

**Response to Public Comments on  
Draft Regulatory Guide (DG)-1331  
“Service Level I, II, III, and In-Scope License Renewal  
Protective Coatings Applied to Nuclear Power Plants.”**

**Proposed Revision 3 of Regulatory Guide (RG) 1.54**

On September 13, 2016, the NRC published a notice in the *Federal Register* (81 FR 62935) that Draft Regulatory Guide, DG-1331 (Proposed Revision 3 of RG 1.54), was available for public comment. The Public Comment period ended on November 14, 2016. The NRC received comments from the organizations listed below. The NRC has combined the comments and NRC staff responses in the following table.

Comments were received from the following:

Kevin Anstee (Entergy)  
Indian Point Energy Center  
450 Broadway  
Buchanan, NY 10511  
ADAMS No. ML16271A183

Jerud Hanson (NEI)  
Nuclear Energy Institute  
1201 F Street NW, Suite 1100  
Washington, DC 20004  
ADAMS No. ML16327A009

David P. Helker (Exelon)  
Exelon Generating Co.  
200 Exelon Way  
Kennett Square, PA 19348  
ADAMS No. ML16334A276

Source	Section of RG	Specific Comment	NRC Resolution
Entergy	Page 2 Applicable Regulations	Add parentheses to 10 CFR 52.157	The NRC staff agrees and has incorporated the editorial comments.
NEI - #1	Page 4, Paragraph 2, Line 2	Delete “... <i>and for wear protection during plant operation and maintenance activities.</i> ” from the sentence. It is not part of the plant’s CLB.	The NRC staff accepts this comment and has incorporated the change.
NEI - #2	Page 4, Paragraph 2 Line 5	Change “design basis event” to “design basis accident” to better align with standard industry terminology.	The NRC staff accepts this comment and has incorporated the change.
NEI - #3	Page 5, Paragraph 1 Line 3	Delete “, <i>by reference,</i> ” and “ <i>ability to be decontaminated,</i> ” from the sentence. The standard no longer addresses or references decontamination aspects.	The NRC staff disagrees with this comment. In section 5 “Coating Material Testing,” ASTM D5144-08 (2016) discusses each of the items listed in this line

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			(including decontamination), and includes references for many.
NEI - #4	Page 5 Definitions Service Level II	The definition for SL II is not accurate. The definition should be revised based on the definition contained in ASTM D4538-15.	The NRC staff disagrees with the comment. The SL II definition is consistent with previous revisions of the Reg. Guide as well as the ASTM D4538-15 definition.
NEI - #5	Page 5 Definitions Service Level II	Revise as follows: The functions of Service Level II coatings are to provide corrosion protection and enhance the <b>substrate's coating's</b> ability to be decontaminated ...  Coatings enhance the ability to decontaminate the substrate, not decontaminate the coating.	The NRC staff agrees with the comment and has made the change. The coating is meant to protect the substrate.
NEI - #6	Page 5, last paragraph, last sentence	Revise as follows: The first example is not covered by the Service Level I <b>and III</b> definition because degradation ...  The first example is not covered by either SL I or SL III definitions.	The NRC staff disagrees with this comment. The first example addresses components located within containment. Service Level III coatings are used in areas outside the reactor containment. Therefore, the statement would not be applicable to Service Level III coatings.
Exelon - #1	Page 5, last paragraph, last sentence	Exelon recommends the following bolded changes for NRC consideration: " ... The first example is not covered by the Service Level I <b>and III</b> definitions because degradation of these coatings would not adversely affect the operation of post-accident fluid systems...."	See response to NEI #6 above
NEI - #7	Page 7, Figure 1	Revise the figure as follows: Add D5144-16, D4538-15 D4277-05 (Reapproved 2012) D4228-05 (Reapproved 2012) D4286-08 (Reapproved 2015)	The NRC staff has updated the versions of the standards in figure 1.

