In the analysis of certain external events it is appropriate to consider the possibility that active engineered safety features will fail to operate. Consequently, escape of radioactivity from the containment building can be mitigated only by natural mechanisms, such as absorption in condensate films on the containment walls and in condensing droplets in the volume of the containment building.

In the present work, a series of experiments was performed to investigate the nature of iodine removal, mainly in order to determine the dependence of iodine removal rate on steam condensation rate. In contradiction to previous work, it was found that the iodine removal rate is invariant to condensation rate. A confirmation of this behavior was obtained by running some additional experiments: steam-free tests (keeping only the walls wet) and delayed tests (wetting the walls after a significant period of time).

The results are explained by abandoning the assumption that the flowing steam carries the iodine along with it. Diffusion, rather than convection, is the mechanism by which bulk iodine is transported to the condensation surface. This result is not surprising if one considers that the molecular weight of water (18) that is only 7.1% of that of elemental iodine (253.8). This implies inefficient momentum transfer by collision from the light steam molecules to the heavy iodine molecules.

The main conclusion is that the iodine removal rate can be estimated without knowing the condensation rate exactly (as long as the walls are wetted). The removal rate is represented by the first-order kinetic coefficient that was found to be about 0.2 m/min. This can be interpreted as a half-life removal period in the range of 5-25 min for reactor containment buildings.

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