



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

**US NUCLEAR REGULATORY COMMISSION STAFF OBSERVATIONS ON
TERRAPOWER, LLC WHITE PAPER NATD-LIC-STDY-0003, "REGULATORY GAP
ANALYSIS REPORT" (EPID NO. L-2022-LRO-0082)**

SPONSOR AND SUBMITTAL INFORMATION

Sponsor: TerraPower, LLC

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Docket /Project No(s): 99902100

Submittal Date: September 30, 2022

Submittal Agencywide Documents Access and Management System Accession No.:
ML22266A285

Brief Description of the White Paper: By letter dated September 23, 2022 (Agencywide Documents Access and Management System Accession No. ML22266A285), TerraPower, LLC (TerraPower) submitted a white paper titled, "Regulatory Gap Analysis Report." This paper provides TerraPower's determination of the applicability of regulations contained in Title 10 of the *Code of Federal Regulations* (10 CFR) as they relate to the Sodium reactor design. The white paper also provides a discussion of potential planned exemptions from the regulations that may be needed to license the Sodium reactor and a comparison against draft NRC guidance contained in the updated NRC staff draft white paper, "Analysis of Applicability of NRC Regulations for Non-Light Water Reactors" (ML21175A287, referred to hereafter as the staff's draft white paper on regulatory applicability).

TECHNICAL ASSESSMENT

The NRC staff reviewed the TerraPower white paper and provided observations below. These observations do not constitute final agency positions. NRC staff observations in this response are not intended as comprehensive feedback. Lack of comment or observations regarding a certain aspect of the white paper should not be interpreted as NRC agreement with TerraPower's position.

GENERAL OBSERVATIONS:

1. TerraPower provided a screening and assessment of the regulations in Tables 1 and 2 of the white paper listing applicable and not applicable regulations, respectively.

Enclosure

TerraPower's screening and assessment appears generally consistent with the staff's draft white paper on regulatory applicability.

2. TerraPower's disposition of several requirements, including some Three Mile Island (TMI) requirements, is based on certain design features currently chosen for the Natrium plant (e.g., use of functional containment approach rather than a pressure-retaining containment). If these design features change, TerraPower should reevaluate the regulatory disposition provided in the white paper.
3. Section 3.2 of the white paper (WP) states that, "Regulations determined to be not applicable were reviewed to identify whether the regulations contained underlying bases that are necessary to consider for a comprehensive licensing evaluation of the Natrium design (e.g., 10 CFR 50.62); while these regulations are not applicable, they may be useful for informing Natrium design and licensing efforts." The staff notes that the underlying purpose of some prescriptive 10 CFR Part 50 regulations, such as 10 CFR 50.62, will remain a consideration in the NRC staff's review. The staff is interested in learning more about instances where TerraPower found regulations to be not applicable but also identified bases that were necessary to consider.
4. Several 10 CFR 50.55a standards identified in Section 4 of the WP are marked as not applicable to non-LWRs. The NRC staff acknowledges that several LWR-specific standards are not applicable to non-LWRs; however, some non-LWRs applicants may elect to use these codes and standards to demonstrate quality and capability of structures, systems, or components (SSCs). The staff encourages the use of existing codes and standards, as doing so can provide a recognized quality standard and alleviate much of the need to justify component quality on a specific basis at the design stage. In instances where non-LWRs use LWR-specific codes and standards, these standards should incorporate conditions in the regulations (such as those in 10 CFR 50.55a(b)) as applicable to the design. The staff notes that in a September 29, 2022, public meeting (ML22269A445) TerraPower indicated an intent to comply with conditions listed in 10 CFR 50.55a(b).

SPECIFIC OBSERVATIONS:

1. Section 4 Tables 1 and 2, contain regulations TerraPower identified as applicable and non-applicable, respectively. The staff noted some minor inconsistencies between the two tables:
 - a. Table 1 indicates 10 CFR 50.34(f)(3)(v)(A)(2) is applicable while Table 2 indicates all of 10 CFR 50.34(f)(3)(v) is not applicable.
 - b. Table 1 indicates all of 10 CFR 50.54 is applicable, while Table 2 indicates 10 CFR 50.54(o) is not applicable.
 - c. Table 1 indicates all of 10 CFR 50.55(a)(h) is applicable, while Table 2 indicates 10 CFR 50.55(a)(h)(2) is not applicable.

