



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

January 8, 2024

MEMORANDUM TO: William Jessup, Chief
Advanced Reactor Licensing Branch 1
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

FROM: Edward Helvenston, Project Manager **/RA/**
Non-Power Production and Utilization Facility Licensing Branch
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF THE NOVEMBER 2, 2023, PUBLIC MEETING
BETWEEN THE U.S. NUCLEAR REGULATORY COMMISSION
STAFF AND KAIROS POWER LLC TO DISCUSS MATERIAL
CONTROL AND ACCOUNTING (EPID NO. L-2018-LRM-0071)

Meeting Information:

Applicant: Kairos Power LLC (Kairos)

Docket Nos.: 50-7513, 50-611, 50-612

Project No.: 99902069

Public Meeting Notice Agencywide Documents Access and Management System (ADAMS)
Accession No.: ML23276A637

Applicant Presentation Slides: ML23304A003

Meeting Attendees: See the enclosure for a list of meeting attendees.

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Meeting Summary:

On November 2, 2023, a public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of Kairos Power LLC (Kairos) via webinar. The purpose of this meeting was to discuss Kairos's plans for developing special nuclear material (SNM) control and accounting (MC&A) programs that would be described in future operating license (OL) applications for Kairos' proposed Hermes, Hermes 2, and commercial power reactor projects using the Kairos Power fluoride high temperature reactor (KP-FHR) technology. The meeting notice indicated that the meeting may be partially closed to allow for discussion of potentially security-related information. However, it was not necessary to close any portion of the meeting. A list of meeting attendees is provided as an enclosure to this summary.

During the meeting, Kairos provided a presentation that began with an overview of its KP-FHR technology and the pebble handling and storage system (PHSS) used in KP-FHR designs. Kairos noted that its reactors would contain fuel pebbles with a mix of different enrichment as well as fuel and moderator pebbles. During initial reactor startup and early operation, primarily natural uranium fuel pebbles would be used and higher enrichment fuel pebbles would be added later. Therefore, the mix of enrichments in canisters of pebbles discharged from the reactor would vary over time. Kairos stated that it does not plan to separate pebbles of different enrichment once they are added to the reactor.

Kairos discussed its understanding of the NRC regulations that would be applicable to its reactors in the areas of MC&A as well as international safeguards. The NRC staff noted that Title 10 of the *Code of Federal Regulations* (10 CFR) Part 74, "Material Control and Accounting of Special Nuclear Material," applies to any person possessing 1 gram or more of SNM. Subpart B, "General Reporting and Recordkeeping Requirements," of 10 CFR Part 74 applies to all persons subject to 10 CFR Part 74, while other subparts include some exclusions for reactors.

Kairos also presented an overview of the MC&A plan it is developing for its proposed Hermes test reactor. Kairos stated that, although primarily intended for power reactors, Kairos plans to use NRC Regulatory Guide (RG) 5.29, "Special Nuclear Material Control and Accounting Systems for Nuclear Power Plants" (ML13051A421), to provide format and content guidance for its Hermes MC&A plan. Kairos noted that it intends for the plan to be high level, and detailed implementation information will be located in Kairos internal procedures. The NRC staff recommended that Kairos ensure that its plan covers potential loss of material, as well as potential theft or diversion, and recommended that the plan list and describe internal procedures, as appropriate.

Kairos highlighted some areas where it plans to deviate from RG 5.29 in developing its Hermes MC&A plan (e.g., parts where Kairos has determined that RG 5.29 is more applicable to a typical power reactor site). Kairos noted that it plans to use bulk accounting for MC&A in-process pebbles, and item accounting for used pebbles discharged from the reactor and stored in canisters. Kairos noted that it plans for Hermes to have a single material balance area for the purposes of Nuclear Materials Management and Safeguards System (NMMSS) reporting, but there will be separate areas within this larger area, for example, to account for the bulk versus item accounting.

