

Reactor Simulations Characterizing Xenon Isotopic Ratios in Nuclear Power Plants

The principle of discrimination between xenon from civil reactor sources and xenon released from a nuclear explosion by analysing xenon isotopic ratios is well established. Xenon isotopic ratios similar to those from explosive sources are of particular relevance for CTBT monitoring. This study investigated which parameters influence the isotopic composition of radioactive xenon in nuclear power plants in a way that they could be more easily mistaken as explosion-like. In order to achieve this we calculated different isotopic vectors of xenon produced in nuclear power plants with neutronic simulations under typical operating conditions in the plant and compared them with older models. Different production mechanisms in nuclear power reactors will be discussed including a sensitivity analysis of the isotopic vector to fuel element geometry, burnup, fuel composition, reactor type, power level and others. Finally we will present estimates about the release of xenon to the atmosphere from a power plant under different operation conditions such as shut-down, start of operation and potential accidental releases.

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