Proceedings of the Korean Nuclear Society Autumn Meeting
Seoul, Korea, October 1998

Inherent Safety Evaluation Models of SSC-K Code

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Abstract

The Korea Atomic Energy Research Institute (KAERI) is developing KALIMER (Korea Advanced LIquid Metal Reactor), which is a sodium cooled, 150 MWe pool-type reactor. The safety design of KALIMER emphasizes accident prevention by using passive processes, which can be accomplished by the safety design objectives including the utilization of inherent safety features to eliminate the need for diverse and redundant engineered safety systems.

KALIMER utilizes the intrinsic negative reactivity feedback effect which is one of the most important inherent safety features of liquid metal reactors (LMRs) even under hypothetical situations where reactor scram failures are postulated. In order to assess the effectiveness of the inherent safety features in achieving the safety design objectives, KAERI has been developing the reactivity feedback models for the metal core of KALIMER.

In addition to the existing models for Doppler, sodium density, fuel axial expansion and core radial expansion effects, a model for the control driveline and reactor vessel expansion has been newly developed and implemented into the system-wide LMR transient analysis code SSC-K. A model also has been developed for a gas expansion module (GEM), which is an empty hexagonal cross section duct located at the periphery of the core, in order to analyze its effect under loss of flow events.

This paper summarizes the modeling efforts of the CRDL expansion and GEM effects for the SSC-K code. Unprotected transient events have been simulated using the modified SSC-K code for the verification of the models developed.