# Principal Design Criteria for the Aurora Powerhouse

March 2026

Oklo Inc., Non-proprietary

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

April 22, 2026

Ross Moore
Vice President of Regulatory and Oversight
Oklo Inc.
3190 Coronado Dr.
Santa Clara, CA 95054

SUBJECT: OKLO INC. – FINAL SAFETY EVALUATION FOR TOPICAL REPORT OKLO-2025-RX-R012-P, “PRINCIPAL DESIGN CRITERIA FOR THE AURORA POWERHOUSE,” REVISION 1 (EPID NO. L-2025-TOP-0028)

Dear Ross Moore:

By letter dated August 6, 2025, Oklo Inc. (Oklo) submitted topical report (TR) Oklo-2025-RX-R012, “Principal Design Criteria for the Aurora Powerhouse,” Revision 0, for the U.S. Nuclear Regulatory Commission (NRC) staff (the staff) review (Agencywide Documents Access and Management System (ADAMS) Accession No. ML25220A124). The TR describes the result of Oklo’s process to develop principal design criteria (PDC) for the Oklo Aurora powerhouse facility, based on Regulatory Guide (RG) 1.232, “Guidance for Developing Principal Design Criteria for Non-Light Water Reactors,” Revision 0 (ML17325A611). On August 25, 2025, the NRC staff informed Oklo that the TR provided sufficient information for the NRC staff to conduct a detailed technical review (ML25232A123). On September 11, 2025, the NRC staff issued an audit plan to Oklo (ML25251A229) and subsequently conducted an audit of materials related to the TR from September 19, 2025, to March 16, 2026. The NRC staff issued the audit summary dated April 13, 2026 (ML26049A258). By letter dated March 5, 2026, Oklo submitted Revision 1 of the TR (ML26064A243) which reflects discussions held with the NRC staff regarding Revision 0 of the TR.

The enclosed final safety evaluation (SE) is being provided to Oklo, because the NRC staff found Oklo-2025-RX-R012-P, Revision 1, acceptable for referencing in licensing actions to the extent specified and under the limitations and conditions delineated in the SE. The final SE defines the basis for the NRC staff’s acceptance of the TR.

The NRC staff requests that Oklo publish an approved version of this TR within 3 months of receipt of this letter. The approved version should incorporate this letter and the enclosed SE after the title page. The approved version should include a “-A” (designating approved) following the TR identification symbol.

If you have any questions, please contact Katherine Wagner at (301) 415-6202 or via email at Katie.Wagner@nrc.gov.

Sincerely,

***/RA/***

Joshua Borromeo, Chief
Advanced Reactor Licensing Branch 1
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Project No.: 99902095

Enclosure:
As stated

cc: Oklo Aurora Powerhouse
via GovDelivery

SUBJECT: OKLO INC. – FINAL SAFETY EVALUATION FOR TOPICAL REPORT OKLO-2025-RX-R012-P, “PRINCIPAL DESIGN CRITERIA FOR THE AURORA POWERHOUSE,” REVISION 1 (EPID NO. L-2025-TOP-0028) DATED: APRIL 22, 2026

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

# OKLO INC. – FINAL SAFETY EVALUATION OF TOPICAL REPORT OKLO-2025-RX-R012-P, “PRINCIPAL DESIGN CRITERIA FOR THE AURORA POWERHOUSE,” REVISION 1 (EPID L-2025-TOP-0028)

## SPONSOR AND SUBMITTAL INFORMATION

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|---|---|
| **Sponsor:** | Oklo Inc. (Oklo) |
| **Sponsor Address:** | 3190 Coronado Dr.<br>Santa Clara, CA 95054 |
| **Project No.:** | 99902095 |
| **Submittal Date:** | August 6, 2025 |

**Submittal Agencywide Documents Access and Management System (ADAMS) Accession No.:** ML25220A124

**Revision Letter Date and ADAMS Accession No**: Revision 1, March 5, 2026, (ML26064A243).

**Brief Description of the Topical Report:**
By letter dated August 6, 2025 (ML25220A125), Oklo, Inc. (Oklo) submitted a topical report (TR) entitled “Principal Design Criteria for the Aurora Powerhouse,” Revision 0, for the U.S. Nuclear Regulatory Commission (NRC) staff’s review. By letter dated March 5, 2026, Oklo submitted Revision 1 of the TR. The TR describes the result of Oklo’s process to develop principal design criteria (PDCs) for the Aurora powerhouse facility to comply with the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) 52.79(a)(4)(i). Oklo requested the NRC’s review and approval of these PDCs for use in future licensing applications for the Aurora powerhouse.

Oklo used Regulatory Guide (RG) 1.232, “Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors,” Revision 0 (ML17325A611), to inform the development of its PDCs for the Aurora powerhouse. In addition, the TR refers to experience and information from prior U.S. Department of Energy sodium-cooled fast reactors (SFRs), particularly the Experimental Breeder Reactor-II (EBR-II) and the Fast Flux Test Facility (FFTF), as technological precedent for the proposed PDCs.

By email dated August 25, 2025, the NRC staff informed Oklo that the TR provided sufficient information for the NRC staff to conduct a detailed technical review (ML25232A123). On September 11, 2025, the NRC staff transmitted an audit plan to Oklo (ML25251A229) and subsequently conducted an audit of materials related to the TR from September 19, 2025, to March 16, 2026. The NRC staff issued the audit summary dated April 13, 2026 (ML26049A258).

## REGULATORY EVALUATION

The provisions in 10 CFR 52.79(a)(4)(i) require combined license applicants to include PDCs as part of the final safety analysis report (FSAR) for a proposed facility. The required design information that must also be provided as part of the FSAR includes: (1) the design bases and the relation of the design bases to the PDCs, in accordance with 10 CFR 52.79(a)(4)(ii); and (2) "[i]nformation relative to materials of construction, arrangement, and dimensions, sufficient to provide reasonable assurance that the design will conform to the design bases with adequate margin for safety," in accordance with 10 CFR 52.79(a)(4)(iii).

The regulations under 10 CFR 52.79(a)(4)(i) state, in part, that "Appendix A to part 50 of this chapter, 'General Design Criteria for Nuclear Power Plants,' establishes minimum requirements for the [PDCs] for water-cooled nuclear power plants similar in design and location to plants for which construction permits have previously been issued by the Commission and provides guidance to applicants in establishing [PDCs] for other types of nuclear power units." Since the Aurora powerhouse is an SFR plant, its PDCs are not required to meet the general design criteria (GDCs) in 10 CFR Part 50, Appendix A. Nonetheless, the introduction to 10 CFR Part 50, Appendix A, generally describes the PDCs as "establish[ing] the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components important to safety; that is, structures, systems, and components that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public."

Recognizing that the GDCs in 10 CFR Part 50, Appendix A may not be appropriate for non-light-water reactors (non-LWRs), the NRC staff issued RG 1.232, Revision 0, which serves as guidance for developing PDCs for non-LWR designs. RG 1.232, Appendix B, "Sodium-Cooled Fast Reactor Design Criteria," provides the guidance for SFR design criteria (SFR-DCs).

## TECHNICAL EVALUATION

### 1. Aurora Powerhouse Design

Section 1.2, "Aurora powerhouse design overview," of the TR provides an overview of the key design features of the Aurora powerhouse. The TR states that the term "Aurora powerhouse" describes the nuclear power plant generically and does not refer to a specific structure, system, or component (SSC). The TR states that the safety of the Aurora reactor and associated heat transport systems relies on inherent features and designed passive safety functions typical of SFRs that were demonstrated through operation at EBR-II and FFTF. The metal-fueled Aurora reactor operates at near-atmospheric pressure, and the powerhouse uses a functional containment with multiple barriers to prevent release of fission products. In addition, the TR states that the passive reactor vessel auxiliary cooling system (RVACS) can provide all necessary residual heat removal.

The NRC staff did not perform a technical review of this information but used it as context to inform the review of the proposed PDCs. Accordingly, an applicant or licensee referencing this TR must propose a design that is substantially similar to the Aurora powerhouse design as discussed in the TR, or otherwise justify that any departures from these design features do not affect the conclusions of the TR and this safety evaluation (SE). This is documented as Limitation and Condition 1 in section 4 of this SE.

## 2. Methodology

Section 2.2, “Approach for the Aurora powerhouse,” of the TR describes Oklo’s process for developing the Aurora powerhouse PDCs. Oklo stated that it first assessed and adopted the SFR-DCs from Appendix B to RG 1.232, where appropriate. Where the powerhouse design was not well represented by the SFR-DCs, Oklo stated that it reviewed the language from the other RG 1.232 appendixes (i.e., Appendix A, “Advanced Reactor Design Criteria” [ARDCs],[1] and Appendix C, “Modular High-Temperature Gas-Cooled Reactor Design Criteria” [MHTGR-DCs]) to determine if a criterion from those other RG 1.232 appendices could be added without modification, with modification, or if a new PDC would be required. Finally, Oklo reviewed the initial list of PDCs to determine whether any additional PDCs were warranted.

The NRC staff considers this overall approach to be acceptable because it uses the NRC staff-approved guidance in RG 1.232 as a basis for developing Aurora powerhouse design-specific criteria and considers the need for PDCs not contemplated in RG 1.232.

