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

November 26, 2019

MEMORANDUM TO: Benjamin G. Beasley, Chief
Advanced Reactor Licensing Branch
Division of Advanced Reactors and Non-Power Production and Utilization Facilities
Office of Nuclear Reactor Regulation

FROM: Stewart L. Magruder, Senior Project Manager ***/RA/***
Advanced Reactor Licensing Branch
Division of Advanced Reactors and Non-Power Production and Utilization Facilities
Office of Nuclear Reactor Regulation

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF KAIROS POWER LLC FUEL AND THERMAL/FLUIDS PHENOMENA IDENTIFICATION AND RANKING TABLES, CORE DESIGN AND SOURCE TERM

Kairos Power LLC (Kairos) began pre-application discussions with the NRC staff on their Kairos Power Fluoride-Salt-Cooled, High-Temperature Reactor (KP-FHR) in October 2018. Over the past year, Kairos has submitted several topical and technical reports and has met with the NRC staff on numerous occasions. During these meetings, Kairos informed the NRC about their plans to submit topical reports in the areas of fuel performance evaluation methodology and fuel qualification (ML19156A242), and transient and accident analysis methodologies including accident source term. Additionally, Kairos discussed the phenomena identification, and ranking tables (PIRTs) which were developed in support of these topical reports. The purpose of this audit is to provide a preliminary review of the PIRTs performed by Kairos to support an efficient review of these licensing topical reports.

The audit will take place at Kairos' offices in Alameda, CA. The audit will be held from December 3, 2019 through December 4, 2019. The contents of the audit plan are provided as an enclosure.

Enclosure:
Audit Plan

CONTACT: Stewart Magruder, NRR/DANU/UARL
301-348-5766

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF KAIROS POWER LLC FUEL AND THERMAL/FLUIDS PHENOMENA IDENTIFICATION AND RANKING TABLES, CORE DESIGN AND SOURCE TERM DATED: NOVEMBER 26, 2019

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UNITED STATES NUCLEAR REGULATORY COMMISSION
AUDIT PLAN FOR THE REGULATORY AUDIT OF
KAIROS POWER LLC LLC FUEL AND THERMAL/FLUIDS PHENOMENA IDENTIFICATION AND RANKING TABLES, CORE DESIGN AND SOURCE TERM

PRE-APPLICANT: Kairos Power LLC

DATE: December 3, 2019 – December 4, 2019

LOCATION: Kairos Power LLC, 707 W Tower Avenue, Alameda, CA

A. Background and Purpose:

Kairos Power LLC (Kairos) began pre-application discussions with the NRC staff on their Kairos Power Fluoride-Salt-Cooled, High-Temperature Reactor (KP-FHR) in October 2018. Over the past year, Kairos has submitted several topical and technical reports and has met with the NRC staff on numerous occasions. During these meetings, Kairos informed the NRC about their plans to submit topical reports in the areas of fuel performance evaluation methodology and fuel qualification (ML19156A242), and transient and accident analysis methodologies including accident source term. Additionally, Kairos discussed the phenomena identification, and ranking tables (PIRTs) which were developed in support of these topical reports. The purpose of this audit is to provide a preliminary review of the PIRTs performed by Kairos to support an efficient review of these licensing topical reports.

B. Regulatory Audit Basis

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.34(a)(4), 10 CFR 50.34(b)(4), 10 CFR 52.47, 10 CFR 52.137, "Contents of Applications; Technical Information," 10 CFR 52.79, and 10 CFR 52.157, "Contents of Applications; Technical Information in Final Safety Analysis Report," require a safety analysis report to analyze the design and performance of structures, systems, and components (SSCs). The analysis for the design and performance of the integrated system of SSCs relies upon the use of evaluation models (i.e., an analytical tool or set of analytical tools). The development of these evaluation models has commonly been performed in accordance with the Evaluation Model Development and Assessment Process (EMDAP) which is described in Regulatory Guide 1.203, "Transient and Accident Analysis Methods," (ML053500170). One of the major steps included in the EMDAP process is the development of PIRTs to identify important relevant phenomena and gain expert opinion regarding the knowledge level of those phenomena.

Additionally, 10 CFR 50.43(e) provides requirements for applications for a design certification, combined license, manufacturing license, operating license, or standard design approval that propose nuclear reactor designs which differ significantly from light-water reactor designs that were licensed before 1997, or use simplified, inherent, passive, or other innovate means to accomplish their safety functions. In the absence of prototype plant testing, 10 CFR 50.43(e) requires that sufficient data exist on the safety features of the design to assess the analytical tools used for safety analyses over a sufficient range of normal operating conditions, transient conditions, and specified accident sequences. The PIRT process is typically used to assess the available data on the safety features of the design, and to identify testing needs.

C. Regulatory Audit Scope

Staff expects discussions will center on the following areas:

- Facility/Lab tour
- Design overview of KP-FHR
- Testing overview of KP-FHR
- Fuel and thermal/fluids Phenomenological Identification and Ranking Tables (PIRT) overview
- Core design overview
- Mechanistic Source Term Overview

D. Information and Other Material Necessary for the Regulatory Audit

Staff expects discussions will center on the areas identified above in the Regulatory Audit Scope section, and documents pertaining to these areas are to be made available to the NRC staff, as applicable based on the discussion.

Other documents will be requested based on the progress of the staff's review.

Appropriate handling and protection of proprietary information shall be acknowledged and observed throughout the audit.

E. Audit Team

The following are the NRC audit team members:

1. Jeffrey Schmidt, Senior Reactor Systems Engineer (NRC)
2. Michelle Hart, Senior Reactor Engineer (NRC)
3. Antonio Barrett, Reactor Systems Engineer (NRC)
4. Chris Van Wert, Senior Reactor Systems Engineer (NRC)
5. Stephen Bajorek, Senior Level Advisor Thermal Hydraulics (NRC)
6. Joseph Kelly, Senior Reactor Systems Engineer (NRC)
7. James Corson, Reactor Engineer (NRC)
8. Stewart Magruder, Senior Project Manager (NRC), Audit lead
9. Luissette Candelario, Project Manager (NRC)

The following are the Kairos contacts:

1. Darrell Gardner, Director, License Application
2. James Tomkins, Project Manager

F. Logistics

The NRC staff will address in the audit report the technical areas identified in the Regulatory Audit Scope of this audit plan along with presenting the audit outcomes.

The audit will be conducted in support of the pre-application interactions with Kairos, with an entrance on December 3, 2019 and exit on December 4, 2019.

The NRC staff acknowledges the potential for the proprietary nature of some of the information requested. It will be handled appropriately throughout the audit. NRC staff will take notes that will be marked as proprietary and will not remove hard copies or copy electronic files.

G. Special Requests

If necessary, any circumstances related to the performance of the audit will be communicated to the applicant.

H. Deliverables

At the completion of the audit, the NRC staff will prepare an audit report within 45 days that will be declared and entered as an official agency record in ADAMS. The audit outcome may be used to identify any additional information to be submitted for making regulatory decisions.