

**From:** Beasley, Benjamin  
**Sent:** Tuesday, April 26, 2022 3:00 PM  
**To:** Drew Peebles  
**Cc:** Darrell Gardner; Martin Bryan; Chereskin, Alexander; Audrain, Meg; Cuadrado de Jesus, Samuel; Helvenston, Edward  
**Subject:** Questions on the Reactor Coolant System for the General Audit

Drew,

Below are some questions on the Reactor Coolant System for the General Audit. We would like to schedule an audit meeting when you are ready to discuss these.

Regards,  
Ben

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| 5.1-1 | PSAR Section 5.1.1.5 indicates that auxiliary heating may be needed to prevent coolant freezing in certain areas of the plant where insulation alone may not be adequate. Describe where this auxiliary heating may be needed and whether Flibe freezing may impair the ability of a system, structure, or component (SSC), to perform its safety function. Additionally, describe scenarios in which auxiliary heating may be needed to prevent Flibe from freezing.                            |
| 5.1-2 | What subsystem provides the thermal management function described in Section 5.1.1.3? The reactor auxiliary heating system described in Section 9.1.5.1.2 doesn't appear to include primary heat transfer system (PHTS) components such as the Heat Rejection Radiator (HRR).                                                                                                                                                                                                                    |
| 5.1-3 | The interface between the primary and intermediate system is now separating Flibe from air. Part of Principal Design Criteria (PDC) 73 states that a single barrier between the systems may be appropriate provided that postulated leakage doesn't result in failure of the safety function of safety related SSCs. Describe how air leakage through the HRR barrier may impact the safety functions of safety related SSCs and whether a single passive barrier is appropriate to meet PDC 73. |
| 5.1-4 | Section 5.1.3 states that significant air ingress is excluded by                                                                                                                                                                                                                                                                                                                                                                                                                                 |

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|        | design basis. How much is 'significant' air ingress in this instance? Additionally, describe how trips of the primary salt pump and air blowers prevents a large quantity of air from reaching the PHTS. Section 5.1.1.3 states that this prevents forced air ingress but doesn't discuss natural convection air ingress. How will the upper bound limit for air in the reactor coolant be determined and measured?                                                                                                                                                                                                                                                                                                                               |
| 5.1-5  | Section 5.1.3 states that design features such as trip of the PSPs and air blowers help to meet PDC 33. However, PDC 33 is not cited in Section 5.1.2. Clarify whether this should be added to Section 5.1.2. Additionally, clarify whether the PSPs need to be tripped to maintain reactor coolant inventory in the event of a leak in the reactor coolant boundary, if only the anti-siphon feature is relied upon, or if a combination of both are needed to maintain coolant inventory.                                                                                                                                                                                                                                                       |
| 5.1-6  | NUREG-1537 Section 5.2, "Primary Coolant System," states that the primary coolant system should maintain high quality coolant to limit corrosion of fuel cladding, control rods, the vessel, and other essential components. The PSAR does not appear to state the required coolant purity to limit corrosion of SSCs other than the reactor vessel. Describe how coolant purity will be maintained to limit corrosion of SSCs other than the reactor vessel (e.g. TRISO, control rods, pump components).                                                                                                                                                                                                                                         |
| 5.1-7  | Section 5.1.1.1, "Reactor Coolant," states that a description of the reactor coolant can be found in KP-TR-005, "Reactor Coolant for the Kairos Power Fluoride-Salt Cooled High Temperature Reactor." However, the PSAR doesn't appear to state that the LiF to BeF <sub>2</sub> stoichiometry needs to be maintained in order to keep thermophysical properties within appropriate bounds. 10 CFR 50.36(c)(2)(ii)(B), "Criterion 2," states an operating restriction that is an initial condition for a DBE or transient analysis which could challenge integrity of a fission product barrier must be a technical specification (TS). Does Kairos plan to include a proposed TS in the OL to maintain the LiF:BeF <sub>2</sub> ratio for Flibe? |
| 5.1-8  | Identify the materials of construction used in the PHTS in order to provide reasonable assurance that no significant galvanic corrosion of safety related SSCs will occur.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5.1-9  | Section 5.1.1 states that the PHTS system functions include "Provide for in-service inspection, maintenance and replacement activities". Clarify if this refers to ISI, maintenance and replacement activities for the PHTS or if this statement is referring to support for these activities for safety related systems.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 5.1-10 | Section 5.1.1 states that the PHTS system functions include "Provide capability to drain the PHTS to reduce parasitic heat loss during over-cooling transients". A description of this does                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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|        | not appear to be included in Chapter 5. Provide a description of this capability and the cases when draining would be necessary.                                                                                                                                                                                                                                                                                                               |
| 5.1-11 | Section 5.1.1.3 provides a description of the HRR blower and states that the blower will be tripped concurrent with the primary salt pump to prevent air ingress. However, there is not a description of other potential blower malfunctions. Provide a description of potential malfunctions of the heat rejection subsystem blower and how under/over cooling events could affect the temperature of the Flibe and other system performance. |
| 5.1-12 | How will an appropriate in-service testing program for the active components in the PHTS be determined? Will the in-service inspection program be performed under a reliability and integrity management (RIM) program as discussed in Ch 6.3.4?                                                                                                                                                                                               |

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