

From: Cuadrado de Jesus, Samuel
Sent: Monday, August 8, 2022 4:59 PM
To: Darrell Gardner; Drew Peebles; Jim Tomkins; Martin Bryan; Nicole Schlichting
Cc: Beasley, Benjamin; Chereskin, Alexander; Helvenston, Edward; Schmidt, Jeffrey
Subject: NRC Final Request for Additional Information 339 for Hermes Construction Permit Application Regarding Inspection of Vessel Internals and the Natural Circulation Flow Path

Darrell, Drew, Jim, Marty, and Nicole,

The Request for Additional Information (RAI) below was transmitted as draft on August 2, 2022. Since no changes were made as a result of the clarification call, this RAI is final. Please respond to this request within 30 days of August 2, 2022.

Regards,

Samuel Cuadrado de Jesús

Project Manager

Advanced Reactor Licensing Branch (UARL)

Division of Advanced Reactors and Non-Power Production and Utilization Facilities (DANU)

U.S. Nuclear Regulatory Commission

Phone: 301-415-2946

Samuel.CuadradoDeJesus@nrc.gov

**REQUEST FOR ADDITIONAL INFORMATION
OFFICE OF NUCLEAR REACTOR REGULATION**

Issue Date: 8/2/2022

Hermes Construction Permit Application

Kairos Power, LLC

Dockets: 05007513--Hermes Non-Power Test Reactor

EPIDS: L-2021-NEW-0011

RAI 339

Section 50.34 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.34), "Contents of applications; technical information," provides requirements for information to be provided in a Construction Permit (CP). 10 CFR 50.34(a)(4) states that a CP shall contain a preliminary analysis and evaluation of systems, structures, and components (SSCs) provided for mitigation of the consequences of accidents to determine margins of safety during normal operations and transient conditions during the life of the facility.

Section 3.1.1, "Design Criteria," of the Kairos Power (KP) Hermes Preliminary Safety Analysis Report (PSAR) references document KP-TR-003-NP-A, "Principal Design Criteria [PDC] for the Kairos Power Fluoride-Salt Cooled, High Temperature Reactor," Revision 1, to provide the principal design criteria for the Hermes test reactor. KP-FHR PDC 32, "Inspection of the reactor coolant boundary," describes requirements to inspect portions of the reactor coolant boundary. The basis for this PDC states that "...the potential for flow blockages/restriction from failed internals (such as graphite reflector blocks) is addressed as part of compliance with PDC 35, 36, and 37, including inspections if appropriate." This indicates that the requirements of PDCs 35, 36, and 37 are applicable to vessel internals as well as other components in the residual heat removal system. PDC 36 states that "[t]he passive residual heat removal system shall be designed to permit appropriate periodic inspection of important components to ensure integrity and capability of the system."

Hermes PSAR, Section 4.3, "Reactor Vessel System," describes SSCs which are needed to maintain the passive residual heat removal path. This pathway is essential to ensure adequate cooling during postulated events where the primary heat transport and primary heat rejection systems are not available. As such, it is vital that adequate measures be available to assure that the natural circulation flow path will be available if called upon in a postulated event. Section 4.3.3, "System Evaluation," of the PSAR describes how the components in the reactor vessel system meet specific PDCs. However, it does not describe how certain components meet PDC 36. Based on information discussed during the General Audit, the staff understands that the vessel head will have four inspection ports and that Kairos has proposed to confirm the capability of the flow path during operation by monitoring temperature and flow. The staff has the following questions:

1. Provide a detail drawing of the natural flow path in the regions above the core.
2. It appears that a potential failure of graphite reflector blocks (e.g., debris, geometry changes, etc.) could cause flow blockages or restrictions of the natural circulation flow path. Where can the flow path be inspected versus where would it need to be verified with flow and temperature monitoring? Can all of the natural circulation flow path that isn't part of forced circulation flow path be inspected?
3. Will flow and temperature monitoring be used to verify the functionality of the relatively stagnant natural circulation flow path during normal (pumped) operation? Will flow and temperature monitoring identify the cause of an off-normal condition and the location of potential issues with SSCs? If so, please describe how these will be accomplished.
4. Provide the number of fluidic diodes in the Hermes design. In the case of failure of one or more fluidic diodes, how many are needed for adequate passive heat removal?

Hearing Identifier: KairosPower_CPDocs_Public
Email Number: 29

Mail Envelope Properties (SA1PR09MB739228CB365075745A690F2D88639)

Subject: NRC Final Request for Additional Information 339 for Hermes Construction Permit Application Regarding Inspection of Vessel Internals and the Natural Circulation Flow Path
Sent Date: 8/8/2022 4:58:46 PM
Received Date: 8/8/2022 4:58:00 PM
From: Cuadrado de Jesus, Samuel

Created By: Samuel.CuadradoDeJesus@nrc.gov

Recipients:

"Beasley, Benjamin" <Benjamin.Beasley@nrc.gov>
Tracking Status: None
"Chereskin, Alexander" <Alexander.Chereskin@nrc.gov>
Tracking Status: None
"Helvenston, Edward" <Edward.Helvenston@nrc.gov>
Tracking Status: None
"Schmidt, Jeffrey" <Jeffrey.Schmidt2@nrc.gov>
Tracking Status: None
"Darrell Gardner" <gardner@kairospower.com>
Tracking Status: None
"Drew Peebles" <peebles@kairospower.com>
Tracking Status: None
"Jim Tomkins" <Tomkins@kairospower.com>
Tracking Status: None
"Martin Bryan" <bryan@kairospower.com>
Tracking Status: None
"Nicole Schlichting" <schlichting@kairospower.com>
Tracking Status: None

Post Office: SA1PR09MB7392.namprd09.prod.outlook.com

Files	Size	Date & Time
MESSAGE	4596	8/8/2022 4:58:00 PM

Options

Priority: Normal
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date: