

Considerations of Xenon-133 to Iodine-131 Ratios for Discriminating Signatures of Nuclear Test Explosions Against Normal Operational Releases from Nuclear Facilities

Isotopic ratios of xenon emissions as well as of iodine emissions can be used to discriminate between releases from nuclear test explosions and normal operational releases from nuclear facilities. Radioisotopes of both elements can be detected by International Monitoring System (IMS) set up by the CTBTO. The scope of this study is to consider whether the ratio between the most frequently observed radioisotopes of these two elements, xenon-133 and iodine-131, can be applied to discriminate between a nuclear test explosion and emissions from nuclear facilities. This was done by comparing calculated and measured data. For nuclear explosions, calculations were performed using the Bateman equation and measured emissions were taken from publicly available data of the continental tests in the United States. For reactor emissions, Monte Carlo simulations of a light water reactor (LWR) burn-up and radioactive effluents records publicized by the European Commission were used. By comparing the calculations and measured emissions, a significant difference cannot be noticed. Without a more comprehensive understanding of diffusion processes from underground cavities and reactors to the atmosphere, it is concluded that the ratio of Xe-133 and I-131 cannot be routinely used to discriminate nuclear test explosions against effluents from nuclear facilities.

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