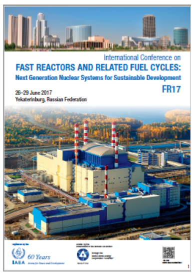

Contribution ID: **433**

Type: **POSTER**

Preliminary transient analyses of SEALER

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

SEALER (SwEdish Advanced LEad Reactor) is a small (8 MWt) lead-cooled fast reactor operating on 19.9 % enriched UO2 fuel. It is designed for commercial production of electricity and heat for off-grid consumers and is intended to function as a nuclear battery for up to 30 years. The reactor features a very small temperature gradient over the core to reduce the degrading process of structural materials. The safety-based design approach for SEALER relies essentially on passive characteristics, such as a negative temperature reactivity feedback, natural convection and heat radiation, the primary safety objective being that under no circumstances shall sheltering or evacuation of the public be necessary.

In this contribution, the present configuration of SEALER is discussed, along with the results of preliminary transient analyses including the coupled primary and secondary systems. The analyzed set of transients covers the consequences of most initiating faults. Based on the current system design, the latter were simulated in un-protected mode, corresponding to unsuccessful insertion of control elements to achieve sub-criticality in the event of failure. Therefore, the system dynamics following (i) reactivity insertions leading to transient overpower (UTOP), (ii) pump failures resulting in a loss of flow (ULOF), (iii) steam generator malfunctions causing a loss of heat sink (ULOHS), and (iv) loss of off-site power resulting in a station blackout (SB), was studied. In addition, changes of boundary conditions on the secondary side, such as decrease/increase of feed-water flow and temperature, and change in steam demand were simulated in order to investigate typical operational transients. Calculations were carried out using BELLA, an in-house code ad hoc developed for dynamic simulation of lead-cooled fast reactors, based on a lumped parameter approach to solve the coupled-physics governing equations.

As major outcomes of this study, it was concluded that, under the postulated accident conditions, adequate safety margins are provided against fuel melting and cladding failure, favored by an overall negative power feedback coefficient. Moreover, due to the negative temperature feedbacks of fuel and coolant, it is ensured that lead freezing will not take place in case of ULOF and ULOHS.
Finally, SEALER's load following capabilities were confirmed.

Country/Int. Organization

Sweden/LeadCold Reactors

Author: Mr MICKUS, Ignas (LeadCold Reactors)

Co-authors: Prof. WALLENIUS, Janne (LeadCold Reactors); Ms BORTOT, Sara (KTH)

Presenter: Mr MICKUS, Ignas (LeadCold Reactors)

Session Classification: Poster Session 1

Track Classification: Track 3. Fast Reactor Safety