SUMMARY RECORD OF DECISION
U.S. NUCLEAR REGULATORY COMMISSION
DOCKET NO. 50-7513
CONSTRUCTION PERMIT APPLICATION FOR THE
KAIROS HERMES TEST REACTOR

BACKGROUND

By letter dated September 29, 2021 (Agencywide Documents Access & Management System (ADAMS) Accession Package No. ML21272A375), Kairos Power, LLC (Kairos) submitted Part 1 of a two-part application to the United States Nuclear Regulatory Commission (NRC) for a construction permit (CP) pursuant to Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR Part 50). The CP would allow construction of a non-power test reactor that Kairos has named Hermes on a 185-acre site in Oak Ridge, Tennessee. Section 104c of the Atomic Energy Act of 1954 (42 U.S.C. 2134) authorizes the NRC to issue CPs for testing facilities. To issue a CP, the NRC is required to consider the environmental impacts of the proposed action under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*, herein referred to as NEPA). The NRC's NEPA-implementing regulations in 10 CFR Part 51 identify several types of licensing actions that require the NRC to prepare an environmental impact statement (EIS). CPs and operating licenses (OLs) for test facilities are identified in 10 CFR 51.20 as actions that require an EIS.

Applicants for NRC licenses are required under 10 CFR 51.45 to submit an environmental report (ER) containing a description of the proposed project, a statement of its purposes, a description of the affected environment, and specific information needed for the staff to evaluate potential environmental impacts. After initially submitting Part 1 of the Kairos Hermes application (consisting of its Preliminary Safety Analysis Report), Kairos submitted an ER (ML21306A131) on October 31, 2021, with information needed to assess potential environmental impacts from the CP licensing action, which was later revised by letter dated March 30, 2023 (ML23089A386).

Consistent with 10 CFR Part 51, the NRC staff published a Notice of Acceptance for Docketing in the *Federal Register* (FR) on December 1, 2021 (86 FR 68290). On February 18, 2022, the NRC staff prepared a FR notice of its intent to prepare an EIS and conduct a scoping process (87 FR 9394). In addition, Federal, State, and local agencies as well as Tribal governments were notified and invited to participate in the environmental review. The scoping notice began the 60-day scoping period. On March 23, 2022, the NRC held a virtual joint public outreach and scoping meeting. The "Environmental Impact Statement Scoping Process Summary Report" prepared for the Kairos Hermes CP Application presents the comments the NRC received during the scoping process (ML22194A014).

In March 2022, the NRC staff conducted a virtual audit to verify information in the Environmental Report. During the audit, the NRC staff reviewed specific documentation and discussed specific information needs with Kairos staff and their contractors. The information needs and the pertinent points from the audit are documented in the staff's audit summary report (ML22196A387).

After the scoping period and environmental audit, the NRC staff compiled its findings in a draft EIS (ML22259A126). In accordance with 10 CFR 51.73, the public comment period for the draft EIS was from October 7, 2022, through December 6, 2022 (87 FR 61014). During this time, the NRC staff hosted a public meeting on November 16, 2022, in Oak Ridge, Tennessee and collected public comments (ML23031A160). On August 17, 2023, the NRC issued the final EIS, "Environmental Impact Statement for the Construction Permit for the Kairos Hermes Test Reactor" (NUREG-2263), (ML23214A269). All comments related to the environmental review during the comment period are included in Appendix G of the final EIS.

Pursuant to 10 CFR 51.102 and 51.103(a)(1)-(4), the NRC staff has prepared this Summary Record of Decision (ROD) to accompany the NRC's action on the construction permit application. This Summary ROD incorporates by reference materials contained in the final EIS. See 10 CFR 51.103(c).

DECISION

The NRC makes the decision to grant or deny a CP application based on whether the applicant has met all applicable requirements, including the NRC's safety and environmental regulations. The NRC's safety review of the application is documented in the safety evaluation (SE) issued on June 13, 2023 (ML23158A265).