## 3. Evaluation of Aurora Powerhouse Principal Design Criteria

Section 2.3, “Summary of changes to the RG 1.232 design criteria,” of the TR provides Oklo’s justification for the types of changes it made to the RG 1.232 DCs to ensure that the Aurora powerhouse PDCs collectively provide a comprehensive design framework for the Aurora powerhouse advanced reactor. Table 3-1, “Principal design criteria for the Aurora powerhouse,” of the TR contains a list of the Aurora powerhouse PDCs, the source language (e.g., SFR-DC, MHTGR-DC), and justification for any changes.

The NRC staff’s review was limited to an evaluation of the PDCs in the context of the proposed Aurora powerhouse design and did not include a detailed review of how Oklo intends for the design to meet the PDCs (e.g., specific design features, design limits, plant programs). Additionally, the NRC staff notes that exemptions from NRC regulations may be necessary to support use of these PDCs and should be addressed in separate licensing actions referencing this TR.

Section 3.1, “General Changes to RG 1.232 DCs,” of this SE, provides the staff’s evaluation of broad, conceptual changes to the RG 1.232 DCs. Section 3.1 of this SE includes high-level updates, such as introducing the concept of functional containment. Section 3.2, “Evaluation of Specific Aurora Powerhouse Principal Design Criteria,” of this SE focuses on the staff’s evaluation of detailed, design-specific changes to the RG 1.232 DCs.

### 3.1 General Changes to RG 1.232 DCs

### 3.1.1 Use of Functional Containment Concept

Section 2.3.1, “Use of functional containment,” of the TR discusses the use of the functional containment concept for the Aurora powerhouse design. A “functional containment” is defined in

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[1] As stated in RG 1.232, Rev. 0, “The NRC intends the ARDC to apply to the six advanced reactor technology types identified in the [U.S. Department of Energy] report [titled ‘Guidance for Developing Principal Design Criteria for Advanced (Non-Light Water) Reactors,’ December 2014 (ML14353A246, ML14353A248)]; however, in some instances, one or more of the criteria from the SFR-DC or MHTGR-DC may be more applicable to a design or technology than the ARDC.”

Appendix C to RG 1.232 as a “barrier, or set of barriers taken together, that effectively limit the physical transport and release of radionuclides to the environment across a full range of normal operating conditions, [anticipated operational occurrences], and accident conditions.” Incorporation of a functional containment concept into the Aurora powerhouse PDCs results in the use of language from MHTGR-DCs 16, 71, and 72; adoption of SFR-DCs 13 and 64 with modifications; and exclusion of PDCs 38-43 and 50-57.

Oklo’s rationale for the use of a functional containment concept is summarized in TR section 2.3.1. Oklo states that a functional containment strategy is appropriate because the Aurora reactor operates with its coolant well below its boiling point, maintains near-atmospheric pressure, and is not susceptible to loss-of-primary-coolant accidents due to the entire primary heat transport system being contained within the reactor vessel and the reactor vessel being surrounded by a guard vessel.

SECY-18-0096, “Functional Containment Performance Criteria for Non-Light-Water Reactors” (ML18114A546), as approved by the Commission in a staff requirements memorandum (ML18338A502), describes considerations for the implementation of a functional containment approach. The NRC staff notes that while the use of a functional containment approach is typically associated with high-temperature gas-cooled reactors (as shown by its incorporation into the RG 1.232 MHTGR-DC), SECY-18-0096 states that it is applicable to all non-LWRs. SECY-18-0096 predicates the use of a functional containment approach on the identification of performance criteria for SSCs that play a role in radionuclide retention. As such, the NRC staff considers it conceptually reasonable to apply a functional containment approach to the Aurora powerhouse, provided that Oklo can appropriately identify functional containment performance criteria and justify those functional containment performance criteria are adequate.

The proposed process for developing functional containment performance criteria documented in SECY-18-0096 is a risk-informed, performance-based process that relies on mechanistic source term analyses. SECY-18-0096 also lists conditions derived from SECY-93-092, “Issues Pertaining to the Advanced Reactor (PRISM, MHTGR, and PIUS) and CANDU 3 Designs and Their Relationship to Current Regulatory Requirements” (ML040210725), that mechanistic source term analyses should meet. Oklo has stated that it intends to use mechanistic source term analyses as part of the safety analysis approach.[2] The NRC staff notes that, in general, mechanistic source term analyses evaluate the capability of the functional containment on a layer-by-layer basis and may provide a starting point for establishing functional containment performance criteria. However, Oklo has not proposed an approach that aligns with the methodology documented in SECY-18-0096 to the NRC staff. To support use of the functional containment concept, the NRC staff expects that Oklo will identify and justify appropriate functional containment performance criteria as part of a future licensing submittal. This is captured in Limitation and Condition 2a in section 4 of this SE.

### 3.1.2 Removal of Important-to-Safety Electrical Power

Section 2.3.2, “Deletion of SFR-DC 17 and 18,” of the TR discusses the removal of SFR-DCs 17 and 18 due to the Aurora powerhouse being designed “such that electrical power is not relied

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[2] The NRC staff previously reviewed and provided feedback (ML23187A577) on an Oklo white paper (WP), “Source Term Modeling Overview,” dated April 2023 (ML23111A297). The WP described a mechanistic source term approach for source term and dose analyses.

upon to support any important-to-safety functions during anticipated operational occurrences or postulated accidents.” The NRC staff determined this deletion to be acceptable provided safety analyses of the Aurora powerhouse or other justification demonstrates that no important-to-safety functions rely on electrical power. As noted in RG 1.232, such important-to-safety functions may include post-accident monitoring, control room habitability, emergency lighting, radiation monitoring, communications, and potentially others appropriate for the design. This is captured in Limitation and Condition 2b in section 4 of this SE.

This determination should not be interpreted as the NRC staff concluding that no criteria for the design of electrical power systems are necessary for the Aurora powerhouse; rather, it indicates that such criteria may appropriately be established through means other than PDCs (e.g., system descriptions in licensing basis documentation) if Limitation and Condition 2b is satisfied. The NRC staff emphasizes that defense in depth remains a fundamental NRC philosophy, relying on multiple independent and redundant layers of protection to address design uncertainties.

### 3.1.3 Onsite Monitoring Room

Section 2.3.3, “Modification of SFR-DC 19,” of the TR discusses the modification of SFR-DC 19 to refer to “onsite monitoring room” rather than “control room.” Oklo’s justification is that automatic controls maintain the plant in safe and stable conditions during power operation with no need for operator action. The TR states that **[[** **]]**. For defense in depth, the operators can shut down the reactor from an alternate location outside of the onsite monitoring room.

The NRC staff notes that Oklo’s operational staffing plan is not within the scope of the PDC TR; therefore, this SE does not address the acceptability of the operational staffing plan.[3] Rather, this SE focuses on the design of the onsite monitoring room. The NRC staff considers Oklo’s changes to SFR-DC 19 to use the terminology “onsite monitoring room” to be primarily nomenclature changes that do not substantively impact the meaning of the PDC. Oklo’s PDC 19 includes the key aspects of SFR-DC 19: capabilities (e.g., control room indications and ability for operators to control and manually shut down the reactor), habitability, and protection of the control room, as well as ability for operators to manually shut down the reactor from a location outside the control room. Therefore, the NRC staff determined that the use of the term “onsite monitoring room” instead of “control room” is acceptable.

The last paragraph of PDC 19 includes several related changes relative to SFR-DC 19: deleting “and controls” from the term “instrumentation and controls,” changing “maintain” to “verify,” and deleting text about the potential capability for cold shutdown. Along with the justification that operators can shut down the plant from a location outside the onsite monitoring room, these changes indicate that operators will have the ability to perform a shutdown from an alternate location but may not have the ability to take additional actions from an alternate location to maintain a safe shutdown condition. The NRC staff determined this is acceptable because the alternative manual shutdown ability is the key design consideration; assuming the shutdown

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[3] Oklo submitted two TRs regarding operator licensing and staffing plans: “Product-Based Operator Licensing Framework,” Rev. 0, dated March 2025 (ML25070A325), and “Staffing Plan Validation Methodology,” dated January 2026 (ML26034C407). Both TRs are currently under NRC staff review.

margin is properly calculated with sufficient allowances for uncertainties and potential malfunctions, no further actions would be needed to hold the reactor subcritical. The NRC staff addresses the concept of cold shutdown in section 3.2.4, “Modifications from SFR- and MHTGR-DCs,” of this SE.

### 3.1.4 Removal of Intermediate Heat Transfer System as Important to Safety

Section 2.3.4, “Deletion of SFR-DC 70 and 75-77,” of the TR discusses the removal of SFR-DCs 70 and 75-77 due to the design of the Aurora powerhouse not requiring the intermediate heat transport system (IHTS) to perform important-to-safety functions. Oklo’s rationale is that “[f]ailure of the intermediate coolant boundary has no significant impact on the plant,” and “[t]he RVACS is designed with sufficient redundancy and margin to preclude the IHTS from being relied upon for important-to-safety decay heat removal functions.”

