From: Benjamin Beasley
Sent: Thursday, March 2, 2023 2:07 PM
To: Weidong Wang; Larry Burkhart
Subject: Preliminary Hermes CP SE Appendix
Attachments: Preliminary Hermes CP SE Appendix A for ACRS.pdf

Weidong,

Attached is Appendix A from the safety evaluation for the Hermes construction permit application. This Appendix has been reviewed by branch chiefs and received a preliminary review by OGC. However, this appendix is not final because it still needs to be reviewed by division management and receive the final OGC review. Thus, this preliminary appendix could change between now and the approved SE that will be sent to ACRS for formal review.

I am sending this in advance so that members can become familiar with the safety evaluation and begin preparing for the formal review. The NRC staff is willing to answer any questions that members may have.

Ben
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APPENDIX A

POST CONSTRUCTION PERMIT ACTIVITIES - CONSTRUCTION PERMIT CONDITIONS AND ADDITIONAL ITEMS FOR THE OPERATING LICENSE APPLICATION

THIS NRC STAFF DRAFT SE HAS BEEN PREPARED AND IS BEING RELEASED TO SUPPORT INTERACTIONS WITH THE ACRS. THIS DRAFT SE HAS NOT BEEN SUBJECT TO FULL NRC MANAGEMENT AND LEGAL REVIEWS AND APPROVALS, AND ITS CONTENTS SHOULD NOT BE INTERPRETED AS OFFICIAL AGENCY POSITIONS.

A.1 Construction Permit Conditions

The U.S. Nuclear Regulatory Commission (NRC) staff (the staff) has determined that a construction permit (CP) needs to be conditioned to require that Kairos will perform analysis of excavations for safety related structures at the site, and implement its quality assurance program during construction. Therefore, the staff recommends that, should the permit be granted, the CP include the conditions set forth below. Additional details on the basis for each of these conditions appears in Chapter 2, "Site Characteristics," and Chapter 12, "Conduct of Operations," of the Hermes CP safety evaluation (SE).

Proposed Permit Condition	SE Section	Description
1	2.5, Geology, Seismology, and Geotechnical Engineering	In order to confirm that the exposed bedrock does not show signs of karstic dissolution when the excavations are complete and before the foundation is prepared, Kairos shall perform detailed geologic mapping of excavations for safety related engineered structures; examine and evaluate geologic features discovered in those excavations; and notify the Director of the Office of Nuclear Reactor Regulation, or the Director's designee, as specified in Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.4, "Written communications," once excavations for safety related structures are open for examination by Staff.
2	12.9, Quality Assurance	In order to provide reasonable assurance that regulatory requirements and license commitments for Quality Assurance (QA) are adequately included in the design, procurement, and construction of the Hermes facility, Kairos shall implement the QA program described, pursuant to 10 CFR 50.34(a)(7), in Appendix 12B of Revision 2 of the Hermes Preliminary Safety Analysis Report (PSAR), including revisions to the QA program in accordance with the provisions below. Kairos may make changes to its previously accepted QA program description without prior Commission approval, provided the changes do not reduce the commitments in the QA program description as accepted by the Commission. Changes to the QA program description that do not reduce the

		commitments must be submitted to the Commission within 90 days. Changes to the QA program description that do reduce the commitments must be submitted to the Commission and receive Commission approval prior to implementation, as follows: • Changes must be submitted as specified in 10 CFR 50.4. • The submittal of changes to the QA program description must include all pages affected by the changes and must be accompanied by a forwarding letter identifying the changes, the reason for the changes, and the basis for concluding that the revised program incorporating the changes continues to satisfy the PSAR Revision 2 QA program description commitments previously accepted by the NRC (the letter need not provide the basis for changes that correct spelling, punctuation, or editorial items). • A copy of the forwarding letter identifying the changes must be maintained as a record by Kairos for three years. • Changes to the QA program description shall be regarded as accepted by the Commission upon Kairos' receipt of a letter to this effect from the appropriate reviewing office of the Commission or 60 days after Kairos' submittal to the Commission, whichever occurs first.

