



Chemistry of fission products in containment (FISKES)

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Introduction

FISKES project investigated the chemistry of fission products inside a NPP containment after severe accident. Pool chemistry is very important part of behaviour of fission products in containment. 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

- 1) Calculate pool pH (ChemPool)
- 2) Analyse iodine behaviour in the containment with ASTEC
- 3) Investigate the chemical effects in the containment pool environment during post-LOCA conditions

Results and conclusions

1) ChemPool is an easy to use tool for adding simulation of pH chemistry to a MELCOR simulation. It has been tested for BWR and PWR cases. In BWR case the calculation is extended about 28 days from the original MELCOR calculation about one day.

2) With current ASTEC version it is not possible to model accurately a BWR core. As a result it was decided to only model the containment and to use previous MELCOR results as boundary conditions. According to the results can be concluded that there is a clear difference for iodine behaviour in the aqueous phase when the pool pH is above and below 7 excluding organic iodides, Fig. 1 and 2 (without pH control (N_NaOH) and when NaOH is added to the wetwell pool (Y_NaOH)).

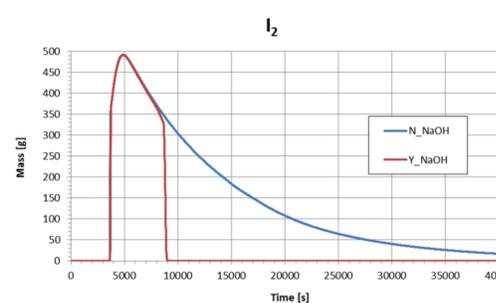


Figure 1. The mass of I₂ in liquid phase.

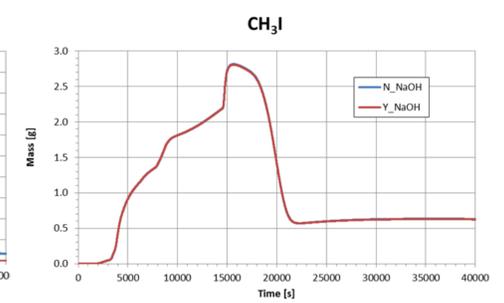
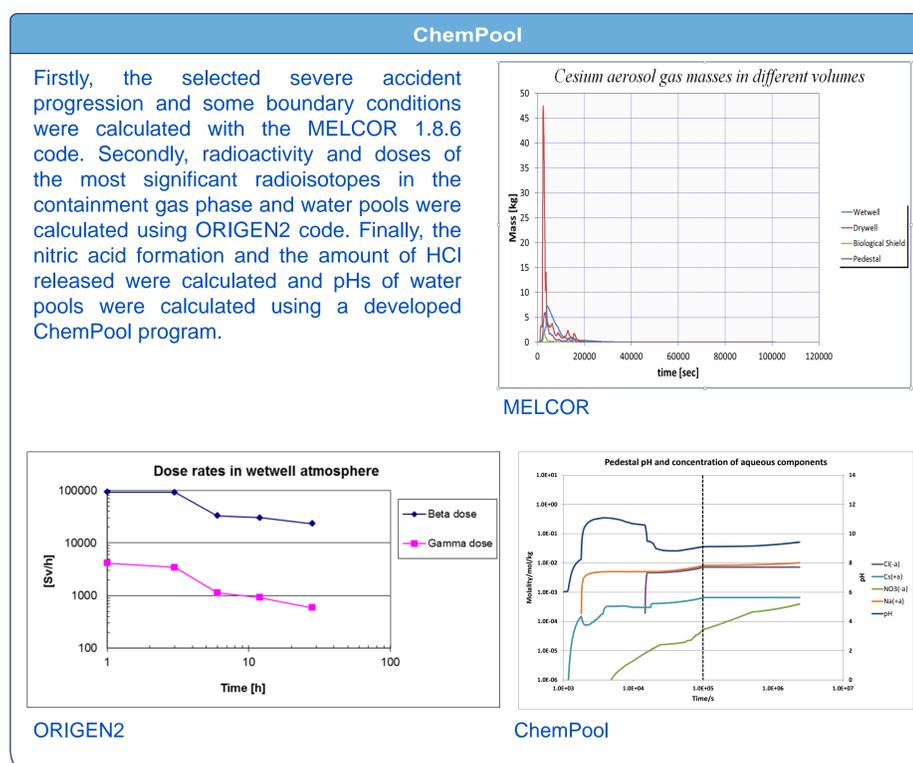


Figure 2. The mass of CH₃I in liquid phase.

3) Based on the information of literature review, laboratory experiments were done to investigate the formation of precipitations, colloids and gels in containment pool environment especially found in the Finnish LWRs. Simple approach was selected for the tests and test setup is presented in Figure 3. Results confirmed that without drastic pH shift during the emergency cooling, visible precipitation will not form when KOH is used as pH buffer. However, if large amounts of coolant are lost due to evaporation and compounds become significantly concentrated precipitation effects could occur.



Latest work has been done to make ChemPool compatible with ASTEC. The idea is that ChemPool can be used with ASTEC in a similar way as with MELCOR. Code for reading ASTEC input files has been implemented but further work will be needed to make ChemPool fully compatible with ASTEC.



Figure 3. Test setup of the chemical effect tests.