During the audit related to this TR, the NRC staff and Oklo discussed Oklo’s statement that failure of the IHTS has no significant impact on the plant (ML26049A258). The NRC staff noted potential impacts of a postulated steam generator tube rupture (SGTR) in the power generation system as well as potential leaks resulting in interactions of intermediate sodium with other media. Oklo clarified that the intermediate heat exchanger (IHX), which forms the interface between the primary and intermediate sodium loops, is designed to a higher pressure than several other components in the IHTS, and portions of the IHX that are part of the primary coolant boundary are safety related. In addition, Oklo stated that each IHTS loop is equipped with redundant rupture discs to mitigate pressure waves that could occur due to a SGTR. Oklo also stated that an uncontrolled release of all activity in the IHTS is expected to have limited off-site consequences.

The NRC staff notes that in the TR, PDC 73, “Sodium leakage detection and reaction prevention and mitigation,” and PDC 74, “Sodium/water reaction prevention/mitigation,” apply to any sodium-containing system, which would include the IHTS. These PDCs address the NRC staff’s primary technical observations related to potential IHTS failures. Furthermore, the NRC staff expects that the portions of the IHX that form part of the primary coolant boundary will meet PDC 14, “Primary coolant boundary,” PDC 30, “Quality of primary coolant boundary,” PDC 31, “Fracture prevention of primary coolant boundary,” and PDC 32, “Inspection of primary coolant boundary,” which would minimize the potential for their failure.

The NRC staff notes that the IHTS rupture discs may have an important-to-safety function in mitigating the pressure wave due to a SGTR. The NRC staff also notes that it may be possible for the remainder of the IHTS to have no important-to-safety functions, but this must be further justified in future licensing submittals. Future licensing submittal justifications could include, for example, safety analyses that show the adequacy of the rupture discs to relieve the worst-case pressure wave from a postulated SGTR; the sufficiency of the RVACS alone to remove decay heat, accounting for single failures as well as diversity and defense-in-depth considerations for decay heat removal; and the radiological and integrated plant consequences of an uncontrolled release of intermediate coolant, considering possible interactions of sodium with other media.

These considerations are captured in Limitation and Condition 2c in section 4 of this SE. Provided that adequate justification is provided in a future submittal, the NRC staff determined the deletion of SFR-DCs 70 and 75-77 is acceptable.

This determination should not be interpreted as the NRC staff concluding that no criteria for the design of the IHTS are necessary for the Aurora powerhouse; rather, it indicates that such criteria may appropriately be established through means other than PDCs (e.g., system descriptions in licensing basis documentation) if Limitation and Condition 2c is satisfied.

## 3.2 Evaluation of Specific Aurora Powerhouse Principal Design Criteria

Table 3-1 of the TR contains each Aurora powerhouse PDC, the source language (e.g., SFR-DC, MHTGR-DC), and justification for any changes from RG 1.232 DC source language.

### 3.2.1 SFR-DC-derived PDCs

Many of the Aurora powerhouse PDCs are derived from the SFR-DCs in Appendix B to RG 1.232, including PDCs 1-5, 10-15, 19-26, 28-36, 60-64, 71-74, 78, and 79. Beyond those subjects considered in the GDCs, the SFR-DCs cover SFR-specific topics, including the intermediate coolant system, coolant and cover gas purity control, cover gas inventory maintenance, sodium heating systems, and issues related to the chemical reactivity of sodium (including leakage detection, sodium and water reaction prevention and mitigation, and separation of sodium from chemically incompatible fluids). Because the SFR-DCs are specific to SFRs like the Aurora powerhouse, the NRC staff considers these PDCs to provide an acceptable basis for the Aurora powerhouse PDCs. Oklo’s adaptations to the SFR-DCs are discussed in SE section 3.2.4.

### 3.2.2 MHTGR-DC-derived PDCs

Aurora powerhouse PDCs 16, 37, 58, and 59 are based on MHTGR-DCs 16, 37, 71, and 72, respectively, in Appendix C to RG 1.232. While the Aurora powerhouse design does not have much in common with the MHTGR design used to develop the criteria in Appendix C to RG 1.232, the RG states that applicants are “free to choose among the ARDC, SFR-DC, or MHTGR-DC to develop each PDC after considering the underlying safety basis for the criterion and evaluating the rationale for the adaptation described in this RG.” The NRC staff therefore considers the use of the MHTGR-DCs acceptable as the basis for establishing DCs for an SFR design, provided that the safety basis is appropriately preserved and the adaptations are relevant to the design.

The MHTGR-DCs used as the basis for Aurora powerhouse PDCs 16, 58, and 59 are used because they implement the functional containment approach. Because the functional containment approach is technology inclusive and Oklo has proposed its use for the Aurora powerhouse, as discussed in section 3.1.1 of this SE, it is appropriate to use the MHTGR-DCs as the basis for these PDCs. MHTGR-DC 37 is used as the basis for PDC 37 because MHTGR-DC 37 pertains to a passive heat removal system, which the NRC staff notes is consistent with the RVACS design. Oklo’s adaptations to the MHTGR-DCs are discussed in SE section 3.2.4.

### 3.2.3 “Deleted” PDCs

Oklo did not include PDCs numbered 17 and 18; these were marked as deleted due to the Aurora powerhouse not being reliant on electric power systems to perform important-to-safety functions. This change is addressed generically in section 3.1.2 of this SE and is considered by the NRC staff to be acceptable, subject to applicable limitations and conditions, for the reasons previously discussed.

Oklo did not include PDCs numbered 38-43 and 50-57 (and therefore did not incorporate SFR-DCs 38-43 and 50-57); these were marked as deleted due to the adoption of the functional containment approach, consistent with the MHTGR-DCs in RG 1.232 Appendix C. The NRC staff determined that this is acceptable, subject to applicable limitations and conditions, because the Aurora powerhouse employs a functional containment as discussed in SE section 3.1.1.

Oklo did not include PDCs numbered 44-46; these were marked as deleted because, according to Oklo in TR Table 3-1, the Aurora powerhouse RVACS provides indefinite core cooling capability without the need for structural and equipment cooling systems. The NRC staff notes that such systems typically provide cooling to SSCs such as primary coolant pumps and control rod drives. Conceptually, it may be possible that no important-to-safety SSCs rely on structural and equipment cooling systems to perform their safety functions. Therefore, the NRC staff determined it is acceptable to delete PDCs 44-46, provided future analyses demonstrate that no SSCs require cooling beyond that provided by RVACS to perform important-to-safety functions. This is captured in Limitation and Condition 2d in section 4 of this SE. However, this determination should not be interpreted as the NRC staff concluding that no criteria for the design of structural and equipment cooling systems are necessary for the Aurora powerhouse; rather, it indicates that such criteria may appropriately be established through means other than PDCs (e.g., system descriptions in licensing basis documentation) if Limitation and Condition 2d is satisfied.

Oklo did not include PDCs numbered 70 and 75-77; these were marked as deleted due to the IHTS not being important to safety. This change is addressed generically in section 3.1.4 of this SE and is considered by the NRC staff to be acceptable, subject to applicable limitations and conditions, for the reasons previously discussed.

### 3.2.4 Modifications from SFR- and MHTGR-DCs

As discussed above, all Aurora powerhouse PDCs are based on either the SFR-DCs or MHTGR-DCs from RG 1.232. Aurora powerhouse PDCs 1-4, 10-12, 14-16, 20-26, 28, 29, 31-33, 36, 60-63, 72-74, 78, and 79 were adopted from the SFR- and MHTGR-DCs with no changes.

Aurora powerhouse PDC 5 modified SFR-DC 5 to change “an orderly shutdown and cooldown” to “the ability to achieve and maintain safe shutdown” for consistency with SECY-94-084, “Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant Designs” (ML003708068). The NRC staff notes that SECY-94-084 recognized that plant states besides cold shutdown may constitute a safe shutdown condition, provided that “reactor subcriticality, decay heat removal, and radioactive materials containment are properly maintained for the long term.” In addition, the temperature-based shutdown conditions in the GDCs were defined for light-water reactors and are not applicable to SFRs. The NRC staff determined that the intent of SFR-DC 5 is met through the concept of safe shutdown and therefore determined that Oklo’s changes to SFR-DC 5 are acceptable. The NRC staff will review Oklo’s criteria for safe shutdown in licensing applications that reference this TR.

Aurora powerhouse PDCs 13 and 64 were modified from SFR-DCs 13 and 64 to refer to “functional containment” rather than a physical containment structure. These changes are acceptable for the reasons discussed in section 3.1.1 of this SE.

In addition to the generic changes discussed in section 3.1.3 of this SE, Aurora powerhouse PDC 19 modified SFR-DC 19 to (1) add “postulated” to “accident conditions;” (2) add protection against inert gases; and (3) delete the terminology related to hot and cold shutdown. Regarding change (1), the addition of the word “postulated” has no significant impact on the PDC because it does not change the scope of accident conditions considered.[4] A postulated accident is an assumed or hypothetical accident scenario used for design and licensing basis analyses; in other words, an accident against which a facility is designed, in part using PDCs. Therefore, the NRC staff determined this change is acceptable. Regarding change (2), the NRC staff notes that SFRs use inert gas as a cover gas above the sodium coolant, so it is appropriate and acceptable for inert gases to be considered as a potential hazard. Regarding change (3), the NRC staff determined the change is acceptable for the reasons given in the discussion of PDC 5.

