Responses to Public Comments on Draft Regulatory Guide DG-1412
"Qualification of Class 1E Battery Chargers, Inverters, and Uninterruptible Power Supply Systems for Production and Utilization Facilities"
Revision 1 to Regulatory Guide 1.210

On February 1, 2023, the U.S Nuclear Regulatory Commission (NRC) published a notice in the *Federal Register* (88 FR 6672) that Draft Regulatory Guide, DG-1412, (Proposed Revision 1 to Regulatory Guide (RG) 1.210), was available for public comment. The Public Comment period ended on March 3rd, 2023. The NRC received comments from the organizations and individuals listed below. The NRC has combined the comments and NRC staff responses in this document.

Comment Submission 1
ADAMS Accession No. ML23061A147
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Comment 1-1 Jeff Bartelme

The NRC's proposed revision to Regulatory Guide (RG) 1.210, "Qualification of Safety-Related Battery Chargers and Inverters for Nuclear Power Plants" (Reference 1), modifies the applicability of the RG from being specific to nuclear power plants to more generally applying to production and utilization facilities. This modification in intended applicability in the proposed revision (Reference 2) is apparent via the modification of the RG title and the described applicability, which states, in part, "Under 10 CFR Part 50, this RG applies to licensees or applicants for nuclear power plants and utilization facilities."

The proposed modification in the applicability of the RG introduces confusion in the applicability to non-power production and utilization facilities (i.e., facilities other than nuclear power plants) licensed under 10 CFR Part 50. The described reason for revision in Section B. of the proposed revision to the RG states, in part, "This revision (Revision 1) of RG 1.210 revises the title of the RG to clarify that other nuclear facilities are also within the scope of this RG…;" however, the revision provides no regulatory basis for expanding the scope of applicability. The applicable regulations listed in the proposed revision (i.e., 10 CFR 50.49(b)(1) and (c)(3); 10 CFR 50.55a(h)(3); Appendices A, B, and S to 10 CFR Part 50; and 10 CFR Part 52) are nuclear power plant-specific regulations and are not applicable to non-power production and utilization facilities. Additionally, the standard endorsed by the proposed revision to the RG, Institute of Electrical and Electronics Engineers (IEEE) Standard 650-2017, "IEEE Standard for Qualification of Class 1E Static Battery Chargers, Inverters, and Uninterruptible Power Supply Systems for Nuclear Power Generating Stations" (Reference 3), is specific to nuclear power plants.

In establishing the licensing basis for a first-of-its-kind facility, non-power production and utilization facility applicants have fewer industry codes and standards which are directly applicable to the facility as compared to nuclear power plants. The applicant is required to review a series of codes and standards developed specifically for other types of facilities, including nuclear power plants, to identify those codes and standards (or portions thereof) required to satisfy facility-specific design criteria, as SHINE did in establishing the licensing basis in our operating license application. As written, this proposed revision to the RG, with the expanded scope of applicability providing equivalent guidance to nuclear power plants and nonpower production and utilization facilities, does not consider the relative risk of these non-power facilities against the risks associated with nuclear power plants. This may lead an applicant to believe compliance with IEEE Standard 650-2017, without any facility-specific exceptions, is required to meet regulatory requirements for qualification of safety-related battery chargers, inverters, and uninterruptible power supply systems at non-power production and utilization facilities.

As the listed applicable regulations and the IEEE standard itself are specific to nuclear power plants, SHINE recommends the applicability of the RG be reverted back to being specific to nuclear power plants, including revision to the title and the described applicability, to remove reference to the more general "production and utilization facilities." SHINE recommends the NRC instead propose a non-power production and utilization facility applicant consider the guidance provided in IEEE Standard 650-2017 on a voluntary basis and to the extent necessary to meet facility-specific design criteria and the relative risk of the facility. This proposal would be more appropriately captured in non-power production and utilization facility application guidance (e.g., a NUREG-series publication or Interim Staff Guidance), with appropriate context for the consideration of the standard, in lieu of establishing the consideration in a power reactor specific division RG (i.e., a Division 1 series RG).

NRC Comment 1-1 Response

The staff partially agrees with the comment. The staff disagrees with the proposed change to the RG. The NRC staff provided guidance related to the use of RGs in the section titled "Purpose of Regulatory Guides" in the RG. The NRC staff notes that based on the above-mentioned guidance, an applicant may choose to use the RG in its entirety or only the parts applicable to its facility provided that the applicant/licensee documents its justification/basis for any deviations from the RG. Expanding the scope of the RG to include non-power facilities does not change the way the RG should be used including taking facility-specific exceptions with justifications.