The final EIS presents the staff's environmental review of the application. As documented in Chapter 5 of the final EIS, after weighing the environmental, economic, technical, and other benefits of the facility against environmental and other costs and considering reasonable alternatives, the NRC staff recommends, unless safety issues mandate otherwise, issuance of the CP. The NRC staff determined that this recommendation is in accordance with NEPA and the NRC's implementing regulations in Subpart A of 10 CFR Part 51, and that all applicable environmental requirements have been satisfied. In the Commission's Order dated December 12, 2023 (ML23346A068), the Commission concluded that the relevant requirements of NEPA section 102(2) and the applicable regulations in 10 CFR Part 51, have been satisfied and authorized issuance of the construction permit.

Accordingly, on December 14, 2023, the NRC issued Construction Permit CPTR- 6, authorizing the construction of the Hermes test reactor in the City of Oak Ridge, Tennessee. The construction permit is effective as of December 14, 2023.

AGENCY ROLES AND RESPONSIBILITIES

The final EIS includes information on a broad range of issues that may be regulated by other Federal, State, or local agencies or Tribes. As documented in the final EIS, Kairos must obtain and maintain permits from other Federal, State, or local agencies or Tribes in order to construct the Hermes test reactor.

As described in the final EIS, Kairos is required to comply with a State-issued general permit for stormwater discharges associated with construction activity. Best management practices and other requirements imposed by the State-issued stormwater discharge permit would ensure that runoff during construction of the proposed facility will meet applicable State water quality standards.

The NRC was the sole agency responsible for the environmental review of the Kairos Hermes CP application, including the development of a final EIS. In the final EIS, the NRC evaluated the impacts of constructing, operating, and decommissioning the proposed test reactor at the proposed site. The NRC contacted Federal, State, Tribal, regional, and local agencies to solicit comments on the draft EIS. In addition to considering the environmental effects of the proposed action, NRC considered reasonable alternatives to the proposed action, including the no-action alternative, and building the Hermes facilities at an alternative site. The NRC ensured that the NEPA process was properly conducted and completed before recommending approval for this project. The NRC also documented applicable requirements and necessary permits of other Federal, State, Tribal and local agencies as part of considering the environmental monitoring and mitigation that Kairos would implement.

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to account for the effects of their undertakings on historic properties and consult with the appropriate parties. Issuance of a construction permit is a Federal undertaking that requires compliance with the NHPA Section 106. In accordance with 36 CFR 800.8(c), the NRC initiated the NHPA Section 106 consultation with the Tennessee Historical Commission (THC, i.e., the State Historic Preservation Officer), the Advisory Council on Historic Preservation, the National Park Service, and 18 Federally recognized Tribes. The NHPA implementing regulations are located at 36 CFR Part 800, “Protection of Historic Properties” (36 CFR Part 800).

PURPOSE AND NEED

As identified in Section 1.2 of the final EIS, the purpose and need of the proposed Federal action is to authorize Kairos to build a non-power test reactor to demonstrate key elements of the Kairos Power Fluoride Salt-Cooled, High Temperature Reactor (KP-FHR) technology for possible future commercial deployment. The Hermes reactor would not generate any power for sale or distribution. The technology is an advanced nuclear reactor technology that leverages TRI-structural ISOtropic (TRISO) particle fuel in pebble form combined with a low-pressure fluoride salt coolant. The Hermes reactor would support the Kairos reactor development program, which relies on learning and risk reduction by narrowing the design space through progressive test cycles. The Hermes reactor would also provide validation and qualification data to support potential future commercial reactors using the Kairos Power Fluoride Salt-Cooled, High Temperature Reactor technology.

PROPOSED FEDERAL ACTION

The proposed Federal action is for the NRC to decide whether to issue a construction permit under 10 CFR Part 50 that would allow construction of the Hermes test reactor. If the NRC were to issue a construction permit, Kairos could build the Hermes test reactor on a 185acre site in the Heritage Center in the East Tennessee Technology Park in the City of Oak Ridge, Tennessee. This site lies within an area formerly occupied by the U.S. Department of Energy (DOE) Buildings K-31 and K-33, which were part of the Oak Ridge Gaseous Diffusion Plant that ceased operation in 1986. Buildings K-31 and K-33 have since been razed, and DOE has remediated the site to a condition suitable for industrial development, and DOE has excessed the land for private development subject to deed restrictions related to environmental protection and conservation.

