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# of Analysis Methods to Identify Radioxenon Isotopes

Four isotopes are of interest for radioxenon monitoring, Xe-135, Xe-133, Xe-133m, and Xe-131m. Many of the detectors in the International Monitoring System (IMS) use β-γ coincidence detection: where NaI(Tl) is the gamma detector and the plastic cell is the source container and beta detector. To characterize the source of radioxenon, ratios between the isotopes are used, which require accurate quantification of each isotope. However, the use of low resolution plastic scintillators for beta detection causes significant challenges for quantifying the metastable isotopes, whose emissions overlap with Xe-133 emissions. This overlap makes it difficult to identify metastable isotopes when Xe-133 is present, which happens frequently. An alternative method of quantifying radioxenon is presented. In this method, the Xe-131m and Xe-133m energy spectra are evaluated through β-anti-γ detection, whereby a signal is detected via beta measurement but vetoed if a simultaneous gamma signal is detected. This exploits the nuclear emissions differences between the β- decay of Xe-133, and the internal conversion decay of the metastable isotopes; all three isotopes are still detected; but our method suppresses Xe-133 signal relative to Xe-131m and Xe-133m signals. We show new experimental and simulated data from a NaI(Tl)-plastic scintillator system.

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