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NUCLEAR REGULATORY COMMISSION
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U.S. NUCLEAR REGULATORY COMMISSION STAFF'S FEEDBACKAND OBSERVATIONS REGARDING ARC CLEAN TECHNOLOGY WHITE PAPER "REGULATORY TREATMENT OF NON-SAFETY SYSTEMS (RTNSS)" (EPID NO. L-2023-LRO-0024)

SPONSOR INFORMATION

Sponsor: ARC Clean Technology (ARC)

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Project No.: 99902103

DOCUMENT INFORMATION

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Purpose of the White Paper: The white paper (WP) provides an overview and description of ARC Clean Technology's (ARC) current approach to the Regulatory Treatment of Non-Safety Systems (RTNSS) for its ARC-100 sodium-cooled fast reactor (SFR) design.

Action Request: ARC requested that the U.S. Nuclear Regulatory Commission (NRC) staff review the WP and provide observations on its content and the approach for determining the classification of structures, systems, and components (SSCs) as RTNSS. ARC also requested responses to three specific questions that were posed to the NRC staff during a May 3, 2023, clarification call regarding the WP.

FEEDBACK AND OBSERVATIONS

The NRC staff's general and specific observations below do not constitute final agency positions and are not intended to be comprehensive feedback. Lack of comment or observations regarding a certain aspect of the WP should not be interpreted as the NRC staff's agreement with ARC's position.

General Observations:

1. In general, ARC's approach to RTNSS follows applicable NRC guidance and policy for RTNSS, including the following:

    a. Section 19.3, "Regulatory Treatment of Non-Safety Systems (RTNSS) for Passive Advanced Light Water Reactors," of NUREG-0800, "Standard Review Plan for the

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Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," (the Standard Review Plan or SRP) (ML14035A149),

b. Regulatory Guide (RG) 1.206, "Combined License Applications for Nuclear Power Plants," Revision 0 (ML070630044),

c. SECY-94-084, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-safety Systems in Passive Plant Designs" (ML003708068), and the associated Staff Requirements Memorandum (SRM) (ML003708098), and

d. SECY-95-132, "Policy and Technical Issues Associated with the [RTNSS] in Passive Plant Designs" (ML003708005), and the associated SRM (ML003708019).

Therefore, the **[[**

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2. As of the date of this letter, the NRC is developing a rule to amend Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (RIN 3150-AI66). Further, the NRC staff is developing an optional performance-based, technology-inclusive regulatory framework for licensing nuclear power plants designated as 10 CFR Part 53, "Risk-Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants," (RIN 3150-AK31). If a final 10 CFR Part 53 rule is promulgated, the NRC staff anticipates that general guidance needed to implement 10 CFR Part 53 will be updated and incorporated into the NRC's RG series or a NUREG series document to address content of application considerations specific to the licensing processes. While it is possible that the guidance discussed in this enclosure could change as a result of the ongoing rulemakings, it is unlikely that there would be major changes to RTNSS guidance.

3. Technical Requirements Manuals (TRMs) are not required as separate documents under 10 CFR Parts 50 and 52 but have been used to document controls associated with RTNSS for light water reactors (LWRs). The information in a TRM is typically incorporated by reference in a facility's Final Safety Analysis Report (FSAR) or included as a general reference in the FSAR.

4. Previous passive LWR design certifications ultimately included RTNSS controls in their FSARs rather than in TSs. Combined License (COL) applicants and holders have incorporated this information in their TRMs or similar applicant- or licensee-controlled documents such as Availability Control Documents.

5. The NRC staff acknowledges that the **[[**

]] the NRC staff is providing the following observations for consideration:

a. In RG 1.233, "Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light Water Reactors," Revision 0 (ML20091L698), the NRC staff endorsed Nuclear Energy Institute (NEI) 18-04, "Risk-Informed Performance-Based Guidance for Non-Light Water Reactor Licensing Basis Development," Revision 1 (ML19241A472), with clarifications and points of emphasis, as one acceptable method for non-light water reactor (non-LWR) designers to use when selecting licensing basis events, classifying SSCs, and assessing defense-in-depth (DID) adequacy.

b. In May 2023, the NRC staff published the Advanced Reactor Content of Application Project interim staff guidance (ISG) documents (ML23044A038). This guidance supports the preparation of risk-informed, performance-based applications for non-LWR license applications (e.g., construction permits or operating licenses under 10 CFR Part 50, and combined licenses (COLs), design certifications, or manufacturing licenses under 10 CFR Part 52). This guidance is also applicable to the NRC staff reviews of these applications.

c. DANU-ISG-2022-08, "Risk-Informed Technical Specifications," (ML22048B548) provides guidance to advanced reactor applicants in developing appropriate technical specifications (TSs) for their designs and includes a discussion relevant to RTNSS for non-LWR designs. The NRC staff anticipates that its review of applications employing non-safety related special treatment (NSRST) SSCs in non-LWR designs using LMP will be similar to its review of applications for designs implementing RTNSS in passive LWRs (e.g., economic simplified boiling water reactor (ESBWR) and AP1000). These latter reviews have been informed by Section 19.3 of the SRP.

