

This NRC staff draft feedback has been prepared and is being released to support interactions with Kairos Power, LLC. This document has not been subject to full NRC management and legal reviews. Its contents should not be interpreted as official agency positions.



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

**KAIROS POWER LLC – DRAFT NRC FEEDBACK REGARDING WHITE PAPER: "Basic Component Definition for Kairos Power Non-Power Test Reactors" (EPID L-2024-LRO-0013)**

**SPONSOR INFORMATION**

**Sponsor:** Kairos Power LLC

**Sponsor Address:** 707 W Tower Ave, Suite A  
Alameda, CA 94501

**Docket /Project No(s):** 99902069

**DOCUMENT INFORMATION**

**Submittal Date:** April 1, 2024

**Submittal Agencywide Documents Access and Management System (ADAMS) Accession No.:** ADAMS Accession No. ML24092A389 (package)

**Purpose of the White Paper:** In summary, Kairos Power LLC (Kairos) stated that the purpose of its white paper is to confirm their understanding of the definitions of the term “basic component” as it applies to the Hermes non-power test reactors considering their “vertically-integrated strategy of performing most safety-related design and manufacturing work internally.” Kairos is seeking this clarification in order to support their understanding of compliance with the requirements in 10 Code of Federal Regulations (CFR) 21.21, “Notification of failure to comply or existence of a defect and its evaluation,” and 10 CFR 50.55(e)(4), “Notification.”

**Action Requested:** Kairos Power requests that the NRC staff review the white paper entitled “Basic Component Definition for the Hermes Non-Power Test Reactors,” and provide written confirmation or other feedback on Kairos’s understanding of the definitions of the term “basic component” as it applies to the Hermes facilities to support compliance with 10 CFR Part 21 and 10 CFR 50.55(e).

**FEEDBACK AND OBSERVATIONS**

The NRC staff has reviewed Kairos’s white paper and provided feedback and observations below. The feedback and observations are not regulatory findings on any specific licensing matter and are not official agency positions. The feedback and observations on this white paper are also not intended to be comprehensive. Lack of feedback or observations regarding a

certain aspect of the white paper should not be interpreted as the NRC staff's agreement with Kairos's position.

### General NRC Staff Observations

#### 1. Definition of "Basic Component"

10 CFR 21.3 states, in part, under the definition of "basic component":

(3) When applied to other facilities and other activities licensed under 10 CFR parts 30, 40, 50 (other than nuclear power plants), 60, 61, 63, 70, 71, or 72 of this chapter, basic component means a structure, system, or component, or part thereof, that affects their safety function, that is directly procured by the licensee of a facility or activity subject to the regulations in this part and in which a defect or failure to comply with any applicable regulation in this chapter, order, or license issued by the Commission could create a substantial safety hazard.

(4) In all cases, basic component includes safety-related design, analysis, inspection, testing, fabrication, replacement of parts, or consulting services that are associated with the component hardware, design certification, design approval, or information in support of an early site permit application under part 52 of this chapter, whether these services are performed by the component supplier or others.

Based on part (3) of the "basic component" definition in 10 CFR 21.3, the Kairos Power white paper defines basic components for Hermes as structures, systems, components (SSCs) or parts thereof that meet the following criteria:

- a. affects a safety function,
- b. are directly procured by the licensee of a facility, and
- c. in which a defect or failure to comply could create a substantial safety hazard.

Section 3.1 of the white paper discusses criterion (b) on the term "directly procured" as follows:

Based on the clarifications and changes to the original draft rule described above, it is clear that the plain language reading of the final rule is that "directly procured" means that a structure, system, component, or part thereof, including safety-related services associated with the "defined" basic component hardware, is purchased directly by the licensee from an organization that is contractually responsible for the basic component used or to be used in a facility based on a contract that defines the requirements which the facility or basic component must meet in order to be considered acceptable by the licensee.