The issuance of a construction permit is a separate licensing action from the issuance of an operating license. If the NRC issues a construction permit, then Kairos could submit a separate application for an operating license, pursuant to the NRC's requirements, and would need to obtain NRC approval before it could operate the Hermes test reactor. If the NRC were to issue an operating license, Kairos has stated that it plans to operate the Hermes test reactor for four years. To conduct an efficient and effective environmental review, the EIS covers the potential impacts from construction, operations, and decommissioning. If Kairos were to submit an application for an operating license, the NRC staff would prepare a supplement to the final EIS in accordance with 10 CFR 51.95(b).

NRC EVALUATION OF THE PROPOSED ACTION:

Section 102(2)(C)(iii) of NEPA[1] states that EISs are to include a detailed statement analyzing alternatives to the proposed action. The NRC staff examined the direct, indirect, and cumulative environmental impacts from construction, operation, and decommissioning of the Hermes test reactor for the following resource areas: land use and visual resources; air quality and noise; hydrogeology and water resources; ecological resources; historic and cultural resources; socioeconomics and environmental justice; human health; nonradiological waste; uranium, fuel cycle, and radiological waste management; transportation of radiological material; postulated accidents; and climate change. The consideration of cumulative impacts accounted for other past, present, and reasonably foreseeable actions that could affect the same resources. The NRC staff also evaluated in the final EIS the environmental impacts of a range of reasonable alternatives including a no-action alternative and an alternative involving siting the Hermes test reactor at an undeveloped Federally-owned site, termed the Eagle Rock site, situated approximately 20 miles west of Idaho Falls, Idaho. The alternatives evaluation helped the staff to determine the environmentally preferable alternative and to weigh the costs and benefits of the proposed action and alternatives to the proposed action.

To guide its assessment of the environmental impacts of the proposed action and alternatives, the NRC has established a standard of significance for impacts based on Council on Environmental Quality guidance (Interim Staff Guidance to NUREG-1537 (ML12156A069 and ML12156A075 (ISG to NUREG-1537)). The NRC established three levels of significance for potential impacts: SMALL, MODERATE, and LARGE. The definitions of these three significance levels, which are presented in the ISG to NUREG-1537, are:

> SMALL—environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered SMALL.
>
> MODERATE—environmental effects are sufficient to noticeably alter important attributes of the resource but not to destabilize them.
>
> LARGE—environmental effects are clearly noticeable and are sufficient to destabilize.

[1] NEPA was amended in June 2023 by the Fiscal Responsibility Act of 2023 (FRA). The Staff determined that the FEIS is consistent with the requirements of the FRA.

The final EIS presents the NRC staff's analysis, which considers and weighs the environmental impacts of the proposed action at the Oak Ridge site. The NRC staff determined that the direct, indirect, and cumulative impacts from construction, operations, and decommissioning of the Hermes test reactor would be SMALL for all resource areas.

EVALUATION OF ALTERNATIVES

In Chapter 4 of the final EIS, the NRC staff considered the following alternatives to construction, operations, and decommissioning of the Hermes test reactor at the proposed site in Oak Ridge, Tennessee:

- the no-action alternative; and
- construction, operations, and decommissioning of the Hermes test reactor at the Eagle Rock site near Idaho Falls, Idaho.

i. No-Action Alternative

Under the no-action alternative, discussed in Section 4.1 of the final EIS, the NRC would not issue the construction permit, and the Hermes test reactor would not be constructed. Kairos could not build the proposed Hermes reactor and would therefore not have an opportunity to test the KP-FHR technologies, design features, and safety functions at a reduced scale relative to an anticipated commercial power reactor. While forgoing the opportunities provided by Hermes might not necessarily preclude future development of reactors using the KP-FHR technologies, it could slow or impede safe and efficient development of the technology. None of the environmental effects described in the EIS would occur under the no action alternative. But because the final EIS characterizes all potential environmental impacts of the proposed action as SMALL, any environmental benefits from selecting the no action alternative instead of the proposed action would be minimal. Additionally, under the no action alternative, the proposed site would remain available for other government or private industrial development projects, and many of the environmental impacts resulting from land disturbance and building new industrial facilities on the site might still occur at some time in the future.