A.2 Additional Items for an Operating License Application

The Hermes CP application provided a preliminary design. In the PSAR and during audit meetings, Kairos identified elements of design, analysis, and administration that require additional development or correction. The staff determined that resolution of these items is not necessary for the issuance of a CP, but that Kairos should ensure that these items are fully addressed in the Final Safety Analysis Report (FSAR) supporting an operating license (OL) application. The staff is tracking these items to ensure that significant issues are considered during the review of an OL application for the Hermes test reactor.

These items constitute information needs but do not form the only acceptable set of information for the FSAR. In addition, these items do not relieve an applicant from any requirement in the regulations that governs the application. After issuance of an OL, these items are not controlled by NRC requirements unless such items are restated in the FSAR.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 1.7, Compliance with the Nuclear Waste Policy Act of 1982		In PSAR Section 1.7, Kairos stated that it will provide additional information in the OL application regarding the disposition of high-level waste and spent nuclear fuel.
Section 2.2.3, Analysis of Potential Accidents at Facilities		In PSAR Section 2.2.3, Kairos stated that the location and quantities of onsite chemical storage have not yet been determined, so the effects of potential hazards from onsite chemicals will be evaluated in the OL application.
Section 2.2.3.4, Fires		In PSAR Section 2.2.3.4, Kairos stated that effects of potential brush or forest fires will be evaluated in the OL application.
Section 2.3.5, Long-Term Atmospheric Dispersion Estimates for Routine Releases		In PSAR Section 2.3.5, Kairos stated that details regarding the long-term dispersion modeling, modeling inputs, and analysis will be provided in the OL application.
Section 2.4, Hydrology		In PSAR Section 2.4, Kairos stated that additional information relevant to stream blockage and diversion flows will be provided in the OL application.
Section 2.4.2, Floods, and Section 2.4.3, Credible Hydrological Events and Design Basis		PSAR Sections 2.4.2 and 2.4.3 stated that a probable maximum flood (PMF) study will be discussed with the application for an OL. The PMF evaluation should consider flood elevations induced by local intense precipitation and watershed wide probable maximum precipitation events.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 2.4.4, Groundwater		In PSAR Section 2.4.4, Kairos stated that seasonal changes to groundwater levels will be addressed in the OL application.
Section 2.5.2.1, Karst, and Section 2.5.4.3, Karst; Site Characteristics Audit (ML22143B016) Question 2.5-11		In PSAR Sections 2.5.2.1 and 2.5.4.3, Kairos stated that it will supplement the karst investigations with a set of tests and surveys in the OL application. These tests and surveys include site reconnaissance, light detection and ranging imaging, and inventory of surface depressions in the site area. In addition, deeper boreholes will be drilled at the reactor location selected. Rock cores recovered will be analyzed in the laboratory to characterize the karst features. A site model of the karst features will be developed and presented with the OL application.
Section 2.5.2.3, Soil Borings; Site Characteristics Audit Question 2.5-3		In PSAR Section 2.5.2.3, Kairos presented results from preliminary laboratory testing of site soil layers limited to soil index properties. Kairos stated that a more comprehensive characterization of the geotechnical properties of both soil and rock layers present at the proposed site will be provided in the OL application. The network of rock fractures (e.g., rock joints, bedding planes, small faults, etc.) will be characterized and used to evaluate the bearing capacity and expected settlement of the reactor foundation.
Section 2.5.3, Vibratory Ground Motion; NRC Preliminary Question 2.5-1 (ML22024A492)	KP-NRC-2202-002 (ML22040A336)	PSAR Section 2.5.3 relies on the information of the Clinch River Early Site Permit application's earthquake catalog, which ends in 2013. In KP-NRC-2202-002, Kairos stated that an updated earthquake catalog will be provided in the OL application to demonstrate that the assumptions and conclusions in the Clinch River probabilistic seismic hazard analysis (PSHA) remain valid.
Section 2.5.3, Vibratory Ground Motion		In PSAR Section 2.5.3, Kairos stated the design response spectra will be supplemented with site response spectra analyses that rely on in-situ shear wave velocity measurements derived from the Clinch River PSHA and updated as appropriate in the OL application.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 2.5.4.1, Surface Faulting		In PSAR Section 2.5.4.1, Kairos stated that information on surface faulting will be provided in the OL application.
Section 2.5.4.2, Liquefaction Potential; Site Characteristics Audit Question 2.5-16		In PSAR Section 2.5.4.2, Kairos proposed to place the Hermes non-safety related foundation mat over a fill. Kairos will address the effects of potential liquefaction on the foundations of the non-safety related structures surrounding the reactor in the OL application.
Section 2.5.5.2.1, Bearing Capacity; Site Characteristics Audit Question 2.5-5		In PSAR Section 2.5.5.2.1, Kairos proposed to provide additional details on the bearing capacity and expected settlement of the safety related reactor foundation and the non-safety related structures in the OL application. In addition, additional details will be provided on the lateral pressure on the reactor structure and non-safety related structures.
Section 3.4.1.5, Structural Model, and Section 3.4.1.6, Response Analysis		In PSAR Sections 3.4.1.5 and 3.4.1.6, Kairos stated that additional details on the models, including the structural model finite element results, assignment of the structural mass, and modeling methods and assumptions for the soil-structure interaction analysis and seismic response analysis, will be provided in the OL application.
Section 3.5.3.2.1, External Flood Design Features		In PSAR Section 3.5.3.2.1, Kairos stated that it will provide the description of the specific grading and drainage features in the OL application. The impacts of the site grading and drainage on the safety related structures, systems, and components (SSCs) should be addressed.
Section 3.5.3.2.2, Internal Flood and Spray Design Features		In PSAR Section 3.5.3.2.2, Kairos stated that it will specify automatic or a manual termination of flow for water sources external to the safety-related portion of the Reactor Building (e.g., fire water) in the OL application.
Section 3.5.3.2.2, Internal Flood and Spray Design Features		In PSAR Section 3.5.3.2.2, Kairos stated further information on the analysis of the impacts of internal flooding and spraying will be provided in the OL application.
Section 3.5.3.3.2, Seismic Isolation System		In PSAR Section 3.5.3.3.2, Kairos stated that it will provide further details of the base isolation

