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Environmental Qualification of Certain Electrical Equipment Important to Safety for Nuclear Power Plants

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General Comment

Please see attached comments. Thanks

Attachments

Comments to Draft RG DG-1361_ Proposed R2 of RG 1_89.doc R2

Review of U.S. Nuclear Regulatory Commission Draft Regulatory Guide DG-1361
(Proposed Revision 2 Regulatory Guide 1.89)

Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants

No.	Page / Section / Paragraph	Comment	Proposed Resolution
1	General	We think it should be made clear that the latest revision of IEEE 323 (IEEE/IEC 60780-323) builds on IEEE 323-1974 and equipment qualified to IEEE/IEC 60780-323 would encompass qualification to IEEE 323-1974. In the forward of IEEE 383-2003 it states that "Electrical equipment qualified in accordance with either IEEE 323-1974 or IEEE 323-1983 will meet the requirements of IEEE 627-1980 which provide the basic principles for design qualification for all safety systems equipment for use in Nuclear Power Generating Stations. This revision to IEEE 323-1974 was made to clarify its requirements and impose no additional requirements for qualifying Class 1E equipment," The 2003 version of IEEE 323 incorporated additional information and clarified several areas that are outlined in the introduction which include the use of IEEE 323 for qualification of equipment in mild environments when desired, design basis event nomenclature, updated test margins, EMI/RFI, and the use of qualified condition. Similarly, in the forward if IEEE/IEC 60780-323, the main technical changes were to harmonize the two documents consider the need to reassess and extend the qualified life. Each revision clarifies and adds information. The white paper by Jim Gleason detailing the major additions and clarifications of IEEE Std 323-2003 Compared to IEEE Std 323-1974	Add a statement to be clear that equipment qualified to this latest edition of IEEE 323 (IEEE/IEC 60780-323) encompasses qualification to IEEE 323-1974.

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		Dated 12/3/07 noted that " IEEE Std 323-2003 contains the same qualification methods and process as was contained in IEEE Std 323-1974, but contains additional requirements that have been identified since the development of IEEE Std 323-1974, including lessons learned from NRC research." Similarly, the white paper on IEEE 323-2003 to IEC/IEEE 6078-323: 2016 Changes by IEEE WG SC2.1 Chairman John White and Vice Chairman Robert Konnik dated 5/1/2017, provided information on the more than 40 changes, but as noted, IEC 60780 was based on IEEE 323-1984, so many of the updates were changes in terminology and additions.	
2	Pg. 10 / Section C.1.a.	Section 3.10 is a general definition of "end condition", which is as stated the condition at the end of the aging. It does not imply that this must be the end of the installed life. Equipment may be qualified to a time that is different than what will ultimately be the installed life (continued qualification, condition-based qualification, etc.). It should also be noted that when used in conjunction with condition-based qualification in 7.3.4 "In this case, the end condition with margin is the basis of qualification, and the time to reach that end condition in service may be more or less than the qualified life established by age conditioning based on the actual service conditions."	Recommend that C.1.a be deleted.

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3.	Pg. 10 / Section C.1.d.	Equipment "service life" is the actual period of time the equipment is in service. The definition for "service life" in IEC/IEEE 60780-323 is the "period from initial operation to final withdrawal from service of a structure, system or component." The definition does not imply or infer aging effect outside of service are insignificant. If equipment is improperly stored, shelf life can impact the "qualified life" of the equipment but not impact the "service life".	Recommend deleting the presumption that the definition for "service life" of IEC/IEEE 60780-323 implies that aging effects are insignificant unless the equipment is in service.
4.	Pg. 11 / Section C.1.e.	Environmental and operational aging of equipment important to safety to the end of its service life in a mild environment is required by IEC/IEEE 60780-323 if it is determined that the equipment has significant aging mechanisms that impacts the ability of the equipment to perform its safety function(s) prior to Design Basis Events (DBE). In a mild environment a seismic event is a DBE. Examples of equipment aging mechanisms in a mild environment prior to DBE are: wear, vibration, thermal and radiation as a function of time.	Recommend deleting Section C.1.e.

