From: Beasley, Benjamin
Sent: Friday, April 8, 2022 5:34 PM
To: Drew Peebles
Cc: Darrell Gardner; Martin Bryan; Chereskin, Alexander; Helvenston, Edward; Cuadrado de Jesus, Samuel
Subject: Questions on Various Chapter 9 Systems for the General Audit

Drew,

Below are some questions on various systems described in PSAR Chapter 9 for the General Audit. We would like to schedule some audit meetings when you are ready to discuss these.

Regards,
Ben

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9.1.1 Chemistry Control System	9.1-1	Please provide the Chemistry Control System (CCS) design requirements document for audit. The document may answer some of the other questions on Section 9.1.1.
	9.1-2	Will the CCS sample from multiple locations in the Primary Heat Transport System or solely though connections with the Inventory Management System (IMS)?
	9.1-3	Will operational limits and required actions for coolant purity be set in the operating license / FSAR?
	9.1-4	Please provide a drawing that shows the location of the CCS in relation to safety related SSCs. This will allow the NRC staff to verify whether potential failures of the CCS will affect safety related SSCs.
	9.1-5	Will a reducing agent be used to control redox potential or will coolant chemistry only be controlled through removing and replacing coolant? It appears that coolant chemistry will be controlled via removing and replacing coolant, however the NRC would like to verify this because additions of reducing agents can alter thermophysical properties of the coolant.
	9.1-6	PDC 70 states that a system shall be provided to maintain purity of the coolant within limits. However, the PSAR states that the CCS is used to monitor the coolant chemistry and the IMS may be used to restore conformance to the Flibe specification. Section 9.1.4 does not state coolant purity control as a function of the IMS. Clarify whether the CCS or IMS is used to maintain coolant purity within specified limits and provide a description of how the system will provide this function.
	9.1-7	Section 9.1.1.3 states that the CCS will monitor reactor coolant chemistry to ensure the coolant is within specifications described

		in the reactor coolant topical report, KP-TR-005, or circulating activity technical specification limits. However, this topical report doesn't consider coolant specifications for impurities that may be introduced during operations, or the effect of coolant chemistry on components such as TRISO or control rods. Describe all of the coolant chemistry limits that will be monitored by the CCS.
9.1.2 Inert Gas System	9.1-8	Please provide the Inert Gas System (IGS) design requirements document for audit.
	9.1-9	It is noted that the IGS is needed to ensure Flibe doesn't freeze in certain areas. How does the IGS achieve this function? If this function is lost and Flibe freezes, does it affect safety functions? Where are the vulnerable areas?
	9.1-10	Is the IGS capable of measuring air and moisture content for the cover gas? HER-EP-RQT-114-0000-Rev A notes that the IGS is required to remove air and moisture from the vessel prior to coolant loading.
	9.1-11	Section 13.1.10.9 states that release of radionuclides from Flibe can be affected by characteristics of the cover gas (e.g. purity of cover gas). How does the design of the IGS ensure assumptions made in Chapter 13 are bounded? Is this through the proposed technical specification to limit radioactive material at risk for release in the cover gas?
	9.1-12	Section 9.1.2.4 states that the backup argon system will be periodically checked for leakage. Will other parts of the IGS also be checked for leakage?
	9.1-13	NUREG-1537, Section 9.6 "Cover Gas Control in Closed Primary Coolant Systems," states that the NRC staff should review analyses of potential effects on reactor safety or operation if the characteristics of the gas mixture are changed. Has Kairos analyzed the impacts of changing characteristics of the gas mixture on other SSCs? If there is a break in the IGS that causes air ingress, will any safety related SSCs be impacted? For example, has potential air ingress been evaluated for the potential to oxidize TRISO in the Pebble Handling and Storage System? Chapter 13 includes an analysis of a break in the Pebble Handling and Storage System, but it isn't clear whether this bounds the potential for a break elsewhere in the IGS. Is the IGS needed to control pressure for any SSCs that could be affected by a change in the gas?
9.2 Reactor Building HVAC	9.2-1	Regarding PSAR Section 9.2.1, the PSAR states "Ventilation exhaust that is discharged to the atmosphere from portions of the RB that potentially contain contaminants during normal operation is monitored and utilizes appropriate filtration, including HEPA filters." Is all of the reactor building exhaust monitored and filtered or is there some portion of the reactor building that is not expected to contain contaminants and its exhaust is not monitored and filtered? If there are RBHVAC exhausts that are not monitored and filtered, is there monitoring or other feature to confirm that no contaminants are present?
	9.2-2	Regarding PSAR Section 9.2, will the RBHVAC have the ability to isolate on a high radiation signal in the system? PSAR Section