PSAR Section and/or Related Audit Question	Associated Documents	Description
		system and associated structural analysis in the OL application.
Section 3.5.3.4, Conformance with PDC 2 for Other Hazards		In PSAR Section 3.5.3.4, Kairos stated additional detail about the structural design features for the safety-related portion of the Reactor Building, informed by the results of the hazards analysis, will be provided in the OL application.
Table 3.6-2, Design and Construction Codes and Standards for Fluid Systems		In footnote 6 to PSAR Table 3.6-2, Kairos stated that departures from American Society of Mechanical Engineers (ASME) Code requirements, if needed, will be identified in the OL application.
General Audit (ML22039A336) Question 3.6-1	KP-TR-013-NP, Revision 4 (ML22263A456)	Kairos stated during the audit that the OL application will document that safety related metallic components in the reactor vessel system are bounded by testing conditions in referenced topical report KP-TR-013-NP, “Metallic Materials Qualification for the Kairos Power Fluoride Salt-Cooled High-Temperature Reactor,” Revision 4.
Section 4.2.1.2, Fuel Qualification	EPRI-AR-1(NP)-A (ML20336A052)	In PSAR Section 4.2.1.2, Kairos stated that it will demonstrate that the fuel meets the conditions and limitations of the NRC SE for EPRI-AR-1(NP)-A, “Uranium Oxycarbide (UCO) Tristructural (TRISO)-Coated Particle Fuel Performance” as part of the OL application.
Section 4.2.1.6, Evaluation of Fuel Design Bases		In PSAR Section 4.2.1.6, Kairos stated that the results of a laboratory testing program to confirm that the fuel’s physical form is maintained during operation, the pebble remains buoyant, and there is no significant salt infiltration into the pebble will be provided in the OL application.
Section 4.2.2.3, System Evaluation		In PSAR Section 4.2.2.3, Kairos stated that the Reactivity Control and Shutdown System shutdown element insertion versus time will be provided in the OL application.
Section 4.3, Reactor Vessel System; General Audit question 4.3-6		PSAR Section 4.3 stated that coolant purity limits will be established with consideration given to chemical attack and fouling of the vessel. During the audit Kairos indicated the OL application will provide relevant coolant purity