2. Section 4.4.1 of the WP states that dispositions of TMI-related requirements in 10 CFR 50.34(f) were provided for information only. Nonetheless, the NRC staff observes that 10 CFR 50.34(f)(1)(xii) is listed as applicable while 10 CFR 50.34(f)(2)(ix) is listed as “not technically relevant to the Natrium design.” However, 10 CFR 50.34(f)(1)(xii) requires the evaluation of hydrogen control systems that would satisfy the requirements of 10 CFR 50.34(f)(2)(ix).
3. Section 4.3 of the WP includes discussions of several potential exemptions TerraPower is considering. The staff makes the following observations regarding these exemptions:
 - a. The planned exemption from 10 CFR 50.120(b)(2)(iii), in Section 4.3.1 of the WP, appropriately references SECY-21-0039, “Elimination of the Shift Technical Advisor for the NuScale Design,” as a source of information in developing the exemption.
 - b. The planned exemption from 10 CFR 50.68, in Section 4.3.2 of the WP, appears to be consistent with the staff’s draft white paper on regulatory applicability. The staff notes that the exemption request should provide reference to the data necessary to validate calculational methods for the analyses required by 10 CFR 50.68(b)(2) through (4). The issue of validation data for neutronics analyses was discussed by TerraPower at the October 25, 2022, closed public meeting regarding spent fuel subcriticality (see publicly available slides at ML22293B830), and was consistent with the staff’s expectation in this area.
 - c. The planned exemptions from 10 CFR 50.34(a)(4) and (b)(4), in Section 4.3.3 of the WP, appear to be consistent with the staff’s draft white paper on regulatory applicability.
 - d. The planned exemption from 10 CFR 50.34(a)(1)(ii)(D), in Section 4.3.4 of the WP, appears to be consistent with the staff’s draft white paper on regulatory applicability.
 - e. Section 4.3.5 briefly discusses exemptions from 10 CFR 50.10 and 10 CFR 50.65 related to the nuclear island to energy island interface. The staff is addressing the basis for these and other exemptions in our review of TerraPower topical report NATD-LIC-RPRT-0001, “Regulatory Management of Natrium Nuclear Island and Energy Island Design Interfaces” (ML22277A824).
 - f. The planned exemptions related to the use of the term “reactor coolant pressure boundary” throughout 10 CFR Part 50, in Section 4.3.6 of the WP, appear to be consistent with the staff’s draft white paper on regulatory applicability.

- g. Section 4.3.7 of the WP discusses emergency preparedness (EP).
 - i. TerraPower's assessment of the applicability of EP regulations on offsite aspects appears to be consistent with the staff's draft white paper on regulatory applicability.
 - ii. It is not clear if TerraPower intends to (i) submit a construction permit (CP) application under 10 CFR Part 50 and Appendix E regardless of the status of 10 CFR 50.160, and then (ii) submit an operating license (OL) application under 10 CFR 50.160 if it is final, or otherwise, choose to submit exemption requests from portions of 10 CFR Part 50. If a CP application is submitted under 10 CFR Part 50 and Appendix E, and an OL application is submitted under 10 CFR 50.160, TerraPower will need to demonstrate how it is meeting applicable criteria under 10 CFR 50.160, including any criteria carried over from the CP application.
 - iii. The premise for TerraPower's determination that exemptions may be necessary from portions of the identified offsite EP regulations is not clear. For example, the WP does not mention if exemption requests would be based on a design and dose analysis that would justify an emergency planning zone (EPZ) not exceeding the site boundary. The staff will need information on the premise for these exemptions to determine if the exemptions would be justified.
 - iv. If TerraPower assumes that their design and dose analysis will justify an EPZ not exceeding the site boundary and if 10 CFR 50.160 is not final, then the proposed exemptions in Section 4.3.7 of the WP appear to be reasonable. The NRC staff notes it will need to examine the EP portion of the licensing application as well as the basis and special circumstances for the exemption requests to determine whether an exemption should or should not be granted.
 - v. It is important to note that the staff will conduct its review of the applications based on the applicable regulations at the time of submittal. At this time, the staff will conduct its review of the CP and OL based on 10 CFR 50.47 and Appendix E.
- h. Section 4.3.8 discusses the approach to seismic design criteria, including potential exemption requests from 10 CFR 50 Appendix S and 10 CFR 100.23 to implement ASCE 43-19. This does not appear to be consistent with the presentation provided to NRC staff on January 26, 2023 (ML23025A133), which indicated TerraPower had not selected ASCE 43-19 for use and was not planning to develop exemption requests.
- i. Section 4.3.9 of the WP discusses a potential need for an exemption from 10 CFR 55.40 due to the nature of the non-LWR technology used in the Natrium plant. While any such exemption request would still need to demonstrate

conformance with the provisions of the Atomic Energy Act of 1954, as amended (specifically as it relates to “uniform conditions” for the licensing of operators), the underlying proposal appears to be appropriate at the high level presented in the paper. In addition, the staff note that it is appropriate to consider the potential need for a related exemption request from certain provisions of 10 CFR 55.69, “Requalification,” that may also be inconsistent with the non-LWR technology used. TerraPower should consider whether submittal of a topical report for these items would be useful.

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SUBJECT: US NUCLEAR REGULATORY COMMISSION STAFF OBSERVATIONS ON TERRAPOWER, LLC WHITE PAPER NATD-LIC-STDY-0003, "REGULATORY GAP ANALYSIS REPORT" (EPID NO. L-2022-LRO-0082) DATED: MAY 1, 2023

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ADAMS Accession No.: ML23080A086

NRC-001

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