



Designation: ~~D7491–08 (Reapproved 2015)~~ D7491 – 21

Standard Guide for Management of Non-Conforming Coatings in Coating Service Level I Areas of Nuclear Power Plants¹

This standard is issued under the fixed designation D7491; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide provides the user with guidance on developing a program for managing non-conforming coatings in Coating Service Level I areas of a nuclear power plant.

1.2 Non-conforming coatings include degraded ~~previously DBA-qualified~~ qualified or acceptable coatings, unqualified coatings, unknown coatings, and unacceptable coatings.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate ~~safety~~ safety, health, and health ~~environmental~~ environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

D4538 Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities ⁵/[astm-d7491-21](#)

2.2 Other Documents:

Regulatory Guide 1.54 Revision 0, Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants³

Regulatory Guide 1.54 Revision 1, Service Level I, II, and III ~~protective~~ Protective Coatings Applied to Nuclear Power Plants³

Regulatory Guide 1.54 Revision 2, Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants³

Regulatory Guide 1.54 Revision 3, Service Level I, II, and III and In-Scope License Renewal Protective Coatings Applied to Nuclear Power Plants³

EPRI Report ~~1003102~~ 1019157 Plant Support Engineering: Guideline on Nuclear Safety-Related Coatings, Revision 4 (formerly ~~TR-109937~~ 2 (formerly TR109937 and 1003102)⁴

3. Terminology

3.1 *Definitions*—Definitions for use with this guide are shown in Terminology D4538 or other applicable standards.

¹ This guide is under the jurisdiction of ASTM Committee D33 on Protective Coating and Lining Work for Power Generation Facilities and is the direct responsibility of Subcommittee D33.10 on Protective Coatings Maintenance Work for Power Generation Facilities.

Current edition approved ~~Dec. 1, 2015~~ Feb. 1, 2021. Published ~~January 2016~~ February 2021. Originally approved in 2008. Last previous edition approved in ~~2008~~ 2015 as ~~D7491D7491 – 08 (2015). – 08~~. DOI: ~~10.1520/D7491-08R15~~ 10.1520/D7491-21.

² For referenced ASTM standards, visit the ASTM website, [www.astm.org](#), or contact ASTM Customer Service at [service@astm.org](#). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from U. S. Nuclear Regulatory Commission, Distribution Services Section, Washington, DC 20555–0001, [http://www.nrc.gov](#).

⁴ Available from EPRI Customer Fulfillment, 1355 Willow Way, Suite 278, Concord, CA 94520.

3.2 Definitions of Terms Specific to This Standard:

~~3.2.1 non-conforming coatings, n—~~a coating or coating system in a Coating Service Level I application that lacks or has insufficient documentation to support or verify DBA qualification.

~~3.2.1.1 Discussion—~~

~~This would include coatings referred to as unqualified, unacceptable, and degraded qualified coatings.~~

~~3.2.2 unacceptable coating system, n—~~A safety related coating system for which no suitability for application review which meets the plant licensing requirements has been completed.

~~3.2.2.1 Discussion—~~

~~Therefore, no reasonable assurance exists that, when properly applied and maintained, the coating or lining will not detach under normal or accident conditions. This is applicable to “pre-ANSI” plants.~~

4. Summary of Practice

4.1 The process and use of this guide is summarized in

Fig. 1.

5. Significance and Use

5.1 There are several methods for managing non-conforming coatings in an operating nuclear power plant. This guide outlines methods that have been determined to be acceptable to the nuclear industry.

5.2 Managing the amount of non-conforming coatings is key to ensuring the amount assumed, in the licensing bases is not exceeded.

5.3 EPRI Report ~~1003402 Revision 1 (formerly TR-109937)~~ 1019157 provides additional information on the selection, application, inspection and maintenance of nuclear plant safety-related protective coatings. This reference offers a detailed discussion of important considerations related to protective coatings and can be used to supplement this guide as deemed necessary.

