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# Modelling and Analysis of selected OECD PKL3 Station-Blackout Experiments using TRACE

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## ABSTRACT

Series of tests dedicated to Station-Blackout (SBO) accident scenarios have been recently performed at the PKL facility in the framework of the OECD/NEA PKL 3 Project. These investigations address current safety issues related to beyond design basis accident transients with significant core heat-up. This work presents a detailed analysis using the best-estimate thermal-hydraulic code TRACE (v5.0 Patch4) of different SBO scenarios conducted at the PKL facility; failures of high and low-pressure safety injection systems together with steam generator (SG) feedwater supply are considered, thus calling for adequate accident management (AM) actions and timely implementation of alternative emergency cooling procedures to prevent core meltdown. The presented analysis evaluates the capability of the applied TRACE model of the PKL facility to correctly capture the sequences of events in the different SBO scenarios, namely the SBO tests H2.1, H2.2 run 1 and H2.2 run 2, including symmetric or asymmetric secondary side depressurization (SDE), primary side depressurization (PDE), accumulator (ACC) injection in the cold legs and secondary side feeding with mobile pump and/or primary side emergency core cooling (ECC) injection from the fuel pool cooling pump (FPCP). This study is focused specifically on the prediction of the Core Exit Temperature (CET), which drives the execution of the most relevant AM actions. This work presents, in particular, the key improvements made to the TRACE model that helped to improve the code predictions, including the modelling of dynamical heat losses, the nodalization of SGs' heat exchanger tubes and the ACCs. Another relevant aspect of this work is to evaluate how well the model simulations of the three different scenarios qualitatively and quantitatively capture the trends and results exhibited by the actual experiments. For instance; how the number of SGs considered for SDE affects the heat transfer from primary side; how the discharge capacity of the pressurizer relief valve affects the dynamics of the transient; how ACC initial pressure and nitrogen release affect the grace time between ACC injection and subsequent core heat up; and how well the alternative feeding modes of the secondary and/or primary side with mobile injection pumps affect core quenching and ensure stable long-term core cooling under controlled boiling conditions.

## KEYWORDS

Station black-out, TRACE, validation, PKL, PCT, CET

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