

Vogle PEmails

From: Hoellman, Jordan
Sent: Friday, August 25, 2017 11:10 AM
To: Vogle PEmails
Subject: Technical Justification Handout for LAR-193, Raceway/Cable Separation Criteria Changes
Attachments: 2017-08-31 Technical Justification Handout for LAR-193, Raceway Cable Separation Criteria Changes.pdf

Please see the attached Technical Justification Handout for the 8/31/17 pre-submittal public meeting on LAR-193 "Raceway/Cable Separation Criteria Changes".

Hearing Identifier: Vogtle_COL_Docs_Public
Email Number: 145

Mail Envelope Properties (701d5001e8554cdfa5a735222cd3be63)

Subject: Technical Justification Handout for LAR-193, Raceway/Cable Separation Criteria Changes
Sent Date: 8/25/2017 11:09:46 AM
Received Date: 8/25/2017 11:09:47 AM
From: Hoellman, Jordan

Created By: Jordan.Hoellman2@nrc.gov

Recipients:
"Vogtle PEmails" <Vogtle.PEmails@nrc.gov>
Tracking Status: None

Post Office: HQPWMSMRS03.nrc.gov

Files	Size	Date & Time
MESSAGE	163	8/25/2017 11:09:47 AM
2017-08-31 Technical Justification Handout for LAR-193, Raceway Cable Separation Criteria Changes.pdf	124914	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Westinghouse LAR 193, Raceway/Cable Separation Distances Pre-Submittal Meeting Handout for August 31, 2017 Proposed Licensing Basis Changes (DRAFT)

Table 1

#	Proposed Licensing Basis Change	Reason for Change	Technical Evaluation
1a	<p>The IEEE 384 exceptions list in UFSAR Subsection 8.3.2.4.2 is reformatted to include a separate comprehensive exception statement for each area.</p> <p>This includes adding a clarification to Table 3.3-6 ITAAC No. 3.3.00.07d.i to refer to the main control room and remote shutdown room as nonhazard areas. Specifically, the phrase “non-hazard area” is added in parentheses after referencing the main control room and remote shutdown room in the ITAAC.</p>	<p>In some instances, it is not clear which exceptions apply to which plant areas (i.e., nonhazard area, limited hazard area, or hazard area) in UFSAR Subsection 8.3.2.4.2. Therefore, the list of exceptions needs to be reformatted to include a separate comprehensive exception statement for each area.</p>	<p>Reformatting the list of exceptions in UFSAR Subsection 8.3.2.4.2 is an administrative change. Clarifying that the main control room and remote shutdown room are nonhazard areas in COL Appendix C Table 3.3-6 ITAAC No. 3.3.00.07d.i is a consistency change to make it align with the UFSAR Subsection 8.3.2.4.2. This activity does not represent a change of content to the information presented in the UFSAR.</p>
1b	<p>Statements are added to the UFSAR to explicitly state that the given IEEE 384 exceptions in UFSAR Subsection 8.3.2.4.2 are only applicable to low voltage power cables and below. The associated ITAAC (i.e., COL Appendix C Table 3.3-6 ITAAC Nos. 3.3.00.07d.i and d.ii) are also revised to clarify, where needed, that the exception is limited to these cables only.</p>	<p>The applicability of the current list of exceptions in UFSAR Subsection 8.3.2.4.2 to a given voltage level of the circuit is ambiguous in some instances. The list of exceptions is not applicable to anything greater than low voltage power cables, because the tests in which the exceptions are based on were only performed using low voltage power cables. Therefore, this fact needs to be explicitly noted.</p>	<p>The tests on which the exceptions are based (Reference 13 in Subsection 8.3.4) were only performed using low voltage power cables and below. Therefore, this clarification is consistent with the referenced tests which justify the exceptions. This clarification will avoid the human error trap of applying these exceptions to configurations involving circuits with greater than low voltage. This is a clarification only. This activity does not represent a change to the exceptions taken to IEEE 384.</p>
1c	<p>Definitions for “open configuration,” “closed configuration,” and “closed raceway” are added to UFSAR Subsection 8.3.2.4.2.</p>	<p>Definitions for “open configuration,” “closed configuration,” and “closed raceway” to UFSAR Subsection 8.3.2.4.2 provide clarity for which exceptions can be used for a given configuration.</p>	<p>The terms are used in UFSAR Subsection 8.3.2.4.2 in a way that is consistent with the minimum separation distance recommendations in Reference 13 in Subsection 8.3.4, and they do not contradict how IEEE 384-1981 uses these terms.</p>