The no-action alternative is the only alternative considered by the NRC staff that does not satisfy the purpose and need stated in the final EIS.

ii. Alternative Sites

The NRC staff independently evaluated the process used by Kairos for screening potential alternative sites, which followed a systematic methodology by applying exclusionary criteria appropriate to the proposed facility. NRC's site-selection process guidance calls for a systematic process to evaluate a broad range of potential sites and determine specific sites to analyze in detail. Based on its evaluation, the NRC staff concluded that the method used by Kairos to identify regions, states, cities, and, ultimately, alternative sites was reasonable and logical and adequately satisfied applicable NRC guidance.

Kairos followed a process based on that of the Electric Power Research Institute (EPRI) in the 2015 version of *Advanced Nuclear Technology: Site Selection and Evaluation Criteria for New Nuclear Power Generation Facilities*. This process involves defining a region of interest (ROI) and candidate areas within the ROI, identifying specific candidate sites for evaluation and

scoring, and finally selecting sites for detailed evaluation. Kairos conducted the process using reconnaissance-level data available in the public domain with limited consultation of stakeholders.

The ROI used by Kairos consisted of the continental United States, based on a preference for future deployment in geographic regions with a strong nexus to future domestic power markets and on the fact that the applicant does not have a specific service territory. Key site screening criteria used by the applicant include the availability of high-quality site data to support licensing and design, proximity to a national laboratory capable of supporting test plans, and connectivity to the targeted commercial reactor market. The applicant identified 11 potential sites in five candidate areas meeting the screening criteria: Eastern Tennessee; the Pacific Northwest; Eastern Idaho; Piketon, Ohio; and southeastern United States. Key criteria used by the applicant to score the potential sites included:

- connectivity to future commercial reactor markets;
- access to construction resources;
- ability for timely acquisition;
- existing local transportation and utility infrastructure;
- strong local community support;
- water availability;
- minimizing conflict with other major projects;
- minimizing reliance on the DOE as the landowner;
- avoiding sensitive environmental resources such as wetlands; and
- access to existing nuclear testing and research.

This process ultimately led Kairos to identify two reasonable alternative sites for a more detailed environmental analysis, the proposed Oak Ridge site and the alternative Eagle Rock site.

The NRC staff determined in the final EIS that the potential environmental impacts from constructing the Hermes test reactor at the proposed site in Oak Ridge would be SMALL for each environmental resource considered. Potential environmental impacts from constructing the reactor at the alternative Eagle Rock site would be SMALL for most environmental resources but would be MODERATE for land use and visual resources, ecological resources, and historic and cultural resources. These MODERATE conclusions reflect the fact that building the proposed Hermes facilities at the Eagle Rock site would require disturbance of soils supporting natural vegetation and potentially containing subsurface archaeological resources. Additionally, the visual appearance of the Hermes facilities could be noticeably intrusive in the rural setting of the Eagle Rock site. In contrast, building the Hermes facilities at the proposed Oak Ridge site would disturb only lands previously disturbed by past industrial development of now-razed Oak Ridge Gaseous Diffusion Plant buildings and would take place within an existing industrial park (the Heritage Center in the East Tennessee Technology Park) that already contains industrial infrastructure and buildings.

iii. Comparison of the Costs and Benefits of the Alternatives

In Section 4.3 of the final EIS, the NRC staff described the costs and benefits of the proposed action as well as alternatives to the proposed action. In weighing the costs and benefits, the NRC staff determined that the overall benefits of the proposed Hermes test reactor at the Oak Ridge site outweigh the disadvantages and costs. The NRC staff concludes that the proposed Hermes test reactor (with the appropriate mitigation measures identified below by the NRC staff) would have accrued benefits that most likely would outweigh its economic, environmental, and social costs.

CONSULTATIONS UNDER NHPA SECTION 106

NHPA Section 106 consultation for the Kairos Hermes environmental review is documented in Section 3.5 of the Final EIS. The staff determined that there would be no adverse effects to historic properties from the proposed undertaking. At the time of publishing the final EIS, NHPA Section 106 consultation with the applicant and a Tribal party was ongoing and the consulting parties had agreed upon a path forward to support NHPA Section 106 consultation closure. Kairos agreed to work with a geoarchaeologist, qualified under Secretary of Interior standards, to develop a methodology for a reconnaissance field investigation and make appropriate updates to the Archaeological Resources Monitoring and Unanticipated Discovery Plan (monitoring plan).