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		<p>D6677-07 (Reapproved 2012)  D7491-08 (Reapproved 2015)  D7230-06 (Reapproved 2013)</p> <p>Delete D3359  RGs should reflect current editions of Stds.</p> <p>Delete D3359 because the tape is no longer manufactured so the Std. is unusable.</p> <p>Add D7230-06 (Reapproved 2013) to first column because it is part of D5144 now.</p>	<p>The NRC staff agrees with adding D7230-06 (2013).</p> <p>The staff does not agree with deleting D3359. ASTM D3359-09e2 is cited on the ASTM International website as an active standard. Note 4 of this standard states that, “[a]lternative tapes with specifications similar to that of Permacal P99 tape are available. Users of alternative tapes should check whether the alternative tapes give comparable results to the Permacal P99 tape.”</p>
Exelon - #2	Page 7 Figure 1	<p>Exelon recommends the following changes to the flowchart for NRC consideration:  Revise</p> <ul style="list-style-type: none"> <li>• D5144-16 (recently reapproved/revised)</li> <li>• D4538-15</li> <li>• D4227-05 (Reapproved 2012)</li> <li>• D4228-05 (Reapproved 2012)</li> <li>• D4286-08 (Reapproved 2015)</li> <li>• D6677-07 (Reapproved 2012)</li> <li>• D7491-08 (Reapproved 2015)</li> </ul> <p>Delete</p> <ul style="list-style-type: none"> <li>• D3359</li> </ul> <p>Add</p> <ul style="list-style-type: none"> <li>• D7230-06 (Reapproved 2013) to first column of flowchart</li> </ul> <p>The RG should reflect current editions of standards, addition of newly developed standards, and deletion of standards that are no longer a part of</p>	See response to NEI #7 above

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		ASTM. Therefore, Exelon suggests deleting D3359, as the tape referenced by the standard is no longer manufactured and renders the standard unusable. With regard to ASTM D7230, this is now part of ASTM D5144 and should be added.	
NEI - #8	Page 7, Figure 1	Delay release of RG 1.54, Rev. 3 until these 3 ASTM standards are published and approved for use by the NRC: D3843-00 (2008), D3911-08, and D5163-08.	The NRC staff agrees with this comment. The 2016 versions have been incorporated.
NEI - #9	Page 7, Figure 1	Delete ASTM D3359-09e2. The tape referenced is no longer available and renders the standard unusable.	This comment is a duplicate of part of comment NEI - #7.
NEI - #10	Page 7, Figure 1	Add ASTM D7230 under QA practices.	This comment is a duplicate of part of comment NEI - #7.
Entergy	Page 7, Figure 1	Center text within box for ASTM D 3843-00	The NRC staff agrees and has incorporated the editorial comments.
Entergy	Page 7, Figure 1	Add e-1 to ASTM D 4541-09	The NRC staff agrees and has incorporated the editorial comments.
Entergy	Page 7, Figure 1	Add (Reapproved 2015) to ASTM D 7491-08	The NRC staff agrees and has incorporated the editorial comments.
Entergy	Page 7, Figure 1	Consider adding ASTM D 7230-06 (Reapproved 2013) "Evaluating Polymeric Lining Systems for Water Immersion" in Coating Service Level III Safety-Related Applications on Metal Substrates.	Agree
NEI - #11a	Page 8, Section C.2.1, Line 3	Replace ASTM D3843-00 with ASTM D3843-16 which is to be published soon. It will be a complete replacement to ANSI N101.4.	The NRC staff agrees with this comment. The 2016 versions have been incorporated.
NEI - #11b	Page 8, Section C.2.1, Line 3	Revise as follows: Service Level II coatings as defined above are not safety related, but they are <b>qualified by testing approved</b> for their particular application <b>by the manufacturer</b> .	The NRC staff accepts this comment and has incorporated the change.