However, the staff agrees that there is an opportunity for clarification to note the regulations that are applicable to production and utilization facilities including non-power production and utilization facilities (NPUF). Therefore, the following regulations and guidance have been added to the "Applicable Regulations," and "Related Guidance," sections of DG-1412, which includes the context in which those regulations and guidance should be understood but which is omitted below.

> *The regulations in 10 CFR Part 50 cover both power production and utilization facilities and non-power production and utilization facilities (NPUF).*
>
> *10 CFR 50.34(a)(1)(i) and 50.34(a)(1)(ii) require applications for NPUFs and power reactors, respectively, to include, among other things, the information in 10 CFR 50.34(a)(3) and 50.34(a)(7).*
>
> *10 CFR 50.34(a)(3) requires the preliminary safety analysis report (PSAR) of a facility to include, among other things, (i) the principal design criteria (PDC) for the facility and (ii) the design bases and the relation of the design bases to the PDC for the preliminary design of the facility.*
>
> *10 CFR 50.34(a)(7) requires the PSAR to include a description of the quality assurance program to be applied to the design and construction of the SSCs of the facility.*
>
> *10 CFR 52.97(b) requires combined licenses to contain inspections, tests, and analyses (ITAAC) that are necessary and sufficient to provide reasonable assurance that the facility has been constructed and will be operated in accordance with the license; the Atomic Energy Act of 1954, as amended; and NRC rules and regulations.*
>
> *10 CFR 52.99(c)(1) requires each combined license holder notify the NRC that the prescribed ITAAC have been performed and that the prescribed acceptance criteria are met for each ITAAC included in their combined license.*

RG 1.215, "Guidance for ITAAC Closure Under 10 CFR Part 52," (Ref. 17) describes a method for documenting the completion of inspections, tests, analyses, and acceptance criteria.

RG 2.5, "Quality Assurance Program Requirements for Research and Test Reactors" (Ref. 20) endorses American National Standards Institute (ANSI) and the American Nuclear Society (ANS) document ANSI/ANS-15.8-1995, "Quality Assurance Program Requirements," (Ref. 21) as an acceptable method for complying with the program requirements of 10 CFR 50.34.

Furthermore, the following statement has been added as a footnote to the "Applicable Regulations," section of DG-1412.

Application-specific PDC for NPUFs include PDC similar to GDC 1, 2, and 4 to the extent necessary for the NRC to find that operation of the proposed facility will provide adequate protection of the public health and safety.

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Comment Submission 2
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Comment 2-1 Richard T. McCarty

Section C of DG-1412 refers to the requirements of IEEE Std. 650-2017. Section 2 of IEEE 650-2017 states that normative references are "indispensable for the application of this document (i.e., they must be understood and used, so each document is cited in text and its relationship to this document is explained)." Section C of DG-1412 should include additional guidance addressing issues with these normative references.

For one normative reference, IEEE 650-2017 lists IEC/IEEE 60780-323-2016. But the IEC/IEEE 60780-323-2016 standard is not yet endorsed by the NRC, pending issuance of RG 1.89 R2. Section C of DG-1412 should provide additional explanation about whether the staff finds the use of normative references that are not endorsed, IEC/IEEE 60780-323-2016, as methods acceptable to the staff in satisfying the applicable regulations from 10CFR50 Appendix A and B. Section C of DG-1412 provides no such clarification related to the use of this normative standard pending issuance of DG- 1361 as RG 1.89 R2.

Additional comments addressing other issues with these normative standards are provided in Comments 2, 3, and 4.

Endorsement of an industry standard that requires the use of a normative reference that is not endorsed needs clarification. Specific guidance is needed regarding use of normative references whose edition level differs from a licensee's current design or licensing basis.

NRC Comment 2-1 Response

The staff partially agrees with the comment. The staff disagrees with including additional guidance to address issues with and the use of normative references in IEEE Std. 650-2017 in the RG. Additional guidance is unnecessary because the staff already provided guidance under the section titled "Documents Discussed in Staff Regulatory Guidance" in the RG to address the use of secondary references, some of

which IEEE Std. 650-2017 designates as "normative references." However, the staff agrees that further clarification on implementation could be provided. As such, the staff has added the following new regulatory position C.1.a. to DG-1412 to clarify that certain regulatory guides contain additional information, and the NRC does not endorse the normative references in Section 2 of IEEE Std. 650-2017:

> *This RG does not endorse Section 2, "Normative References," of IEEE Std. 650-2017. The following RGs contain additional information with respect to the qualification of safety-related or Class 1E battery chargers, inverters, and UPS systems: with clarifications:*
>
> > *RG 1.100, "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," which endorses IEEE Std. 344, with clarifications.*
> >
> > *RG 1.211, "Qualification of Safety-Related Cables and Field Splices for Nuclear Power Plants," which endorses IEEE Std. 383, with clarifications.*
> >
> > *RG 1.75, "Physical Independence of Electric Systems," which endorses IEEE Std. 384, with clarifications.*
> >
> > *RG 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants," which endorses IEEE Std. 7-4.3.2, with clarifications.*
> >
> > *RG 1.156, "Qualification of Connection Assemblies for Nuclear Power Plants" which endorses IEEE 572, with clarifications.*

The staff also added a reference to RG 1.89 Revision 2 , in the "Related Guidance" portion of Section A, "Introduction," of the RG as follows:

> *RG 1.89, Revision 2,"Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants," (Ref. 8), describes an approach to meet regulatory requirements for environmental qualification of certain electric equipment important to safety for nuclear power plants.*

Comment 2-2 Richard T. McCarty

Section 2 of IEEE 650-2017 states that, "[f]or undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies." One such undated, normative reference is IEEE Std IEEE Std. 344™, which addresses seismic qualification. This reference was current at the time IEEE 650-2017 was issued and is currently endorsed by RG 1.100 R4. However, this reference is out of date and the current version is the joint logo standard IEC/IEEE 60980-344-2020. Because the normative reference for IEEE Std. 344TM is undated, IEEE 650-2017 would require the use of the latest edition of the referenced document. This would imply the requirement to adopt IEC/IEEE 60980-344-2020, which is not currently endorsed by the NRC. Section C of DG-1412 should include a general position regarding the use of endorsed normative standards, and in particular, the required use of editions of industry standards that may be different from the plant's current design and/or licensing basis.

Endorsement of an industry standard that requires the use of a normative reference that is not endorsed needs clarification.

NRC Comment 2-2 Response

The staff disagrees with the comment. The staff disagrees that there is a need for an additional regulatory position regarding the use of endorsed normative standards and the required use of editions of industry standards that may be different from the plant's current design and/or licensing basis because RG 1.210 already includes general guidance on the use of endorsed normative references in the IEEE Std. 650-2017 under the sections titled "Documents Discussed in Staff Regulatory Guidance" and "Purpose of Regulatory Guides" in the RG.

The staff has added a new regulatory position C.1.a. to clarify that certain regulatory guides contain additional information, and the NRC does not endorse the normative references in Section 2 of IEEE Std. 650-2017 (see response to Comment 2-1). The staff also updated the reference to RG 1.100 in the "Related Guidance" portion of Section A, "Introduction," of the RG by adding the following text:

> *RG 1.100, , "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants" (Ref. 9), discusses, in part, the seismic qualification of electrical equipment.*

Comment 2-3 Richard T. McCarty

Section 2 of IEEE 650-2017 lists IEEE Std. 383TM as another undated, normative reference as explained in comment 2 above. The current NRC endorsement of IEEE Std 383 in RG 1.211 is specific to the 2003 edition of the IEEE standard for qualifying Class 1E electric cable and field splices for nuclear power generating stations. This edition has been superseded by IEEE 383-2015. Because IEEE Std. 383TM is undated, this would require the use of an edition of IEEE 383 that is not currently endorsed.

Section C of DG-1412 should include a general position regarding the use of endorsed normative standards, and in particular, the required use of editions of industry standards that may be different from the plant's current design and/or licensing basis.

Other normative references listed in IEEE 650-2017 have similar problems. The current edition of IEEE 384 is not currently endorsed. RG 1.75 R3 endorses IEEE 384-1992 and not the current 2018 edition. Also, RG 1.152 Rev. 3 currently endorses IEEE 7-4.3.2-2003 and not the current 2016 edition.

These are additional examples for why there should be some general position regarding the use of normative standards when the current regulatory endorsement does not cover the currently issued edition.

Endorsement of an industry standard that requires the use of a normative reference that is not endorsed needs clarification.

NRC Comment 2-3 Response

The staff disagrees with the comment. The staff disagrees that there is a need for an additional regulatory position regarding the use of endorsed normative standards, and in particular, the required use of editions of industry standards that may be different from the plant's current design and/or licensing basis because RG 1.210 already includes general guidance on the use of endorsed normative references in the IEEE Std. 650-2017 under the sections titled "Documents Discussed in Staff Regulatory Guidance" and "Purpose of Regulatory Guides" in the RG.

The staff has added new regulatory position C.1.a. to clarify that certain regulatory guides contain additional information, and the NRC does not endorse the normative references in Section 2 of IEEE Std.

650-2017 (see response to Comment 2-1). The staff also added a reference to RG 1.75 in the "Related Guidance" portion of Section A, "Introduction," of the RG as follows:

> *RG 1.75., "Physical Independence of Electric Systems," (Ref. 7) provides guidance concerning physical independence of the circuits and electrical equipment that comprise or are associated with safety systems.*

The staff also updated the references to RG 1.211 and RG 1.152 in the "Related Guidance" portion of Section A, "Introduction," of the RG by adding the red text as follows:

> *RG 1.211 "Qualification of Safety-Related Cables and Field Splices for Nuclear Power Plants" (Ref. 16), describes a method that the NRC staff considers acceptable for complying with the Commission's regulations for the qualification of safety-related cables and field splices.*
>
> *RG 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants" (Ref. 10), gives guidance for addressing the design and qualification of digital systems, including computer hardware, software, firmware, and interfaces in the safety systems.*

Comment 2-4 Richard T. McCarty

Section 2 of IEEE 650-2017 makes no reference to IEEE 572-2019, which is currently endorsed by RG 1.156 R2. There is overlap in the qualification of connectors between IEEE 650-2017 and IEEE 572-2019. As a result, DG-1412 should include a statement explaining that one should also look to additional guidance in IEEE 572-2019, as endorsed by RG 1.156 R2, on qualification of electrical connection assemblies. Consistency between RGs that endorse qualification standards.

NRC Comment 2-4 Response

The staff agrees with the comment. The staff notes that IEEE Std. 650-2017, Section 5.2.2.4, "Wire, cable, terminal blocks, and connections," references IEEE Std. 572 as additional guidance for the qualification of connectors. In addition, other sections of IEEE Std. 650-2017 reference IEEE standards as additional guidance for certain considerations of the qualification of components. Therefore, the staff has added a new regulatory position C.1.a. clarify that certain regulatory guides contain additional information, and the NRC does not endorse the normative references in Section 2 of IEEE Std. 650-2017 (see response to comment 2-1). No additional changes were made to DG-1412 as a result of this comment.

Comment 2-5 Richard T. McCarty

The definition of qualified life in IEEE 650-2017 appears to conflict with itself regarding the applicability of qualified life to design extension (e.g., severe accident or beyond design basis events) since the note below the definition states that, at the end of the qualified life, the equipment shall be capable of performing the safety function(s) required for the postulated design basis event and design extension (post-design-basis events) conditions.

Keeping in mind that IEEE 650-2017 is specific to mild environment applications, it should be recognized that the term qualified life has historically been associated with the qualification of equipment for harsh environment applications. Service life or design life is typically used for mild environment equipment. The concept of a qualified life being applicable to mild environment equipment is also inconsistent with the Introduction in RG 1.209 Rev. 0 that *"..., because of ready accessibility for monitoring and maintenance in mild environments, the need to establish a qualified life does not apply.*"

DG-1412 should specifically clarify that the term "qualified life" is specific to harsh environment equipment and is not applicable to mild environment equipment. A service life should be established for mild environment equipment that has significant aging mechanisms. DG-1412 should also clarify that the term "qualified life" does not apply to design-extension conditions, which per IEC/IEEE 60780-323-2016 is related to severe accident (e.g., beyond design basis) conditions.

Consistency between RGs for mild environment equipment. IEEE 650-2017 uses the term "qualified life" throughout the document even though it clearly indicates that this standard is only applicable for equipment located in a mild environment where the only design basis event (DBE) of consequence is a seismic event. See Sections 4.2.2, 4.2.3, 5.1.1, 5.1.2.3.1, 5.2, 5.2.1, 5.2.2.1, 5.2.2.2, 5.2.2.4, 5.2.2.7, 5.2.2.8, 5.2.2.11, 5.3.1.1, 5.5, 6.1, 6.2, 6.3, Annex B-Section B.2, and Annex D.

The NOTE after the definition of "qualified life" in IEEE 650-2017 expands the definition beyond what is currently cited in Definition 3.20 in IEC/IEEE 60780-323-2016

NRC Comment 2-5 Response

The staff partially agrees with the comment. The staff agrees that historically, the NRC has used the term "qualified life" for the qualification of equipment meeting the requirements of 10 CFR 50.49 (i.e., equipment located in harsh environments). Therefore, the term "qualified life" in RG 1.89, Revision 2, should be used in lieu of the definition provided in IEEE Std. 650-2017.