PSAR Section and/or Related Audit Question	Associated Documents	Description
		limits and describe the bases for establishing the limits, required actions, and time to complete these actions.
Section 4.3 Reactor Vessel System; General Audit question 4.3-8		PSAR Section 4.3 stated the graphite reflector will be qualified and designed to meet ASME Boiler and Pressure Vessel Code Section III Division 5 requirements. During the audit, Kairos indicated the OL application will describe how all applicable requirements of the ASME Boiler and Pressure Vessel Code Section III Division 5 are met.
Section 4.3 Reactor Vessel System; General Audit question 4.3-11		PSAR Sections 4.3.1.1 and 4.3.1.2 state that the vessel and vessel internals are designed to support on-line monitoring, inspection, and maintenance activities. Kairos stated during the general audit that the OL application will provide additional details on how vessel integrity will be assured through monitoring and inspection programs and confirm the vessel is designed to allows for those programs.
Section 4.3.4, Testing and Inspection		In PSAR Section 4.3.4, Kairos stated that an in-service inspection program that includes the reactor vessel and internals will be provided in the OL application.
Section 4.4.3, Biological Shield - Evaluation		In PSAR Section 4.4.3, Kairos stated that an evaluation of the performance of the biological shield to meet 10 CFR Part 20, “Standards for Protection Against Radiation,” will be provided in the OL application.
Section 4.5.1.1, Overview of Core Nuclear Design		In PSAR Section 4.5.1.1, Kairos stated that initial startup and power ascension will be discussed in the OL application.
Section 4.5, Nuclear Design; Accident Analysis Audit (ML22041B665) question 67		Kairos stated during the audit that the OL application will provide specific details of the pebble burnup monitoring.
Section 4.6.1.2, Coolant Flow Path		In PSAR Section 4.6.1.2, Kairos stated that qualification or functional testing plans and results needed to validate performance assumed in the safety analysis will be provided in the OL application.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 4.6.3, System Evaluation		In PSAR Section 4.6.3, Kairos stated that the results of analyses supporting the inherent stability of the reactor will be provided in the OL application.
Section 4.7.4, Testing and Inspection		In PSAR Section 4.7.4, Kairos stated that an in-service inspection program that includes the reactor vessel support system will be provided in the OL application.
Section 5.1.1.1, Reactor Coolant; General Audit question 5.1-13	KP-TR-005-NP-A, Revision 1 (ML20219A591)	PSAR Section 5.1.1.1 stated that the properties of the Flibe reactor coolant can be found in KP-TR-005-NP-A, Revision 1. Kairos stated during the audit that the OL application will describe how Flibe properties are confirmed.
Section 5.1.3, Primary Heat Transport System		In PSAR Section 5.1.3, Kairos stated that thermodynamic data to calculate transport of radionuclides through Flibe will be justified in the OL application.
Section 5.1.3, Primary Heat Transport System; General Audit question 5.1-4		PSAR Section 5.1.3 describes a postulated air ingress event. Kairos stated during the audit that the OL application will provide results of material qualification testing related to postulated air ingress into the primary heat transport system (PHTS) and its effects on materials used in the reactor vessel system, including graphite components.
Section 5.1.4, Primary Heat Transport System		In PSAR Section 5.1.4, Kairos stated that descriptions of testing and inspection of PHTS will be provided with the OL application.
Section 6.2, Functional Containment		In PSAR Section 6.2, Kairos stated that the specified acceptable system radionuclide release design limits and technical specifications supporting the functional containment concept will be provided in the OL application.
Section 6.3, Decay Heat Removal System (DHRS) Audit (ML22039A226) question 6.3-10		Kairos stated during the audit that the OL application will evaluate the magnitude and effects of thermal gradient asymmetry in the event of loss of inventory in one DHRS train.
Section 6.3.4, Decay Heat Removal System		In PSAR Section 6.3.4, Kairos stated that descriptions of testing and inspection of DHRS will be provided with the OL application.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 7.2.3, System Evaluation		In PSAR Section 7.2.3, Kairos stated that further analysis of the timeliness of Plant Control System (PCS) signals will be provided in the OL application.
Section 7.2.3, System Evaluation		In PSAR Section 7.2.3, Kairos stated that specific design features and the SSCs to which they are applied will be provided in the OL application.
Section 7.2.3, System Evaluation		In PSAR Section 7.2.3, Kairos stated that additional information on the PCS that is dependent on the final design of reactor SSCs, such as hardware and software specifics, software flow diagrams, a description of how the operation and support requirements will be met, and the basis for PCS system reliability and reliability targets, will be provided in the OL application.
Section 7.3, Reactor Protection System		In PSAR Section 7.3, Kairos stated that the final design for the neutron flux monitoring will be provided in the OL application.
Section 7.3, Reactor Protection System		In PSAR Section 7.3, Kairos stated that the Reactor Protection System (RPS) alarm signals to the main control room and information on the minimum redundancy in the RPS to permit period testing without compromising RPS function will be provided in the OL application.
Section 7.3, Reactor Protection System		In PSAR Section 7.3, Kairos stated that a description of how the RPS operational and support requirements will be met, including the enclosure housing the RPS cabinets, will be provided in the OL application.
Section 7.4.3.1, Main Control Room		In PSAR Section 7.4.3.1, Kairos stated that a description of the analysis of operator dose will be provided in the OL application.
Section 7.4.3.2, Remote Onside Shutdown Panel		In PSAR Section 7.4.3.2, Kairos stated that procedures for safe shutdown of the reactor through the remote onsite shutdown panel will be provided in the OL application.
Section 7.5.3, Sensors–System Evaluation		In PSAR Section 7.5.3, Kairos stated that the number and type of RPS sensors needed to be consistent with the safety analysis and their suitability for their operating environment will be provided in the OL application.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Table 7.5-1, Parameter Range for Safety-Related Sensors		In PSAR Table 7.5-1, Kairos stated that the parameter ranges for vessel level, area radiation, source range neutronics, and power range neutronics will be provided in the OL application.
Table 7.5-2, Parameter Range for Non-Safety Related Sensors		In PSAR Table 7.5-2, Kairos stated that the parameter ranges for vessel level, area radiation, pressure, and flow rate in the reactor vessel will be provided in the OL application.
Section 8.3.1.1, Backup Generators		In PSAR Section 8.3.1.1, Kairos stated that a list of the specific essential loads that receive backup power will be provided in the OL application.
Section 9.1.1, Chemistry Control System		In PSAR Section 9.1.1, Kairos stated that a list of the specific essential loads that receive backup power will be provided in the OL application.
Section 9.1.1, Chemistry Control System; General Audit question 9.1-3		Kairos stated during the audit that the OL application will provide all coolant purity specifications, required actions, time to complete these actions if specifications are not met, and how the specifications are consistent with results of material compatibility testing (e.g., metallic material corrosion testing, fuel qualification testing, etc.).
Section 9.1.1, Chemistry Control System; General Audit question 9.1-2	KP-NRC-2208-007 (ML22231B228)	In KP-NRC-2208-007, Kairos stated that the OL application will demonstrate that the Chemistry Control System can measure a well-mixed representative sample of the reactor coolant.
Section 9.1.4.1.1, RV Coolant Level Management Tank		In PSAR Section 9.1.4.1.1, Kairos stated that additional details on the inventory management system vessel level monitoring will be provided in the OL application.
Section 9.3, Pebble Handling and Storage System		In PSAR Section 9.3.1.5, Kairos stated that a summary of the criticality analyses confirming the Pebble Handling and Storage System (PHSS) design maintains a safe geometrical configuration will be provided in the OL application.
Section 9.3, Pebble Handling and Storage System; General Audit question 9.3-2		Kairos stated during the audit that the OL application will provide the detailed spent fuel storage canister design, including how hydrofluoric acid (HF) effects will be managed.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 9.3.1.5, Pebble Inspection		In PSAR Section 9.3.1.5, Kairos stated that further details related to inspections for wear and damage of moderator and fuel pebbles will be provided in the OL application.
Section 9.4, Fire Protection Systems and Programs		In PSAR Section 9.4, Kairos stated that a description of the fire protection program and a fire hazards analysis will be provided in the OL application.
Section 9.6, Possession and Use of Byproduct, Source, and Special Nuclear Material		In PSAR Section 9.6, Kairos stated that a description of the administrative procedures related to use of byproduct, source, and special nuclear material will be provided in the OL application.
Section 9.7, Plant Water Systems; General Audit question 9.7-2		Kairos stated during the audit that the OL application will identify all auxiliary water systems which connect to a system containing radioactive material and will be designed to meet the requirements of 10 CFR 20.1406.
Section 9.7.3, Component Cooling Water System		In PSAR Section 9.7.3, Kairos stated that, for the Component Cooling Water System, specific design features and the SSCs to which they are applied will be provided in the OL application.
Section 9.8.1, Remote Maintenance and Inspection System		In PSAR Section 9.8.1, Kairos stated that, for the Remote Maintenance and Inspection System, specific design features and the SSCs to which they are applied will be provided in the OL application.
Section 9.8.4, Cranes and Rigging		In PSAR Section 9.8.4, Kairos stated that further information about the design of the superstructure in the event of a fire will be provided in the OL application.
Section 11.1, Radiation Protection		In PSAR Section 11.1, Kairos stated that additional details of the radiation protection (RP) programs will be provided in the OL application.
Section 11.1.1, Radiation Sources		In PSAR Section 11.1.1, Kairos stated that additional details of radiation sources, including activity and external radiation fields in the facility, will be provided in the OL application.
Section 11.1.2, Radiation Protection Program, and		In PSAR Section 11.1.2 and 11.1.3, Kairos stated that additional details for both the RP program and the as low as reasonably