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Source	Section of RG	Specific Comment	NRC Resolution
Entergy	Page 8, Section C.2.2	Revise as follows: “The ASTM International <b>approved</b> and issued ASTM D 3911-95, “Standard Test Method for Evaluating Coatings ...”  ASTM D 3911-95 was first issued in 1980.	The addition of the word “approved” is unnecessary. The NRC staff deleted the word “and” so the sentence reads as follows: “The ASTM International issued ASTM D 3911-95, “Standard ...”  The NRC staff agrees that D3911 was first issued in 1980 but the information is not germane to the guide. Thus, no change was made to the RG.
Entergy	PAGE 8, Section C.2.2	ASTM D 3911-08 was first issued in 2003.	The NRC staff agrees. However, no change was made to the RG.
Entergy	Page 10, Section C.3.1	Suggest deleting the words “ <b>the inspection</b> ” from the sentence ... “This standard provides guidance on <b>the inspection of</b> the education, training, experience, qualifications, and certification of Service Level I, II, and III coatings inspectors.	The NRC staff accepts this comment and has incorporated the change. The standard presents guidance on qualifications/ certifications for the inspectors.
NEI - #12	Page 11, Section C.4.1.d Line 3	Revise as follows: “Although the ASTM D 5163-08 standard reasonably ensures that qualified coatings left in service after a visual inspection will remain adhered to their substrates under accident conditions, it <b>does may</b> not guarantee that visual inspection will detect all degraded coatings.”  Studies/OE have not to date determined that visual inspections will not detect degraded coatings when performed. Changing “does not” to “may not” leaves room for the possibility.	The NRC staff disagrees with the proposed edit. See discussion in response to NEI #20.
NEI - #13	Page 11, Section C.4.3	Delete entire section. Tape referenced in D3359-09 is no longer available. Thus the standard is no longer useable.	This is a duplicate to part of NEI - #7

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Entergy	Page 12, Section C.5.1	Add “TR-” in front of EPRI technical report numbers in the first sentence of section C.5.1.	The NRC staff agrees and has incorporated the editorial comments.
NEI - #14	Page 17, Reference 31	Delete reference to D3359. Tape is no longer available and standard is no longer usable. Comment above (NEI - #13) eliminates the need for this reference.	This is a duplicate to part of NEI - #7 and a duplicate of NEI - #13
NEI - #15	Entire Document	Reference to current standards will result in additional changes throughout the documents including references. The new standards would also potentially result in revisions to NRC guidance contained in Part C of this regulatory guide.	The standards have been updated throughout the RG.
NEI - #16	Entire Document	<p>The intent of the following comment is to address the generic observation that this draft RG appears to represent a shift in the reliance upon destructive examination techniques and methods, with respect to coating evaluations, as opposed to reliance and acceptance of visual inspections. It is requested that the following comment be generically considered, as it summarizes what was done in order to previously obtain USNRC formal written agreement that visual precursors can be acceptably used to predict coating degradation. In 2006, Licensees typically followed ASTM D5163-05a, "Standard Guide Document for Establishing Procedures to Monitor the Performance of Coating Service Level I Coatings in an Operating Nuclear Power Plant", as a guideline to conduct containment coatings condition assessment activities. ASTM 05163 had been endorsed by the U.S. Nuclear Regulatory Commission (USNRC) in Regulatory Guide (RG) 1.54 Revs.1 and 2 and NUREG 1801 (the GALL Report). ASTM 05163 is predicated around the fact that OBA-qualified reactor containment coatings will exhibit "visual precursors" prior to failure. These visual precursors can be identified by trained condition assessment personnel.</p> <p>To validate the visual precursor prior to failure concept, Electric Power Research Institute (EPRI), the Nuclear Utilities Coating Council (NUCC), and ASTM Committee D33 needed to select a measurable physical property of OBA-qualified coatings which could be measured on visually</p>	See discussion in response to NEI #19.

