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Containment surface interactions of gaseous elemental iodine and ruthenium tetroxide during severe nuclear accidents in LWRs

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During severe nuclear accidents in LWRs several hazardous and radiotoxic gaseous fission products will be released from damaged UO₂ fuel. Volatile iodine species (CsI, IO_x, I₂, org. iodides such as MeI) will be released and formed already in an early stage of a severe accident, while the release of volatile oxides of ruthenium (RuO₃, RuO₄) will require a rupture of the containment with a significant air ingress.

Considerable amounts of released CsI and elemental iodine will dissolve in the water pools and steam. Remaining gaseous elemental iodine can be partly immobilized by sorption on the containment surface and structural materials (paint, Al, Cu, Zn).

A fraction of the iodine will be physisorbed and thus can be rather quickly revaporised or washed off from the surfaces. Some of the iodine will be chemisorbed, like on copper and epoxy paint surfaces (Teknopox Aqua VA).

Ruthenium tetroxide has a high affinity to deposit on all the available surface materials. It is a strong oxidizing agent and thus possibly affects the volatile iodine source term.

Differences of the sorption behavior of RuO₄ on plane and iodine covered surfaces have been investigated qualitatively and quantitatively, as well as the effects on the iodine revaporisation behavior.

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