Contribution ID: **356** Type: **POSTER**

VOIDING OF ELSY PRIMARY SYSTEM DURING STEAM GENERATOR LEAKAGE

Tuesday 27 June 2017 17:30 (1h 30m)

Lead-cooled fast reactor (LFR) is one of most attractive innovative reactor design considered for research and development by the Generation IV International Forum (GIF). The major advantages of LFRs are related to the use of heavy liquid metal coolant (lead or lead-alloy). However, there are still pending safety issues that need resolution. Steam generation tube leakage and/or rupture (SGTL/R) is one of them. During SGTL/R, water from high-pressure secondary side enters the low-pressure primary side. This can potentially lead to void ingression to the core, which has adverse effects on the reactor performance including heat transfer deterioration and reactivity feedbacks.

The main objective of this study is to analyze the steam bubble entrainment phenomena and the extent of primary system and core voiding during an SGTL accident in ELSY reactor. A CFD (computational fluid dynamics) model of ELSY primary system nominal operation flow field is prepared and verified. Assuming small leaks, a Eulerian-Lagrangian approach with one-way coupling between the phases with no bubble-bubble interaction models is used. Validation of the drag model representing the main forces acting on the gas-liquid interface has been carried out.

A probabilistic methodology to estimate the core and primary system voiding rates is presented. The results include identification of the most important factors governing the entrainment phenomena and quantification of voiding rates.

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Session Classification: Poster Session 1

Track Classification: Track 3. Fast Reactor Safety