



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

April 27, 2023

MEMORANDUM TO: David Petti, Lead
Kairos Power Licensing Subcommittee
Advisory Committee on Reactor Safeguards

FROM: Vicki Bier, Member *Vicki M Bier*
Joy Rempe, Chairman
Matthew Sunseri, Member
Advisory Committee on Reactor Safeguards

SUBJECT: INPUT FOR ACRS REVIEW OF KAIROS NON-POWER
REACTOR HERMES CONSTRUCTION PERMIT
APPLICATION – DRAFT SAFETY EVALUATION FOR
CHAPTER 2, "SITE CHARACTERISTICS"

In response to the Subcommittee's request, I have reviewed the NRC staff's draft safety evaluation (SE) with no open items, and the associated section of the applicant's Preliminary Safety Analysis Report (PSAR), for Chapter 2, "Site Characteristics." The following is my recommended course of action concerning further review of this chapter and associated safety evaluation.

Background

Chapter 2 of the SE documents the staff's review of the preliminary information on site characteristics provided in Chapter 2, "Site Characteristics," of the Hermes PSAR, Revision 2. This chapter addresses site geography, demography, meteorology, hydrology, and geology.

SE Summary

The SE documents the staff's evaluation of the applicant's design for compliance with applicable regulations and standards. The NRC staff evaluated the descriptions and discussions of Kairos's proposed Hermes site characteristics. Based on this evaluation, the NRC staff found that the descriptions and discussions of Kairos's proposed Hermes site characteristics are sufficient and meet the applicable regulatory requirements and guidance, and acceptance criteria, for the issuance of a construction permit.

In Appendix A to the SE, staff recommends a condition on the construction permit to confirm the safety of geologic conditions once excavations for safety-related conditions have been completed and are available for examination by the staff. Appendix A also lists several site features for which information will be provided at the time of the operating-license application.

Discussion

I did not identify any specific deficiencies in my review. I would observe that the application was well documented and provides a good starting point for an eventual site-specific probabilistic risk assessment of external events. Likewise, the staff's evaluation was thorough. The licensee also benefited from the fact that many aspects of the site were already well characterized in the Site Safety Analysis Report submitted as part of the early site permit application for the Clinch River Site.

I do have some minor observations, none of which require further review prior to issuance of a construction permit.

- The proposed Oak Ridge general-aviation airport is anticipated to be built less than one mile from the proposed Hermes site, with operation anticipated by 2025. Even though the runway is anticipated to be oriented in such a way that aircraft would not land or take off over the proposed site, it is important to carefully monitor plans for the airport in case any developments are indicative of increased risk. Any concerns that may arise will obviously be easier to address the earlier they are identified. This is especially important since the estimated aircraft-impact probabilities are nonnegligible ($1.44\text{E}-5$ per year for takeoffs and $2.42\text{E}-5$ per year for landings). Even though these estimates are for small general-aviation aircraft, any changes that might increase those risks would merit further review.
- The SE indicates that during an eventual operating license application, NRC staff would assess the potential hazards from an accident at the proposed Clinch River Nuclear Site, Coqui Pharmaceutical, and Oak Ridge Airport facilities (including the fuel farm) on the proposed reactor facility. It may also be prudent for the licensee to assess whether an accident at the Hermes site (e.g., an airborne release) would pose potential hazards to safe operation of the above or other nearby industrial facilities.
- Staff notes in the SE that "current and future projected populations within 1 mi (1.6 km) of the proposed site are very small." Notably, though, Table 2.1-1 in the PSAR actually projects a decrease in population. This is presumably due to population projections for Roane and Morgan Counties from the Boyd Center for Business and Economic Research, the demographer for the State of Tennessee. The PSAR also indicates zero transient population in the area. However, considering the proposed Clinch River Nuclear Site, Coqui Pharmaceutical, and Oak Ridge Airport, population growth within five miles of the airport could be substantial (esp. daytime population), even if decreases are projected for the relevant counties overall.

Recommendation

As lead reviewer for Hermes SE Chapter 2, I recommend that no additional Committee reviews are necessary for "Site Characteristics" prior to finalizing and issuing the NRC staff draft SE, with the above-mentioned condition and additional items listed in Appendix A.

References

1. USNRC, Draft Safety Evaluation for Hermes Non-Power Reactor Preliminary Safety Analysis Report Chapter 2, February 7, 2023 (ML23065A010)
2. Kairos Power LLC, "Submittal of the Preliminary Safety Analysis Report for the Kairos Power Fluoride Salt-Cooled, High Temperature Non-Power Reactor (Hermes)," Revision 2, February 2023 (ML23055A672)
3. USNRC, NUREG-1537, Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Format and Content," issued February 1996 (ML042430055)
4. USNRC, NUREG-1537, Part 2, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Standard Review Plan and Acceptance Criteria," issued February 1996 (ML042430048)
5. USNRC, Appendix A to the safety evaluation for the Hermes construction permit application, "Post Construction Permit Activities – Construction Permit Conditions and Additional Items for the Operating License Application," March 2, 2023 (ML23065A058)

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