Aurora powerhouse PDC 30 modified SFR-DC 30 to change the wording from “highest quality standards practical” to “commensurate with their importance to safety,” consistent with PDC 1. Conceptually, it is reasonable to apply quality standards commensurate with their importance to safety. Therefore, the NRC staff determined PDC 30 is acceptable but notes that a future licensing submittal will have to clearly identify and justify the safety importance of primary coolant boundary components and demonstrate the adequacy of their corresponding standards for quality and design.

Aurora powerhouse PDCs 34 and 35 modified SFR-DCs 34 and 35 to delete “suitable interconnections, leak detection, and isolation capabilities” for the residual heat removal (RHR) and emergency core cooling systems. Per PDCs 34 and 35, the RVACS is credited for RHR and emergency core cooling in the Aurora powerhouse. The TR describes the RVACS as a passive, “always-on” system that relies upon natural circulation of ambient air for cooling. The NRC staff understands that the RVACS is not isolable in the same sense as the active, liquid-cooled systems contemplated by the original GDC. The NRC staff views interconnections for the RVACS as covered by the redundancy portion of the PDC. In addition, system (air) leakage is of little consequence for RVACS, as further discussed under PDC 37 below. The NRC staff determined that PDCs 34 and 35 are acceptable because they retain the pertinent portions of SFR-DCs 34 and 35.

Aurora powerhouse PDC 37 modified MHTGR-DC 37 to delete the leaktight aspect of the passive RHR system and to delete “and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation, including associated systems, for [anticipated operational occurrence] or postulated accident decay heat removal to the ultimate heat sink and, if applicable, any system(s) necessary to transition from active normal operation to passive mode.” The NRC rationale for MHTGR-DC 37 adaptations to

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[4] The NRC staff notes that “postulated accidents” has a specific meaning in the context of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition” (https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0800/index); specifically, per Section 15.0, “Introduction – Transient and Accident Analyses,” Revision 3 (ML070710376), occurrences that could happen but are not expected to occur during the life of the nuclear power plant. The other category of initiating event in NUREG-0800, based on frequency, is an anticipated operational occurrence, which is defined in 10 CFR Part 50, Appendix A, as conditions of normal operation that are expected to occur one or more times during the life of the nuclear power unit. Normal conditions are already addressed in Oklo’s PDC 19.

GDC 37 in RG 1.232 states that reactor cavity cooling system (RCCS) performance does not require “leaktight” conditions, and abnormal leakage of RCCS coolant to locations other than the exhaust structure may be acceptable provided that the leakage does not impact safety functions or functional containment. In addition, the NRC staff rationale for adaptations to GDC 37 acknowledges that some RCCS designs will provide continuous passive operation, which negates the need to test the operation sequence that brings the system into operation. Because the NRC staff understands the RVACS to be consistent with this rationale, the NRC staff determined Oklo’s proposed PDC 37 is acceptable.

Aurora powerhouse PDCs 58 and 59 were modified from MHTGR-DCs 71 and 72 to delete the text related to a pathway for the release of helium from the building in the event of depressurization events. The NRC staff determined this change is acceptable because SFRs, including the Aurora design, do not use pressurized helium coolant. Therefore, the depressurization accidents referred to in the MHTGR-DCs are not applicable to SFRs.

Finally, Aurora powerhouse PDC 71 was modified from SFR-DC 71 to fix a typographical error in RG 1.232. The NRC staff determined the change is acceptable because it makes an appropriate and clarifying correction.

### 3.2.5 Considerations for Residual Heat Removal and Emergency Core Cooling

The TR shows that RVACS is the sole system relied upon for residual heat removal and emergency core cooling (see PDC 34-37), which is consistent with the statement from RG 1.232, “[i]n most advanced reactor designs, a single system (i.e., the residual heat removal system) is provided to perform both the residual heat removal and emergency core cooling functions.” However, RG 1.232 also states, “the applicant is responsible for considering public safety matters and fundamental concepts, such as defense in depth, in the design of their specific facility and for identifying and satisfying necessary safety requirements.” As part of a future licensing submittal, Oklo should address whether the RVACS provides sufficient diversity and defense in depth to support the safety case of the Aurora powerhouse.

## 4. LIMITATIONS AND CONDITIONS

The NRC staff imposes the following limitations and conditions regarding the TR:

1. An applicant or licensee referencing this TR must propose a design that is substantially similar to the Aurora powerhouse design as discussed in the TR, or otherwise justify that any departures from these design features do not affect the conclusions of the TR and this SE.

2. An applicant or licensee referencing this TR must provide additional justification to support the adequacy of the proposed PDCs for the Aurora powerhouse design. Specifically:

    a. An applicant or licensee referencing this TR must identify and justify appropriate functional containment performance criteria.

    b. An applicant or licensee referencing this TR must justify that no important-to-safety functions rely on electrical power.

c. An applicant or licensee referencing this TR must justify that the IHTS has no important-to-safety functions. Examples of such justification are provided in section 3.1.4 of this SE.

d. An applicant or licensee referencing this TR must demonstrate that no SSCs require cooling beyond that provided by RVACS to perform important-to-safety functions

## CONCLUSION

Based on the above evaluation, the NRC staff concludes that Oklo has considered each of the design aspects presented in RG 1.232 and provided a sufficient set of PDCs that are appropriate for establishing requirements for the Aurora powerhouse design, subject to the limitations and conditions listed in this SE. Subject to these limitations and conditions, these PDCs establish the necessary design, fabrication, construction, testing, and performance DCs for important-to-safety SSCs to provide reasonable assurance that the Aurora powerhouse could be operated without undue risk to the health and safety of the public. The subject TR is therefore suitable for referencing in future licensing applications for the Aurora powerhouse.

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# Principal Design Criteria for the Aurora Powerhouse executive summary

This topical report provides the U.S. Nuclear Regulatory Commission (NRC) staff with information on the development of principal design criteria (PDC) for the Oklo Inc. (Oklo) Aurora powerhouse, based on Regulatory Guide (RG) 1.232, “Guidance for Developing Principal Design Criteria for Non-Light Water Reactors,” Revision 0, issued April 2018. Oklo requests NRC review and approval that the PDC for Aurora powerhouses meet the requirements within Title 10 of the *Code of Federal Regulations* (10 CFR) 52.79, “Contents of applications; technical information in final safety analysis report,” paragraph (a)(4)(i), and can be used in future licensing applications for Aurora powerhouses.

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# 1 Introduction

The development of the principal design criteria (PDC) for the Aurora powerhouse is informed by a robust foundation of prior U.S. Department of Energy (DOE) demonstrations and operational experience with fast reactor technologies, most notably the Experimental Breeder Reactor-II (EBR-II) and the Fast Flux Test Facility (FFTF). These DOE reactors provided decades of valuable data and operational insights that directly inform modern sodium-cooled fast reactor (SFR) safety design approaches, materials performance expectations, and functional requirements under both normal and off-normal conditions.

The EBR-II and FFTF designs and operating experience represent a substantial technical pedigree that remains relevant to the proposed Aurora SFR design. Their performance data, safety reviews, and licensing experience underpin many of the assumptions and conclusions reflected in this topical report.

Accordingly, this topical report leverages the lessons learned from EBR-II and FFTF as part of a broader effort to ensure the proposed PDC for the Aurora powerhouse are rooted in proven technological precedent. The functional similarities between these DOE reactors and the Aurora powerhouse, particularly in core configuration, coolant behavior, and passive safety features, support the applicability of historic design and safety basis elements. These parallels provide an essential context for regulatory evaluation and serve as a foundation for establishing credible design criteria that align with modern licensing expectations.

## 1.1 Purpose

This topical report provides the PDC for the Aurora powerhouse and the basis for their selection. Oklo requests that the U.S. Nuclear Regulatory Commission (NRC) staff review and approve these PDC.

Oklo intends to use this topical report to support future license applications for Aurora powerhouses and to demonstrate compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) 52.79, “Contents of applications; technical information in final safety analysis report,” paragraph (a)(4)(i), which states:

> The principal design criteria for the facility.
>
> Appendix A to part 50 of this chapter, “General Design Criteria for Nuclear Power Plants,” establishes minimum requirements for the principal design criteria for water-cooled nuclear power plants similar in design and location to plants for which construction permits have previously been issued by the Commission and provides guidance to applicants in establishing principal design criteria for other types of nuclear power units.

## 1.2 Aurora powerhouse design overview

The design of the Aurora powerhouse builds on the legacy of the DOE’s Integral Fast Reactor Program and the extensive operating experience of the EBR-II and FFTF in the United States. In the context of this report, the Aurora powerhouse is used to describe the nuclear power plant generically and does not refer to a specific structure, system, or component within the Aurora design. The overall safety of the Aurora reactor design and associated heat transport systems relies on inherent features and designed passive safety functions typical of SFRs—characteristics that were demonstrated through the decades of successful operation at EBR-II and FFTF.

The Aurora reactor utilizes metal fuel, which offers both safety and performance benefits. Compared to traditional large light water reactors (LWRs), the design has a significantly smaller fuel inventory and corresponding source term for radiological release. The reactor operates at near-ambient pressure, and off-normal events do not result in significant pressure increases, thereby limiting the driving force for radiological release. In addition, the functional containment provides multiple barriers to ensure retention of fission products.