d. A summary of LMP special treatments for safety related (SR) and NSRST SSCs is provided in NEI 18-04 Table 4-1, "Summary of Special Treatments for SR and NSRST SSCs." RTNSS guidance in SRP Section 19.3 is referenced in NEI 18-04 Table 4-1 under the item related to the reliability assurance program (RAP). It is up to the applicant to determine the special treatment for NSRST SSCs and NEI 18-04 provides the option for the applicant to consider RTNSS-type availability controls.

e. There are additional special treatment options that an applicant has for NSRST SSCs other than RTNSS-type controls. In addition, RTNSS is not the only type of control that may be needed for applicants following the LMP approach.

f. As noted in NEI 18-04 and in DANU-ISG-2022-08, availability controls outside of TSs, similar to those approved for some SSCs of passive LWRs under the RTNSS approach, could be appropriate for the NSRST SSCs that only perform functions credited for DID.

g. The TRM may provide a convenient vehicle to document and maintain special treatment requirements for SSCs classified as NSRST under the LMP methodology. The LMP methodology includes the identification and implementation of special treatment of those SSCs found to be risk significant due to their roles in

preventing or mitigating specific event sequences or their contributions to one of the cumulative risk metrics.

h. As described in RG 1.233, the LMP methodology calls for the reactor designer to put in place an integrated decision process (IDP) to evaluate and document the DID of the design, which may result in the development of information that can be controlled through the TRM. For example, a plant feature may be one of several means needed to ensure DID but may involve the use of SSCs that are neither SR nor risk significant. In such a case, the IDP panel (IDPP) would classify the SSCs as safety significant and NSRST because the SSCs perform functions required for DID adequacy. Special treatment requirements for NSRST SSCs include the setting of performance requirements for SSC reliability, availability, and capability and any other treatments the IDPP deems necessary. To this end, the IDPP could recommend availability controls like those associated with RTNSS developed for previous passive LWRs.

i. Non-LWR applicants may include both passive and other systems that perform functions that are not SR but warrant inclusion of special treatment as part of system design. As noted above, if the IDPP identifies availability controls similar to those found in the LWR AP1000 and ESBWR design certifications, the applicant may develop RTNSS-type controls for its non-LWR application.

Specific Observations:

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However, the NRC staff published RG 1.233 in June 2020. This RG provides guidance on using a technology-inclusive, risk-informed, and performance-based methodology to inform the licensing basis and content of applications for non-LWRs.

2. During a clarification call on May 3, 2023, ARC requested the NRC staff's feedback on the following questions related to the content of the WP:

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b. What does the NRC staff think of ARC's plan to use one diesel generator (DG) classified as RTNSS, instead of two?

NRC staff response: The NRC staff notes that the rationale for the use of one RTNSS DG in the WP is consistent with SFR design criterion (SFR-DC) 17, "Electric power systems," described in Appendix B to RG 1.232 "Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors," Revision 0 (ML17325A611). As discussed in Appendices A and B to RG 1.232, SFR-DC 17 was adapted to general design criterion 17 from 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants."

It is worth noting that the use of only one RTNSS DG is also dependent upon the reliability of the DG, use of appropriate assumptions, and considering the insights and results from the ARC-100 baseline PRA and focused PRAs and associated uncertainties. The NRC staff understands that the RTNSS DG will provide electrical power to the battery charging systems and other important systems, such as the SR battery room HVAC, diverse protection system, emergency communication systems, emergency lighting, fire detection, instrumentation, indication, and monitoring systems, that support beyond design basis accident performance requirements and long-term safety. **[[**

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NRC staff response: The NRC staff is developing guidance (ML22284A141 pages 81-100) on risk-informed and performance-based seismic design criteria for determining required SSC capacities and on the safety criteria that SSCs, through their seismic design, need to meet. **[[**

]] In a future licensing review, the NRC staff may also consider the fragility assessment for the DG, support equipment such as the DG fuel oil tanks, and the structure that houses the DG to reach its findings regarding the ability of these SSCs to withstand seismic events. For ARC's further consideration, as stated in SRP Section 19.3, the augmented design standards that should be met by SSCs in the scope of the RTNSS program include the seismic design standards, standards for protection against natural phenomena, standards for protection against internal hazards (e.g., internal floods) and standards for assuring that SSC functions can be achieved expeditiously.

3. Section 4.0 of the WP, "Application of the Approach to Date," mentions the ARC-100 RAP, which is currently under development. In accordance with the guidance in SRP Section 19.3, the NRC staff may review the performance, reliability, and availability missions of risk significant SSCs to determine if they are adequate and whether the RAP and administrative control program can provide reasonable assurance that the missions can be achieved.

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