m distance, ensuring no disbondment >2% area per mock-up test per NUREG-0800 Branch 5.2.1.
D. Calculate coating stress under LOCA using finite element analysis (FEA) with ANSYS, inputting Young's E=3 GPa, yield strength 50 MPa, and validate model against strain gauge data at 0.5% strain.

Answer: A, B, C

Explanation:
BWR torus baffles endure cyclic two-phase flow inducing shear stresses that propagate delamination in vinyl ester coatings, risking debris in ECCS sumps during accidents. The model predicts 0.08 mm crack growth, nearing critical 0.1 mm threshold, mandating removal to Sa 2.5 for clean substrate, followed by epoxy spot-repair for chemical resistance in wet environment, with IR curing accelerating to outage timeline. Adhesion verification via X-cut (5B no lift-off) and pull-off (800 psi for hydrodynamic durability) ensures repair integrity per ASTM standards. Hydrodynamic simulation with jet testing replicates LOCA bubble collapse forces, limiting disbondment to prevent failure modes in NUREG-reviewed designs. FEA is design-phase tool, not repair QC; strain validation supports but isn't sequential step.

Question: 4

When transferring qualification data between plants, which ASTM approach ensures applicability regarding substrate composition differences?

A. Assuming all carbon steels behave identically without consideration
B. Evaluation according to ASTM D8104 focusing on substrate metallurgical similarity
C. Matching only the nominal steel thickness value
D. Ignoring substrate differences if coating system is certified elsewhere

Answer: B

Explanation:
ASTM D8104 emphasizes assessment of metallurgical and surface compatibility to verify applicability of qualification data, as substrate chemistry can significantly impact coating performance.

Question: 5

A coating removal process provides a DF of 5 on a radioactive surface. The plant requires minimum DF of 10 for reusable coatings. What is the status of this coating?

A. Coating qualifies as safe for reuse with slight remediation

B. Coating is unqualified due to insufficient removal of contamination
C. Coating can be used for non-safety applications only
D. Coating requires additional radiological monitoring but remains qualified

Answer: B

Explanation:
The coating does not meet minimum DF criteria (which is 10) set by the plant for safe reuse; therefore, it is categorized as unqualified for reuse in safety-related applications.

Question: 6

During application of a CSL I epoxy coating on a containment sump strainer, the applicator must maintain environmental controls per ASTM D4228. In a scenario with ambient conditions of 85°F and 75% RH, which controls and measurements must be implemented to ensure defect-free application?

A. Dew point measurement every 4 hours, maintaining surface temp ≥5°F above dew point
B. Substrate temperature control at 80-100°F, verified with infrared thermometer per ASTM E1862
C. Relative humidity reduction to <60% using dehumidifiers with 500 cfm capacity
D. Airflow monitoring at 50-100 fpm in spray booth, per ANSI Z9.3 ventilation standards

Answer: A, B, D

Explanation:
ASTM D4228 mandates environmental controls for CSL I coatings to prevent moisture entrapment. Dew point ≥5°F above surface temp avoids condensation, critical for adhesion in sumps exposed to LOCA sprays. Substrate temp of 80-100°F ensures proper cure kinetics, avoiding amine blush. Airflow at 50-100 fpm removes overspray, maintaining DFT uniformity within ±10% of 10 mils, ensuring strainer integrity.

Question: 7

Scenario: A PWR enters a 45-day refueling outage (RFO) after 18 months at 95% capacity factor, with reactor coolant system (RCS) drained to mid-loop for inspections. Coatings on the refueling canal exhibit chalking (ASTM D4214 rating 3) due to prior borated water exposure at pH 4.5. Procedure follows NRC Bulletin 89-01 and AMPP SP0892 for nuclear-specific inspections. As the inspector, which complex evaluations and procedural steps must you perform to restore operability before reenabling fuel handling?

A. Quantify chalking extent via ASTM D659-14 surface tension measurement, requiring >30 dynes/cm for rewettability, and apply de minimis criteria per RG 1.82 allowing up to 5% affected area if no loose particles >0.125 inch diameter.
B. Execute a full Qualified/Unqualified Coatings Inventory (QUCI) per EPRI TR-101248, categorizing the system as Safety-Related Coating System (SRCS) and verifying post-repair qualification under LOCA simulation at 315°C/150 psig for 30 days.