Therefore, for facilities other than power reactors, a basic component is a structure, system, component, or part thereof, including safety-related services associated with the basic component hardware, that affects a safety function, is purchased directly by the licensee from an organization that is contractually responsible for the component or service associated with the component based on requirements defined

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in a contract that must be met for the component or service to be considered acceptable to the licensee, and in which a deviation in a delivered component from the contract requirements or failure to comply could create a substantial safety hazard. This does not include all safety related SSCs utilized at a facility other than a nuclear power reactor within the scope of the definition of basic components in the rule as issued.

The NRC staff agrees that basic components must meet criteria (a) and (c) above consistent with the definition in 10 CFR 21.3. However, Kairos's interpretation of criterion (b) does not appear to fully consider the statutory language in Section 206 of the Energy Reorganization Act (ERA) of 1974, the purpose and scope of the 10 CFR Part 21 rule, and relevant guidance in NUREG-0302. Given Kairos's "unique" strategy to be the "designer of the Hermes facility, the manufacturer of most safety-related components for the Hermes facility, and the licensee/operator of the Hermes facility," Kairos's proposed implementation of criterion (b) is too narrowly focused to include only items that are provided to Kairos by another organization under contract. The scope of basic components for the Hermes facilities also includes components manufactured by Kairos that also meet criteria (a) and (c) above as explained in more detail below.

#### Statutory and 10 CFR Part 21 Requirements

The NRC staff notes the following requirements.

Section 206, Noncompliance, of the Energy Reorganization Act of 1974 (P.L. 93-438) states, in part:

*(a) Any individual director, or responsible officer of a firm **constructing, owning, operation, or supplying the components** [emphasis added] of any facility or activity which is licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954 as amended, or pursuant to this Act, who obtains information reasonably indicating that such **facility or activity or basic components** [emphasis added] supplied to such facility or activity—*

*(1) fails to comply with the Atomic Energy Act of 1954, as amended, or any applicable rule, regulation, order, or license of the Commission relating to substantial safety hazards, or*

*(2) contains a defect which could create a substantial safety hazard, as defined by regulations which the Commission shall promulgate, shall immediately notify the Commission of such failure to comply, or of such defect, unless such person has actual knowledge that the Commission has been adequately informed of such defect or failure to comply.*

*(b) Any person who knowingly and consciously fails to provide the notice required by subsection (a) of this section shall be subject to a civil penalty in an amount equal to the amount provided by section 234 of the Atomic energy Act of 1954, as amended.*

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10 CFR 21.1, "Purpose," states the following:

*The regulations in this part establish procedures and requirements for implementation of section 206 of the Energy Reorganization Act of 1974. That section requires any individual director or responsible officer of a firm **constructing, owning, operating or supplying the components** [emphasis added] of any facility or activity which is licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954, as amended, or the Energy Reorganization Act of 1974, who obtains information reasonably indicating: (a) That the facility, activity or basic component supplied to such facility or activity fails to comply with the Atomic Energy Act of 1954, as amended, or any applicable rule, regulation, order, or license of the Commission relating to substantial safety hazards or (b) that the **facility, activity, or basic component** [emphasis added] supplied to such facility or activity contains defects, which could create a substantial safety hazard, to immediately notify the Commission of such failure to comply or such defect, unless he has actual knowledge that the Commission has been adequately informed of such defect or failure to comply.*

10 CFR 21.2(a)(1) states that these regulations apply to "[e]ach individual, partnership, corporation, or other entity applying for or holding a license or permit under the regulations in this chapter [...] to construct, manufacture, possess, own, operate, or transfer within the United States, any production or utilization facility [...]; and each director and responsible officer of such a licensee."

10 CFR 21.2(b) goes on to state that "[f]or persons licensed to construct a facility under [...] a construction permit issued under § 50.23 of this chapter [...] evaluation of potential defects and failures to comply and reporting of defects and failures to comply under § 50.55(e) of this chapter satisfies each person's evaluation, notification, and reporting obligation to report defects and failures to comply under this part and the responsibility of individual directors and responsible officers of these licensees to report defects under Section 206 of the Energy Reorganization Act of 1974."

