



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

June 20, 2023

Mr. Daniel H. Dorman
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: GENERAL ATOMICS TOPICAL REPORT, "FAST MODULAR REACTOR PRINCIPAL DESIGN CRITERIA," REVISION 2

Dear Mr. Dorman:

During the 706th meeting of the Advisory Committee on Reactor Safeguards, June 7-8, 2023, we completed our review of the General Atomics Topical Report, "Fast Modular Reactor Principal Design Criteria," Revision 2, and the associated NRC staff safety evaluation (SE). Our General Atomics Subcommittee reviewed this matter on May 2, 2023. During these meetings, we had the benefit of discussions with the staff and representatives of General Atomics Electromagnetic Systems (GA). We also had the benefit of the referenced documents.

CONCLUSION AND RECOMMENDATION

1. The proposed Fast Modular Reactor Principal Design Criteria (FMR-DCs) provide an adequate basis to guide ongoing GA design decisions and the staff review.
2. The staff SE report should be issued.

BACKGROUND

The General Design Criteria (GDCs) for Nuclear Power Plants, Appendix A to *Title 10 of the Code of Federal Regulation* (10 CFR) Part 50, are the minimum requirements for the principal design criteria (PDCs) for water-cooled nuclear plants to provide reasonable assurance that a facility can be operated without undue risk to the health and safety of the public. The GDCs were developed to focus attention on the most prominent issues and improve the predictability and efficiency of NRC reviews of licensing applications. Design criteria are established to provide a solid basis for the staff review and ensure that a given facility can be operated safely. They provide assurance that structures, systems, and components important to safety will remain functional during and following identified design basis events.

Regulatory Guide (RG) 1.232, "Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors," provides guidance on how the GDCs can be adapted for non-light-water reactor (non-LWR) designs. It includes generic advanced reactor design criteria (ARDCs)

and technology-specific criteria for sodium-cooled fast reactors (SFRs) and modular high temperature gas-cooled reactors (MHTGRs). The RG notes that applicants may choose to develop entirely new PDCs as needed to address unique design features. Early engagement and agreement on plant specific PDCs facilitate a more effective design development and regulatory review.

The proposed GA fast modular reactor (FMR) is a 50-MWe helium-cooled reactor with design features that affect the selection of PDCs. In particular, the FMR relies on two redundant passive reactor vessel cooling systems, an active helium-based maintenance cooling system, and a below-grade leak-tight containment. Notably, the FMR uses a direct power cycle, with high-speed turbomachinery inside the reactor helium pressure boundary requiring the PDCs to address the potential for internally generated missiles.

Representatives of GA stated they considered FMR critical safety functions (e.g., control radionuclide release, control heat generation, control heat removal, and control chemical attack) to identify PDCs using the RG 1.232 ARDCs (refined as appropriate). When the ARDCs did not fully apply to features of the FMR, GA instead relied on the MHTGR design criteria (MHTGR-DCs) or the SFR design criteria (SFR-DCs), depending on which aspect was more closely representative of the FMR technology and facility design.

Of the FMR-DCs, the majority were either the same as the original GDCs from 10 CFR Part 50 or based closely on the generic ARDCs. Some were either adopted directly or refined from the MHTGR-DCs, to reflect features such as passive heat removal and the reactor helium pressure boundary. One of the FMR-DCs addresses the potential for both internal and external missiles. The containment design criterion was based on the SFR-DCs, since the GA FMR uses a leak-tight containment, rather than the functional-containment concept often used for high-temperature gas-cooled reactors.

DISCUSSION

It is recognized in RG 1.232 that it may be necessary to customize the ARDCs as design innovations are proposed. The specific features of the GA FMR design make it important to carefully consider the completeness of the proposed GA FMR PDCs, because the novel design does not completely fit the DCs from RG 1.232. The design of this reactor has characteristics of both fast and gas cooled reactors, so it is conceivable that in choosing which design criteria to use, some accident phenomena may be overlooked.

The staff focused on this concern to provide confidence that no gaps remain in the final list of FMR-DCs and found that GA adequately considered each of the design criteria discussed in RG 1.232. Thus, the staff concluded the resulting FMR-DCs are sufficient for establishing requirements to provide reasonable assurance that the FMR can be operated without undue risk to the health and safety of the public.

SUMMARY

It is valuable for applicants to develop PDCs early in the pre-application process. The proposed FMR-DCs provide an adequate basis to guide ongoing GA design decisions and the staff review. The staff SE report should be issued.

No response to this letter is required.

Sincerely,



Signed by Rempe, Joy
on 06/20/23

Chairman

REFERENCES

1. USNRC, "General Atomics Electromagnetic Systems - Draft Safety Evaluation of Topical Report 30599T00005, Fast Modular Reactor Principal Design Criteria, Revision 2 (EPID No. L-2022-TOP-0033)," March 17, 2023 (ML23076A196).
2. General Atomics, "Transmittal of Revised GA-EMS Fast Modular Reactor Principal Design Criteria Topical Report," 30599T00005, Revision 2, PD-06, dated January 5, 2023, (ML23005A290).
3. General Atomics, "Transmittal of Responses to Request for Additional Information on GA-EMS Fast Modular Reactor Principal Design Criteria Topical Report," November 07, 2022 (ML22311A472).
4. The General Design Criteria for Nuclear Power Plants, Appendix A to *Title 10 of the Code of Federal Regulation* Part 50 - Domestic Licensing of Production and Utilization Facilities (<https://www.ecfr.gov/current/title-10/chapter-I/part-50/appendix-Appendix%20A%20to%20Part%2050>).
5. USNRC, Regulatory Guide 1.232, "Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors," Revision 0, April 2018 (ML17325A611).

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