Enclosure 5

Exemptions (Non-proprietary)

Introduction

The "Regulatory Analysis for the Kairos Power Fluoride Salt-Cooled, High Temperature Reactor" topical report, KP-TR-004-P-A, as refenced in the preliminary safety analysis report, applies to this application but the application departs from the exemptions identified in the topical report for a test reactor. After further review and discussion with NRC staff, 10 CFR 50.34(a)(4) and 10 CFR 50.34(b)(4) identified within Table D-3 of the regulatory analysis topical report are not technically relevant and do not require an exemption as discussed below.

The last sentence in both 10 CFR 50.34(a)(4) for a PSAR and 10 CFR 50.34(b)(4) for an FSAR require an analysis of emergency core cooling system (ECCS) performance and high point vents following postulated loss of coolant accidents. The underlying purpose of these requirements is based on light water reactor designs that utilize an emergency system to inject cooling fluids as a result of coolant loss due to coolant pipe breaks and to prevent the accumulation of non-condensible gases that may affect this cooling function. The Kairos Power fluoride salt-cooled, high temperature reactor (KP-FHR) design removes heat from the core without reliance on makeup fluid injection from an emergency core cooling system. Heat is removed passively from the reactor vessel and does not rely on fluid addition to replace coolant that losses from pipe breaks. Therefore, the requirement for an analysis of ECCS performance and high point vents following postulated loss of coolant accidents is not technically relevant to the KP-FHR design.

Regulatory Conformance

The underlying purpose of these specific regulations is to demonstrate, by analysis, the capability of the emergency core cooling system to remove decay heat from the reactor core by the injection of makeup cooling fluid to replace fluids lost as a result of coolant piping breaks. The KP-FHR design supports passive decay heat removal directly from the reactor vessel and reactor core without reliance on makeup fluid injection from an emergency core cooling system. The KP-FHR design utilizes a passive decay heat removal system that relies on direct heat rejection to an external set of thimbles to absorb heat as described in Section 6.3 of the safety analysis report. Natural circulation of fluid in the reactor core to support the heat removal occurs entirely within the reactor vessel and does not rely on externally connected coolant system piping.

The loss of coolant fluids in connected piping (pipe breaks) are not considered "accidents" and are postulated to occur during plant operations. The design of the reactor vessel and connected piping includes siphon breaks which preclude a loss of vessel inventory should there be a break in connected coolant piping as described in Section 4.3 of the safety analysis report. A loss of the vessel integrity to maintain fluid over the active core is not a credible event by design. As a result, the safety strategy for the KP-FHR design does not rely on the injection of make-up coolant nor does it need a high point that could be opened in an emergency to remove gases. Postulated events analyzed in Chapter 13 of the safety analysis report do not result in the accumulation of non-condensible gases in the reactor vessel and coolant lines. Non-condensible gases are minimized during normal operation via the inert gas system described in Section 9.1 of the safety analysis report.

Exemptions (continued)

Therefore, the requirements in the last sentence of both 10 CFR 50.34(a)(4) and 10 CFR 50.34(b)(4) are not technically relevant to the KP-FHR design and the requested evaluations are not provided in the PSAR or FSAR. The underlying purpose of these regulations is satisfied by the design and analysis described in the safety analysis reports. Because the regulations are not technically relevant, an exemption from these regulations is not required.