# A comparative study on severe accident phenomena in SFR and PWR

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## Abstract

The nuclear safety approach has to cover accident sequences involving core degradation in order to develop reliable mitigation strategies for both existing and future reactors. In particular, the long-term stabilization of the degraded core materials and their coolability has to be ensured after a severe accident. This poster focuses on severe accident phenomena in Pressurized Water Reactors (PWR) compared to future GenIV-type Sodium Fast Reactors (SFR). Firstly, two reactor concepts are introduced focusing on safety aspects. The severe accident scenarios leading to core melting are introduced and the initiating events are highlighted. The poster focuses on in-vessel severe accident phenomena, including the chronology of core damage, major changes in core configuration and molten corium progression. Regarding the mitigation means, the in-vessel retention phenomena and the core catcher characteristics are reviewed for these different nuclear generation concepts (II, III and IV). The robustness of the safety demonstration is established by means of a combined probabilistic and deterministic approach. Some experimental studies and the state of development and validation of mechanistic computer codes and fast-running physical parametric tools are highlighted. The latter enable us to perform physical-statistical analyses of the accident scenarios. The poster highlights some key modeling issues related to molten corium heat transfer and relocation in ASTEC code (ICARE module) and SEASON platform (SIMMER code), as well as in the PROCOR tool. Finally, on the basis of the main results, a comparison between the PWR and SFR severe accident evolution is provided as well as the relation between governing physical parameters and the adopted mitigation provisions for each reactor concept.

**Keywords:** severe accident, SFR, PWR, ASTEC, SEASON, PROCOR