6. Establishing the Design Limit of Non-Conforming Coatings

6.1 Determine what coatings do not meet the licensing basis for the plant. For plants that have commitments to meet Regulatory Guide 1.54 (applicable revision) ~~and/or~~ related ANSI/ASTM ~~standards—standards,~~ or both, typically require DBA testing of coatings and extensive documentation associated with the application of the qualified coatings. This may be a more significant requirement to satisfy than for an older plant which has not made commitments to these requirements.

6.2 The key to ensuring plant safety is to manage the amount of non-conforming coatings so that it does not exceed the amount assumed in calculations that support plant operation, such as sump suction strainer head loss.

6.3 Managing non-conforming coatings, must consider the capacity of the Emergency Core Cooling System (ECCS) suction strainer to accommodate debris expected to reach the ECCS suction strainer (including coating debris) without reducing the overall ECCS pump net positive suction head (NPSH) margin below an acceptable value. Those plants with significant operational NPSH margin for accommodating additional debris may require less precision when determining the amount of non-conforming coatings; simplified bounding techniques may be sufficient.

6.4 The non-conforming condition may also affect other plant design and licensing limits, such as coating thickness affects on the accident heat transfer and peak temperature calculations, and Fire Hazards Analysis.

7. Determining the Amount of Non-Conforming Coatings

7.1 Essentially every plant has some amount of non-conforming coatings inside of primary containment and this may be an acceptable condition. There are two considerations when identifying non-conforming coatings.

7.1.1 Does the coating meet the licensing basis commitments?

7.1.2 Is there reasonable assurance the coating will not detach during normal operation or a Design Basis Accident (DBA)?

