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Monitoring of reported sudden emission rate changes of major radioxenon emitters in the northern and southern hemispheres in 2008 to assess their contribution to the respective radioxenon backgrounds

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Abstract

Atmospheric radioxenon monitoring is a key component of the verification of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Radiopharmaceutical production facilities (RPF) have recently been identified of emitting the major part of the environmental radioxenon measured at globally distributed monitoring sites deployed to strengthen the radionuclide part of the CTBT verification regime. Efforts to raise a global radioxenon emission inventory revealed that the global total emission from RPF's is 2-3 orders of magnitude higher than the respective emissions related to maintenance of all nuclear power plants (NPP).

Given that situation we have seen in 2008 two peculiar hemisphere-specific situations:

1) In the northern hemisphere, a joint shutdown of the global largest four radiopharmaceutical facilities revealed the contribution of the normally 'masked' NPP related emissions.

Due to an incident, the Molybdenum production at the "Institut des Radioéléments" (IRE) in Fleurus, Belgium, was shut down between Monday 25 August and 2 December 2008. IRE is the third largest global producer of medical isotopes. In the same period, but for different reasons, the other three worldwide largest producers (CRL in Canada, HFR in The Netherlands and NTP in South Africa) also had scheduled and unscheduled shutdowns.

The activity concentrations of ^{133}Xe measured at the Schauinsland Mountain station near Freiburg in Germany (situated 380 km SW of Fleurus) which have a mean of 4.8 mBq/m^3 for the period February 2004 – August 2008, went down to 0.87 mBq/m^3 for the period September – November 2008.

2) In the southern hemisphere, after a long break, the only radiopharmaceutical facility in Australia started up test production in late November 2008.

In the period before the start-up, the background of radioxenon in Australia (Melbourne and Darwin) was below measurable quantities. During six test runs of the renewed RPF at ANSTO in Lucas Heights, up to 6 mBq/m^3 of ^{133}Xe were measured in the station at Melbourne, 700 km SW from the facility.

This paper confirms the hypothesis that radiopharmaceutical production facilities are the major emitters of radioxenon first of all. Moreover it demonstrates how the temporal shut down of these facilities indicates the scale of their contribution to the European radioxenon background, which decreased 6 fold. Finally we have studied the contribution of the start-up of a renewed RFP to the buildup of a radioxenon background across Australia and the southern hemisphere.

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