UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
245 PEACHTREE CENTER AVENUE N.E., SUITE 1200
ATLANTA, GEORGIA 30303-1200

July 3, 2025

Michael Laufer, Ph.D.
Kairos Power LLC
707 W Tower Ave, Suite A
Alameda, CA 94501

SUBJECT: HERMES TEST REACTOR – U.S. NUCLEAR REGULATORY COMMISSION INSPECTION REPORT 05007513/2025001

Dear Dr. Michael Laufer:

On May 29, 2025, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Kairos Power LLC (Kairos) Hermes Test Reactor (Hermes) and discussed the results of this inspection with Dr. Edward Blandford and other members of your staff. The results of this inspection are documented in the enclosed report.

The inspection examined a sample of construction activities conducted under your construction permit as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of these documents. The inspectors observed construction activities, reviewed selected procedures and records, and interviewed personnel.

No findings or violations of more than minor significance were identified during this inspection.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document Room in accordance with Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

Signed by McKown, Louis
on 07/03/25

Louis J. McKown II, Chief
Engineering Branch 3
Division of Operating Reactor Safety

Docket No. 05007513
Construction Permit No. CPTR-6

Enclosure: U.S. Nuclear Regulatory Commission Inspection Report (IR) 05007513/2025001
w/attachment: Supplementary Information

cc w/ encls:

Edward Blandford, Ph. D,
Chief Technology Officer
Kairos Power LLC
via email

Peter Hastings, PE,
Vice President, Regulatory, Quality, and Public Affairs
Kairos Power LLC
via email

Darrell Gardner
Sr. Director, Licensing
Kairos Power LLC
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Martin Brian
Director, TN Site Integration
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Jordan Hagaman
Director, Reliability Engineering and Quality Assurance
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Rhonda Reynolds, PE
Sr. Manager, Construction Projects
Kairos Power LLC
via email

Brian Song, PE
Director, Civil Structures
Kairos Power LLC
via email

SUBJECT: HERMES TEST REACTOR – U.S. NUCLEAR REGULATORY COMMISSION INSPECTION REPORT 05007513/2025001 DATED JULY 3, 2025

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DATE	7/3/25	7/03/25			

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

INSPECTION REPORT

Docket Number:	05007513
Construction Permit Number:	CPTR-6
Report Numbers:	05007513/2025001
Enterprise Identifier:	I-2025-001-0042
Permit Holder:	Kairos Power LLC
Facility:	Hermes Test Reactor
Location:	Oak Ridge, TN
Inspection Dates:	April 27, 2025 to April 29, 2025
Inspectors:	A. Ponko, Senior Project Construction Inspector, Division of Operating Reactor Safety
Approved By:	Louis J. McKown II, Chief Engineering Branch 3 Division of Operating Reactor Safety

Enclosure

EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the permit holder's performance by conducting inspections of safety-related items and services during construction at Kairos Power LLC (Kairos) Hermes Test Reactor (Hermes). The NRC program for overseeing the construction of non-power utilization facilities is described in Inspection Manual Chapter (IMC) 2550, Non-Power Production and Utilization Facilities (NPUFs) Licensed Under 10 CFR Part 50: Construction Inspection Program (CIP).

List of Findings and Violations

No findings or violations of more than minor significance were identified.

Additional Tracking Items

None.

REPORT DETAILS

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess the permit holder's performance and compliance with Commission rules and regulations, construction permit conditions, operating license application conditions, site procedures, and standards.

SAFETY-RELATED ITEMS AND SERVICES DURING CONSTRUCTION

a. Inspection Scope

The inspectors conducted interviews, reviewed documents, and observed construction activities associated with the installation of drilled pier foundations to determine if:

- Safety-related foundation work was being performed in accordance with regulatory requirements, the construction permit, specifications, drawings, and work procedures.
- The permit holder's system for preparing, reviewing, and maintaining records relative to safety-related foundation activities reflect work accomplishment consistent with specifications and procedures.
- The as-built condition of safety-related foundations meet specified design requirements, specifications, and drawings.
- The implementation of the quality assurance program (QAP) related to work activities for safety-related foundations was effective and deviations from requirements were appropriately resolved.

Foundations (IP 69020, Appendix A)

The inspectors reviewed completed inspection checklists for drilled piers DP6-1, DP6-2, DP6-12, DP6-13, and DP6-23 to verify if records of as-built construction confirm that specified materials and components were installed, required inspections were performed, and acceptance criteria were met.

The inspectors verified if engineering direction was available on-site to monitor geotechnical/foundation construction activities and whether the geotechnical engineer of record was evaluating and approving the adequacy of the foundation subgrade and rock sockets prior to concrete placement.

