

Radioiodine Chemistry: The Unfinished Story

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ABSTRACT

Because of its importance in the source term for postulated nuclear accidents, considerable effort has been expended worldwide to understand the behaviour of radioiodine under accident conditions. This has led to significant progress in our understanding of complex and sophisticated radiolysis-driven iodine chemistry and transport behaviour under potential reactor accident conditions. Models that describe, with some confidence, the chemistry of radioiodines and, in particular, the chemistry of those radioiodine species having a propensity to become airborne under appropriate conditions, have been developed and used to establish and prioritize key processes and phenomena under conditions of interest.

The focus of research can now shift to address the more challenging roles that other chemical species and chemically reactive surfaces can play in influencing radioiodine chemistry. In the real world, we face situations in which many chemicals may be present (from paints, solvents, etc) as 'impurities' in the environment, and these additional chemicals have the potential to strongly influence radioiodine chemistry. This is the most evident through the reactions of organic compounds with water radiolysis products and consequential impact of these reactions on radioiodine species in a solution. Heterogeneous reactions of radioiodine with metallic surfaces raise the level of complexity further: metallic surfaces may release metal ions which could react catalytically with radiolysis products, and, more importantly, such surfaces could act as temporary or permanent radioiodine sinks. This becomes a dominant concern when trying to control, monitor, or prevent airborne radioiodine movement.

This paper will briefly summarize the successes that have been achieved by the international nuclear radioiodine chemistry community and then explore the challenges and opportunities that are now being explored.