

Isotopic Ratios from Medical Isotope Production and CANDU

The nuclear and radiopharmaceutical industrial emissions of the four CTBT-relevant radioxenon isotopes are detected by the IMS along with possible treaty violations. To better understand the source terms of these background emissions, a joint project between Health Canada (HC), Australian Nuclear Science and Technology Organisation (ANSTO), Pacific Northwest National Lab (PNNL) and Chalk River Laboratory (CRL) to install real-time detection systems to monitor ^{135}Xe , ^{133}Xe , $^{131\text{m}}\text{Xe}$ and $^{133\text{m}}\text{Xe}$ at ANSTO and CRL ^{99}Mo production facility stacks as well as the CANDU (CANada Deuterium Uranium) primary coolant monitoring system at CRL. At each site, high-resolution gamma spectra were collected from a bypass stack feed or CANDU primary coolant system as it passed through a sampling cell. HC also conducted radioxenon atmospheric monitoring approximately 200 km from CRL. The isotopic signatures of the various radioxenon species can be determined from different source terms. Comparison of $^{133\text{m}}\text{Xe}$ and ^{133}Xe activity ratios showed distinct differences between the closed CANDU primary coolant system and radiopharmaceutical production releases. The multiple isotopic activity ratios were distributed in different domains (civilian/nuclear test). Most measurements were found to be civilian in nature. There were some situations where isotopic ratios from ^{99}Mo production emissions fell within the nuclear test domain.

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