The inspectors observed geotechnical evaluation of a completed drilled pier shaft prior to concrete placement to determine if measures were being implemented to verify that the foundation subgrade and rock socket met requirements prior to concrete placement. Specifically, the inspectors observed rock socket inspection, geological mapping, and shaft profile evaluation using the Shaft Area Profile Evaluator (SHAPE) tool of the opened shaft for drilled pier DP6-14 to determine if required inspections were being performed in accordance with KP-1000007452, "Quality Control Inspection Plan for Hermes Drilled Pier Installations," Revision 2.

Structural Concrete (IP 69020, Appendix B)

The inspectors reviewed the structural calculations and construction specifications prepared by Simpson Gumpertz & Heger, Inc. (SGH), the design authority for the Hermes building structure, to determine if the design and detailing of the drilled piers were consistent with American Concrete Institute (ACI), "Code Requirements for Nuclear Safety-Related Concrete Structures (ACI 349-13)," the applicable standard identified in Section 3.5 of the Preliminary Safety Analysis Report (PSAR). The inspectors verified if the load combinations, applicable to safety-related reinforced concrete elements, summarized in Table 5 of SGH Document No. 221722-CD-01, "Criteria Document for Structural Design of Hermes Reactor Building," Revision B were consistent with Table 3.5-1 of the PSAR. The inspectors also verified if the drilled pier design documented in SGH calculations 221722-CA-03, "Safety-Related Foundation Element Design," Revision A and 221722-CA-10, "Reactor Building Drilled Pier Analysis and Design," Revision A were appropriately translated into the design drawings, construction specifications, and shop drawings. Additionally, the inspectors reviewed the thermal control plan for mass concrete to determine if measures were being taken to address the potential for undesirable thermal stresses, cracking, deleterious chemical reactions, or reduction in the long-term strength resulting from elevated concrete temperature due to heat of hydration.

The inspectors observed in-process construction of drilled piers DP6-24 and DP6-34. Specifically, the inspectors observed the installed reinforcing cages, concrete placement, and removal of temporary casings to verify if the construction conformed to the design documents. The inspectors also observed field sampling and testing of fresh concrete for drilled pier DP6-34 to verify if the temperature, slump, and air content of the material delivered to the site conformed to the specified requirements and whether activities were completed in accordance with the inspection plan referenced above; the associated "Hermes 1 Construction Quality Control Concrete Material Testing Work Plan," prepared by RIZZO International, Inc. (RIZZO), the independent material testing agency; and referenced American Society of Testing and Materials (ASTM) standards. The inspectors also reviewed the qualification records of the individual performing in-process tests of fresh concrete as well as the calibration records of the equipment used to verify conformance with project requirements.

Additionally, the inspectors reviewed the drilled pier concrete mix design and associated material test reports and data sheets to determine if the concrete mix and constituents met the requirements of SGH Specification No. 03 31 25, "Nuclear Structural Concrete Procurement," Revision 1; SGH Specification No. 31 63 29, "Nuclear Drilled Piers," Revision 1; ACI 349-13; and referenced ASTM standards.

The inspectors verified if the lengths of the vertical reinforcing bars extending above the top of drilled piers DP6-1, DP6-2, and DP6-12 were adequate to fully develop the bars within the pier cap/mat slab.

b. Findings

No findings of more than minor significance were identified.

QUALITY ASSURANCE PROGRAM IMPLEMENTATION

Quality Assurance Program Implementation (IP 69021, Appendices B, E, G, J, and R)

a. Inspection Scope

The inspectors conducted interviews and reviewed documents associated with implementation of the permit holder's quality assurance program to determine if:

- The holder of a Construction Permit (CP) for a Non-power Production and Utilization Facility (NPUF) has developed quality assurance (QA) procedures, instructions, and other documents (collectively: implementing documents) that are consistent with the permit holder's QA program as referenced in the permit holder's Preliminary Safety Analysis Report (PSAR).
- The permit holder has effectively implemented its QA program during construction activities.

Quality Assurance Program (Appendix B)

The inspectors reviewed KP-1000007259, "Quality Assurance Project Plan (QAPP) for Hermes Foundation Construction," Revision 3. The QAPP implements relevant portions of KP-1000005908, "Quality Assurance Program (QAP) for the Kairos Power Hermes Reactor Facility," Revision 2, or H-QAPD, which is based on ANSI 15.8-1995, "Quality Assurance Program Requirements for Research Reactors." The inspectors noted that Kairos is pursuing a phased approach to implementing the Hermes Reactor QAP and has excluded Design Control from the QAPP. Consistent with this approach, current design documents for the Hermes foundation have been procured from SGH as commercial services. Kairos intends to perform design verification and reconciliation of the as-built foundation system through a future safety-related final design procurement with SGH. To support these activities, Kairos Power is implementing quality assurance measures in accordance with the QAPP for the inspection of the Hermes reactor safety-related drilled piers. These measures are intended to provide a quality record of the as-built construction that can be used as a basis for the verification and reconciliation of the as-built drilled pier foundations with the final design of the Hermes test reactor.

