



UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of

KAIROS POWER LLC

(Hermes Test Reactor)

Docket No. 50-7513-CP

Hearing Exhibit


Exhibit Number:

Exhibit Title:



KAIROS HERMES MANDATORY HEARING CONSTRUCTION PERMIT APPLICATION REVIEW

Overview of Review Methodology and
Summary of Key Regulatory Findings



Robert Taylor

Deputy Director for New
Reactors, Office of Nuclear
Reactor Regulation (NRR)

PANELISTS

Robert Taylor

- Deputy Director for New Reactors, NRR

Mohamed Shams

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

Jeremy Bowen

- Deputy Director, DANU, NRR

Christopher Regan

- Director, Division of Rulemaking, Environmental, and Financial Support (REFS), Office of Nuclear Material Safety and Safeguards (NMSS)

HERMES OVERVIEW

In September 2021, Kairos applied for a 10 CFR Part 50 construction permit (CP) for a testing facility known as Hermes

- 35 megawatts-thermal test reactor with a 4-year lifetime
- Located on a brownfield site in Oak Ridge, Tennessee

Hermes is a key part of Kairos's iterative approach to designing and demonstrating their technology

- Includes non-nuclear test units prior to Hermes and commercial design

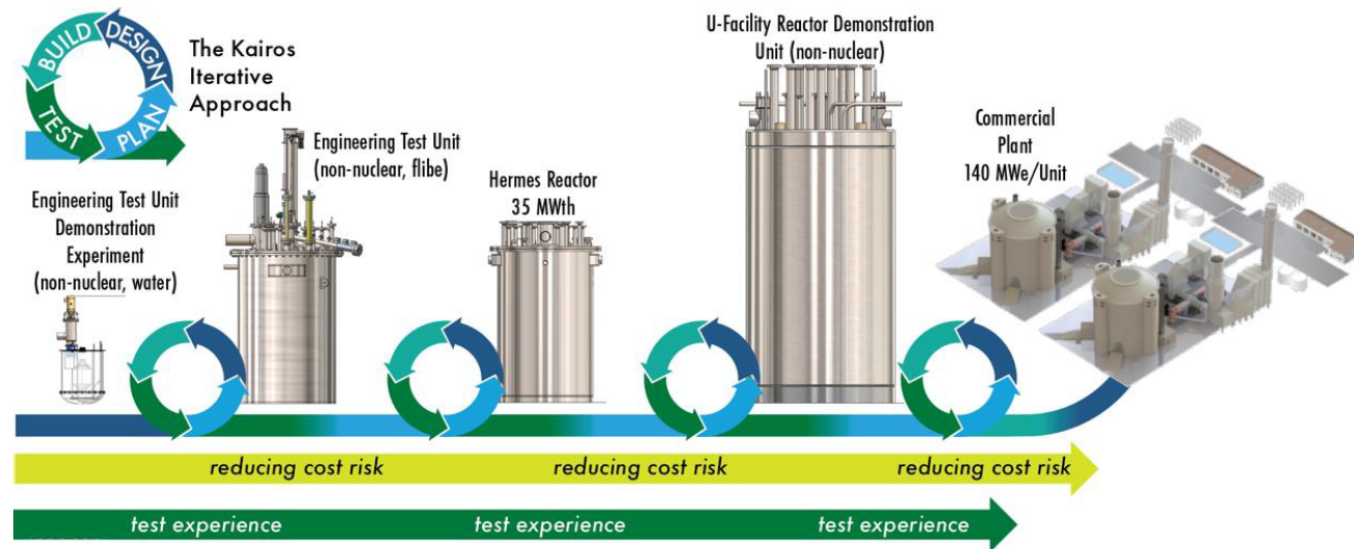


Figure from ML22119A253

ADVANCED REACTOR TECHNOLOGY DEVELOPMENT

If approved, Hermes would be the first non-LWR to receive a permit or license under 10 CFR Part 50 in several decades

The staff is currently reviewing two other CP applications under Part 50

- Also engaged with other vendors in pre-application activities

HERMES REVIEW PERFORMANCE

The Hermes review provided the staff with experience applying Part 50 to an advanced test reactor review

ACRS review recommended CP issuance

The Hermes CP review was completed ahead of schedule and within the estimated budget

