UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

July 26, 2021

Ms. Margaret M. Doane
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: PROPOSED DRAFT REGULATORY GUIDE 1.9, REVISION 5, APPLICATION AND TESTING OF ONSITE EMERGENCY ALTERNATING CURRENT POWER SOURCES IN NUCLEAR POWER PLANTS

Dear Ms. Doane:

During the 687th meeting of the Advisory Committee on Reactor Safeguards, July 7-9, 2021, we reviewed "Proposed Draft Regulatory Guide (RG) 1.9, Revision 5, 'Application and Testing of Onsite Emergency Alternating Current Power Sources in Nuclear Plants,' Draft Issued: April 2021." Our Digital Instrumentation and Control (DI&C) Systems Subcommittee (SC) also reviewed this matter on June 25, 2021. During this review, we had the benefit of discussions with representatives of the U.S. Nuclear Regulatory Commission (NRC) staff and comments from industry representatives. We also had the benefit of the documents referenced.

CONCLUSIONS AND RECOMMENDATIONS

1. For Alternating Current (AC) Sources Other than Emergency Diesel Generators (EDGs) and Combustion Turbine Generators (CTGs), RG 1.9, Revision 5, Section C.1 becomes the default standard. In the absence of an industry standard, the regulatory guidance for AC Sources Other than EDGs and CTGs is not consistent in defining functional criteria with that provided by the industry standards and regulatory guidance for EDGs and CTGs. RG 1.9, Section C.1 should be structured and expanded to be consistent with applicable guidance in the Institute of Electrical and Electronics Engineers (IEEE) Standards (Stds.) for EDGs and CTGs.

2. For consistency, the definitions for ratings in Sections C.1 and C.3 should use the definition derived in IEEE Std. 387-2017. Consistency of rating definitions is even more important when applied to AC Sources Other than EDGs and CTGs since they will involve technologies much different from conventional sources, including possible energy storage systems which must also provide power capability and duration consistent with EDGs and CTGs.

BACKGROUND

The purpose of RG 1.9 is to provide guidance that the staff of the NRC considers acceptable to comply with the NRC regulations for onsite emergency AC power sources in nuclear power plants. These power sources include the currently used sources, EDGs and CTGs. It also incorporates guidance for other alternative sources of AC for onsite emergency power systems that may be proposed for future large light water reactors, small modular reactors, advanced reactors, and other nuclear facilities.

DISCUSSION

Proposed Revision 5 to RG 1.9 endorses updated IEEE Std 387-2017, "IEEE Standard for Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations," and IEEE Std. 2420-2019, "IEEE Standard Criteria for Combustion Turbine-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations," with positions/clarifications as acceptable for the design of onsite emergency AC power systems. With the exception of the issues of continuous rating and "mission time," which will be addressed later in this report, these two IEEE Stds. with clarifications are consistent and suitable for endorsement.

Issue 1 – Inconsistent definition of functional criteria in regulatory guidance

In the absence of an industry standard, the regulatory guidance for AC sources other than EDGs and CTGs is not consistent in defining functional criteria with that provided by the industry standards and regulatory guidance for EDGs and CTGs.

As currently written, there is a major inconsistency between the industry standards and RG guidance being applied for EDGs and CTGs and those being applied to AC Sources Other than EDGs and CTGs (Other AC Sources) that could result in the lack of performance attributes that provide safe and long-term plant operation when off-site power is lost.

For "Other AC Sources," standards do not exist similar to IEEE Stds. 387-2017 (EDGs) and 2420-2019 (CTGs) that can be endorsed for this category of potential emergency power sources. The only guidance is the lead-in sentence for C.1 which states that "…the following considerations should be addressed to meet the regulations cited in Part A of this RG…" What follows are 13 performance attributes with sub-paragraphs stating that various items should be assessed and discussed. There are not any specific expectations or guidance which identify criteria to be evaluated.

For example:

1. IEEE Std. 387- 2017 (EDG), Section 3 has a series of criteria for evaluating start demand, start demand failures, load run demand and load run demand failures that were not included in the CTG standard. They were incorporated into RG 1.9, Section C.3 for the CTG, but not into Section C.1 for "Other AC Sources."

2. Both of the IEEE Stds. for EDGs and CTGs include similar Section 4 Principal Design Criteria that are tailored for those machines. Many of those would also apply to "Other AC Sources," such as, light-load and no-load operation, dynamic load performance criteria for voltage and frequency under step load application or removal.

3. RG 1.9, Revision 5, Sections C.2.3 (EDGs) and C.3.8 (CTGs) provide guidance positions on paralleling operations.

Each of the above examples are functional, performance-based criteria that should also apply to "Other AC Sources" and should be incorporated into Section C.1.

This same thought process applies to Sections 1, 2, 5, 6, and 7 including the Annexes in each of the IEEE Stds. for the EDGs and CTGs, respectively. Many of the criteria would apply to "Other AC Sources" and are performance based. They should be evaluated and incorporated.