Procedures, Instructions, and Drawings (Appendix E)

The inspectors reviewed the SGH design drawings and construction specifications to verify if activities affecting quality were being performed in accordance with documented instructions and drawings appropriate to the circumstances.

Control of Purchased Items and Services (Appendix G)

The inspectors observed receipt inspection of delivered reinforcing steel bars and reviewed associated material test reports to determine if adequate measures had been established and were being implemented for the control of purchased items to assure conformance with specified requirements.

Inspection (Appendix J)

The inspectors reviewed KP-1000007452, “Quality Control Inspection Plan for Hermes Drilled Pier Installations” Revision 2 and KP-1000007453, “Quality Control Inspection Plan Steel Reinforcement,” Revision 1 as well as associated inspection checklists to determine if the measures that had been established and were being implemented to verify conformance of an item or activity to requirements were consistent with the Hermes test reactor construction permit. The inspectors also verified if appropriate hold points and acceptance criteria had been established in the applicable specifications and inspection checklists for determining and documenting activities affecting quality had been satisfactorily accomplished.

The inspectors reviewed RIZZO work plans associated with rebar sampling and testing, concrete material testing, pile integrity testing (PIT), and thermal integrity profile (TIP) testing to determine if measures had been established to perform specified or required tests.

The inspectors reviewed records of completed inspections for drilled piers DP6-1, DP6-2, DP6-12, DP6-13, and DP6-23 to verify that required inspections were performed and results documented.

The inspectors also observed inspection of assembled drilled pier reinforcing steel cages using the “DPCI-B – Rebar Cage Construction and Placement” checklist to verify conformance with specified requirements.

Assessments (Appendix R)

The inspectors reviewed KP-1000007852, “Assessment of Hermes Drilled Piers DP6-01 and DP6-02,” Revision 0 to determine if the permit holder was conducting periodic assessments of quality affecting activities during construction to evaluate the effectiveness of the as-implemented quality program.

b. Findings

No findings of more than minor safety significance were identified.

EXIT MEETING SUMMARY

On May 29, 2025, the inspectors presented the inspection results to Dr. Edward Blandford and other members of the permit holder’s staff. The inspectors verified that no proprietary information was retained or documented in this report.

SUPPLEMENTARY INFORMATION

KEY POINTS OF CONTACT

J. Hagaman, Kairos, Director, Reliability Engineering and Quality Assurance
M. Ellett, Kairos, Senior Licensing Engineer
A. Fernandez, Kairos, Distinguished Engineer
R. Benitez, RIZZO, Lead Geologist
Z. Kurtik, RIZZO, Director QHSE

LIST OF DOCUMENTS REVIEWED

Licensing Basis Documents
HER-PSAR-001, Hermes Non-Power Reactor Preliminary Safety Analysis Report, Revision 3
KP-1000005908, "Quality Assurance Program (QAP) for the Kairos Power Hermes Reactor Facility," Revision 2
KP-1000007259, "Quality Assurance Project Plan (QAPP) for Hermes Foundation Construction," Revision 3.

Calculations
KP-1000000653, C02_Geotechnical Input for Hermes Drilled Pier Foundation
SGH Document No. 221722-CD-01, "Criteria Document for Structural Design of Hermes Reactor Building," Revision B
SGH Calculation No. 221722-CA-03, "Safety-Related Foundation Element Design," Revision A
SGH Calculation No. 221722-CA-10, "Reactor Building Drilled Pier Analysis and Design," Revision A

Construction Specifications
SGH Specification No. 03 21 11, "Nuclear Rebar," Revision 1
SGH Specification No. 03 31 25, "Nuclear Structural Concrete Procurement," Revision 1
SGH Specification No. 03 31 26, "Nuclear Structural Concrete Installation," Revision 1
SGH Specification No. 31 63 29, "Nuclear Drilled Piers," Revision 1

Drawings
SGH Drawing Sheet Number 1-S000, "Structural Symbols and Abbreviations," Mark 2
SGH Drawing Sheet Number 1-S001, "Special Inspections and Structural Testing," Mark 2
SGH Drawing Sheet Number 1-S003, "Site Coordination Plan," Mark 0
SGH Drawing Sheet Number 1-S010, "Nuclear Structural General Notes," Mark 2
SGH Drawing Sheet Number 1-S100, "Drilled Pier Plan," Mark 2
SGH Drawing Sheet Number 1-S500, "Drilled Pier Details," Mark 3
Berkel Submittal KP-HER-SUB-004, "Hermes 1 Drilled Pier Rebar Shop Drawings," Revision 3

