

# Chemistry of fission products (FISKE)

Tommi Kekki, Senior Scientist • Karri Penttilä, Senior Scientist • Suvi Lamminmäki, Research Trainee •  
Niina Könönen, Research Scientist • Jukka Rossi, Senior Scientist

## Introduction

FISKE project investigated the chemistry of fission products inside a NPP containment. In severe accident scenario the molten core materials, when flowing out of the reactor vessel, may interact with the concrete of the reactor building. The cooling water vaporized by the melting core flows through compartments where it condenses again. Results of various experiments have shown that sump solution pH has major effect in fission products release rate. Radiation plays a strongly role, as it induces fast radiochemical reactions.

## Main objectives

- Calculate pool pH (ChemPool)
- Calculate corium/concrete interactions (GEMINI2 and Chemsheet)
- Calculate viscosity of corium/concrete mixture (CSFoam)
- Study the formation of nitric acid during high dose rates (experimental work with Chalmers University of Technology)
- Follow-up the OECD/BIP2 project investigating the behaviour of iodine

## Results and conclusions

ChemPool is an easy to use tool for adding simulation of pH chemistry to a MELCOR simulation. It is tested for typical BWR case using Olkiluoto NPP as an example plant. In 2012 the code has upgraded and PWR case calculations have been made for Loviisa NPP.

ChemSheet and GEMINI2- calculations for the L8 ACE-test case show that the amounts of gaseous Sr, Ba and La are very small or non-existent; the amounts of species actually observed in aerosol samples were in same level. The results from GEMINI2 and ChemSheet are practically identical except for Fe, Cr and Ni that have small differences. ChemSheet has a limitation considering the number of interaction parameters for a solution phase.

ChemSheet with NUCLEA database and CSFoam are very efficient tools to calculate and study different severe accident scenarios that involve the melting of the core and the formation of different partly molten oxide and metals phases. CSFoam tool was used to calculate the viscosity of corium/concrete mixture at various temperatures and compositions (HECLA tests).

## ChemPool

Firstly, the selected severe accident progression and some boundary conditions were calculated with the MELCOR 1.8.6 code. Secondly, radioactivity and doses of the most significant radioisotopes in the containment gas phase and water pools were calculated using ORIGEN2 code. Finally, the nitric acid formation and the amount of HCl released were calculated and pHs of water pools were calculated using a new developed ChemPool program.