Demonstrates staff's ability to efficiently review advanced reactor applications



Mohamed Shams

Director, DANU, NRR

CONDUCTING THE KAIROS HERMES REVIEW

10 CFR Part 50 Licensing Process



CP = Construction Permit OL = Operating License SE = Safety Evaluation EIS = Environmental Impact Statement

NON-POWER REACTOR CONSTRUCTION PERMIT

Hermes is a non-power reactor for research and development activities

- Staff conducted the review consistent with the appropriate regulatory requirements

The Hermes CP application appropriately describes the preliminary design of the facility

- OL application should describe the final design of the facility to support approving the design features and specifications

HERMES REVIEW BEST PRACTICES

Hermes - Kairos Project Status Dashboard

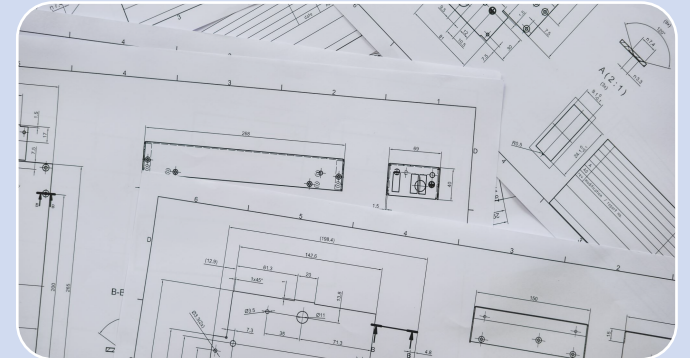
Overall Project Status

Schedule Progress vs. Hours Spent Technical Issue Resolution

Safety Review: Completion Status



Environmental Review: Completion Status



Review Approach

- Core team
- Use of audits
- Dashboards

Applicant Preparedness

- Substantial pre-application work
- Very responsive to NRC staff requests

Review Documentation

- Streamlined SE and EIS
- Early legal reviews
- Early ACRS review with preliminary SE chapters



Jeremy Bowen

Deputy Director, DANU, NRR

SAFETY REVIEW INFORMED BY KEY HERMES DESIGN FEATURES

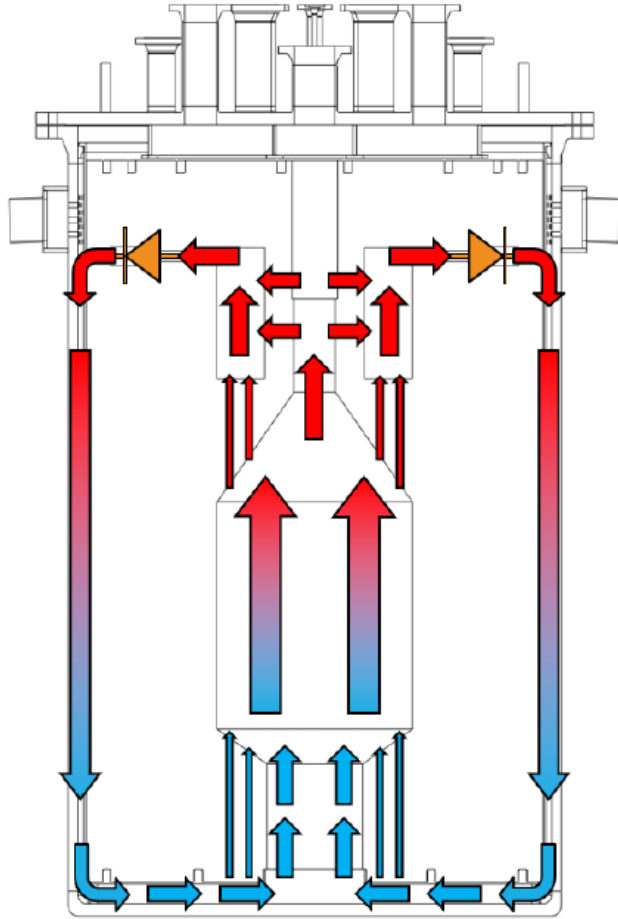


Figure from ML22119A253

- Fuel pebbles with TRISO particles
- Flibe molten salt
- Low pressure primary system
- Air-cooled heat rejection
- Passive safety-related heat removal