Kairos also referred to other guidance, including NUREG-2159, "Acceptable Standard Format and Content for the Fundamental Nuclear Material Control Plan Required for Special Nuclear Material of Moderate Strategic Significance" (ML22143A963), and American National Standards Institute (ANSI) N15.8-2009, "Methods of Nuclear Material Control – Material Control Systems –

Special Nuclear Material Control and Accounting Systems for Nuclear Power Plants,” as guidance it planned to consider in developing its Hermes MC&A plan. The NRC staff noted that, although primarily developed for fuel cycle facilities, other guidance that Kairos could consider using includes NRC RG 5.88, “Physical Inventories and Material Balances at Fuel Cycle Facilities” (ML17167A292), and NRC RG 5.51, “Independent Assessment of Nuclear Material Control and Accounting Systems” (ML16223A915).

Following Kairos’s discussion of its proposed Hermes MC&A plan outline, the NRC staff also recommended that Kairos consider the requirement under 10 CFR 73.60(f) in developing its Hermes MC&A plan. Additionally, the NRC staff recommended that Kairos consider whether the MC&A plan should include a chapter on investigating indicators of theft, loss, or diversion of SNM consistent with guidance in NUREG-2159.

Kairos noted the “Rulemaking for Enhanced Security of Special Nuclear Material” regulatory basis document published by the NRC in 2015 (ML14321A007), which discusses an approach for applying physical security requirements for facilities with Category III quantities of SNM, instead of Category II quantities, if the material is sufficiently dilute (the Hermes facility would have a Category II quantity of SNM). Kairos noted that the NRC recently approved an exemption to allow a fuel cycle facility to use this approach for applying physical security requirements and asked whether it may be possible to use a similar approach for MC&A (i.e., whether a facility with sufficiently dilute SNM may be able to get an exemption to apply Category III instead of Category II requirements for MC&A). The NRC staff noted that this regulatory basis document is specific to physical security and that for MC&A, 10 CFR Part 74 already applies a graded approach based on SNM type and quantity (and reactors are excepted from certain subparts of 10 CFR Part 74). However, the NRC staff noted that this may be an area for further discussion.

Kairos concluded the meeting with a brief discussion of its preliminary understanding of the NMMSS reporting requirements that would apply for its reactors. The NRC staff noted that, generally, NMMSS should have the flexibility to accommodate Kairos’s planned reactors, although some adjustments may potentially be needed, considering some differences in the designs compared to existing reactors. Representatives of the NMMSS group at the National Nuclear Security Administration (NNSA) who were present at the meeting also stated that they could separately meet with Kairos to provide an overview of NMMSS’ capabilities.

No regulatory decisions were made during this meeting.

Enclosure: List of Attendees

cc: Kairos Power via GovDelivery

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DATE	1/8/2024	1/8/2024

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List of Meeting Attendees

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Name	Organization
Edward Helvenston	U.S. Nuclear Regulatory Commission (NRC)
James Rubenstone	NRC
Suzanne Ani	NRC
Glenn Tuttle	NRC
Mirabelle Shoemaker	NRC
Andrew Waugh	NRC
Beth Reed	NRC
Michael Orenak	NRC
Seamus Flanagan	NRC
Cayetano Santos	NRC
Chuck Teal	NRC
Matthew Hiser	NRC
Samuel Cuadrado de Jesus	NRC
Carolyn Wolf	NRC
Margaret Ellenson	Kairos Power LLC (Kairos)
Per Peterson	Kairos
Darrell Gardner	Kairos
Gareth Walcott	Kairos
Matthew Strangeway	Kairos
Guy Symonds	Kairos
Andrew Lingenfelter	Kairos
Ahmed Moustafa	Kairos
Steve Yang	Kairos
Brian Song	Kairos
Mitch Hembree	National Nuclear Security Administration (NNSA)
Loida Begley	NNSA
Genevieve Weaver	NNSA
Elaine Beacom	NNSA
Marcos Crabtree	NNSA
RL Carbo	NNSA
Ali Tabatabai	NNSA
Timothy Polich	RoPower Nuclear
Charlyne Smith	Breakthrough Institute
Andrew Brenner	Holtec International Inc.