The staff disagrees with the specific recommendation with regard to the use of the term "service life" because the "service life," as defined in IEC/IEEE 60780-323-2016 and as endorsed by RG 1.89, Rev.2, i.e., the period from initial operation to final withdrawal from service of a structure, system, or component, is broad.

The staff notes that the term "design life," as defined in IEEE Std. 627-2019, is more suitable for equipment qualification than the term "service life":

> *The "design life" is the time period during which satisfactory performance can be expected for a specific set of service conditions (Note – The time period may be specified in real time, operating time, number of operating cycles or other performance interval, as appropriate).*

The service conditions used for the qualification of equipment located in a mild environment (as defined in applicable IEEE standards) are the conditions under which successful performance of the equipment is demonstrated before, during, and after a design basis event, as applicable. Therefore, for the purposes of this RG, the term "qualified life," as used in IEEE Std. 650-2017, should be considered equivalent to the term "design life." Regardless of the term used, the qualification processes, including consideration of significant aging mechanisms, described in IEEE Std. 650-2017 should be followed to demonstrate that safety-related battery chargers, inverters, and UPSs are capable of remaining functional during and following design basis events. The staff is not endorsing IEEE 627-2019 in this RG.

The staff agrees that the term 'qualified life' is not applicable to design-extension conditions (i.e., beyond design basis events).

As a result of this comment, the staff has modified DG-1412 to add the following positions C.1.b. and C.1.c.:

> *Section 5.2, "Maintenance/replacement interval assignment," and Figure 1, "Flowchart for qualification of Class 1E static battery chargers, inverters, and UPS systems," of IEEE Std. 650-2017 recommend that "qualified life" be established for any component or equipment that is*

subject to a significant aging mechanism that cannot be addressed by surveillance and maintenance activities. The NRC staff recognizes that the term "qualified life," as defined in RG 1.89, Revision 2, is used for the qualification of equipment meeting the requirements of 10 CFR 50.49 (i.e., equipment located in harsh environments). Because the requirements of 10 CFR 50.49 are not applicable to equipment located in mild environments, the use of the term "qualified life" for battery chargers, inverters, and UPs located in mild environment could cause confusion. Therefore, for the purposes of this RG, the staff clarifies that the term "qualified life" as used in IEEE Std. 650-2017 should be deemed equivalent to the term "design life," as defined in IEEE Std. 627-2019, "*IEEE Standard for Qualification of Equipment Used in Nuclear Facilities*," *for the qualification of battery chargers, inverters, and UPSs. The staff notes that regardless of the term used, the qualification processes, including considerations of significant aging mechanisms, described in IEEE Std. 650-2017, as endorsed in this RG, should be followed to demonstrate that safety-related battery chargers, inverters, and UPSs are capable of remaining functional during and following design basis events. The staff is not endorsing IEEE Std. 627-2019 in this RG.*

Section 3.1, "Definitions," of IEEE Std. 650-2017 includes a note to indicate that design-extension conditions (i.e., beyond design basis events) are applicable to the qualification of equipment located in a mild environment. The staff clarifies that battery chargers, inverters, and UPSs need not be qualified for design-extension conditions (i.e., beyond design basis events).

Comment 2-6 Richard T. McCarty

One statement from Section 5.2 of IEEE 650-2017—that is, "[*c*]*omponents with significant aging mechanisms need not be aged prior to the type test if they can be addressed by periodic in-service surveillance/maintenance*"—is inconsistent with another statement on the top of the next page: [*c*]*omponents with significant aging mechanisms shall be aged in accordance with one or more of the following techniques, as applicable*." Given the apparent inconsistency in these statements, there should be some clarification or guidance in DG-1412 regarding the need for environmental type testing for mild environment equipment.

DG-1412 should clarify what criteria must be satisfied for an aging mechanism to be considered significant. The guidance in IEEE 650-2017 centers around whether a component has significant aging mechanisms (SAM) or not. The guidance, however, does not include a definition for significant aging mechanisms or list criteria to make this determination.