Residual (i.e., decay) heat removal is ensured by the passive, always-on reactor vessel auxiliary cooling system (RVACS). Under normal shutdown conditions, RVACS supplements the gradual cooldown of the reactor, maintaining fuel and structural temperatures within design limits without the need for active systems. The large thermal mass of the coolant and reactor vessel structures, combined with the high thermal conductivity of the fuel and coolant, facilitates gradual and stable heat removal. In postulated accident and beyond-design-basis conditions, the RVACS is capable of removing all residual heat on its own, without reliance on operator action or active system actuation. By using passive air cooling, RVACS maintains long-term cooling capability indefinitely without additional human actions.

## 1.3 Limitations and conditions

This topical report presents only the PDC for the Aurora powerhouse and the basis for their selection. Demonstration that the Aurora powerhouse design satisfies these PDC will be included in future license applications.

# 2 Methodology

## 2.1 Regulatory guidance

As described in 10 CFR 52.79(a)(4)(i), Appendix A to 10 CFR Part 50, "General design criteria for nuclear power plants," establishes minimum requirements for PDC for LWRs. These general design criteria (GDC) are prescriptive and technology-specific, explicitly setting the minimum requirements for LWRs. Paragraph 52.79(a)(4) of 10 CFR states that the GDC also provide "guidance to applicants in establishing principal design criteria for other types of nuclear power units," but the regulation does not specify how this guidance should be applied to non-LWR designs.

Because the GDC are tailored to LWR technology, the NRC issued Regulatory Guide (RG) 1.232, "Guidance for Developing Principal Design Criteria for Non-Light Water-Reactors," Revision 0, in April 2018. RG 1.232 provides guidance for modifying and supplementing the GDC to establish appropriate PDC for any non-LWR designs. RG 1.232 introduces a new set of technology-inclusive design criteria, termed advanced reactor design criteria (ARDC). These ARDC can serve the same purpose for generic non-LWR designs as the GDC do for LWRs. Additionally, the guide includes two sets of technology-specific design criteria: one for generic SFR designs, referred to as SFR design criteria (SFR-DC), and one for generic modular high-temperature gas-cooled reactor (MHTGR) designs, referred to as MHTGR design criteria (MHTGR-DC). Importantly, RG 1.232 states that

> Applicants may use this RG to develop all or part of the PDC and are free to choose among the ARDC, SFR-DC, or MHTGR-DC to develop each PDC after considering the underlying safety basis for the criterion and evaluating the rationale for adaptation described in this RG… In instances where a GDC or non-LWR design criterion (ARDC, SFR-DFC [sic], and MHTGR-DC) is not proposed, the designer/applicant must provide a basis and justify the omission from a safety perspective.

## 2.2 Approach for the Aurora powerhouse

To develop PDC for the Aurora powerhouse design, Oklo first assessed the SFR-DC provided in RG 1.232 to determine their applicability. SFR-DC that were not applicable were not retained, while SFR-DC that were applicable were considered further. Applicable RG 1.232 SFR-DC were then assessed for whether they could be adopted directly or required modification to account for specific design features of the Aurora powerhouse. Prior to modifying any SFR-DC, corresponding ARDC or MHGTR-DC were considered for direct adoption. After the initial list of PDC was compiled, the list was reviewed to determine whether additional PDC were required.

## 2.3 Summary of changes to the RG 1.232 design criteria

### 2.3.1 Use of functional containment

Oklo considers the use of functional containment, as described in SECY-18-0096, "Functional Containment Performance Criteria for Non-Light-Water-Reactors," appropriate for the Aurora powerhouse. The reactor is a pool-type SFR with all parts of the primary heat transport system coolant contained inside the reactor vessel. Furthermore, the reactor vessel is surrounded by a guard vessel. The coolant is maintained at near-atmospheric pressure and at temperatures well below the boiling point of sodium. These reactor features preclude a rapid energy release of primary coolant. As such, radionuclide migration can be suitably controlled without the use of a conventional pressure-retaining containment structure. The containment-related SFR-DC (i.e., 16, 38–43, and 50–57) are replaced by the functional containment MHTGR-DC (i.e., 16, 71, and 72).

### 2.3.2 Deletion of SFR-DC 17 and 18

Oklo has designed the Aurora powerhouse such that electrical power is not relied upon to support any important-to-safety functions during anticipated operational occurrences or postulated accidents.

### 2.3.3 Modification of SFR-DC 19

During power operation, the plant is maintained in safe and stable conditions by automatic controls, and operator action is not required. {

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### 2.3.4 Deletion of SFR-DC 70 and 75-77

Oklo has designed the Aurora powerhouse such that the intermediate heat transport system (IHTS) does not perform important-to-safety functions. Failure of the intermediate coolant boundary has no significant impact on the safety of the plant. The RVACS is designed with sufficient redundancy and margin to preclude the IHTS from being relied upon for important-to-safety decay heat removal functions.

# 3 Principal design criteria for the Aurora powerhouse

Table 3-1 presents the final list of PDC for the Aurora powerhouse and the basis for their selection. Where modifications to RG 1.232 PDC were made, additions are identified by underline and deletions are identified by ~~strikethrough~~.