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		<p>intact reactor containment protective coatings at commercial nuclear power plants. The coating property selected was pull-off adhesion testing</p> <p>EPRI and NUCC conducted a project entitled, "Evaluation of Coating Failures and the Potential Influence of Aging." Task 3 of the project involved adhesion testing of visually intact, Design Basis Accident (DBA) qualified coatings on concrete and steel. Per ANSI N5.12-1974, Section 6.4, which requires "that containment coatings exhibit 200 lbs. minimum adhesion when measured using an Elcometer adhesion tester".</p>	
NEI - #17		<p>The pull-off adhesion testing was performed at four operating Document commercial nuclear power plants, each with different protective coating systems on the reactor containment SSC's.</p> <p>The procedure performed at each unit was as follows: ·</p> <ol style="list-style-type: none"> <li>1. Perform a documentation review at each volunteer plant to identify areas of DBA-qualified/acceptable coatings on steel and concrete substrates.</li> <li>2. Perform a general visual inspection of selected areas of DBA-qualified/acceptable coatings on steel and concrete substrates according to ASTM D5163~05a. Coated test areas include visually sound coatings and visually sound coatings adjacent to visually degraded coatings.</li> <li>3. Document each selected test area (including photography).</li> <li>4. At each test area, perform all of the following:             <ol style="list-style-type: none"> <li>a. Dry film thickness testing as stated in SSPC-PA 2, ASTM D4138-94 (re-approved 2000), and/or ASTM D6132-04 as appropriate</li> <li>b. Adhesion testing according to ASTM D4541-02</li> <li>c. Adhesion testing according to ASTM D6677-01</li> </ol> </li> </ol>	See discussion in response to NEI #19.

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NEI - #18	General Comment	<p>The results of the test program were provided to industry and USNRC in EPRI Report 1014883. After completion of testing at all four volunteer plants, the following conclusions were reached by USNRC and documented in "NRC Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Coatings Evaluation" (ML080230462): "In a letter to the Nuclear Energy Institute dated January 16, 2006 (ADAMS Accession Number ML053470467), the NRC staff expressed concerns regarding the adequacy of the current industry method for assessment of qualified coatings within containment. The staff specifically questioned the adequacy of visual assessment to verify the condition of qualified coatings. In response to the staff concerns, EPRI sponsored a project (see EPRI Report No. 1014883 July 2007) to collect coating adhesion data for coating systems applied in the containments of operating U.S. nuclear power plants to provide confirmatory support for coating inspection methods that rely upon visual inspection as an initial step. The staff has reviewed this report and determined that it provides adequate supporting evidence that the containment coatings monitoring approach contained in ASTM 05163, as implemented by licensees, and endorsed by USNRC in Regulatory Guide 1.54, Rev.1, and NUREG 1801, Vol. 2, Appendix XI.SB; is valid.</p> <p>Licensees may reference the EPRI coatings adhesion testing program as confirmation of the validity of their coatings assessment program. In addition, licensees may choose to provide a discussion of other activities in which they have participated in to support their coatings program. Such activities may include the EPRI Coatings Aging Task Group, the EPRI survey of coating failure operating experience, physical testing performed by the licensee, and plant operating experience with coating performance."</p>	See discussion in response to NEI #19.
NEI - #19	General Comment	The formal approval by USNRC of the use of visual assessment of coatings, as defined in ASTM D5163, is clearly defined. Suggesting now in the draft revision to RG 1.54 Rev. 3 that Licensees include undefined extra coatings debris margin for undefined conservatism is technically unsupported at such time.	The NRC does not agree with the multiple comments about ASTM 5163 and visual assessment, the industry objects to the staff recommendation that margins be