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 11.1.3, ALARA Program		achievable (ALARA) program will be provided in the OL application.
Section 11.1.4, Radiation Monitoring and Surveying		In PSAR Section 11.1.4, Kairos stated that additional details of radiation monitoring and surveying, including a description of the equipment, methods, and procedures, will be provided in the OL application.
Section 11.1.5, Radiation Exposure Control and Dosimetry		In PSAR Section 11.1.5, Kairos stated that additional details on dosimetry, radiation exposure control and assess control, including locations of radiological control areas, access controls, shielding, remote handling equipment, and expected annual radiation exposures, will be provided in the OL application.
Section 11.1.5, Radiation Exposure Control and Dosimetry		In PSAR Section 11.1.5, Kairos stated that an effluent analysis corresponding to the final detailed design will be provided in the OL application.
Section 11.1.6, Contamination Control		In PSAR Section 11.1.6, Kairos stated that a description of design features for the control of radioactive contamination at the Hermes facility will be provided in the OL application.
Section 11.1.7, Environmental Monitoring		In PSAR Section 11.1.7, Kairos stated that a description of the radiological environmental monitoring program will be provided in the OL application.
Section 11.2.1, Radioactive Waste Management Program		In PSAR Section 11.2.1, Kairos stated that a detailed description of the radioactive waste management program will be provided with the OL application.
Section 11.2.2, Radioactive Waste Handling Systems and Controls		In PSAR Section 11.2.2, Kairos stated that a description of radioactive waste handling systems design and controls will be provided in the OL application.
Section 11.2.3, Release of Radioactive Waste		In PSAR Section 11.2.3, Kairos stated that a description of the radioactive effluents from the facility, including points of effluent release and effluent monitoring equipment, will be provided in the OL application.
Section 12.1.3, Staffing		In PSAR Section 12.1.3, Kairos stated that specific staffing considerations, minimum staffing levels, allocation of control functions,