10 CFR 50.55(e)(1) states that "for the purposes of this paragraph, the definitions in § 21.3 of this chapter apply." The notification requirements of 10 CFR 50.55(e)(4), in part, are listed below:

*(i) The holder of a facility construction permit subject to this part [...] who obtains information reasonably indicating that the facility fails to comply with the AEA, as amended, or any applicable regulation, order, or license of the Commission relating to a substantial safety hazard must notify the Commission of the failure to comply through a director or responsible officer or designated person as discussed in paragraph (e)(4)(v) of this section.*

*(ii) The holder of a facility construction permit subject to this part [...] who obtains information reasonably indicating the existence of any defect found in the construction or manufacture, or any defect found in the final design of a facility as approved and released for construction or manufacture, must notify the Commission of the defect through a director or responsible officer or designated person as discussed in paragraph (e)(4)(v) of this section.*

...

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*(iv) A dedicating entity is responsible for identifying and evaluating deviations and reporting defects and failures to comply associated with substantial safety hazards for dedicated items . . . .*

In the preamble to the final 10 CFR Part 21 rule as published in Federal Register (FR) on June 6, 1977 (42 FR 28892), the NRC states the following:

*“In order that the implementation of Section 206 may be responsive to anticipation of problems before the event, a broad interpretation of “firm constructing, owning, operating or supplying the components” has been used. This interpretation includes not only licensees and organizations that physically construct facilities and physically supply components but also includes organizations that only supply safety-related services such as design, inspection, testing or consultation; e.g., site geological investigations. [emphasis added] This interpretation is intended to bring within the regulations in this part those various organizations that can create a substantial safety hazard considering the various methods available for consultation, procurement, design, construction, testing, inspection and operation. These methods include not only the option where design and construction are accomplished by one organization but also the option where one organization does safety-related consultation, another safety-related design and another the actual construction. Each of these organizations has the capability to generate a defect and a potential for failing to comply.”*

Based on these requirements and the discussion in the preamble to the 10 CFR Part 21 rule in 42 FR 28892, the NRC staff observes that the reporting requirements of 10 CFR 21.21 and 10 CFR 50.55(e) apply to all entities responsible for **constructing, owning, operating or supplying components** to a facility licensed under 10 CFR Part 50, including Kairos as the constructor, owner, operator, and supplier of components for the Hermes facilities. The staff also notes that the broad interpretation discussed in the preamble to the 10 CFR Part 21 rule should be kept in mind when interpreting the meaning of individual terms within the broader purpose, scope, and definitions of 10 CFR Part 21.

NUREG-0302 Discussion of “Delivery” and “Procurement Document”

Page 21.3(d)-2 of NUREG-0302, Revision 1, “Remarks Presented (Questions/Answers Discussed) at Public Regional Meetings to Discuss Regulations (10 CFR Part 21) for Reporting of Defects and Noncompliance,” responds to a question regarding the concept of delivered:

*The rule makes no distinction between inter and intra entity delivery of components as long as the transaction occurs pursuant to a procurement document. In determining whether a component has been delivered, the basic element is when the purchaser has taken control over the item.*

Kairos evaluates this response in the white paper by stating that “[s]ince ‘delivery’ as described in the response to this question requires that the transaction occurs pursuant to a procurement document and that the purchaser has taken control over the item, the response

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to this question confirms that a contractual relationship between the purchaser and supplier is necessary for the item to be a basic component.” The NRC staff observes that Kairos appears to base its evaluation on a narrow interpretation of the definition of a procurement document. The staff notes that this response is focused on the timing of when 10 CFR Part 21 should be applied. How this response influences the interpretation of “basic component” depends on the definition of “procurement document.” This response also supports the general interpretation that there is no difference from a 10 CFR Part 21 perspective in whether a component is manufactured in-house or from an external organization.

Moreover, the NRC staff notes that NUREG-0302, Revision 1 (page 5) takes a broad view of the definition of procurement document.