For example, a pending update to IEEE 1205 incorporates four criteria from IEEE 627-2010 that need to be satisfied for an aging mechanism to be considered significant. The criteria for a SAM from IEEE 627-2010 states: "***Aging is significant for the purpose of an aging program if it satisfies all of the following criteria:***

a) In the normal service environments, an aging mechanism promotes the same failure mode as that resulting from exposure to abnormal or DBE service conditions.
b) The aging mechanism adversely affects the ability of the equipment to perform its required function in accordance with its specification requirements.
c) The deterioration caused by the aging mechanism is not amenable to assessment by in-service inspection or surveillance activities that provide confidence in the equipment's ability to function in accordance with its specification requirements during the intervals between surveillance.
d) In the normal service environment, the aging mechanism causes degradation during the design life of the equipment that is appreciable compared to degradation caused by the DBE."

The NRC has previously used very similar criteria presented in Section 3.4.5 of Technical Evaluation Report TER-C5257-532, "Implementation Guidance for New and Corrective Equipment Environmental Qualification" dated 04/22/1983 [ML20244C266]. Like the above examples, DG-1412 should clarify what criteria must be satisfied for an aging mechanism to be considered significant.

Note that type testing to establish environmental qualification has not been required for mild environment equipment whose service conditions were specified at the time of procurement and are being used within the manufacturer's ratings (*see* SRP 3.11 Acceptance Criteria #15 in NUREG-0800 as well as in GL 82-09). GDC-4 simply requires that the equipment be **designed** to be compatible with and accommodate the effects of the specified environmental service conditions.

IEEE and ASME use the same four criteria for a SAM but differ in whether a SAM needs to meet all four criteria (e.g., IEEE position) or any one of the four criteria (e.g., ASME position).

Satisfying all four criteria is consistent with the definition of a significant aging mechanism provided in IEEE 1205-2014. Section 3 of IEEE 1205-2014 defines a SAM as: "*An aging mechanism that, under normal and abnormal service conditions, causes degradation of equipment that progressively and appreciably renders the equipment vulnerable to failure to perform its specified function(s).*" However, the criteria from Section QR-5310 of ASME QME-1-2017 (endorsed by RG 1.100 R4) is inconsistent with the definition of a SAM since it can identify an aging mechanism as being significant even if the degradation has no effect on the equipment's ability to perform its required function.

NRC Comment 2-6 Response

The staff disagrees with this comment that the guidance in IEEE Std. 650-2017 does not include a definition for significant aging mechanisms. The following definition of significant aging mechanism is provided in IEEE Std. 650-2017, section 5.1.2.3, "Component classification:"

"An aging mechanism is significant if, in the normal and abnormal service environment, it causes degradation during the installed life of the equipment that progressively and appreciably renders the equipment vulnerable to failure to perform its safety function(s) under DBE conditions…." This RG endorses that definition. The IEEE Std. 650-2017 definition of "significant aging mechanism" is nearly identical to the IEEE Std. 1205-2014, "IEEE Guide for Assessing, Monitoring, and Mitigating Aging Effects on Electrical Equipment Used in Nuclear Power Generating Stations and Other Nuclear Facilities," definition to which the comment refers, as endorsed in RG 1.248, "Guide for Assessing, Monitoring, and Mitigating Aging Effects on Electrical Equipment Used in Production and Utilization Facilities," Revision 0.

Furthermore, IEEE Std. 650-2017, section 5.1.2.3 provides a guideline for identifying certain components that are not subject to a significant aging mechanism and examples of components for which aging may or may not be a significant failure mechanism.

The staff also disagrees with the comment that the RG should provide additional criteria, beyond what is already provided in IEEE Std. 650-2017, that must be satisfied for an aging mechanism to be considered significant. The staff acknowledges that additional criteria are available, but such criteria are unnecessary given the definition in IEEE Std. 650-2017, section 5.1.2.3, and the adequacy of those criteria in the context of this RG is beyond the scope of this RG.

The staff disagrees with the comment that there is inconsistency with the referenced excerpts from section 5.2 of IEEE 650-2017. The staff notes that the first excerpt mentioned in the comment clarifies that aging is only required for components with significant aging mechanisms that *cannot* [emphasis added] be addressed by periodic in-service surveillance/maintenance.

The staff disagrees with the comment that type testing has not been required for equipment located in a mild environment. The requirements in 10 CFR 50.55a(h)(3) incorporate by reference IEEE Std. 603-1991 that states, in part: "Safety system equipment shall be qualified by type test, previous operating experience, or analysis, or any combination of these three methods, to substantiate that it will be capable of meeting, on a continuing basis, the performance requirements as specified in the design basis." Also, 10 CFR Part 50, Appendix B, Criterion III (see Criterion III, third paragraph) requires that if a test program is used to verify the adequacy of a specific design feature of safety-related equipment, it shall include suitable qualification testing of a prototype unit under the most adverse design conditions. These requirements apply to safety-related equipment located in both mild and harsh environments. Furthermore, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," acceptance criteria #15, provides guidance for the staff review of the environmental design (not qualification) of equipment located in mild environments for compliance with the requirements of GDC 4 (see also NUREG-0800, section 3.11, subsection I.2, page 3.11-2, which covers both mild and harsh environments).

No changes were made to DG-1412 as a result of this comment.

Comment 2-7 Richard T. McCarty

DG-1412 endorses IEEE 650-2017 without any clarification or exception as it relates to the use of environmental type testing as a special treatment that verifies the designed capability of equipment. The NRC Commission explained its logic regarding equipment located in a mild environment in the paragraphs of the Statement of Considerations (SOC) for 10 C.F.R 50.49 [48FR2731-2732]. Review of Generic Letter No. 82-09 as well as Section 3.11 of NUREG-0800 also provides guidance on the method of qualification for safety-related electrical equipment located in mild environment areas and the associated documentation requirements. DG-1412 endorses a different method than that previously identified by both the Commission (48FR2731) and Generic Letter No. 82-09 as well as the SRP acceptance criteria 15 in Section 3.11 of NUREG-0800 without any clarification or exception. As the Commission has previously found these methods acceptable, they should all be included within DG-1412.

The NRC endorsement of "Qualification requirements" for equipment specifically excluded (Mild Environment) from 10 C.F.R. 50.49 appears to be in direct conflict with the Statement of Considerations for publication of the Final Rule on Environmental Qualification at 48FR2731-2732 which states in part:

(3) Scope-Equipment in a Mild Environment- Paragraph 50.49(b) Issue: The rule makes no distinction between equipment located in a harsh or mild environment. The stresses for equipment located in a mild environment are less severe than for those in a harsh environment.

Response: The final rule does not cover the electric equipment located in a mild environment. The Commission has concluded that the general quality and surveillance requirements applicable to electric equipment as a result of other commission regulations, including 10CFR50, Appendix B (See for example Regulatory Guide 1.33, Quality Assurance Program Requirements (Operation)," Revision 3) are sufficient to ensure adequate performance of electric important to safety located in mild environments. Since it has been concluded that no further environmental qualification requirements are needed for such equipment, they fully satisfy all other applicable regulations, the Commission has determined that no additional requirements are necessary with respect to electric equipment important to safety located in mild environments in order for licensees to satisfy, with respect to such equipment, existing license conditions or technical specifications calling for qualification of safety related electric equipment in accordance with DOR Guidelines or NUREG-0588.

NRC Comment 2-7 Response

The staff partially agrees with the comment as follows:

1) The staff disagrees with the comment that the Commission's Statement of Considerations (SOC) in the *Federal Register,* 48 FR 2733, dated January 21, 1983, provides a method of qualification for safety-related electrical equipment located in mild environments. The Commission SOC in 48 FR 2733 explained why the proposed rule 10 CFR 50.49 did not cover the electrical equipment located in a mild environment. The Commission stated that no additional environmental qualification requirements are needed for electrical equipment important to safety located in mild environments because such requirements are covered in other applicable regulations that are sufficient to ensure adequate performance of this equipment.

   The staff finds no issues with the SOC in 48 FR 2733 with respect to the RG because the RG is not a new requirement but a guidance to meet the applicable regulations, as listed in the "Applicable Regulations," section of the RG.

2) The staff agrees with the comment that the RG endorses a method of equipment qualification different than that previously identified in Generic Letter No. 82-09, "Environmental Qualification of Safety-Related Electrical Equipment," (GL 82-09). GL 82-09 provided three programs (i.e., periodic maintenance, inspection, and/or replacement program; periodic testing program; and equipment surveillance program) that can be used to adequately demonstrate and maintain the environmental qualification of existing equipment located in mild environments. For replacement and new equipment, GL 82-09 states: "…the licensee must also establish and document the environmental design basis for the equipment locations. The purchase specifications must reflect those design basis environmental conditions that are bounding for all applicable equipment locations."

   The staff notes that the IEEE 650-2017 methods of qualification (i.e., combination of test and analysis) of electrical equipment in a mild environment endorsed by the RG is one way of meeting the applicable regulatory requirements listed in the "Applicable Regulations," section of the RG. Also, GL 82-09 is another way of meeting these same regulatory requirements. Therefore, the staff notes that the IEEE 650-2017 method of qualification does not conflict with the GL 82-09 method of qualification because both methods are valid for demonstrating the qualification of equipment located in mild environments to meet the applicable regulations.

