

Ratio Estimation Based on Activity Concentration Profile and Decay Correction During Sampling for CTBT-Relevant Radionuclides with a Short Half-Life

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An activity evolution model which goes from the release of an assumed underground nuclear explosion, through the atmospheric transport modelling (ATM), to sample collection and measurements can be used to link various quantities, including activities released from a nuclear event, activity concentrations in a plume over an International Monitoring System (IMS) station and activities collected in samples. The concentration profile at an IMS station can be estimated by using an assumed release scenario and ATM forward simulations. Activities collected in samples are determined by spectrum analysis, then the concentrations are estimated based on an assumption on the concentration profile. Generally, concentrations are assumed constant during sampling. It might be a challenge for isotopes with short half-life, such as Xe-135 (9.14 hours), compared to the collection duration of 12 hours. In this work, the decay correction during sampling is investigated using two approaches, 1) the collection duration is divided into multiple intervals in which a constant concentration is assumed in each one respectively; 2) the activity collected in the sample is based on an analytical solution of ordinary differential equations regarding activity decay and accumulation. The impacts on isotopic ratios are demonstrated in three cases, Ba-140/La-140, and Xe-133m/Xe-133 and Xe-135/Xe-133.

E-mail

boxue.liu@ctbto.org

Promotional text

Isotopic ratios can be affected a lot by using different concentration profiles, resulting in an impact on characterization of CTBT-relevant nuclear events.

Oral preference format

in-person

Primary author: Mr LIU, Boxue (CTBTO Preparatory Commission)

Co-authors: Mr SCHOEMAKER, Robin (CTBTO Preparatory Commission); Mr SARAGIOTIS, Christos (CTBTO Preparatory Commission); Mr KUNKLE, Joshua (CTBTO Preparatory Commission); Mr KIJJIMA, Yuichi (CTBTO Preparatory Commission); Ms TIPKA, Anne (CTBTO Preparatory Commission); KUSMIERCZYK-MICHULEC, Jolanta (CTBTO Preparatory Commission); Mr KALINOWSKI, Martin B. (CTBTO Preparatory Commission)

Presenter: Mr LIU, Boxue (CTBTO Preparatory Commission)

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