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Radioxenon Measurements in Regions with multiple Sources

M. Auer, C. Schlosser, H. Sartorius
Federal Office for Radiation Protection, Freiburg, Germany

Atmospheric measurement of radioactive xenon isotopes (radioxenon) plays a key role in remote monitoring of nuclear explosions, since it has a high capability to capture radioactive debris for many explosion scenarios. It is therefore a powerful tool in providing evidence for nuclear testing and is one of the key components of the verification regime of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The interpretation of radioxenon signals is however not always straightforward, in particular since there is a variety of sources other than nuclear explosions, such as nuclear reactors or radioisotope production facilities. Therefore, the interpretation of a radioxenon signal strongly depends, among other factors, on the sampling location, since the sources which can potentially influence this location have to be taken into account.

The German Federal Office for Radiation Protection has a long history of continuous radioxenon measurement in various regions worldwide. Since 1976, radioxenon measurement sites are operated in Germany and since 1995 also in various sites worldwide. In addition four noble gas systems have been operated in parallel for a comparison experiment in Freiburg, Germany in 2000 and a radioxenon measurement system of the International Monitoring Network (IMS) of the CTBT is operated by BfS at mount Schauinsland, Germany since 2004. Most of these measurement locations are under the influence of a large number of nuclear facilities and offer the opportunity to investigate the effect of a complex source receptor situation on the measured radioxenon signal. In this contribution, data from the German national radioxenon monitoring network and from the IMS noble gas station at Schauinsland are presented. The observed concentrations are highly variable and typically range from below 1 mBq/m^3 to more than 100 mBq/m^3, but can be several orders of magnitude higher for

sites which are close to isotope production facilities. Enhanced levels of radioxenon can be measured for periods of one day or less up to several days. Due to the vicinity of a relatively large number of nuclear facilities, the reported data also provide a valuable opportunity to test the capabilities and limitations of radioxenon source identification.