#	Proposed Licensing Basis Change	Reason for Change	Technical Evaluation
1d	The phrase "horizontal and" is deleted from COL Appendix C Table 3.3-6 ITAAC No 3.3.00.07.d.i, item 2.	COL Appendix C Table 3.3-6 ITAAC No. 3.3.00.07.d.i item 2 contains a horizontal separation distance for a configuration involving an enclosed raceway directly below an open raceway that duplicates the minimum required horizontal distance covered for this case in items 1) and 3) of this ITAAC.	This activity does not represent a change in separation requirement. The minimum required horizontal distance is already covered in items 1) and 3) of this ITAAC.
2	Additional exceptions for minimum required separation distances are provided in UFSAR Subsection 8.3.2.4.2 and the associated ITAAC.	Reference 13 in Subsection 8.3.4 documents tests and analyses performed for additional configurations, with additional recommendations for lesser separation distances, in addition to the exceptions currently included in UFSAR Subsection 8.3.2.4.2 and the associated ITAAC. Therefore, additional exceptions to the minimum separation distances in IEEE 384-1981 are possible. These additional exceptions reduce the amount of barriers needed between circuits and relieve unnecessary burden during in installation.	See Table 2 for Technical Evaluation of each of the additional exceptions and revised ITAAC.

#	Proposed Licensing Basis Change	Reason for Change	Technical Evaluation
3	<p>There are clarifications and changes made to the minimum separation distance requirements for hazards areas, as documented in UFSAR Subsection 8.3.2.4.2 and the associated ITAAC:</p> <ul style="list-style-type: none"> • COL Appendix C Table 3.3-6 ITAAC No. 3.3.00.07d.ii.a is revised to refer to containment as a hazard area, instead of a limited hazard area. • COL Appendix C Table 3.3-6 ITAAC No. 3.3.00.07d.ii.a is changed to clarify that limited hazard area separation distances apply in hazard areas only between non-Class 1E cables and Class 1E divisions. UFSAR Subsection 8.3.2.4.3 is also updated to make this change. 	<p>Containment is a hazard area but is not currently identified as such. Therefore, COL Appendix C Table 3.3-6 ITAAC No. 3.3.00.07d.ii.a, which refers to containment as a limited hazard area, needs to be revised.</p> <p>COL Appendix C Table 3.3-6 ITAAC No. 3.3.00.07d.ii.a gives the required separation distances between non-Class 1E cables and Class 1E divisional cables, and the required separation between Class 1E divisional cables inside containment (a hazard area). The IEEE 384 exceptions listed in this ITAAC for containment are identical to the exceptions applicable to limited hazard areas. However, safety-related divisions have unique separation requirements for hazard areas and the minimum separation distances in hazard areas provide additional protection against an external hazard from impacting redundant safety-related divisions. Therefore, the limited hazard area exceptions to the IEEE 384 separation requirements can be appropriately applied between nonsafety-related cables and safety-related divisions, but they should not be applied between safety-related divisions. Therefore, the ITAAC is revised to only permit the limited hazard area exceptions in hazard areas between non-Class 1E cables and Class 1E divisions.</p> <p>In addition, Tier 2 information is revised to accurately reflect the applicability of IEEE 384 exceptions in hazard areas and make COL Appendix C (and the corresponding plant-specific Tier 1 information) and Tier 2 information consistent.</p>	<p>The components inside containment meet the IEEE 384 definition of a hazard area.</p> <p>UFSAR Subsection 8.3.2.4.3, which discusses hazard area protection using raceway separation, refers to UFSAR Section 3.5 and Section 3.6. UFSAR Subsection 3.5.1.2.1.4 discusses the missile hazards and UFSAR Subsection 3.6.1 discusses piping hazards inside containment. Specific examples of external hazards inside containment include the high energy pipes in the reactor coolant system and potential missile sources of the containment air recirculation system fans.</p> <p>Hazard areas are also subject to certain external hazards. Per UFSAR Subsection 8.3.2.4.3, hazard area separation distances are given to prevent an external hazard from impacting redundant systems. Where redundant circuits, devices, or equipment (different separation groups) are exposed to the same external hazards, predetermined spatial separation is provided. This requirement is not necessary between safety-related and nonsafety-related circuits because they do not perform redundant safety-related functions to safely shutdown the plant.</p> <p>UFSAR Section 3.5 discusses missile protection. Per UFSAR Section 3.5, a missile must not damage structures, systems, or components to the extent that could prevent achieving or maintaining safe shutdown of the plant or result in a significant release of radioactivity. However, per UFSAR Section 3.5, safe shutdown is accomplished using only safety-related systems, although nonsafety-related systems not affected by the missile are available to support safe shutdown. Therefore, applying this exception between safety-related divisions and nonsafety-related cables would not impact the ability to achieve safe shutdown.</p> <p>UFSAR Section 3.6 discusses protection against pipe ruptures. Per UFSAR Section 3.6, in the event of a high-energy or moderate-energy pipe failure within the plant, adequate protection is provided so that essential structures, systems, or components are not impacted by the adverse effects of postulated piping failure. Essential systems and components are those required to shut down the reactor and mitigate the consequences of the postulated piping failure.</p>