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5.	Pg. 12 / Section C.1.j.	Information presented regarding aging may be better suited to be with the aging details presently in Clause 7.4.1.9.3 (Age Conditioning). Also note that it is not clear that electromagnetic conditions are generally independent of aging and design basis events. For active canceling that may not be the case. It may generally be the case for passive canceling, but seismic may still effect this. Also note that in 7.4.1.8 of IEEE/IEC 60780-323 it already states that EMI/RFI tests need not use the same sample.	Recommend changing "Section 7.3.2" to "Section 7.4.1.9.3.
6.	Pg. 12 / Section C.1.j.(1)	Section 7.4.1.9.3 of IEEE/IEC 60780-323 already states that age conditioning should consider synergistic effects.	Refer to Section 7.4.1.9.3 of IEEE/IEC 60780-323 if this is needed.
7.	Pg. 12 / Section C.1.j.(2)	Section 7.4.1.9.3 of IEEE/IEC 60780-323 already discusses the maximum temperature during normal operation being used and Arrhenius methodology being acceptable. If there are other methods besides the Arrhenius method (IEEE 98 and 99), it is expected that IEEE will modify an existing standard or develop a new standard that IEEE/IEC 60780-323 can reference.	Refer to Section 7.4.1.9.3 of IEEE/IEC 60780-323 if this is needed.
8	Pg. 12 / Section C.1.j.(3)	Section 7.4.1.9.3 of IEEE/IEC 60780-323 already discusses acceleration of aging and appropriate documentation. Ideally you would want to establish the activation energy using the temperatures that you will operate the equipment in, but this would take at	Delete "Of note, the activation energy should be selected based on the temperature range of the equipment in service to ensure that the equipment remains functional during and following a design-basis event." and replace with

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		least 60 or 80 years (if this is the expected life), but likely hundreds of years or more. Since this is impracticable, IEEE 98 and 99 were developed to be able to determine the activation energy within a reasonable time. For some materials, such as cables and splices (IEEE 383), the specific compound must be used as noted but, in some cases, it is not feasible to identify the specific material compound used in the equipment. It is important though to use a conservative activation energy in this case. The industry has used generic materials activation energies as an acceptable method when the exact compounds cannot be determined. The industry has judged the lowest applicable generic published activation energy for materials aging programs for many years as acceptable.	"Activation energy should be determined using the guidance in IEEE 98 or 99 to ensure that the equipment remains functional during and following a design-basis event." Remove the wording "testing of the specific" in second sentence. Add "Testing of the specific material is required by some standards such as IEEE 383. It is recognized that in some cases, it is not practicable to use the specific compound on all parts in a piece of equipment and the use a conservative activation energy may be used if justified."

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9.	Page 16 / Section C.2.c.	This states from RG 1.209 that: "An additional stressor to be considered in the qualification of digital systems is smoke exposure from an electrical fire." Stressors caused by fire and smoke are addressed in design, construction, installation, and procedural practices (e.g., redundancy, diversity, site location, protective barriers, etc.) for the equipment and the nuclear facility it is to be installed. These potential stressors are addressed by others and not in equipment qualification programs addressed by test, analysis, combined test and analysis, or experience programs documented in IEC/IEEE 60780-323. 10 CFR 50.48 and RG 1.209 are the correct documents to address fire and smoke as it relates to the nuclear facility and the impact it has on electric equipment important to safety (not in RG 1.89).	Recommend deleting Section 2.c. starting with "An additional stressor to be considered…."

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10.	Page 16 / Section C.2.d.	Note that IEEE/IEC 60780-323 section 7.4.1.9.3 discusses the use of Arrhenius aging and the sequence of age conditioning should consider sequential, simultaneous, and synergistic effects in order to achieve the worst state of degradation expected. What are the specific degradation processes that are not amenable to preconditioning that could result in a common cause failure during design basis accidents?	It should noted that IEEE/IEC 60780-323 states that preconditioning for thermal should use the Arrhenius theory as well as the sequence of age conditioning should consider sequential, simultaneous, and synergistic effects in order to achieve the worst state of degradation expected. Also state the specific degradation processes that are not amenable to preconditioning that could result in a common cause failure during design basis accidents.
11.	Page 17 / Section C.2.e.	We do not know if equipment outside containment would generally experience a less severe environment, but we do know that in some plants more severe environments are outside containment. Is item 4 a new analysis that plants need to perform?	Delete item 1 and clarify item 4.
12.	Page 19 / References / Ref. 9. and Ref. 10.	Editorial: Reference 9 and 10 are out of order has they appear in the main body of the document.	Change Reference 9 to Reference 10 and vice-versa.
13.	Page D-1/Appendix D	Note that IEEE 383 requires testing with normal dose and total integrated dose. Additionally, to perform condition monitoring would need to perform tests	It should be noted that testing with normal dose is required by some standards and to perform condition

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		without combining normal and accident dose.	monitoring testing would need to be performed without combining normal and accident dose.