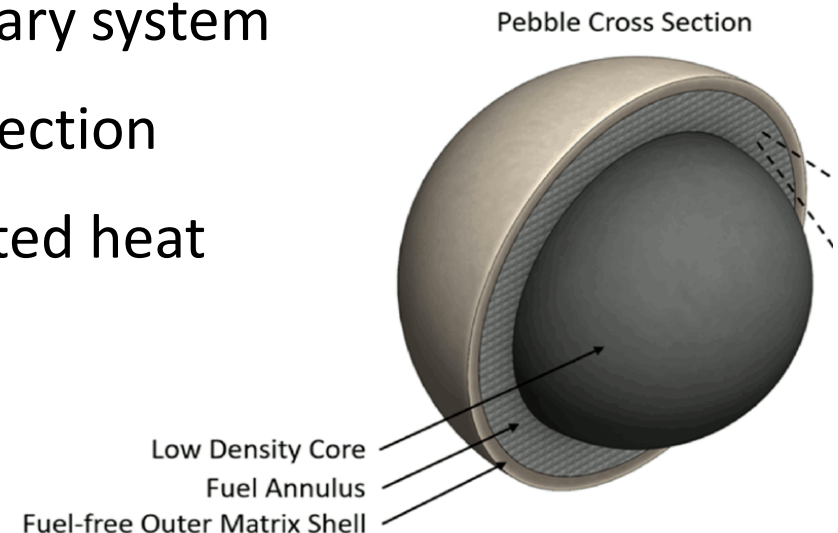


Figure from PSAR Figure 4.2-2 (ML23151A743)

RISK-INFORMED SAFETY REVIEW

The depth and scope of the safety review was commensurate with the risk and safety significance

- The staff maintained a “big picture” safety perspective of the Hermes design
- Considered the small size of Hermes and that the review was for a non-power reactor CP application

The staff’s review was tailored to the unique and novel Kairos technology

- Used the appropriate regulatory guidance in NUREG-1537, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors,” as applicable

SAFETY REVIEW FINDINGS

In accordance with 10 CFR 50.35, NRC staff finds:

- The facility has been described and the major features for the protection of public health and safety have been identified
- Further technical or design information may be reasonably left for the FSAR
- Safety features or components requiring research and development have been identified
- Safety questions will be resolved prior to the completion of construction and the proposed facility can be constructed without undue risk to the health and safety of the public

Staff's conclusions are also based on the considerations in 10 CFR 50.40 and 50.50



Christopher Regan

Director, REFS, NMSS

ENVIRONMENTAL REVIEW

EIS completed in accordance with the National Environmental Policy Act (NEPA); related laws, regulations, and processes; and 10 CFR Part 51

Evaluated impacts from the construction, operation, and decommissioning of the Hermes test reactor at the proposed and alternative sites

Included large number of opportunities for public participation and high level of public disclosure

