

Name of research institute or organization:

**Bundesamt für Strahlenschutz, Freiburg i.Br.
Climate and Environmental Physics, University of Bern**

Title of project:

⁸⁵Kr Activity Determination in Tropospheric Air

Project leader and team

Clemens Schlosser Martina Konrad, and Sabine Schmid, *Bundesamt für Strahlenschutz, Rosastr. 9, D-79098 Freiburg, Germany*

Roland Purtschert, *Climate and Environmental Physics, Physics Institute and Oeschger Centre for Climate Change Research, University of Bern*

Project description:

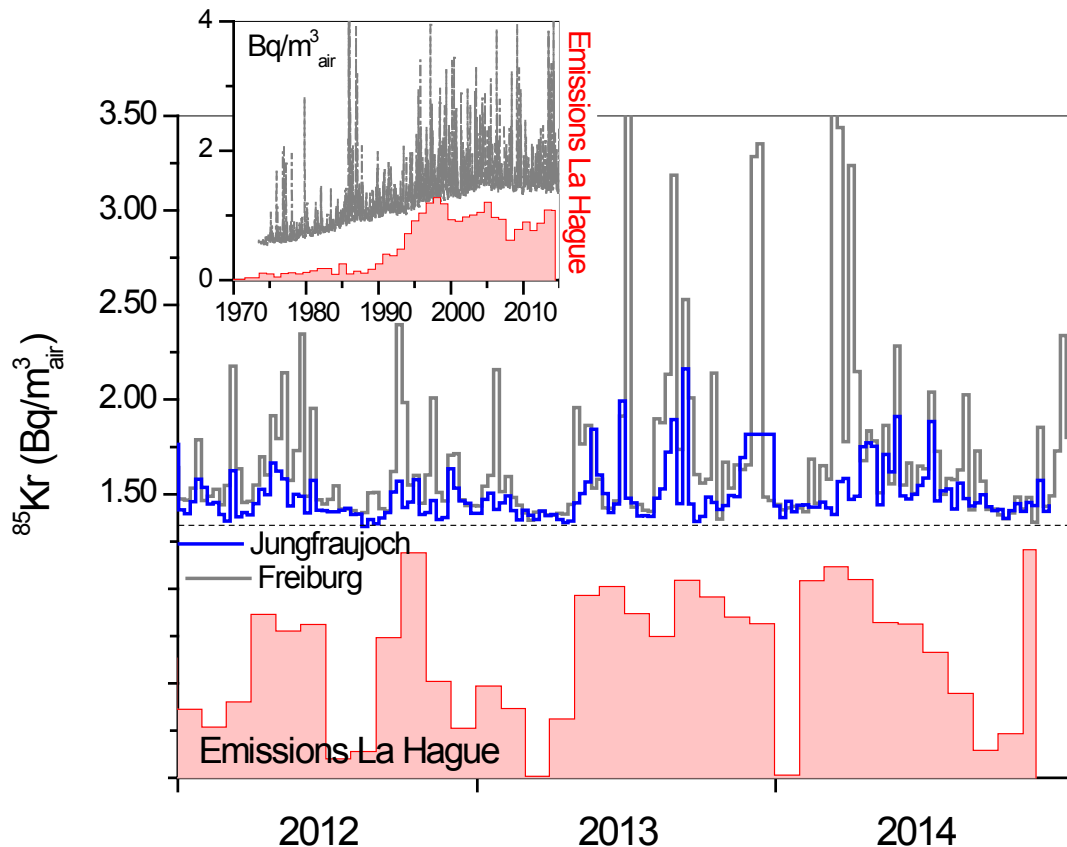


Figure 1. Measured atmospheric ⁸⁵Kr activity concentrations in weekly air samples, collected at Jungfraujoch (3500 m asl) and Freiburg i. Br. (280 m asl), during the last three years. Inset: Values for Freiburg i. Br. over the last 40 years. The red columns represent the monthly emissions from La Hague in arbitrary units (the value for December 2013 is missing; the order of magnitude is 10¹⁶ Bq Kr-85 per month). The dotted line represents a baseline activity of 1.4 Bq/m³ air.

Monitoring of tropospheric Kr-85 activity concentrations at Jungfraujoch (JFJ) continued in 2014. Krypton is separated from about 10 m³ of air continuously collected during one week and sent to the Bundesamt für Strahlenschutz (BfS) in Freiburg i.Br. for measuring the Kr-85

activity concentration. Since 2014 the noble gas laboratory at BfS in Freiburg is accredited according to DIN EN ISO/IEC 17025.

The major sources of atmospheric Kr-85 are nuclear reprocessing plants which are characterized by pulsed releases. During the last few decades the most relevant emitter has been the facility in La Hague in France. The released plumes can be detected at sampling stations located in downwind direction even at distances of a few hundred kilometres (spikes in Figure 1). Due to a half-life of 10.76 years Kr-85 accumulates in the atmosphere if the release rate exceeds the decay rate of the ^{85}Kr inventory in the atmosphere. Between 2005 and 2010 the yearly emission from La Hague showed a decreasing trend (Figure 1, inset). This evolution reversed over the last 5 years, which is reflected by a stable or even slight increase of the baseline ^{85}Kr activity over North West Europe. The continuous and relatively high emissions from La Hague in the first half-year in 2014 lead to a quasi-stationary ^{85}Kr enriched air plume over this time. The activity level returned to the baseline of $\sim 1.4 \text{ Bq/m}^3_{\text{air}}$ towards the end of the year.

The location of the JFJ sampling site is crucial because of its altitude. The data are representative for the northern tropospheric background level and are important for the assessment and quantification of environmental radioactivity and radiation exposure in Switzerland. Krypton-85 data are also used for studies about the dispersion of air masses, e.g. the inter-hemispheric exchange. The known temporal ^{85}Kr activity evolution in the atmosphere is also the basis for dating groundwater on timescales of decades.

Key words:

Krypton, ^{85}Kr , radioactivity in air, reprocessing plants

Scientific publications and public outreach 2014:

Refereed journal articles and their internet access

Nitta, W., T. Sanada, K. Isogai and C. Schlosser, Atmospheric ^{85}Kr and ^{133}Xe activity concentrations at locations across Japan following the Fukushima Dai-ichi Nuclear Power Plant accident, *Journal of Nuclear Science and Technology*, **51**, 5, 712-719, doi: 10.1080/00223131.2014.888960, 2014.
<http://dx.doi.org/10.1080/00223131.2014.888960>

Data books and reports

Umweltradioaktivität und Strahlendosen in der Schweiz, Bundesamt für Gesundheit, Abteilung Strahlenschutz, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014 (in preparation).

Umweltradioaktivität und Strahlenbelastung, Deutschland, Jahresberichte 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014 (in preparation), Reihe Umweltpolitik, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit.

Address:

Bundesamt für Strahlenschutz
Rosastrasse 9
D-79098 Freiburg

Contacts:

Clemens Schlosser
Tel.: +49 301 8333 6772
e-mail: cschlosser@bfs.de
URL: <http://www.bfs.de/bfs>