*Table 3-1: Principal design criteria for the Aurora powerhouse*

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| **I. Overall requirements** | | | |
| 1 | *Quality standards and records.*<br>Structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. A quality assurance program shall be established and implemented in order to provide adequate assurance that these structures, systems, and components will satisfactorily perform their safety functions. Appropriate records of the design, fabrication, erection, and testing of structures, systems, and components important to safety shall be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit. | SFR-DC 1 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 2 | *Design bases for protection against natural phenomena.*<br>Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed. | SFR-DC 2 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 3 | *Fire protection.*<br>Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and fire-resistant materials shall be used wherever practical throughout the unit, particularly in locations with structures, systems, or components important to safety. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety. Firefighting systems shall be designed to ensure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components. | SFR-DC 3 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 4 | *Environmental and dynamic effects design bases.*<br>Structures, systems, and components important to safety shall be designed to accommodate the effects of, and to be compatible with, the environmental conditions associated with normal operation, maintenance, testing, anticipated operational occurrences, and postulated accidents, including the effects of liquid sodium and its aerosols and oxidation products. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids that may result from equipment failures and from events and conditions outside the nuclear power unit. However, dynamic effects associated with postulated pipe ruptures in nuclear power units may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping. Chemical consequences of accidents, such as sodium leakage, shall be appropriately considered for the design of structures, systems, and components important to safety, which must be protected. | SFR-DC 4 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 5 | *Sharing of structures, systems, and components*.<br>Structures, systems, and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, the ability to achieve and maintain safe ~~an orderly~~ shutdown ~~and cooldown~~ of the remaining units. | SFR-DC 5 | The criterion is applicable to the Aurora powerhouse.<br>SFR-DC 5 is modified to include "the ability to achieve and maintain safe shutdown," for consistency with SECY-94-084, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant Designs," which describes a "safe shutdown" condition as maintaining "reactor subcriticality, decay heat removal, and radioactive materials containment," issued March 1994. |
| **II. Multiple barriers** | | | |
| 10 | *Reactor design.*<br>The reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences. | SFR-DC 10 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 11 | *Reactor inherent protection.*<br>The reactor core and associated systems that contribute to reactivity feedback shall be designed so that, in the power operating range, the net effect of the prompt inherent nuclear feedback characteristics tends to compensate for a rapid increase in reactivity. | SFR-DC 11 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 12 | *Suppression of reactor power oscillations.*<br>The reactor core; associated structures; and associated coolant, control, and protection systems shall be designed to ensure that power oscillations that can result in conditions exceeding specified acceptable fuel design limits are not possible or can be reliably and readily detected and suppressed. | SFR-DC 12 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 13 | *Instrumentation and control.*<br>Instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions, as appropriate to ensure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the primary coolant boundary, and the functional containment ~~and its associated systems~~. Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges. | SFR-DC 13 | The criterion is applicable to the Aurora powerhouse.<br>The Aurora powerhouse does not have a traditional containment and instead utilizes a functional containment. |
| 14 | *Primary coolant boundary.*<br>The primary coolant boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. | SFR-DC 14 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 15 | *Primary coolant system design.*<br>The primary coolant system and associated auxiliary, control, and protection systems shall be designed with sufficient margin to ensure that the design conditions of the primary coolant boundary are not exceeded during any condition of normal operation, including anticipated operational occurrences. | SFR-DC 15 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 16 | *Containment design.*<br>A reactor functional containment, consisting of multiple barriers internal and/or external to the reactor and its cooling system, shall be provided to control the release of radioactivity to the environment and to ensure that the functional containment design conditions important to safety are not exceeded for as long as postulated accident conditions require. | MHTGR-DC 16 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment, so MHTGR-DC 16 is more appropriate than SFR-DC 16. MHTGR-DC 16 is directly adopted. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| ~~17~~ | ~~*Electric power systems.*~~<br>~~Electric power systems shall be provided when required to permit functioning of structures, systems, and components. The safety function for each power system shall be to provide sufficient capacity and capability to ensure that (1) that the design limits for the fission product barriers are not exceeded as a result of anticipated operational occurrences and (2) safety functions that rely on electric power are maintained in the event of postulated accidents.~~<br>~~The electric power systems shall include an onsite power system and an additional power system. The onsite electric power system shall have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. An additional power system shall have sufficient independence and testability to perform its safety function.~~<br>~~If electric power is not needed for anticipated operational occurrences or postulated accidents, the design shall demonstrate that power for important to safety functions is provided.~~ | SFR-DC 17 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse does not rely on electric power systems to perform important-to-safety functions during anticipated operational occurrences or postulated accidents. |
| ~~18~~ | ~~*Inspection and testing of electric power systems.*~~<br>~~Electric power systems important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the condition of their components. The systems shall be designed with a capability to test periodically (1) the operability and functional performance of the components of the systems, such as onsite power sources, relays, switches, and buses, and (2) the operability of the systems as a whole and, under conditions as close to design as practical, the full operation sequence that brings the systems into operation, including operation of applicable portions of the protection system, and the transfer of power among systems.~~ | SFR-DC 18 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse does not have electric power systems important to safety. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 19 | *~~Control~~ Onsite Monitoring room.*<br><br>An ~~control~~ onsite monitoring room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under postulated accident conditions. Adequate radiation protection shall be provided to permit access and occupancy of the ~~control~~ onsite monitoring room under postulated accident conditions without personnel receiving radiation exposures in excess of 5 rem total effective dose equivalent, as defined in § 50.2 for the duration of the accident.<br><br>Adequate habitability measures shall be provided to permit access and occupancy of the ~~control~~ onsite monitoring room during normal operations and under postulated accident conditions.<br><br>Adequate protection against sodium aerosols and inert gases shall be provided to permit access and occupancy of the ~~control~~ onsite monitoring room under postulated accident conditions.<br><br>Equipment at appropriate locations outside the ~~control~~ onsite monitoring room shall be provided ~~(1)~~ with a design capability for prompt ~~hot~~ shutdown of the reactor, including necessary instrumentation ~~and controls~~ to ~~maintain~~ verify the unit is in a safe condition during ~~hot~~ shutdown~~, and (2) with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures~~. | SFR-DC 19 | The criterion is applicable to the Aurora powerhouse.<br><br>The Aurora powerhouse does not have a traditional control room and instead utilizes an onsite monitoring room. {<br>}{i}{vii}<br>The monitoring room includes the capability to manually shut down the plant. For defense-in-depth, operators can shut down the plant from a location outside the onsite monitoring room.<br><br>{<br>}{i}{vi}<br><br>Inert gases have been incorporated into the PDC to address their potential hazard in the onsite monitoring room. |
| **III. Reactivity control** | | | |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 20 | *Protection system functions.*<br>The protection system shall be designed (1) to initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences and (2) to sense accident conditions and to initiate the operation of systems and components important to safety. | SFR-DC 20 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 21 | *Protection system reliability and testability.*<br>The protection system shall be designed for high functional reliability and inservice testability commensurate with the safety functions to be performed. Redundancy and independence designed into the protection system shall be sufficient to assure that (1) no single failure results in loss of the protection function and (2) removal from service of any component or channel does not result in loss of the required minimum redundancy unless the acceptable reliability of operation of the protection system can be otherwise demonstrated. The protection system shall be designed to permit periodic testing of its functioning when the reactor is in operation, including a capability to test channels independently to determine failures and losses of redundancy that may have occurred. | SFR-DC 21 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 22 | *Protection system independence.*<br>The protection system shall be designed to assure that the effects of natural phenomena, and of normal operating, maintenance, testing, and postulated accident conditions on redundant channels do not result in loss of the protection function, or shall be demonstrated to be acceptable on some other defined basis. Design techniques, such as functional diversity or diversity in component design and principles of operation, shall be used to the extent practical to prevent loss of the protection function. | SFR-DC 22 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 23 | *Protection system failure modes.*<br>The protection system shall be designed to fail into a safe state or into a state demonstrated to be acceptable on some other defined basis, if conditions such as disconnection of the system, loss of energy (e.g., electric power, instrument air), or postulated adverse environments (e.g., extreme heat or cold, fire, sodium and sodium reaction products, pressure, steam, water, and radiation) are experienced. | SFR-DC 23 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 24 | *Separation of protection and control systems.*<br>The protection system shall be separated from control systems to the extent that failure of any single control system component or channel, or failure or removal from service of any single protection system component or channel which is common to the control and protection systems leaves intact a system satisfying all reliability, redundancy, and independence requirements of the protection system. Interconnection of the protection and control systems shall be limited so as to assure that safety is not significantly impaired. | SFR-DC 24 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 25 | *Protection system requirements for reactivity control malfunctions.*<br>The protection system shall be designed to ensure that specified acceptable fuel design limits are not exceeded during any anticipated operational occurrence accounting for a single malfunction of the reactivity control systems. | SFR-DC 25 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 26 | *Reactivity control systems.*<br>A minimum of two reactivity control systems or means shall provide:<br>(1) A means of inserting negative reactivity at a sufficient rate and amount to assure, with appropriate margin for malfunctions, that the design limits for the fission product barriers are not exceeded and safe shutdown is achieved and maintained during normal operation, including anticipated operational occurrences.<br>(2) A means which is independent and diverse from the other(s), shall be capable of controlling the rate of reactivity changes resulting from planned, normal power changes to assure that the design limits for the fission product barriers are not exceeded.<br>(3) A means of inserting negative reactivity at a sufficient rate and amount to assure, with appropriate margin for malfunctions, that the capability to cool the core is maintained and a means of shutting down the reactor and maintaining, at a minimum, a safe shutdown condition following a postulated accident.<br>(4) A means for holding the reactor shutdown under conditions which allow for interventions such as fuel loading, inspection and repair shall be provided. | SFR-DC 26 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| ~~27~~ | ~~*Combined reactivity control systems capability.*~~<br>~~DELETED—Information incorporated into ARDC 26~~ | SFR-DC 27 | This PDC is deleted per RG 1.232. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 28 | *Reactivity limits.*<br>The reactivity control systems shall be designed with appropriate limits on the potential amount and rate of reactivity increase to ensure that the effects of postulated reactivity accidents can neither (1) result in damage to the primary coolant boundary greater than limited local yielding nor (2) sufficiently disturb the core, its support structures or other reactor vessel internals to impair significantly the capability to cool the core. | SFR-DC 28 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 29 | *Protection against anticipated operational occurrences.*<br>The protection and reactivity control systems shall be designed to assure an extremely high probability of accomplishing their safety functions in the event of anticipated operational occurrences. | SFR-DC 29 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| **IV. Fluid systems** | | | |
| 30 | *Quality of primary coolant boundary.*<br>Components that are part of the primary coolant boundary shall be designed, fabricated, erected, and tested to the ~~highest~~ quality standards <u>commensurate with their importance to safety</u> ~~practical~~. Means shall be provided for detecting and, to the extent practical, identifying the location of the source of primary coolant leakage. | SFR-DC 30 | The criterion is applicable to the Aurora powerhouse.<br>PDC 30 is reworded for conformance with PDC 1. |
| 31 | *Fracture prevention of primary coolant boundary.*<br>The primary coolant boundary shall be designed with sufficient margin to ensure that, when stressed under operating, maintenance, testing, and postulated accident conditions, (1) the boundary behaves in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures, service degradation of material properties, creep, fatigue, stress rupture, and other conditions of the boundary material under operating, maintenance, testing, and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation and coolant composition, including contaminants and reaction products, on material properties, (3) residual, steady–state, and transient stresses, and (4) size of flaws. | SFR-DC 31 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 32 | *Inspection of primary coolant boundary.*<br>Components that are part of the primary coolant boundary shall be designed to permit (1) periodic inspection and functional testing of important areas and features to assess their structural and leaktight integrity, and (2) an appropriate material surveillance program for the reactor vessel. | SFR-DC 32 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 33 | *Primary coolant inventory maintenance.*<br>A system to maintain primary coolant inventory for protection against small breaks in the primary coolant boundary shall be provided as necessary to ensure that specified acceptable fuel design limits are not exceeded as a result of primary coolant inventory loss due to leakage from the primary coolant boundary and rupture of small piping or other small components that are part of the boundary. The system shall be designed to ensure that the system safety function can be accomplished using the piping, pumps, and valves used to maintain primary coolant inventory during normal reactor operation. | SFR-DC 33 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 34 | *Residual heat removal.*<br>A system to remove residual heat shall be provided. For normal operations and anticipated operational occurrences, the system safety function shall be to transfer fission product decay heat and other residual heat from the reactor core at a rate such that specified acceptable fuel design limits and the design conditions of the primary coolant boundary are not exceeded.<br>Suitable redundancy in components and features ~~and suitable interconnections leak detection, and isolation capabilities,~~ shall be provided to ensure that the system safety function can be accomplished, assuming a single failure. | SFR-DC 34 | The criterion is applicable to the Aurora powerhouse.<br>The RVACS ensures residual heat removal for the Aurora powerhouse. As a passive, always-operating system that relies on the natural circulation of ambient air, there are no pressure-driven leaks requiring detection or isolation capabilities. |
| 35 | *Emergency core cooling system.*<br>A system to assure sufficient core cooling during postulated accidents and to remove residual heat following postulated accidents shall be provided. The system safety function shall be to transfer heat from the reactor core during and following postulated accidents such that fuel and clad damage that could interfere with continued effective core cooling is prevented.<br>Suitable redundancy in components and features ~~and suitable interconnections, leak detection, isolation, and containment capabilities~~ shall be provided to ensure that the system safety function can be accomplished, assuming a single failure. | SFR-DC 35 | The criterion is applicable to the Aurora powerhouse.<br>The RVACS ensures emergency core cooling for the Aurora powerhouse. As noted in PDC 34, leak detection and isolation capabilities are not required for the RVACS system. |
| 36 | *Inspection of emergency core cooling system.*<br>A system that provides emergency core cooling shall be designed to permit appropriate periodic inspection of important components to ensure the integrity and capability of the system. | SFR-DC 36 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 37 | *Testing of passive residual heat removal system.*<br>The passive residual heat removal system shall be designed to permit appropriate periodic functional testing to ensure (1) the structural ~~and leaktight~~ integrity of its components, (2) the operability and performance of the system components, and (3) the operability of the system as a whole ~~and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation, including associated systems, for AOO or postulated accident decay heat removal to the ultimate heat sink and, if applicable, any system(s) necessary to transition from active normal operation to passive mode~~. | MHTGR-DC 37 | The criterion is applicable to the Aurora powerhouse.<br>MHTGR-DC 37 was chosen over the SFR-DC 37 source text because the RVACS, which provides core cooling, is a passive system and therefore more closely aligns with the MHTGR-DC 37 text.<br>{<br>}{i}{vi}{ix}<br>The RVACS is a fully passive system that is always operating. It does not require any operational sequence to bring the system into operation. |