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			<p>incorporated in the strainer blockage analysis in order to account for any degraded coatings that are not identified during visual inspection. This staff recommendation was incorporated in Rev 2 of the Reg Guide and remains valid. It is not reasonable to assume that 100% of degraded coatings would be identified during a routine inspection via ASTM 5163. Therefore, the staff finds that it is a best practice for licensees to allow some margin in their analysis to account for any degraded coatings that are not already included in the debris calculations.</p>
Exelon - #1	General Comment	<p>Exelon believes that reference to the proposed American Society for Testing and Materials (ASTM) standards will result in additional changes throughout the document including other references. The new standards being proposed may also potentially result in revisions to NRC guidance described in Section C, "Staff Regulatory Guidance," of the draft RG. The intent of the following comment is to address the generic observation that this draft RG appears to represent a shift in the reliance upon destructive examination techniques and methods, with respect to coating evaluations, as opposed to reliance and acceptance of visual inspections. Exelon requests that the following comment be generically considered, as it summarizes what has been done in order to previously obtain NRC formal written agreement that visual precursors can be acceptably used to predict coating degradation.</p>	<p>See discussion in response to NEI #19.</p>

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Source	Section of RG	Specific Comment	NRC Resolution
		<p>In 2006, licensees typically followed the guidance in ASTM D5163-05a, "Standard Guide for Establishing Procedures to Monitor the Performance of Coating Service Level I Coatings in an Operating Nuclear Power Plant," to conduct containment coatings condition assessment activities. ASTM D5163 had been endorsed by the NRG in RG 1.54, Revisions 1 and 2, and NUREG-1801, "Generic Aging Lessons Learned (GALL) Report." ASTM D5163 is predicated around the fact that Design Basis Accident (OBA) qualified reactor containment coatings will exhibit "visual precursors" prior to failure. These visual precursors can be identified by trained condition assessment personnel.</p> <p>To validate the visual precursor prior to failure concept, the Electric Power Research Institute (EPRI), the Nuclear Utilities Coating Council (NUCC), and ASTM Committee D33 needed to select a measurable physical property of OBA-qualified coatings which could be measured on visually-intact reactor containment protective coatings at commercial NPPs. The coating property selected was pull-off adhesion testing.</p> <p>EPRI and NUCC conducted a project entitled, "Evaluation of Coating Failures and the Potential Influence of Aging." Task 3 of the project involved adhesion testing of visually intact, OBA-qualified coatings on concrete and steel. ANSI N5.12-197 4, Section 6.4 requires "that containment coatings exhibit 200 lbs. minimum adhesion when measured using an Elcometer adhesion tester."</p> <p>The pull-off adhesion testing was performed at four operating commercial NPP units, each with different protective coating systems on the reactor containment Structures, Systems, and Components (SSCs).</p> <p>The procedure performed 'at each unit was as follows:</p> <ul style="list-style-type: none"> <li>• Perform a documentation review at each volunteer plant to identify areas of DBA-qualified/acceptable coatings on steel and concrete substrates.</li> </ul>	

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		<ul style="list-style-type: none"> <li>• Perform a general visual inspection of selected areas of OBA-qualified/acceptable coatings on steel and concrete substrates according to ASTM D5163-05a. Coated test areas include visually sound coatings and visually sound coatings adjacent to visually degraded coatings.</li> <li>• Document each selected test area (including photography).</li> <li>• At each test area, perform all of the following:               <ul style="list-style-type: none"> <li>○ Dry film thickness testing as stated in SSPC-PA 2, ASTM 04138-94 (reapproved 2000), and/or ASTM 06132-04 as appropriate.</li> <li>○ Adhesion testing according to ASTM 04541-02</li> <li>○ Adhesion testing according to ASTM 06677-01</li> </ul> </li> </ul> <p>The results of the test program were provided to the industry and NRC in EPRI Report 1014883.</p> <p>After completion of testing at all four volunteer plants, the following conclusions were reached by the NRC and documented in a document entitled "NRG Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Coatings Evaluation" (ML080230462), in which the following discussion was provided (Page 2, Item 2):</p> <p>... In a letter to the Nuclear Energy Institute dated January 16, 2006 (ADAMS Accession Number ML053470467), the NRC staff expressed concerns regarding the adequacy of the current industry method for assessment of qualified coatings within containment. The staff specifically questioned the adequacy of visual assessment to verify the condition of qualified coatings. In response to the staff concerns, EPRI sponsored a project (see EPRI Report No. 1014883 July 2007) to collect coating adhesion data for coating systems applied in the containments of operating U.S. nuclear power plants to provide confirmatory support for coating inspection methods that rely upon visual inspection as an initial step. The staff has reviewed this report and determined that it provides adequate supporting evidence that the containment coatings monitoring approach contained in ASTM 05163, as implemented by licensees, and endorsed by USNRC in Regulatory Guide 1.54, Rev.1, and NUREG</p>	