PSAR Section and/or Related Audit Question	Associated Documents	Description
		overtime restrictions, shift turnover, procedures, training, and availability of Senior Operators during routine operations will be provided in the OL application.
Section 12.1.4, Selection and Training of Personnel		In PSAR Section 12.1.4, Kairos stated that a description of the training program and the required minimum qualifications for facility staff will be provided in the OL application.
Section 12.1.5, Radiation Safety		In PSAR Section 12.1.5, Kairos stated that details related to the authority of the RP program staff with respect to facility operations will be provided in the OL application.
Section 12.2, Review and Audit Activities		In PSAR Section 12.2, Kairos stated that details of review and audit activities and who holds the approval authority and how it communicates and interacts with facility and corporate management will be provided in the OL application.
Section 12.3, Procedures		In PSAR Section 12.3, Kairos stated that a description of the facility procedures, including the review, approval, and changes processes, will be provided in the OL application.
Sections 12.4, Required Actions, 12.5, Reports, and 12.6, Records		In PSAR Sections 12.4, 12.5 and 12.6, Kairos stated that technical specifications will be provided in the OL application.
Appendix 12A, Section A.2, Authorities and Responsibilities of Facility Emergency Personnel		In PSAR Appendix 12A, Section A.2, Kairos stated that additional roles and responsibilities for emergency response personnel emergency classification levels and the associated protective actions will be provided in the OL application.
Appendix 12A, Section B, Authorities and Responsibilities of Governmental Agencies		In PSAR Appendix 12A, Section B, Kairos stated that the arrangements with the City of Oak Ridge and Oak Ridge Central Fire Station, Oak Ridge Police Department, Oak Ridge Methodist Medical Center, and the State of Tennessee, will be obtained and documented in the OL application.
Appendix 12A, Section F, Training		In PSAR Appendix 12A, Section F, Kairos stated that the details of the training program for emergency response personnel will be provided in the OL application.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Appendix 12A, Section H.2, Assessment Facilities and Equipment		In PSAR Appendix 12A, Section H.2, Kairos stated that a listing of the current locations for emergency equipment cabinets and other emergency equipment storage areas, plus representative equipment inventories for these storage locations, will be provided in the OL application.
Appendix 12A, Section H.5, Instrumentation for Specific Radionuclide Identification and Analysis		In PSAR Appendix 12A, Section H.5, Kairos stated that the actual equipment in the Hermes facility for specific radionuclide identification and analysis will be provided in the OL application.
General Audit question 12.2.7-1	NUREG-0849, Standard Review Plan for the Review and Evaluation of Emergency Plans for Research and Test Reactors, (ML062190191)	Kairos stated during the audit that the OL application will provide additional details and features on the Hermes reactor facility access routes following the guidance in NUREG-0849.
General Audit question 12.2.7-2a	10 CFR 50, Appendix E, Section II.A and NUREG-0849	Kairos stated during the audit that the OL application will provide additional details on the emergency organization and the relationship with other support organizations consistent with NUREG-0849.
General Audit question 12.2.7-2c	10 CFR 50, Appendix E, Section II.A and NUREG-0849	Kairos stated during the audit that the OL application will provide additional descriptions of organizational responsibilities, including the 24-hour on-shift staff positions and lines of succession consistent with NUREG-0849.
General Audit question 12.2.7-3	NUREG-0849	Kairos stated during the audit that the OL application will describe agreements or arrangements with local emergency response agencies that would augment and extend the capability of the Hermes facility's emergency organization and also identify any procedures developed for emergency response coordination consistent with NUREG-0849.
General Audit question 12.2.7-4	NUREG-0849	Kairos stated during the audit that the OL application will provide Hermes emergency classification descriptions as described in NUREG-0849, Section 4.0.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 13.1, Initiating Events and Scenarios, and Section 13.2, Accident Analysis and Determination of Consequences, Accident Analysis Audit question 13		Kairos stated during the audit that the OL application will provide dose analyses for events bounded by the maximum hypothetical accident (MHA) release, such as salt spill, PHSS break, and seismic, along with a comparison to the acceptance criteria for the figures of merit in PSAR Table 13.1-1.
Section 13.1.2, Insertion of Excess Reactivity; Accident Analysis Audit question 48		In KP-TR-018-NP Section 4.5.2.2 and during the audit, Kairos stated that the OL application will provide analyses for a range of insertion rates for insertion of excess reactivity scenarios.
Section 13.1.2, Insertion of Excess Reactivity; Accident Analysis Audit question 55		Kairos stated during the audit that the OL application will provide a justification for the conservatism of the decay heat methodology used as part of the postulated event analysis methodology and Chapter 13 calculations.
Section 13.1.2, Insertion of Excess Reactivity; Accident Analysis Audit question 56		Kairos stated during the audit that deviations of component temperatures above the MHA will be addressed and justified case by case in the OL application.
Section 13.1.2, Insertion of Excess Reactivity; Accident Analysis Audit question 57		Kairos stated during the audit that the OL application will provide the underlying assumptions for mapping between nuclear design, fuel performance, and safety analysis assumptions.
Accident Analysis Audit question 53-8	KP-TR-018-NP	Kairos stated during the audit that the methodology in KP-TR-018-NP, “Postulated Event Analysis Methodology,” will be updated as part of the OL application (or in a separate topical report).
Section 13.1.4, Loss of Forced Circulation		In KP-TR-018-NP, Section 3.2.2.4, Kairos stated that the OL application will provide analyses with a spectrum of reactor decay heat levels and operating power levels for long-term overcooling scenarios.
General Audit question 14-3		Kairos stated during the audit that the OL application will provide analyses demonstrating that vessel temperature is not needed as a Limiting Safety System Setting (LSSS) because the other LSSSs will ensure that unacceptable vessel temperatures will not be reached.