Inspection Plans and Checklists
KP-1000007452, "Quality Control Inspection Plan for Hermes Drilled Pier Installations" Revision 2
KP-1000007453, "Quality Control Inspection Plan Steel Reinforcement," Revision 1
KP-1000007708, "Drilled Pier Completion Inspection Checklist A – Drilled Shafts – Hermes 1," Revision 0
KP-1000007710, "Drilled Pier Completion Inspection Checklist C – Concrete Placement – Hermes 1," Revision 2
KP-1000007711, "Rock Socket Approval Inspection Checklist – Hermes 1," Revision 0

KP-1000007712, “Reinforcing Steel Inspection Checklist A – Steel Inspection – Hermes 1,” Revision 1
KP-1000007718, “Curing and Temperature Control Checklist – Hermes 1,” Revision 1
Work Plan, RIZZO “Hermes 1 Construction Quality Control Concrete Material Testing Work Plan,” Revision 1
Work Plan, RIZZO “Pile Integrity Test Hermes Reactor Building Foundation Drilled Piers,” Revision 0
Work Plan, RIZZO “Rebar Sampling and Testing Hermes Reactor Building Foundation Drilled Piers,” Revision 0
Work Plan, RIZZO “Thermal Integrity Profile Test Hermes Reactor Building Foundation Drilled Piers,” Revision 0

Inspection Records
Inspection Checklist, 250428 – RSI-A – Steel Inspection, April 28, 2025
Inspection Checklist, 250429 – RSI-A – Steel Inspection, May 3, 2025
Inspection Checklist, 250502 – RSI-A – Steel Inspection, April 30, 2025
Inspection Checklist, 250506 – RSI-A – Steel Inspection, May 7, 2025
Inspection Checklist, DP6-13 – RSI-A – Steel Inspection, May 13, 2025
Inspection Checklist, DP6-23 – RSI-A – Steel Inspection, May 13, 2025
Inspection Checklist, DP6-01, Rock Socket Approval, May 6, 2025
Inspection Checklist, DP6-01, DPCI-A – Drilled Shafts, May 7, 2025
Inspection Checklist, DP6-01, DPCI-B – Rebar Cage Construction and Placement, May 7, 2025
Inspection Checklist, DP6-01, DPCI-C – Concrete Placement, May 7, 2025
Inspection Checklist, DP6-02, Rock Socket Approval, May 7, 2025
Inspection Checklist, DP6-02, DPCI-A – Drilled Shafts, May 9, 2025
Inspection Checklist, DP6-02, DPCI-B – Rebar Cage Construction and Placement, May 8, 2025
Inspection Checklist, DP6-02, DPCI-C – Concrete Placement, May 9, 2025
Inspection Checklist, DP6-12, Rock Socket Approval, May 14, 2025
Inspection Checklist, DP6-12, DPCI-A – Drilled Shafts, May 14, 2025
Inspection Checklist, DP6-12, DPCI-B – Rebar Cage Construction and Placement, May 14, 2025
Inspection Checklist, DP6-12, DPCI-C – Concrete Placement, May 19, 2025
Inspection Checklist, DP6-13, Rock Socket Approval, May 19, 2025
Inspection Checklist, DP6-13, DPCI-A – Drilled Shafts, May 19, 2025
Inspection Checklist, DP6-13, DPCI-B – Rebar Cage Construction and Placement, May 19, 2025
Inspection Checklist, DP6-13, DPCI-C – Concrete Placement, May 19, 2025
Inspection Checklist, DP6-23, Rock Socket Approval, May 19, 2025
Inspection Checklist, DP6-23, DPCI-A – Drilled Shafts, May 19, 2025
Inspection Checklist, DP6-23, DPCI-B – Rebar Cage Construction and Placement, May 19, 2025
Inspection Checklist, DP6-23, DPCI-C – Concrete Placement, May 19, 2025

Miscellaneous
KP-HER-SUB-013, “Hermes 1 Drilled Pier Concrete Mix Design,” Revision 2
KP-HER-SUB-010, “Hermes 1 Drilled Pier Thermal Control Plan,” Revision 2
KP-1000007852, “Assessment of Hermes Drilled Piers DP6-01 and DP6-02,” Revision 0

LIST OF INSPECTION PROCEDURES USED

IP 69020	Inspection of Safety-Related Items (and Services) During Construction of Non-Power Production and Utilization Facilities
IP 69021	Inspections of Quality Assurance Program Implementation During Construction of Non-Power Production and Utilization Facilities

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Item Number	Type	Status	Description
None			