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		<p>1801, Vol. 2, Appendix XI.SB, is valid. Licensees may reference the EPRI coatings adhesion testing program as confirmation of the validity of their coatings assessment program. In addition, licensees may choose to provide a discussion of other activities in which they have participated in to support their coatings program. Such activities may include the EPRI Coatings Aging Task Group, the EPRI survey of coating failure operating experience, physical testing performed by the licensee, and plant operating experience with coating performance.” Exelon believes that the formal acceptance by the NRC of the use of visual assessment of coatings, as discussed in ASTM D5163, is clearly defined. Therefore, the suggestion in the draft RG that licensees include undefined extra coatings debris margin for undefined conservatism is considered by Exelon to be technically unsupported at this point.</p>	
Exelon #2	Page 8, Section 2.1	<p>Exelon recommends the-following strikethrough/bolded changes for NRC consideration:  <i>"ASTM D 3843-1600 (reapproved 2008), "Standard Practice for Quality Assurance for Protective Coatings Applied to Nuclear Facilities" (Ref. 16). The ASTM International approved and issued ASTM International Standard D 3843-1600 as a <del>partial</del><b>complete</b> replacement for ANSI N101.4-1972. ASTM D 3843-1600 provides QA practices that are acceptable to NRG staff and are applicable to safety related protective coating work in coating Service Level I areas of nuclear facilities. Service Level II coatings as defined above are not safety related, but they are <del>qualified</del><b>approved</b> by testing for their particular application by the manufacturer. Licensees and applicants may use applicable portions of the QA practices described in ASTM D 3843-1600 as the basis for limited QA for protective coating work in coating Service Level II areas of nuclear facilities. "</i></p> <p>The forthcoming ASTM committee revision of 03843 (16) was made to eliminate the "partial" replacement qualifier that the RG has applied in the past and is now a complete replacement to ANSI N101.4 and should be reflected here. In addition, Service Level II coatings are not required to be tested for their applications as they are non-safety related coatings. The</p>	<p>The NRC staff accepts this comment and has updated the standard throughout. The NRC staff removed the word “partial” and replaced the word “qualified” with “approved” in order to address a previous comment.</p>

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Source	Section of RG	Specific Comment	NRC Resolution
		coatings are evaluated by Engineering to be suitable for their intended application.	
Exelon #3	Page 11, Section 4.1.d	Exelon recommends the following strikethrough/bolded changes for NRC consideration: <i>"Although the ASTM D 5163-08 standard reasonably ensures that qualified coatings left in service after a visual inspection will remain adhered to their substrates under accident conditions, it <del>does</del> <b>may</b> not guarantee that visual inspection will detect all degraded coatings .... "</i> To date, studies and operating experience have not definitively determined that visual inspections will not detect degraded coatings when performed. However, using the word "may" in the sentence provides the opportunity for some flexibility related to visual inspection in detecting degraded coatings.	See discussion in response to NEI #19.
Exelon #4	Page 17, Reference 31	Exelon recommends deleting the reference to D3359, since tape referenced in this standard is no longer available and this standard would no longer be usable.	See the response to NEI #7.