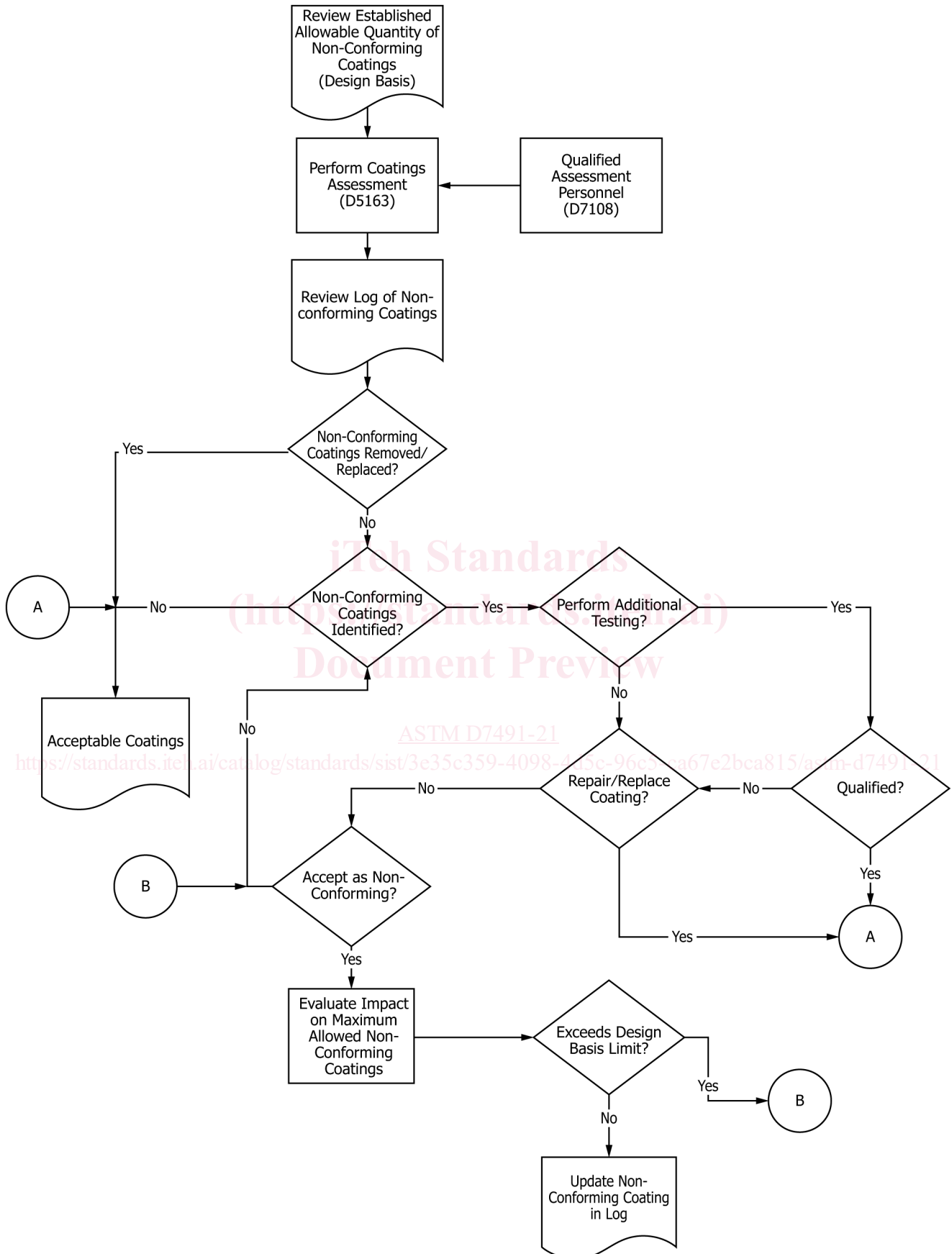


FIG. 1 Managing Non-Conforming Coatings

7.2 The amount of coating that was applied inconsistent with licensing commitments and design requirements needs to be identified.

7.3 It may also be appropriate to review procurement documents (including records of work performed) for equipment installed in containment to determine if coating applications performed off site conforms to licensing bases and design requirements.

7.4 If records cannot be found that identify the types and quantities of coatings (for example, weight or volume) installed in containment, then some area, thickness, and density estimations need to be performed.

7.5 The results of the investigation should be tabulated according to the various containment surfaces, indicating the type, quantity, location, and qualification classification of the coating applied. Photographic documentation is also helpful for reference to the findings.

7.6 The tabulation should also consider identification of the complete coating system as applied.

7.7 Periodic reassessment or establishing a new baseline should be considered.

8. Guidance on Managing Non-Conforming Coatings

8.1 Once an accounting of the amount of non-conforming coatings is determined, a decision will need to be made as to how to manage the results. It is important to know the reason a particular area of coating is non-conforming.

8.1.1 Conditions that may cause a coating to be non-conforming:

- (1) Lack of or incomplete documentation for the application process.
- (2) Lack of or incomplete documentation regarding applicator qualification.
- (3) Lack of or incomplete documentation regarding inspector qualification.
- (4) Lack of incomplete design change documentation for the use of alternate coatings.
- (5) Improper or inadequate specification of technical and quality procurement requirements for services and materials.
- (6) Improper dedication of commercial grade coatings.
- (7) Incomplete documentation for the testing used to establish conformance with the design bases.
- (8) Incomplete/inadequate specifications and procedures.
- (9) Undefined or vague personnel qualification criteria.
- (10) Degraded coatings, both qualified and unqualified.
- (11) Misapplication of a DBA qualified coating system.

8.2 *Remove, Repair, or Replace Non-Conforming Coatings:*

8.2.1 If a condition assessment reveals that the coating has physically degraded in service, the degraded coating should be removed or replaced in accordance with the coatings program as appropriate to restore that area to a qualified status.

8.2.2 Another option may be the replacement of a non-conforming coating with a qualified or an acceptable coating system.

8.3 *Mitigate the Consequences of Further Coating Degradation:*

8.3.1 To preclude the removal, repair, or replacement of non-conforming coatings, techniques may be used to mitigate the consequences of further degradation and detachment of coatings.

8.3.1.1 These measures may include construction of containment devices around the equipment coated with the non-conforming coating to prevent debris formation or transport.

8.3.1.2 The acceptable resolutions must be based on plant-specific conditions, and the impact such containment would have on the operation and maintenance of the equipment.

8.4 *Evaluate the Safety Impact of ~~Non-Conforming~~ Non-Conforming Coatings:*