#	Proposed Licensing Basis Change	Reason for Change	Technical Evaluation
4	<p>The paragraph introducing the IEEE 384-1981 exceptions in UFSAR Subsection 8.3.2.4.2 is revised to make the exceptions applicable between safety-related groups.</p>	<p>The paragraph introducing the IEEE 384-1981 exceptions in UFSAR Subsection 8.3.2.4.2 restricts the applicability of the exceptions. As currently worded, the exceptions only apply between nonsafety-related raceways and safety-related divisions. However, these exceptions are also applicable between safety-related divisions (except in a hazard areas, as discussed in Change 3), and thus, are revised to be consistent with the existing ITAAC applicability..</p>	<p>COL Appendix C Table 3.3-6 ITAAC Nos. 3.3.00.07d.i and 3.3.00.07d.ii already permit the exceptions to be applied between Class 1E divisions. Furthermore, the tests and analysis in which these exception allowances based do not limit the reduced separation allowances to between nonsafety-related cables and safety-related divisions.</p> <p>The current Tier 2 text, which restricts applicability to between non-Class 1E cables and Class 1E divisions, is not consistent with COL Appendix C (plant-specific Tier 1). Making the listed exceptions applicable between Class 1E divisions is consistent with COL Appendix C Table 3.3-6 ITAAC Nos. 3.3.00.07d.i and 3.3.00.07d.ii. Per 10 CFR Part 52, "if there is a conflict between Tier 1 and Tier 2 of a DCD, then Tier 1 controls." Furthermore, the separation distance requirements included in IEEE 384-1981 are applicable between non-Class 1E cables and Class 1E divisions, and between Class 1E divisions. The current exceptions are based on testing and analysis (i.e., Reference 13 of UFSAR Subsection 8.3.4) that does not restrict their applicability in this manner. The recommendations for lesser separation distances are based on the tests conducted which showed that a failure in a given circuit did not adversely impact a given target circuit. The recommendations are not based on the safety classification of the circuits.</p>