		11.1.5 and 11.2.2.1 describe monitoring and filtration in the RBHVAC but do not mention any action based on the monitoring. Is monitoring only for recordkeeping or does it contribute to automatic or manual control (contain or confine) of reactor facility atmospheres? If containment or confinement are a function of the RBHVAC, describe the features which serve that function. This response should be provided on the docket to support the finding in the safety evaluation.
	9.2-3	Regarding PSAR Section 9.2 and 11.1.5, describe features of the RBHVAC and the reactor building that limit inadvertent or uncontrolled release of airborne radioactive material to areas outside the reactor building, controlled areas, and the environment. This response should be provided on the docket to support the finding in the safety evaluation.
	9.2-4	PSAR Section 9.2.1 states that ventilation flow is from areas of low hazard potential to higher hazard potential. Please confirm that, as part of the RBHVAC design, the reactor cell and PHSS cell are designed such that leakage will be from areas of low hazard potential to higher hazard potential? This response should be provided on the docket to support the finding in the safety evaluation.
9.6 Possession of Source, Byproduct, and SNM	9.6-1	PSAR Section 9.6 states that the CP application is intended to support applications for 10 CFR Parts 30, 40, and 70 licenses for the Hermes site, as well as the 10 CFR Part 50 CP application. In addition, PSAR Sections 9.6.1, 9.6.2, and 9.6.3 state that special nuclear material, source material, and byproduct material will be managed by compliance with 10 CFR Part 70, 40, and 30 licenses, respectively. The guidance in NUREG-1537, Part 1, Section 9.5, states that 10 CFR Part 50 non-power reactor licenses typically include material that is produced by the reactor or is required to operate the reactor, including byproduct, source, or special nuclear material. Please clarify whether Kairos intends to submit separate license applications for possession and use of radioactive material at the Hermes site, or whether Kairos intends for all material associated with the Hermes reactor to be possessed under a 10 CFR Part 50 operating license (material under a 10 CFR Part 50 license would still be subject to applicable 10 CFR Part 30, 40, or 70 requirements).
	9.6-2	PSAR Section 9.6.3 states that tritium is present “throughout the primary system, in the secondary coolant, [and] in the graphite core of fuel pebbles.” Should the reference to secondary coolant be removed, given that Kairos indicated by letter dated February 18, 2022, that it plans to eliminate the intermediate nitrate salt coolant loop from the Hermes design? (Kairos’ letter provided PSAR updates to reflect the elimination of this loop, but did not appear to provide any edits for PSAR Section 9.6.)
9.7 Plant Water Systems	9.7-1	The other water systems in section 9.7 state “The XXXX water system is also not credited with performing safe shutdown functions.” Please confirm that the Service Water system will not perform any safe shutdown function.
	9.7-2	The introduction to PSAR Section 9.7 states that water systems which directly interface with systems containing radioactive

		material will be designed to meet the requirements of 10 CFR 20.1406. Section 9.7 and the subsections do not state which water systems are expected to interface with systems containing radioactive material. Figure 9.7-1 seems to indicate that only the Component Cooling Water System interfaces with systems containing radioactive material. Confirm that, among the auxiliary water systems, only the Component Cooling Water System will interface with systems that contain radioactive material.
9.8.4 Cranes and Rigging	9.8-1	Section 9.8.4.4 states that crane design will implement ASME B30.2. Will ASME B30.2 also be implemented for testing, inspection, operator training, operation, and maintenance of the crane and rigging?

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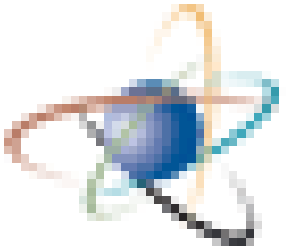

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