| ~~38~~ | ~~*Containment heat removal.*~~<br>~~A system to remove heat from the reactor containment shall be provided as necessary to maintain the containment pressure and temperature within acceptable limits following postulated accidents.~~<br>~~Suitable redundancy in components and features and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to ensure that the system safety function can be accomplished, assuming a single failure.~~ | SFR-DC 38 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |
| ~~39~~ | ~~*Inspection of containment heat removal system.*~~<br>~~The containment heat removal system shall be designed to permit appropriate periodic inspection of important components to ensure the integrity and capability of the system.~~ | SFR-DC 39 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| ~~40~~ | ~~*Testing of containment heat removal system.*~~<br>~~The containment heat removal system shall be designed to permit appropriate periodic functional testing to ensure (1) the structural and leaktight integrity of its components, (2) the operability and performance of the system components, and (3) the operability of the system as a whole, and under conditions as close to the design as practical, the performance of the full operational sequence that brings the system into operation, including the operation of associated systems.~~ | SFR-DC 40 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |
| ~~41~~ | ~~*Containment atmosphere cleanup.*~~<br>~~Systems to control fission products and other substances that may be released into the reactor containment shall be provided as necessary to reduce, consistent with the functioning of other associated systems, the concentration and quality of fission products released to the environment following postulated accidents and to control the concentration of other substances in the containment atmosphere following postulated accidents to ensure that containment integrity and other safety functions are maintained.~~<br>~~Each system shall have suitable redundancy in components and features and suitable interconnections, leak detection, isolation, and containment capabilities to ensure that its safety function can be accomplished, assuming a single failure.~~ | SFR-DC 41 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |
| ~~42~~ | ~~*Inspection of containment atmosphere cleanup systems.*~~<br>~~The containment atmosphere cleanup systems shall be designed to permit appropriate periodic inspection of important components, such as filter frames, ducts, and piping to assure the integrity and capability of the systems.~~ | SFR-DC 42 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |
| ~~43~~ | ~~*Testing of containment atmosphere cleanup systems.*~~<br>~~The containment atmosphere cleanup systems shall be designed to permit appropriate periodic functional testing to ensure (1) the structural and leaktight integrity of its components, (2) the operability and performance of the system components, and (3) the operability of the systems as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the systems into operation, including the operation of associated systems.~~ | SFR-DC 43 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 44 | ~~*Structural and equipment cooling.*~~<br>~~In addition to the heat rejection capability of the passive residual heat removal system, systems to transfer heat from structures, systems, and components important to safety to an ultimate heat sink shall be provided, as necessary, to transfer the combined heat load of these structures, systems, and components under normal operating and accident conditions.~~<br>~~Suitable redundancy in components and features and suitable interconnections leak detection, and isolation capabilities shall be provided to ensure that the system safety function can be accomplished, assuming a single failure.~~ | MHTGR-DC 44 | The criterion is inapplicable to the Aurora powerhouse.<br>While both MHTGR-DC 44 and SFR-DC 44 are inapplicable to the Aurora powerhouse, MHTGR-DC 44 was selected as the source text for this PDC based on the discussion in RG 1.232, which states that “if a specific MHTGR design can demonstrate that the reactor cavity cooling system (RCCS) provides indefinite core cooling capability, then structural and equipment cooling systems would not be needed.”<br>Although the Aurora powerhouse is an SFR rather than an MHTGR, the RVACS provides indefinite core cooling capability; no other structural and equipment cooling systems are required. |
| ~~45~~ | ~~*Inspection of structural and equipment cooling systems.*~~<br>~~The structural and equipment cooling systems shall be designed to permit appropriate periodic inspection of important components, such as heat exchangers and piping, to ensure the integrity and capability of the systems.~~ | SFR-DC 45 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse does not require structural and equipment cooling systems. |
| ~~46~~ | ~~*Testing of structural and equipment cooling systems.*~~<br>~~The structural and equipment cooling systems shall be designed to permit appropriate periodic functional testing to ensure (1) the structural and leaktight integrity of their components, (2) the operability and performance of the system components, and (3) the operability of the systems as a whole and, under conditions as close to design as practical, the performance of the full operational sequences that bring the systems into operation for reactor shutdown and postulated accidents, including the operation of associated systems.~~ | SFR-DC 46 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse does not require structural and equipment cooling systems. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| **V. Reactor functional containment** | | | |
| ~~50~~ | ~~*Containment design basis.*~~<br>~~The reactor containment structure, including access openings, penetrations, and the containment heat removal system shall be designed so that the containment structure and its internal compartments can accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from postulated accidents. This margin shall reflect consideration of (1) the effects of potential energy sources that have not been included in the determination of the peak conditions, (2) the limited experience and experimental data available for defining accident phenomena and containment responses, and (3) the conservatism of the calculational model and input parameters.~~ | SFR-DC 50 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |
| ~~51~~ | ~~*Fracture prevention of containment pressure boundary.*~~<br>~~The boundary of the reactor containment structure shall be designed with sufficient margin to ensure that, under operating, maintenance, testing, and postulated accident conditions, (1) its materials behave in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the containment boundary materials during operation, maintenance, testing, and postulated accident conditions, and the uncertainties in determining (1) material properties, (2) residual, steady-state, and transient stresses, and (3) size of flaws.~~ | SFR-DC 51 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |
| ~~52~~ | ~~*Capability for containment leakage rate testing.*~~<br>~~The reactor containment structure and other equipment that may be subjected to containment test conditions shall be designed so that periodic integrated leakage rate testing can be conducted to demonstrate resistance at containment design pressure.~~ | SFR-DC 52 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |
| ~~53~~ | ~~*Provisions for containment testing and inspection.*~~<br>~~The reactor containment structure shall be designed to permit (1) appropriate periodic inspection of all important areas, such as penetrations, (2) an appropriate surveillance program, and (3) periodic testing at containment design pressure of the leaktightness of penetrations that have resilient seals and expansion bellows.~~ | SFR-DC 53 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| ~~54~~ | ~~*Piping systems penetrating containment.*~~<br>~~Piping systems penetrating the reactor containment structure shall be provided with leak detection, isolation, and containment capabilities that have redundancy, reliability, and performance capabilities necessary to perform the containment safety function and that reflect the importance to safety of preventing radioactivity releases from containment through these piping systems. Such piping systems shall be designed with the capability to verify, by testing, the operational readiness of any isolation valves and associated apparatus periodically and to confirm that valve leakage is within acceptable limits.~~ | SFR-DC 54 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| ~~55~~ | ~~*Primary coolant boundary penetrating containment.*~~<br>~~Each line that is part of the primary coolant boundary and that penetrates the reactor containment structure shall be provided with containment isolation valves as follows, unless it can be demonstrated that the containment isolation provisions for a specific class of lines, such as instrument lines, are acceptable on some other defined basis:~~<br>~~(1) One locked closed isolation valve inside and one locked closed isolation valve outside containment; or~~<br>~~(2) One automatic isolation valve inside and one locked closed isolation valve outside containment; or~~<br>~~(3) One locked closed isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment; or~~<br>~~(4) One automatic isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment.~~<br>~~Isolation valves outside containment shall be located as close to containment as practical and, upon loss of actuating power, automatic isolation valves shall be designed to take the position that provides greater safety.~~<br>~~Other appropriate requirements to minimize the probability or consequences of an accidental rupture of these lines or of lines connected to them shall be provided as necessary to ensure adequate safety. Determination of the appropriateness of these requirements, such as higher quality in design, fabrication, and testing, additional provisions for inservice inspection, protection against more severe natural phenomena, and additional isolation valves and containment, shall include consideration of the population density, use characteristics, and physical characteristics of the site environs.~~ | SFR-DC 55 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| ~~56~~ | ~~*Containment isolation.*~~<br>~~Each line that connects directly to the containment atmosphere and penetrates the reactor containment structure shall be provided with containment isolation valves as follows, unless it can be demonstrated that the containment isolation provisions for a specific class of lines, such as instrument lines, are acceptable on some other defined basis:~~<br>~~(1) One locked closed isolation valve inside and one locked closed isolation valve outside containment; or~~<br>~~(2) One automatic isolation valve inside and one locked closed isolation valve outside containment; or~~<br>~~(3) One locked closed isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment; or~~<br>~~(4) One automatic isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment.~~<br>~~Isolation valves outside containment shall be located as close to the containment as practical and upon loss of actuating power, automatic isolation valves shall be designed to take the position that provides greater safety.~~ | SFR-DC 56 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |
| ~~57~~ | ~~*Closed system isolation valves.*~~<br>~~Each line that penetrates the reactor containment structure and is neither part of the primary coolant boundary nor connected directly to the containment atmosphere shall have at least one containment isolation valve unless it can be demonstrated that the containment safety function can be met without an isolation valve and assuming failure of a single active component. The isolation valve, if required, shall be either automatic, or locked closed, or capable of remote manual operation. This valve shall be outside containment and located as close to the containment as practical. A simple check valve may not be used as the automatic isolation valve.~~ | SFR-DC 57 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse utilizes a functional containment rather than a traditional containment. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 58 | *Reactor building design basis.*<br>The design of the reactor building shall be such that, during postulated accidents, it structurally protects the geometry for passive removal of residual heat from the reactor core to the ultimate heat sink ~~and provides a pathway for the release of reactor helium from the building in the event of depressurization accidents~~. | MHTGR-DC 71 | The Aurora powerhouse design utilizes a functional containment and therefore MHTGR-DC 71 is adopted. Modifications are made to reflect the Aurora powerhouse functional containment. Depressurization accidents are not applicable to the Aurora powerhouse. |
| 59 | *Provisions for periodic reactor building inspection.*<br>The reactor building shall be designed to permit (1) appropriate periodic inspection of all important structural areas ~~and the depressurization pathway~~, and (2) an appropriate surveillance program. | MHTGR-DC 72 | The Aurora powerhouse design utilizes a functional containment and therefore MHTGR-DC 72 is adopted. Modifications are made to reflect the Aurora powerhouse functional containment. Depressurization accidents are not applicable to the Aurora powerhouse. |
| **VI. Fuel and reactivity control** | | | |
| 60 | *Control of releases of radioactive materials to the environment.*<br>The nuclear power unit design shall include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences. Sufficient holdup capacity shall be provided for retention of gaseous and liquid effluents containing radioactive materials, particularly where unfavorable site environmental conditions can be expected to impose unusual operational limitations upon the release of such effluents to the environment. | SFR-DC 60 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 61 | *Fuel storage and handling and radioactivity control.*<br>The fuel storage and handling, radioactive waste, and other systems that may contain radioactivity shall be designed to ensure adequate safety under normal and postulated accident conditions. These systems shall be designed (1) with a capability to permit appropriate periodic inspection and testing of components important to safety, (2) with suitable shielding for radiation protection, (3) with appropriate containment, confinement, and filtering systems, (4) with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal, and (5) to prevent significant reduction in fuel storage cooling under accident conditions. | SFR-DC 61 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 62 | *Prevention of criticality in fuel storage and handling.*<br>Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations. | SFR-DC 62 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 63 | *Monitoring fuel and waste storage.*<br>Appropriate systems shall be provided in fuel storage and radioactive waste systems and associated handling areas (1) to detect conditions that may result in loss of residual heat removal capability and excessive radiation levels and (2) to initiate appropriate safety actions. | SFR-DC 63 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 64 | *Monitoring radioactivity releases.*<br>Means shall be provided for monitoring the ~~reactor~~ functional containment atmosphere, spaces containing components for primary system sodium and cover gas cleanup and processing, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents. | SFR-DC 64 | The criterion is applicable to the Aurora powerhouse.<br>The Aurora powerhouse does not have a traditional containment and instead utilizes a functional containment. |
| **VII. Additional technology-specific design criteria** | | | |
| ~~70~~ | ~~*Intermediate coolant system.*~~<br>~~If an intermediate cooling system is provided, then the intermediate coolant system shall be designed with sufficient margin to assure that (1) the design conditions of the intermediate coolant boundary are not exceeded during normal operations, including anticipated occupational occurrences, and (2) the integrity of the primary coolant boundary is maintained during postulated accidents.~~ | SFR-DC 70 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse intermediate coolant system is not important to safety. Failure of the intermediate coolant system has no significant impact on the safety of the plant. |
| 71 | *Primary coolant and cover gas purity control.*<br>Systems shall be provided as necessary to maintain the purity of primary coolant sodium and cover gas within specified design limits. These limits shall be based on consideration of (1) chemical attack, (2) fouling and plugging of passages, ~~and~~ (3) radionuclide concentrations, and (4) air or moisture ingress as a result of a leak of cover gas. | SFR-DC 71 | The criterion is applicable to the Aurora powerhouse.<br>The modification fixes a typographical error in RG 1.232. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| 72 | *Sodium heating systems.*<br>Heating systems shall be provided for systems and components that are important to safety, and that contain or could be required to contain sodium. These heating systems and their controls shall be appropriately designed to ensure that the temperature distribution and rate of change of temperature in systems and components containing sodium are maintained within design limits assuming a single failure. If plugging of any cover gas line due to condensation or plate out of sodium aerosol or vapor could prevent accomplishing a safety function, the temperature control and the relevant corrective measures associated with that line shall be considered important to safety. | SFR-DC 72 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 73 | *Sodium leakage detection and reaction prevention and mitigation.*<br>Means to detect and identify sodium leakage as practical and to limit and control the extent of sodium-air and sodium-concrete reactions and to mitigate the effects of fires resulting from these sodium-air and sodium-concrete reactions shall be provided to ensure that the safety functions of structures, systems, and components important to safety are maintained. Systems from which sodium leakage constitutes a significant safety hazard shall include measures for protection, such as inerted enclosures or guard vessels. | SFR-DC 73 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 74 | *Sodium/water reaction prevention/mitigation.*<br>Structures, systems, and components containing sodium shall be designed and located to avoid contact between sodium and water and to limit the adverse effects of chemical reactions between sodium and water on the capability of any structure, system, or component to perform any of its intended safety functions. If steam-water is used for energy conversion, to prevent loss of any plant safety function, the sodium-steam generator system shall be designed to detect and contain sodium-water reactions and limit the effects of the energy and reaction products released by such reactions, including mitigation of the effects of any resulting fire involving sodium. | SFR-DC 74 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| ~~75~~ | ~~*Quality of the intermediate coolant boundary.*~~<br>~~Components that are part of the intermediate coolant boundary shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.~~ | SFR-DC 75 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse intermediate coolant boundary is not important to safety. Failure of the intermediate coolant boundary has no significant impact on the safety of the plant. |

