

UIUC Topical Report: “Applicability of Nuclear Regulatory Commission Regulations”

Discussion Topics

By letter dated December 9, 2022 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML22343A282), University of Illinois at Urbana-Champaign (UIUC) submitted topical report (TR), “University of Illinois Urbana-Champaign High Temperature Gas-cooled Research Reactor: Applicability of Nuclear Regulatory Commission Regulations,” for the U.S. Nuclear Regulatory Commission (NRC) staff’s review.

UIUC requested the NRC approval of the process for determining applicability of regulations in Title 10 of the *Code of Federal Regulations* (10 CFR), Chapter I, “Nuclear Regulatory Commission,” and the methodology used to identify and develop justification for regulatory exemptions, which were described in Sections 4 and 5 of the TR, respectively. UIUC also requested approval of the applicability determinations for individual regulations provided in Attachment 1 to the TR for the Ultra Safe Nuclear Corporation’s (USNC) Micro Modular Reactor (MMR) high-temperature, gas-cooled reactor (HTGR) design. UIUC stated that licensed power will not exceed the lesser of the MMR rating of 15MW(t) or the maximum allowable power for qualifying as a research reactor per 10 CFR 50.21(c). The NRC staff predicated its review on this outcome, and identified the following areas for discussion:

- 1) Section 5.4 of the UIUC TR, titled “Exclusion vs. Exemption – Entry Conditions Obviate Exemptions,” lists reasons why exemption requests should be minimized. Please clarify how UIUC used this information to determine an exclusion based on regulation entry conditions (e.g., applicability only to certain facility types (power reactors, light-water reactors (LWRs), or testing facilities) or specific application parameters) instead of identifying a potential requested exemption.
- 2) Table 4-1 of the TR describes the category of “2 N/A to NPUF [non-power utilization facility]” used to indicate regulations that do not apply to NPUFs on the following basis: “NPUFs do not need to meet regulations that have entry conditions pertaining to “power reactor.” Based upon UIUC qualifying for a Class 104(c) license, which is a non-power reactor, the power reactor regulations are not applicable.” Clarify how the categorization process was applied to the following regulations that include entry conditions of “power reactors” to determine applicability.
 - a) 10 CFR 50.49, Environmental qualification of electric equipment important to safety for nuclear power plants [Expand on UIUC TR Section 4.2.1, Item 3.c].
 - b) 10 CFR 50.65, Requirements for monitoring the effectiveness of maintenance at nuclear power plants [Expand on UIUC TR Section 4.2.1, Item 3.d].
 - c) 10 CFR 50.68, Criticality accident requirements, paragraph (b) (7) [Expand on UIUC TR Section 4.2.1, Item 2 and Section 6.1.1].
 - d) 10 CFR 50.60, Acceptance criteria for fracture prevention measures for light-water nuclear power reactors for normal operation.
- 3) Entry conditions in 10 CFR 50.34(f) currently apply only to specific Part 50 construction permit (CP) applicants (applications pending as of February 16, 1982) and applications

under Part 52 (Type 103 license applications only per 10 CFR 52.2). Commission direction in the staff requirements memorandum (ML15266A023) to SECY-15-0002, "Proposed Updates of Licensing Policies, Rules, and Guidance for Future New Reactor Applications," (ML13277A420) confirmed that its earlier directions for the 10 CFR Part 52 new power reactor applications be applied consistently to 10 CFR Part 50 new power reactor applications. SECY 22-0052, "Proposed Rule: Alignment of Licensing Processes and Lessons Learned from New Reactor Licensing," (ML21159A055) includes the proposed draft final rule, which modifies the introduction to 10 CFR 50.34(f) such that the regulation would apply to Part 50 CP applications for nuclear power reactors.

Clarify how the process described in Section 4 of the TR was used to determine applicability subgroups of "3 Applicable as is" and "3B Meet intent" as shown in Attachment 1 to the TR for the regulations in 10 CFR 50.34(f) [Expand on discussion in Section 5.5 of the UIUC TR]. The NRC staff noted that the accepted Kairos topical report KP-TR-004, "Regulatory Analysis for the Kairos Power Fluoride Salt-Cooled High Temperature Reactor," Revision 4, (ML22159A358) identified 10 CFR 50.34(f) as not applicable to the proposed non-power Hermes reactor.