PSAR Section and/or Related Audit Question	Associated Documents	Description
Section 14.1, Technical Specifications Introduction		In PSAR Section 14.1, Kairos stated that the technical specifications and parameter limits will be provided in the OL application.
Table 14.1-1, Proposed Variables and Conditions for Technical Specifications		In PSAR Table 14.1-1, Kairos stated that design features and administrative controls will be provided in the OL application.
Section 15.2, Financial Ability to Operate the Kairos Power Facility		In PSAR Section 15.2, Kairos stated that estimates of the total annual operating costs for each of the first five years of operation of the facility will be provided in the OL application.
Section 15.3, Financial Ability to Decommission the Kairos Power Facility		In PSAR Section 15.3, Kairos stated that information regarding funds to decommission the facility and a site-specific decommissioning plan will be provided in the OL application.
Section 15.5, Nuclear Insurance and Indemnity		In PSAR Section 15.5, Kairos stated that it will obtain $1 million in financial protection in accordance with 10 CFR 140.13 prior to being licensed to possess fuel. Kairos also stated that the amounts of financial insurance required by 10 CFR 140.12(b) and documentation required by 10 CFR 140.15 will be provided in the OL application.
Section 17.1, Decommissioning		In PSAR Section 17.1, Kairos stated that a decommissioning report for the facility will be provided in the OL application.
KP-TR-017-NP, KP-FHR Core Design and Analysis Methodology, Section 7.1		In KP-TR-017-NP Section 7.1, Kairos stated that the completion of verification and validation of the core design and analysis codes and methodology, including uncertainties, will be provided in the OL application.