| Criterion | Aurora powerhouse PDC | Corresponding RG 1.232 criterion | Justification |
|---|---|---|---|
| ~~76~~ | ~~*Fracture prevention of the intermediate coolant boundary.*~~<br>~~The intermediate coolant boundary shall be designed with sufficient margin to ensure that, when stressed under operating, maintenance, testing, and postulated accident conditions, (1) the boundary behaves in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized.~~ | SFR-DC 76 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse intermediate coolant boundary is not important to safety. Failure of the intermediate coolant boundary has no significant impact on the safety of the plant. |
| ~~77~~ | ~~*Inspection of the intermediate coolant boundary.*~~<br>~~Components that are part of the intermediate coolant boundary shall be designed to permit (1) periodic inspection and functional testing of important areas and features to assess their structural and leaktight integrity commensurate with the system's importance to safety, and (2) an appropriate material surveillance program for the intermediate coolant boundary~~ | SFR-DC 77 | The criterion is inapplicable to the Aurora powerhouse.<br>The Aurora powerhouse intermediate coolant boundary is not important to safety. Failure of the intermediate coolant boundary has no significant impact on the safety of the plant. |
| 78 | *Primary coolant system interfaces.*<br>When the primary coolant system interfaces with a structure, system, or component containing fluid that is chemically incompatible with the primary coolant, the interface location shall be designed to ensure that the primary coolant is separated from the chemically incompatible fluid by two redundant, passive barriers. When the primary coolant system interfaces with a structure, system, or component containing fluid that is chemically compatible with the primary coolant, then the interface location may be a single passive barrier provided that the following conditions are met:<br>(1) postulated leakage at the interface location does not result in failure of the intended safety functions of structures, systems or components important to safety or result in exceeding the fuel design limits<br>(2) the fluid contained in the structure, system, or component is maintained at a higher pressure than the primary coolant during normal operation, anticipated operational occurrences, shutdown, and accident conditions. | SFR-DC 78 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |
| 79 | *Cover gas inventory maintenance.*<br>A system to maintain cover gas inventory shall be provided as necessary to ensure that the primary coolant sodium design limits are not exceeded as a result of cover gas loss due to leakage from the primary coolant boundary and rupture of small piping or other small components that are part of the primary coolant boundary. | SFR-DC 79 | The criterion is applicable to the Aurora powerhouse and is adopted from RG 1.232 without modification. |

# 4 Conclusion

The Aurora powerhouse PDC were developed using the guidance in RG 1.232 and include justification for each criterion. As shown in Table 3-1, the PDC meet the requirements in 10 CFR 52.79(a)(4)(i) and can be used in future licensing applications for the Aurora powerhouse.