C. Perform holiday detection per NACE SP0188 using 30 kV DC pulse on 20 mil DFT, documenting holidays as Coating Degradation Mechanism (CDM) Type 3 (pinholes), and calculate repair epoxy volume: V = A * t * (1 - p), where A=100 m², t=15 mil, p=0.9 porosity.
D. Initiate radiation survey per 10 CFR 20.1501 with smear tests <5000 dpm/100 cm² beta-gamma, followed by surface prep to SSPC-SP 10 near-white metal and recoating with Carboline Carcothane 134 HG polyurethane per manufacturer PDS.

Answer: A, B, D

Explanation:
In PWR RFOs, chalking in refueling canals from borated water (pH 4.5, ~2500 ppm B) degrades epoxy integrity, risking particulate release during fuel movement that could clog fuel transfer tubes per NRC Bulletin 89-01. ASTM D659 surface tension measurement assesses cleanability, with de minimis thresholds per RG 1.82 permitting minor defects if particles are controlled to prevent ECCS interference. Q UCI per EPRI ensures SRCS compliance, mandating LOCA qualification to confirm no >1% weight loss or cracking post-exposure, critical for post-outage licensing. Holiday detection per NACE SP0188 identifies voids in 20 mil systems, classifying as CDM to prioritize repairs, though volume calculation aids material planning but isn't a direct procedural step. Radiation surveys per 10 CFR 20 confirm fixability (<5000 dpm limits), enabling SSPC-SP 10 prep (achieving <3% staining) and application of nuclear-qualified polyurethanes like Carcothane 134 HG (per PDS: 4-6 mil DFT, pot life 4 hrs at 70°F), ensuring 99% solids for minimal VOC during confined space work.

Question: 8

In a nuclear HVAC duct coating (atmospheric, galvanized steel), a single-coat acrylic is proposed. Previous qual on ferritic. DBA test shows 0.18 in. debris in airflow. Calculate duct velocity increase if 10 ducts, 5000 cfm each, debris blocks 5% are
a. Select requalification.
A. Change to two-coat epoxy/urethane, primer 3 mils, topcoat 4 mils for adhesion to zinc
B. Requalify per ASTM D8104 with galvanized substrate, 1000 h ASTM D2247 humidity; no corrosion>5%
C. Simulate DBA airflow: 50 ft/s, 300°F, 50 Mrad; debris <0.05 in.
D. Update matching to exclude concrete; galvanized system isolated

Answer: A, B

Explanation:
Multi-coat required for galvanized adhesion. Humidity test verifies zinc compatibility. DBA airflow prevents loose debris in ventilation.

Question: 9

A coating system in a nuclear plant exhibits delamination after several thermal cycles involving rapid cooling. Which modification would improve its resistance to such conditions?

A. Incorporation of elastomeric components to enhance flexibility
B. Increasing the coating’s hardness by adding mineral fillers

C. Reducing overall coating thickness to minimize stress accumulation
D. Applying a thin primer layer with high permeability

Answer: A

Explanation:
Elastomeric components improve the coating's flexibility, allowing it to absorb thermal stresses during rapid cooling cycles and prevent delamination. Increasing hardness or reducing thickness alone may not address the flexibility needed, and a high-permeability primer could exacerbate environmental ingress.

Question: 10

Scenario: HTGR phenolic at 330°F, 10^7 rads, then mixed nuclide decon D4256, 93% for Cs/Co. Use MCNP code for dose simulation, F4 tally for flux. Which inspections?

A. Flux ϕ <10^{14} n/cm²s equivalent for gamma
B. Nuclide-specific DF >20 via gamma spec
C. Post-decon adhesion pull-off 2,000 psi D4541
D. MCNP variance reduction <5% for accuracy

Answer: B, C, D

Explanation:
DF >20 per gamma spec verifies 93% for mixed per D4256. Pull-off 2,000 psi ensures lining post-decon/irradiation. MCNP <5% variance validates simulation tying to D4082.

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