Table 2

#	Applicable Area	Configuration	New Exception for Given Configuration(s)	Technical Evaluation	Licensing Basis Change
2a	Nonhazard	i. Open to closed configurations with low voltage power cables*	<p>i. The minimum vertical separation is 3 inches and the minimum horizontal separation is 1 inch.</p>	<p><u>For configuration "1"</u> This configuration was tested and analyzed, as shown below, to support the expansion of this exception:</p> <ul style="list-style-type: none"> • Conduit to Cable Tray (Page 592 of Reference 13 in Subsection 8.3.4) - Recommendation 3 recommends a minimum vertical separation of 3 inches and a minimum horizontal separation of 1 inch for nonhazard areas between open cable trays and conduits. • Conduit to Cable In Free Air (Page 598 of Reference 13 in Subsection 8.3.4) - Recommendations 1A, 1C, and 2 recommend a minimum vertical separation of 3 inches and a minimum horizontal separation of 1 inch for nonhazard areas between conduits and cables in free air. <p>Configurations involving an open cable tray and an enclosed cable tray are bounded by configurations only involving open cable trays, because there is added protection provided by the enclosed cable tray. Therefore, expanding the exception to configurations involving an open cable tray and an enclosed cable tray is consistent with the current exception.</p>	<p>i. This change represented in the first bullet under the Non-hazard area exceptions in UFSAR Subsection 8.3.2.4.2 and COL Table 3.3-6 ITAAC No. 3.3.00.07d.i, item 1).</p>

#	Applicable Area	Configuration	New Exception for Given Configuration(s)	Technical Evaluation	Licensing Basis Change
2a	Nonhazard	ii. Open to open configurations, and open to closed configurations with instrumentation and control cables*	<p>ii. The minimum vertical separation is 1 inch and the minimum horizontal separation is 1 inch for both configurations.</p> <p>The current exception in UFSAR Subsection 8.3.2.4.2 gives a minimum vertical and horizontal separation distance of 3 inches and 1 inch, respectively (see first bullet in UFSAR Subsection 8.3.2.4.2). This change applies this exception to additional open configurations, and between open and closed configurations.</p> <p>Furthermore, it reduces the vertical separation distance to 1 inch for configurations involving exclusively instrumentation and control cables.</p>	<p><u>For configuration "ii"</u></p> <p>This configuration was tested and analyzed, as shown below, to support the expansion of this exception:</p> <ul style="list-style-type: none"> Free Air Cables (Page 600 of Reference 13 in Subsection 8.3.4) – Recommendation 2 recommends a minimum vertical separation of 1 inch and a minimum horizontal separation of 1 inch between instrumentation and control cables in free air. <p>Configurations involving an open configuration and closed configuration are bounded by configuration involving open configurations because there is additional protection provided by the enclosed raceway. Therefore expanding the exceptions to configurations involving an enclosed to open configurations based on the tests made on free air cables is consistent.</p>	<p>ii. This change represented in the second bullet under the Non-hazard area exceptions in UFSAR Subsection 8.3.2.4.2 and COL Table 3.3-6 ITAAC No. 3.3.00.07d.i, item 4).</p>

#	Applicable Area	Configuration	New Exception for Given Configuration(s)	Technical Evaluation	Licensing Basis Change
2b	Limited Hazard	<p>i. Configurations involving low-voltage power cables for cables sizes less than or equal to 2/0 AWG.*</p> <p>ii. Conduit above and crossing an open tray at an angle equal to or greater than 45 degrees for cables sizes less than or equal to 2/0 AWG.</p>	<p>i. The minimum vertical separation is 12 inches and the minimum horizontal separation is 6 inches</p> <p>ii. The minimum vertical separation is 3 inches.</p> <p>The current exception gives a minimum vertical separation of 12 inches and a minimum horizontal separation of 6 inches for open top cable trays that involve low voltage power cables for cables sizes less than or equal to 2/0 AWG (see second bullet in UFSAR Subsection 8.3.2.4.2). This exception is expanded to additional configurations. Specifically, this expansion of the exception includes free-air cables, and configurations involving enclosed raceway and open configurations. In addition, the minimum vertical distance is reduced to 3 inches for configurations with a conduit above and crossing the open tray at an angle equal to or greater than 45 degrees.</p>	<p>Reference 13 in Subsection 8.3.4 tests and analyzes the separation distance for various configurations, as shown below, to support the expansion of this exception:</p> <ul style="list-style-type: none"> • Cable Tray to Cable in Free Air (Reference 13 in Subsection 8.3.4 Page 590) ○ Recommendation 2A recommends a horizontal separation of 6 inches between an open tray and a free air cable. This recommendation is applicable to limited hazard areas with cable sizes less than or equal to 2/0 AWG. ○ Recommendation 2B recommends a vertical separation of 12 inches between an open tray and a free air cable. This recommendation is applicable to limited hazard areas with cable sizes less than or equal to 2/0 AWG. • Conduit to Cable Tray (Reference 13 in Subsection 8.3.4 Page 592) ○ Recommendation 2A recommends a horizontal separation of 6 inches between a conduit and an open cable tray. ○ Recommendation 2B recommends a vertical separation of 12 inches between a conduit and an open cable tray where the conduit is above and parallel with the cable tray or crossing at an angle less than 45°. For a conduit and an open cable tray where the conduit is above and crossing at an angle equal to or greater than 45° a vertical separation of 3 inches is recommended • Cables in Free Air (Reference 13 in Subsection 8.3.4 Page 599) – Recommendation 1 states that the separation criteria for power cables in free air in a limited hazard area should be identical to the separation criteria for the open tray to open tray configuration. Therefore, since the current licensing basis allows for a minimum vertical separation of 12 inches and a minimum horizontal separation of 6 inches of open cable trays, this same exception is applicable to free-air cables. 	<p>This change is represented in the second bullet under the limited hazard area exceptions in UFSAR Subsection 8.3.2.4.2 and COL Table 3.3-6 ITAAC No. 3.3.00.07d.ii.a/b/c item 2).</p>