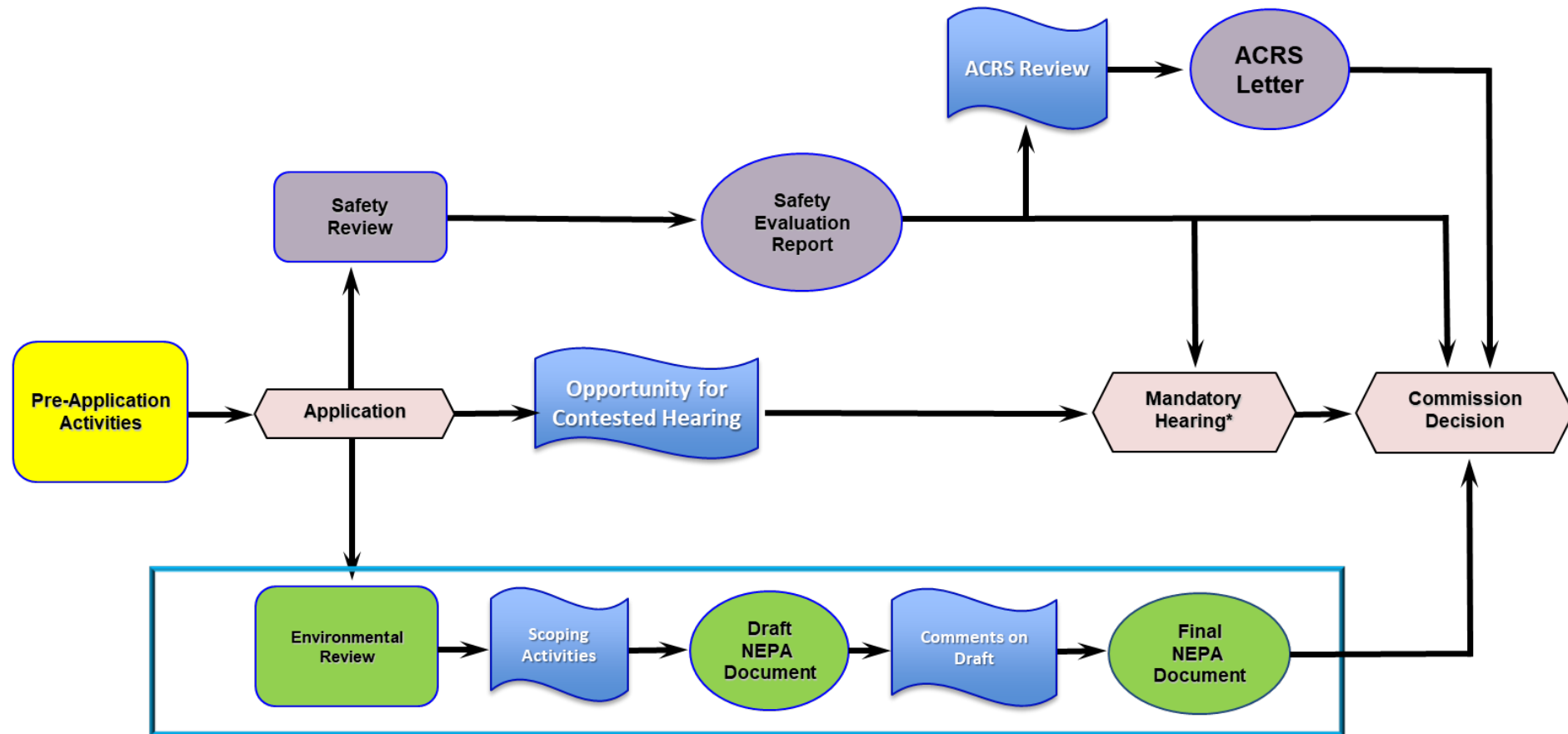
PROPOSED KAIROS HERMES SITE



- 185-acre site in East Tennessee Technology Park in Oak Ridge, TN
- Previous site for Oak Ridge Gaseous Diffusion Plant

From PSAR Figure 2.5-19 (ML23151A743)

LICENSING PROCESS AND ENVIRONMENTAL REVIEW



ACRS - Advisory Committee on Reactor Safeguards
NEPA - National Environmental Policy Act

*Required for early site permits, construction permits, or combined licenses



RECORD OF DECISION

Draft Record
of Decision
States the
Agency
Decision

- Identifies alternatives considered
- Discusses preferences among alternatives
- States that the Commission has taken all practicable measures to avoid or minimize environmental harm
- Will be updated to document closure of consultations under Section 106 of the National Historic Preservation Act

ENVIRONMENTAL REVIEW FINDINGS

10 CFR 51.105(A)

Requirements of NEPA Section 102(2)(A), (C), and (E) and 10 CFR Part 51, Subpart A, have been met

After considering the final balance among the factors in the record of the proceeding, the appropriate action is issuance of the CP

After weighing environmental, economic, technical, and other benefits against environmental and other costs, and after considering reasonable alternatives, it is recommended that the CP should be issued

The staff's NEPA review has been adequate

INTRODUCING THE REVIEW PANELS

Safety Panel

- Safety review approach and conclusions
- Focused on novel issues in Hermes design, such as TRISO fuel, molten salt, and functional containment

Environmental Panel

- Final Environmental Impact Statement
- Proposed Federal action, public outreach, impact evaluations, alternatives, and consultation status

ACRONYMS

- ACRS – Advisory Committee on Reactor Safeguards
- CFR – Code of Federal Regulations
- CP – construction permit
- DANU – Division of Advanced Reactors and Non-Power Production and Utilization Facilities
- EIS – environmental impact statement
- Flibe – molten salt made from a mixture of lithium fluoride and beryllium fluoride
- FSAR – final safety analysis report
- LWR – light water reactor

ACRONYMS

- NEPA – National Environmental Policy Act
- NMSS – Office of Nuclear Material Safety and Safeguards
- NRC – U.S. Nuclear Regulatory Commission
- NRR – Office of Nuclear Reactor Regulation
- NUREG – U.S. Nuclear Regulatory Commission technical report designation
- OL – operating license
- REFS – Division of Rulemaking, Environmental, and Financial Support
- SE – safety evaluation
- TRISO – tristructural isotropic