Because there is not a standard for "Other AC Sources," RG 1.9 becomes the default standard. Section C.1 should be structured and expanded to be consistent with applicable guidance in the IEEE Stds. for EDGs and CTGs. Depending on the particular source, energy storage may be required; for those cases, additional criteria would need to be identified and incorporated. When industry standards are developed for these sources, we expect that the RG will be updated to endorse the new standards.

Issue 2 – Definition of CTG Rating

IEEE Stds. 387-1995 and 2017 define the continuous rating of diesel-generator unit as "The electric power output capability that the diesel generator unit can maintain in the service environment for 8760 hours of operation per year with only scheduled outages for maintenance."

IEEE Std. 2420-2019 defines the rating of combustion turbine-generator unit as "The electric power output capability that the combustion turbine-generator unit can maintain in a specified environment and is stamped on its name plate and/or described in its specification."

The IEEE EDG Std. provides a more complete definition by specifying an operating time frame for the term continuous rating. We recommend that this more complete definition be included in RG 1.9, Revision 5. This would provide consistent guidance for the meaning of continuous rating for both the EDGs and CTGs.

"Other AC Sources" involve technologies much different from conventional sources including possible energy storage systems. Many new but related issues may apply to these sources, for example power quality (harmonics generated by DC to AC conversion), generation and storage compatibility with demand requirements, and short and long-term power delivery capability. Therefore, consistency of rating definitions is even more important when applied to "Other AC Sources."

Finally, the NRC staff introduced the term "mission time" in this revision of the RG. Although we agree with the intended use of the term in this RG, there are varied regulatory references that use this term in facility inspections. There is also a succinct and different definition in the NRC endorsed Nuclear Energy Institute (NEI)- 99-02, "Regulatory Assessment Performance Indicator Guideline." As a result, the introduction of this term in this RG may be problematic during performance of the Reactor Oversight Program (ROP). Alternative language could be considered.

SUMMARY

For AC Sources Other than EDGs and CTGs, RG 1.9, Revision 5, Section C.1 becomes the default standard. In the absence of an industry standard, the regulatory guidance for AC Sources Other than EDGs and CTGs is not consistent in defining functional criteria with that provided by the industry standards and regulatory guidance for EDGs and CTGs. Section C.1 should be structured and expanded to be consistent with applicable guidance in the IEEE Stds. for EDGs and CTGs.

For consistency, the definitions for ratings in Sections C.1 and C.3 should use the definition derived in IEEE Std. 387-2017. Consistency of rating definitions is even more important when applied to AC Sources Other than EDGs and CTGs since they will involve technologies much different from conventional sources, including possible energy storage systems which must also provide power capability and duration consistent with EDGs and CTGs.

As discussed above, the introduction of “mission time” in this RG may be problematic during performance of the ROP; alternative language could be considered.

Sincerely,

Signed by Sunseri, Matthew on 07/26/21

Matthew W. Sunseri
Chairman

REFERENCES

1. Regulatory Guide (RG) 1.9, “Application and Testing of Onsite Emergency Alternating Current Power Sources in Nuclear Plants,” Revision 5, April 2021 (ML21181A249)

2. Institute of Electrical and Electronics Engineers (IEEE) Standard (Std.) 387, “IEEE Standard for Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations,” September 28, 2017, Piscataway, NJ

3. IEEE Std. 2420, “IEEE Standard Criteria for Combustion Turbine-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations,” November 7, 2019, Piscataway, NJ

4. RG 1.27, “Ultimate Heat Sink for Nuclear Power Plants,” Revision 3, November 2015

5. U.S. Code of Federal Regulations (CFR)*, Title 10, Energy,* Part 50, “Domestic Licensing of Production and Utilization Facilities,” 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors,” 10 CFR 50.46(b)(5) - Long-term cooling

6. Nuclear Energy Institute (NEI) 99-02, “Regulatory Assessment Performance Indicator Guideline,” Revision 7, August 31, 2013

July 26, 2021

SUBJECT: PROPOSED DRAFT REGULATORY GUIDE 1.9, REVISION 5, APPLICATION AND TESTING OF ONSITE EMERGENCY ALTERNATING CURRENT POWER SOURCES IN NUCLEAR POWER PLANTS

Accession No: ML21202A149 **Publicly Available (Y/N):** Y **Sensitive (Y/N):** N
If Sensitive, which category?
Viewing Rights: ☒ NRC Users or ☐ ACRS only or ☐ See restricted distribution

OFFICE	ACRS	SUNSI Review	ACRS	ACRS	ACRS
NAME	CAntonescu	CAntonescu	LBurkhart	SMoore	MSunseri
DATE	7/22/21	7/22/21	7/ 22 /21	7/23/21	7/26/21

OFFICIAL RECORD COPY