*The Procurement Document is defined in Part 21 as "A contract that defines the requirements which facilities or basic components must meet in order to be considered acceptable by the purchaser."*

*The definition includes both an inter-organizational and an intraorganizational document that defines the technical requirements. This document is the vehicle by which a supplier is informed that the procurement action comes under Part 21.*

Consistent with NUREG-0302, Revision 1, which indicates that a procurement document includes an intraorganizational document that defines technical requirements, the NRC staff observes that “procurement document” is reasonably interpreted to include internal Kairos documents that define the technical requirements of components that could create a substantial safety hazard. Therefore, the NRC staff disagrees with Kairos’s position that the above response on page 21.3(d)-2 of NUREG-0302, Revision 1 confirms that a contractual relationship between the purchaser and supplier is necessary for the item to be a basic component.

#### Part (4) of the 10 CFR Part 21 “Basic component” definition

Page 21.3(a)-5 of NUREG-0302, Revision 1 responds to a question clarifying the meaning of basic component based on language in part (4) of the “basic component” definition from 10 CFR 21.3 (quoted above):

***The broad scope of Section 206 activities of construction, operation, owning and supplying in themselves include activities such as design, consultation or inspection that are important to safety and are associated with component hardware. Thus, such activities which could in themselves result in creating or identifying a defect in associated hardware, system or structure are included in the definition of basic component. An organization may accomplish all of these activities in-house [emphasis added] or may choose to authorize others to do some of the safety-related activities; e.g., consultation, design, inspection or tests, for it. When such contractual arrangements are made for safety-related services the organization accomplishing the service is within the scope of Part 21.***

Kairos concludes in the white paper that “[b]ased on the response to this question and the understanding that basic components are directly procured for facilities other than power

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reactors, safety-related services that are performed in-house (not under a contractual arrangement) are not within the scope of Part 21 for facilities other than power reactors.”

Based on the prior discussion of Section 206 of the ERA, the purpose and scope of 10 CFR Part 21, the prior NUREG-0302 discussion around “delivery” and “procurement document,” and the specific context of this response, the NRC staff disagrees with this conclusion. Rather than creating an implied limitation on the scope of 10 CFR Part 21 to exclude components manufactured by the licensee, the NRC staff observes that the final sentence of the response is simply making clear that the scope of 10 CFR Part 21 extends to organizations providing safety-related services to the licensee. Accordingly, the NRC staff observes that as the owner, constructor, operator, and component supplier of the Hermes facilities, safety-related activities and components manufactured by Kairos in-house would be within the scope of 10 CFR Part 21, consistent with the broad scope of Section 206 of the ERA, the purpose and scope of 10 CFR Part 21, and the statements in NUREG-0302, Revision 1 regarding “delivery” and “procurement document” that explicitly do not distinguish between inter-organization or intra-organization processes as discussed above.

The NRC staff disagrees with Kairos’s conclusion that safety-related services that are performed in-house are not within the scope of 10 CFR Part 21. The response on page 21.3(a)-5 of NUREG-0302, Revision 1 states that the “broad scope of Section 206 activities” such as “supplying” include activities that are important to safety and therefore these activities are included in the definition of basic component. The response goes on to state that organizations may accomplish safety-related activities in-house or via contracts and when contractual arrangements are made for safety-related services the organization accomplishing the service is within the scope of 10 CFR Part 21.

Based on the staff’s observations discussed above, including the regulations cited above and the statements in NUREG-0302, Revision 1, the NRC staff observes that organizations that choose to accomplish safety-related activities in-house, including component manufacturing, would be within the scope of 10 CFR Part 21. As such, the reporting requirements of 10 CFR 21.21 and 10 CFR 50.55(e) would apply to Kairos as the owner, constructor, operator, and supplier of components to the Hermes facilities. Therefore, if Kairos obtained information reasonably indicating that the Hermes facilities or an activity or component within those facilities fails to comply with the Atomic Energy Act of 1954, as amended, or any applicable rule, regulation, order, or license of the Commission relating to substantial safety hazards or contains a defect which would create a substantial safety hazard, it would be required to notify the Commission, regardless of whether the component was provided to Kairos by another organization under contract or designed and manufactured in-house by Kairos.