#	Applicable Area	Configuration	New Exception for Given Configuration(s)	Technical Evaluation	Licensing Basis Change
2c	Limited Hazard	<p>i. Conduit and open configurations with low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil.*</p> <p>ii. Conduit above and crossing an open tray at an angle equal to or greater than 45 degrees for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil.</p>	<p>i. The minimum vertical separation is 12 inches and the minimum horizontal separation is 6 inches</p> <p>ii. The minimum vertical separation is 3 inches.</p> <p>These configurations are not explicitly addressed in the current IEEE 384 exceptions listed in UFSAR Subsection 8.3.2.4.2.</p>	<p>The minimum vertical separation is 12 inches, and the minimum horizontal separation is 6" between a conduit and an open configuration for low-voltage power cables greater than 2/0 AWG but not greater than 750 kcmil.</p> <p>The vertical distance is reduced to 3" if the conduit is above and crossing an open tray at an angle equal to or greater than 45 degrees.</p> <p>Unlike Change 2b.i above, this change allows for a minimum vertical separation of 12 inches and a minimum horizontal separation of 6" for configurations involving cables greater than 2/0 AWG (but less than 750 kcmil). To take this exception, the configuration must be between a conduit and an open configuration only. This configuration was tested in Reference 13 in Subsection 8.3.4, as follows:</p> <ul style="list-style-type: none"> • Conduit to Cable Tray (Reference 13 in Subsection 8.3.4 Page 592) <ul style="list-style-type: none"> ○ Recommendation 2A recommends a horizontal separation of 6 inches between a conduit and an open cable tray. ○ Recommendation 2B recommends a vertical separation of 12 inches between a conduit and an open cable tray where the conduit is above and parallel with the cable tray or crossing at an angle less than 45°. For a conduit and an open cable tray where the conduit is above and crossing at an angle equal to or greater than 45° a vertical separation of 3 inches is recommended. <p>As is shown in the discussion related to this test, the range of cable sizes used was 12 AWG to 750 kcmil.</p>	<p>This change is represented in the third bullet under the limited hazard area exceptions in UFSAR Subsection 8.3.2.4.2 and COL Table 3.3-6 ITAAC No. 3.3.00.07d.ii.a/b/c item 3).</p>