3) The staff disagrees with the comment that NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," provides a method of qualification for safety-related electrical equipment located in mild environment areas. NUREG-0800, section 3.11, makes a distinction between environmental qualification and environmental design. NUREG-0800, section 3.11 provides guidance for the staff review of 1) s the environmental qualification of equipment located in harsh environments in accordance with 10 CFR 50.49 and 2) the environmental designs of equipment located in both mild and harsh environments in accordance with 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion 4. (see NUREG-0800, section 3.11, subsection I.2, page 3.11-2).

   The staff notes that the IEEE 650-2017 method of qualification of electrical equipment in mild environments, does not conflict with the NUREG-0800 section 3.11 method of verifying the environmental design of electrical equipment in mild environments because both methods are valid for demonstrating compliance with the requirements of 10 CFR Part 50, Appendix A, General Design Criterion 4 and Appendix B, Criterion III.

No changes to DG-1412 were made as a result of this comment.

Comment 2-8 Richard T. McCarty

NRC should add to the Staff Regulatory Guidance section of the DG that this equipment is generally maintained in a mild environment and the requirements of 10 C.F.R. 50.49 and RG 1.89 Rev 1 are not legal requirements for this equipment, if so located.

NRC Comment 2-8 Response

The staff disagrees with the comment and recommendation to add the suggested guidance since it is already addressed in footnote 1 in the RG, which states:

> *The reference to 10 CFR 50.49(c)(3) is being provided for definitional purposes. The environmental qualification of electrical equipment important to safety located in a mild environment is not within the scope of 10 CFR 50.49.*

Furthermore, the staff notes that the guidance in RG 1.89 is not a legal requirement unless a condition of a facility's license requires it. No changes were made to DG-1412 as a result of this comment.

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Comment Submission 3
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Comment 3-1 Tania Martinez Navedo

On page 6: "The NRC staff did not identify any IAEA Safety Requirements or Guides with information related to the topic of this RG." However, IAEA discusses electrical equipment qualification in 3 Safety Guides: IAEA Safety Standards Series No. SSG-34 (Design of Electrical Power Systems for Nuclear Power Plants), IAEA Safety Standards Series No. SSG-69 (Equipment Qualification for Nuclear Installations), & IAEA Safety Standards Series No. SSG-67 (Seismic Design for Nuclear Installations). I recommend softening the language of that statement because there are 2 documents that discuss the subject of qualification. While none of these 3 safety guides are specific to the subject of qualification of chargers, they do address the subject of equipment qualification and we should highlight the fact that IAEA has guidance to that effect (not mentioning these guides or acknowledging their existence might be perceived as the US doesn't recognize this work, we need to be sensitive to our international counterparts).

NRC Comment 3-1 Response

The staff partially agrees with the comment. The staff agrees that IAEA Safety Standards Series No. SSG-69, "Equipment Qualification for Nuclear Installations," and IAEA Safety Standards Series No. SSG-67, "Seismic Design for Nuclear Installations," should be referenced in this RG. DG-1412 has been revised to include these references.

The staff disagrees with including IAEA Safety Standards Series No. SSG-34, "Design of Electrical Power Systems for Nuclear Power Plants," in the RG because it is already listed in section 1, "Introduction" of IAEA Safety Standards Series No. SSG-69, which is referenced in the RG.

Comment 3-2 Tania Martinez Navedo

The biggest lift that the NRC faced during its participation in the IEEE 946 Working Group was to have the WG include language about the failure discussed in IN 2017-06 (Vijay Goel is the SME on this). While it eventually made it to the 946 final version, this RG does not mention 946 and there should be language about this since it could be a failure mechanism and should be considered as part of the design considerations under qualification.

NRC Comment 3-2 Response

The staff disagrees with the comment that language about the failure related to battery chargers' fault current contributions discussed in Information Notice (IN) 2017-06, "Battery and Battery Charger Short-circuit Current Contributions to a Fault on the Direct Current Distribution System," should be incorporated in the RG. Fault current contributions from battery chargers are considered in the selection of the overcurrent protective devices for the direct current (dc) power systems that protect the dc power equipment against failures caused by fault currents (see IEEE Standard 946-2020, "IEEE Recommended Practice for the Design of DC Power Systems for Stationary Applications"). Therefore, failure due to fault current contributions from battery chargers are not considered in the qualification of the chargers. No changes were made to DG-1412 as a result of this comment.

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