The reconnaissance field investigation was completed in early August. By letter dated October 18, 2023 (ML23291A461), Kairos submitted a Geoarchaeological Reconnaissance Survey Report and an updated monitoring plan. The monitoring plan incorporates both tribal and NRC staff feedback. By letter dated October 25, 2023, the NRC issued a consultation summary letter to the Tribe, which included the Kairos report and monitoring plan. (ML23304A252). By letter dated November 2, 2023, the NRC provided a consultation summary letter to the Tennessee Historical Commission (THC) (ML23310A059). The THC responded on November 6, 2023 (ML23317A368) that they had no objections to the project proceeding as proposed. By letter dated November 7, 2023 (ML23332A001), the consulting Tribe similarly stated they had no objections to the project proceeding, provided the NRC agrees to notify the consulting Tribe of changes to project activities on the site and to any unanticipated discoveries. These stipulations are items which had been discussed and agreed upon with the consulting parties during consultation interactions. The NRC staff prepared a memo to the NRC's Federal Preservation Officer (ML23318A516) to document the NRC's process for implementing the stipulations mentioned in the consulting Tribe's public summary of their November 7, 2023 closeout letter.

MITIGATION MEASURES

The NRC has taken all practicable measures within its jurisdiction to avoid or minimize environmental harm from the proposed action. Construction, operations, and decommissioning of the Hermes test reactor at the proposed site in Oak Ridge would have SMALL environmental impacts in all resource areas. An Environmental Protection Plan is included as Appendix A in the CP to ensure compliance with the Endangered Species Act of 1973, as amended (ESA), and to ensure that the Commission is kept informed of other environmental matters. The Environmental Protection Plan describes reporting requirements regarding potential impacts to protected environmental resources during construction activities and a provision that Kairos will implement its Archaeological Resource Monitoring and Unanticipated Discovery Plan. The Environmental Protection Plan is intended to be consistent with Federal, State, and local requirements for environmental protection.

Below are mitigation measures and best management practices described in Table 5-2 of the final EIS with respect to individual resource areas.

Land Use and Visual Resources

Kairos plans to restore lands temporarily disturbed for parking or staging with native plants or landscaping. Kairos plans to establish fencing, retain trees near the site perimeter, and install landscaping. Best management practices (BMPs) proposed by Kairos would control erosion and runoff. Kairos would have to comply with City of Oak Ridge zoning ordinances.

Air Quality and Noise

BMPs proposed by Kairos would control dust. Construction equipment and vehicles would be properly maintained. Posted speed limits, traffic controls, and administrative measures such as staggered shift hours to reduce traffic noise would be implemented.

Geologic and Water Resources

Kairos would use BMPs to manage stormwater and control erosion and runoff. Kairos would develop and implement a stormwater pollution prevention plan. Water from dewatering processes would be disposed of in accordance with DOE requirements established in the deed to the site.

Ecological resources

No mitigation is proposed with respect to wildlife. BMPs proposed by Kairos would control runoff and sedimentation of aquatic habitats adjoining the site. The Environmental Protection Plan outlines NRC responsibilities under the Endangered Species Act of 1973.

Historic and Cultural Properties

There are no known historic properties under 36 CFR 800.4(d)(1) or historic and cultural resources located on the proposed Kairos site. As described above under the section titled “Consultations Under NHPA Section 106”, Kairos has developed an Archaeological Resource Monitoring and Unanticipated Discovery Plan (monitoring plan) to manage and protect as-yet unidentified cultural resources.

Socioeconomics

No mitigation is proposed.

Human Health

Kairos would implement BMPs to control human exposure to dust. Site-specific training of workers would minimize potential for injuries. The NRC staff expects that Kairos would implement normal safety practices contained in Occupational Safety and Health Administration regulations in 29 CFR Part 1910.

Nonradiological Waste Management

Kairos would implement recycling and reuse programs.

Transportation

No mitigation measures are proposed.

Accidents

No mitigation measures are proposed.

DETERMINATION

Based on an independent review, analysis, and evaluation contained in the final EIS; careful consideration of all the identified social, economic, and environmental factors and input received from other Federal, State, and local agencies, Tribes, organizations, and public; consideration of the mitigation measures outlined above; and the input received during the mandatory hearing; it is determined that the standards for issuance of a CP, as described in 10 CFR Part 50, have been met and that the requirements of Section 102 of NEPA have been satisfied.

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