#	Applicable Area	Configuration	New Exception for Given Configuration(s)	Technical Evaluation	Licensing Basis Change
2d	Limited Hazard	<p>Conduit routing nonsafety-related circuits and a free-air safety-related circuit routing low voltage power cables.*</p> <p>The conduit and free-air cables are in one of the following configurations:</p> <ul style="list-style-type: none"> i. Vertical parallel ii. 90 degree horizontal crossing iii. Parallel horizontal configurations 	<ul style="list-style-type: none"> i. The minimum horizontal separation is 1 inch ii. The minimum vertical and horizontal separation is 1 inch iii. The minimum horizontal configuration is 1 inch <p>These configurations are not explicitly addressed in the current IEEE 384 exceptions listed in UFSAR Subsection 8.3.2.4.2.</p>	<p>Reference 13 in Subsection 8.3.4 tests and analyzes the separation distance for this configuration, as shown below, to support the expansion of this exception:</p> <p>Conduit to Cable in Free Air (Reference 13 in Subsection 8.3.4 Page 598)</p> <ul style="list-style-type: none"> o Recommendation 1A recommends a horizontal separation distance of 1 inch for conduit and free air cables in a parallel horizontal configuration. o Recommendation 2 recommends a vertical and horizontal separation distance of 1 inch in horizontal crossing and vertical parallel configurations. <p>These exceptions are limited to a conduit routing nonsafety related cable, with the free air cable being safety-related. This is because the test only failed the cable in the conduit, with the target being the free-air cable. Therefore, there is clear data on the impact to the (safety-related) cable in free air when the (nonsafety-related) cable in the conduit fails. However, there is no specific test data showing the impact to the cable in the conduit if the free air cable is faulted. If the free air safety-related cable were to fail in this configuration it would only impact a non-redundant nonsafety-related cable.</p>	<p>This change is represented in the fifth bullet under the limited hazard area exceptions in UFSAR Subsection 8.3.2.4.2 and COL Table 3.3-6 ITAAC No. 3.3.00.07d.ii.a/b/c item 6).</p>

#	Applicable Area	Configuration	New Exception for Given Configuration(s)	Technical Evaluation	Licensing Basis Change
2e	Nonhazard and Limited Hazard	Within panels and control switchboards*	<p>The minimum vertical separation distance is 1 inch.</p> <p>The current minimum vertical separation distance for this configuration is 6 inches (see third bullet in UFSAR Subsection 8.3.2.4.2).</p>	<p>Reference 13 in Subsection 8.3.4 tests and analyzes the separation distance for this configuration, as shown below, to support the expansion of this exception:</p> <p>Cables In Free Air (Reference 13 in Subsection 8.3.4 Page 599)</p> <ul style="list-style-type: none"> ○ Recommendation 3 recommends a vertical separation distance of 1 inch for internal panels. 	<p>This change is represented in the fourth bullet under the non-hazard area exceptions and the sixth bullet under the limited hazard area exceptions in UFSAR Subsection 8.3.2.4.2.</p>

#	Applicable Area	Configuration	New Exception for Given Configuration(s)	Technical Evaluation	Licensing Basis Change
2f	Limited Hazard Area	Open to open configurations, and open to closed configurations with instrumentation and control cables*	<p>The minimum vertical separation is 1 inch and the minimum horizontal separation is 1 inch for both configurations.</p> <p>The current minimum vertical and horizontal separation distances are 3 inches and 1 inch, respectively, for open top cable trays with instrumentation and control cables (see second bullet in UFSAR Subsection 8.3.2.4.2). The minimum vertical separation distance is reduced to 1 inch, and the exception is expanded to include additional configurations.</p>	<p>Reference 13 in Subsection 8.3.4 tests and analyzes the separation distance for this configuration, as shown below, to support the expansion of this exception:</p> <ul style="list-style-type: none"> Free Air Cables (Page 600 of Reference 13 in Subsection 8.3.4) – Recommendation 2 recommends a minimum vertical separation of 1 inch and a minimum horizontal separation of 1 inch between instrumentation and control cables in free air. <p>Configurations involving an open configuration and closed configuration are bounded by configuration involving open configurations because there is additional protection provided by the enclosed raceway. Therefore expanding the exceptions to configurations involving an enclosed to open configurations based on the tests made on free air cables is consistent.</p>	<p>This change is represented in the first bullet under the limited hazard area exceptions in UFSAR Subsection 8.3.2.4.2 and COL Table 3.3-6 ITAAC No. 3.3.00.07d.ii.a/b/c item 4).</p>

*This configuration includes situations where the open configuration is above and below the closed configuration