- 4) The requirement at 10 CFR 50.34(a)(3)(i) involves inclusion of the facility principal design criteria in the application. Separately, the regulation describes applicability of the general design criteria (GDC) in Appendix A to 10 CFR Part 50 based on reactor type (the GDC reflect the minimum requirements for LWRs and guidance for other reactor types). Clarify how the process described in Section 4 of the TR was used to determine applicability subgroup "3B Meet intent" as shown in Attachment 1 to the TR.
- 5) The regulations at 10 CFR 50.34 (g) and 10 CFR 50.44(d) related to combustible gas control state that those requirements apply to all applicants for a reactor CP or operating license (OL) whose application is submitted after October 16, 2003. Clarify how the category of "3B Meet intent" was assigned to 10 CFR 50.34(g) and the category of "2 N/A to NPUF" was assigned to 10 CFR 50.44 using process described in Section 4 of TR. The NRC staff noted that the accepted Kairos topical report, KP-TR-004, Rev. 4, identifies 10 CFR 50.34(g) as applicable and 10 CFR 50.44 as partially applicable to the proposed non-power Hermes reactor.
- 6) The regulation at 10 CFR 50.48, Fire protection, states that each holder of an operating license under 10 CFR Part 50 must have a fire protection plan that satisfies Criterion 3 of Appendix A to 10 CFR Part 50. Section 9.3 of NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Part 1, "Format and Content," (ML042430055) also states that the applicant should describe the systems and programs designed to protect the reactor facility from damage by fire and discuss how the facility meets all local building and fire codes. Clarify how the process described in Section 4 of the TR was used to determine applicability of "2 N/A to NPUF" as shown in Attachment 1 to the TR for the regulation at 10 CFR 50.48.
- 7) Under 10 CFR 50.36(c)(2)(ii), Criterion 1 requires a limiting condition for operation (LCO) be established for installed instrumentation used to detect and indicate in the control room a significant abnormal degradation of the *reactor coolant pressure boundary*, which is a defined term in 10 CFR 50.2 applicable to LWRs. The "Updated NRC Staff Draft White Paper Analysis of Applicability of NRC Regulations for Non-Light Water Reactors,"

(ML21175A287) includes discussion in Table 5, “Areas with anticipated exemptions,” with respect to the effect of the reactor coolant pressure boundary definition on applicable regulations. The discussion states:

The reactor coolant pressure boundary for an LWR provides a fission product retention barrier for the release of radionuclides. However, in some non-LWRs, the reactor coolant boundary would not serve this function. Fission product retention is provided by the functional containment. [...] In 10 CFR 50.36(c)(2)(ii), “significant abnormal degradation of the reactor coolant pressure boundary” is likewise not a safety consideration for some non-LWRs and can be replaced by “significant abnormal degradation of the functional containment” via an exemption.

UIUC TR Section 4.2.1, Item 3.b addresses the regulation by indicating that safety is based on a functional containment and maintaining the integrity of the helium pressure boundary is a defense in depth, thereby meeting the intent of 10 CFR 50.36(c)(2)(ii). Attachment 1 to the TR categorized this regulation as “3B Meet intent”, for which the basis in Table 4-1 of the TR states that the underlying safety basis is relevant and must be addressed, but an alternative approach would be more appropriate for the MMR design.

The requirements of 10 CFR 50.12, “Specific Exemptions,” state, in part, that the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of the regulations of Part 50 when:

- The exemptions are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security; and
- Special circumstances are present.

Special circumstances listed in 10 CFR 50.12(a)(2) include, in part:

- Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule; or
- The exemption would result in benefit to the public health and safety that compensates for any decrease in safety that may result from the grant of the exemption.

Please clarify how the categorization basis under “3B Meets intent” is distinct from the effect of an exemption under 10 CFR 50.12 when the special circumstance of compliance not being necessary to meet the underlying purpose of the rule applies. Please also address consistency with the NRC staff white paper regarding the treatment of the requirement for an LCO addressing Criterion 1 of 10 CFR 50.36(c)(2)(ii).

- 8) Section 6.1.2 and Attachment 1 to the UIUC TR identify 50.109, Backfitting, as a regulation for which an exemption would be requested. As noted, SECY 19-0062, “Final Rule: Non-power Production or Utilization Facility License Renewal,” (ML18031A000) states that the regulatory basis of 10 CFR 50.109 was expressed solely in terms of nuclear power reactors. In addition, the requirements of the regulation apply to the Commission itself rather than to

applicants or licensees. Please clarify the purpose of the proposed request for exemption and applicability to UIUC.

- 9) Attachment 1 of the UIUC TR, 10 CFR 55.5(b)(1) through end of 55.5 is identified as “2 N/A to NPUF.” However, per 10 CFR 55.5, Communications, paragraph (b)(3) specifically addresses any application for a license or license renewal filed under the regulations in Part 55 and all other submissions involving a test and research reactor or non-power reactor facility licensed under 10 CFR part 50. Please clarify the categorization of 10 CFR 55.5(b)(3).
- 10) The definitions in 10 CFR 21.3 for basic component, commercial grade item, and dedication, as well as the definition of basic component in 10 CFR 50.2 contain specific applicability broader than nuclear power reactors. The definitions in Part 21 include paragraphs beginning: “When applied to other facilities and other activities licensed under 10 CFR parts 30, 40, 50 (other than nuclear power plants), 60, 61, 63, 70, 71, or 72 of this chapter...” that have applicability to non-power reactors. Similarly, 10 CFR 50.2 includes alternate applicability under the definition of basic component. Please clarify the categorization of these definitions.