## 2. Quality Assurance Program

Kairos states that safety-related SSCs, and parts thereof manufactured by Kairos Power will be subject to the Hermes Quality Assurance Program requirements, including the requirements for corrective action. This is as expected by the NRC staff. The staff notes that, if the Hermes testing facilities will be licensed under 10 CFR 50.21, “Class 104 licenses; for medical therapy and research and development facilities,” the requirements of Appendix B to 10 CFR Part 50, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” do not apply. Instead, non-power production or utilization

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facilities (NPUFs) are reviewed using the guidance in ANS/ANSI 15.8-1995, "Quality Assurance Program Requirements for Research Reactors." The staff notes that the quality assurance program under ANS/ANSI 15.8, as endorsed by Regulatory Guide (RG) 2.5, "Quality Assurance Program Requirements for Research and Test Reactors," provides the NRC guidance for complying with the quality assurance (QA) provisions of 10 CFR 50.34(a)(7). ANS/ANS 15.8 contains controls to prevent inadvertent installation or use for non-conforming items and or services. However, neither ANS/ANS-15.8-1995 nor RG-2.5 contain any guidance for reporting requirements of defects or deviations. Instead, reporting requirements for NPUFs are contained in the technical specifications (TS) per the guidance on review and audit stated in ANS/ANSI 15.1, "The Development of Technical Specifications for Research Reactors." Thus, the typical NPUF TS reviewed and approved by the NRC staff contain a provision for immediate reporting of deficiencies uncovered that affect reactor safety to Level 1 management (TS 6.2.4) and reporting to the NRC under TS 6.7.2.

In summary, the NRC staff disagrees, in part, with Kairos's interpretation of the definition of "basic component" for the Hermes facilities. As discussed above, the Kairos white paper position that the 10 CFR Part 21 and 10 CFR 50.55(e) reporting requirements are limited only to SSCs which are provided to Kairos by another organization under contract and do not encompass components designed and manufactured by Kairos is inconsistent with the scope and purpose of the regulations in 10 CFR Part 21, 10 CFR Part 50, Section 206 of the ERA, as well as specific responses and statements in NUREG-0302, Revision 1. Given Kairos's "unique" strategy to manufacture most of the safety-related components for the Hermes facilities, the NRC staff observes that the scope of basic components for the Hermes facilities would include components manufactured by Kairos as well as those provided to Kairos by another organization under contract. In addition, the NRC staff would expect that the Hermes and Hermes 2 TS would contain TS typical of NPUFs requiring the immediate reporting of deficiencies that affect reactor safety to the NRC, consistent with ANS/ANSI 15.1.

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## REFERENCES

1. U.S. Nuclear Regulatory Commission, Title 10 of the *Code of Federal Regulations*, (10 CFR), Part 21, "REPORTING OF DEFECTS AND NONCOMPLIANCE."
2. U.S. Nuclear Regulatory Commission, Title 10 of the Code of Federal Regulations, (10 CFR), Part 50, "DOMESTIC LICENSING OF PRODUCTION AND UTILIZATION FACILITIES."
3. Energy Reorganization Act of 1974, Sec. 206 NONCOMPLIANCE, As Amended Through P.L. 109-58, Enacted August 8, 2005.
4. U.S. Nuclear Regulatory Commission, NUREG-0302, Revision 1, "Remarks Presented (Questions/Answers Discussed) at Public Regional Meetings to Discuss Regulations (10 CFR Part 21) for Reporting of Defects and Noncompliance," October 1977, ADAMS Accession No. ML062080399.
5. American Nuclear Society/American National Standards Institute (ANS/ANSI) 15.8, quality assurance program requirements for research reactors, September 12, 1995.
6. American Nuclear Society/American National Standards Institute (ANS/ANSI) 15.1, the development of technical specifications for research reactors, April 20, 2007.

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