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Modeling Of Triggering and Steam Explosion Pressure Propagation with Validation Against KROTOS Experiments.

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Severe accidents (SA) mitigation strategy in Nordic Boiling Water Reactors (BWRs) may lead to ex-vessel steam explosion (SE) scenario. The molten corium falls from the reactor vessel lower head that failed due to thermal and mechanical loads into a pool of water to form a coolable debris bed after fragmenting and quenching the corium melt. Ultimately, preventing containment failure and the release of radioactivity into the environment.

During corium fragmentation in water, a vapor film is formed around the melt which prevents the direct melt water contact and limits the heat transfer between the two liquids. In case of vapor film collapse, in a phase called (triggering) an explosive transfer of energy from the melt to the volatile coolant may occur as a shock wave that traverses along the water body causing steam explosion that affects the containment integrity.

The numerical instability of old SE codes causes a large spread in predictions of SE loads. In this work, we develop a code that utilizes improved numerical methods to assess steam explosions and their uncertainty.

In this paper, we address the triggering and propagation of a shock wave generated in a SE scenario. We build a numerically stable code using WENO solver with AUSM+-up and Godunov flux schemes to model pressure propagation in a multiphase domain.

We compare the results of shock wave propagation obtained with the experimental results from KROTOS facility and with the results from TEXAS-V code. We discuss the results and how they contribute to the enhancement of triggering and propagation modeling in a SE code.

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