A.3 Research and Development Items

The provisions of 10 CFR 50.34(a)(8) require that the PSAR identify those structures, systems, or components of the facility that require additional research and development to confirm the adequacy of their design; and identification and description of the research and development program which will be conducted to resolve any safety questions associated with such structures, systems, or components; and a schedule of the research and development program showing that such safety questions will be resolved at or before the latest date stated in the application for completion of construction of the facility. Kairos stated it will complete the following research and development activities before the latest date of completion of construction activities in December 2026.

PSAR Section	Associated Documents	Description
Section 4.2.1, Reactor Fuel	KP-TR-011-NP, Fuel Qualification Methodology for the Kairos Power Fluoride Salt-Cooled High Temperature Reactor (KP-FHR), Revision 2 (ML22186A215)	Perform a laboratory testing program to confirm fuel pebble behavior.
Section 4.3, Reactor Vessel System	KP-TR-013-NP, Metallic Materials Qualification for the Kairos Power Fluoride Salt-Cooled High-Temperature Reactor, Revision 4 (ML22263A456)	Perform testing of high temperature material to qualify Alloy 316H and ER16-8-2.
Section 4.3, Reactor Vessel System	KP-TR-014-NP, Graphite Material Qualification for the Kairos Power Fluoride Salt-Cooled High-Temperature Reactor, Revision 4 (ML22259A142)	Perform analysis related to potential oxidation in certain postulated events for the qualification of the graphite used in the reflector structure.
Section 4.3.4, Reactor Vessel System Testing and Inspection		Develop a high temperature material surveillance sampling program for the reactor vessel and internals.
Section 4.5, Nuclear Design		Development and validation of computer codes for core design and analysis methodology.
Section 4.6, Thermal-Hydraulic Design		Develop and perform qualification testing for a fluidic diode device.
Section 5.1.3, Primary Heat Transport System – System Evaluation		Justification of thermodynamic data and associated vapor pressure correlations of representative species.

PSAR Section	Associated Documents	Description
Section 7.5.3, Sensors - System Evaluation		Develop process sensor technology for key reactor process variables.
Section 9.1.1, Chemistry Control System		Develop the reactor coolant chemical monitoring instrumentation.