

Name of research institute or organization:

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

Title of project:

$^{85}\text{Kr}$  Activity Determination in Tropospheric Air

Project leader and team

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Project description:

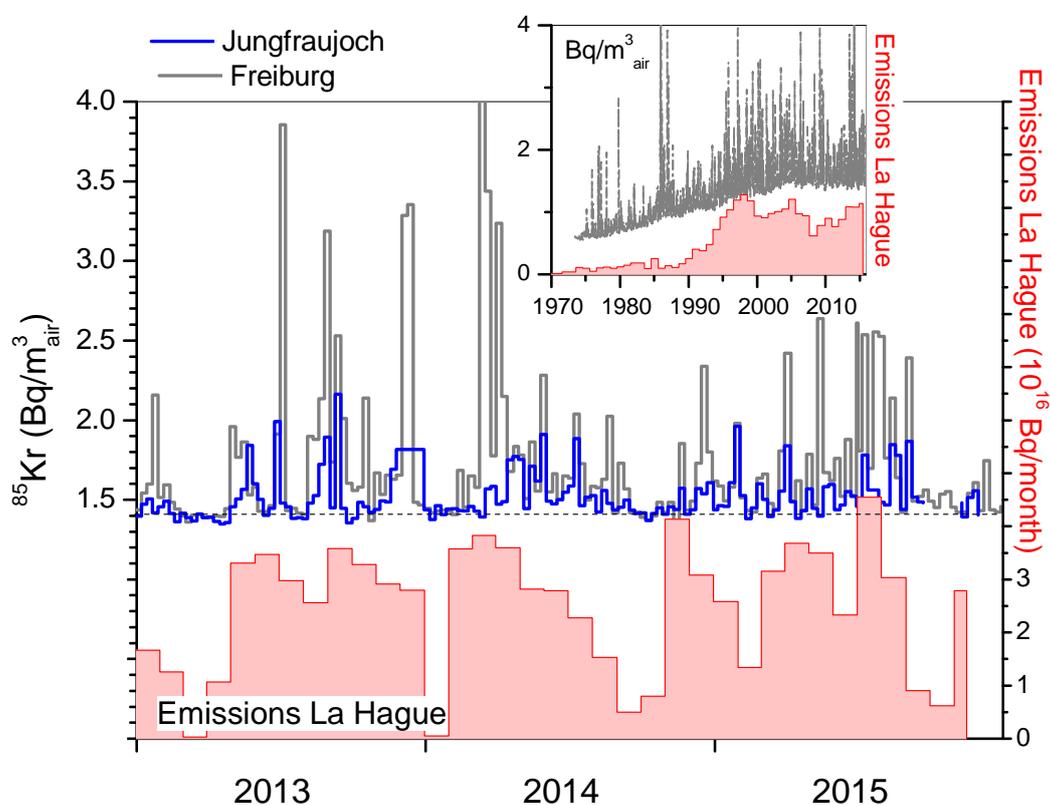


Figure 1. Measured atmospheric  $^{85}\text{Kr}$  activity concentrations in weekly air samples, collected at Jungfrauoch (3500 m asl) and Freiburg i. Br. (280 m asl), during the last three years (October values for 2015 not yet measured). Inset: Values for Freiburg i. Br. over the last 40 years. The red columns represent the monthly emissions from La Hague (the value for December 2015 is missing). The dotted line represents a baseline activity of  $1.4 \text{ Bq}/\text{m}^3_{\text{air}}$ .

Monitoring of tropospheric Kr-85 activity concentrations at Jungfrauoch (JFJ) was continued in 2015. Krypton is separated from about  $10 \text{ m}^3$  of air continuously collected during one week and sent to the Bundesamt für Strahlenschutz 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 is 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  $^{85}\text{Kr}$  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 what is reflected by a stable or even slightly increase of the baseline  $^{85}\text{Kr}$  activity over North West Europe. Amplitude and frequency of activity concentration peaks at Freiburg but also at JFJ are generally highest during periods of high reprocessing activities in La Hague (Figure 1). Although the yearly emissions in 2015 were very similar to previous years, the maximal weekly activity concentrations from the Freiburg station in 2015 were lower than in previous years. The reason for that is unclear. It may be attributed to the exceptionally hot summer with a stable anticyclone over mid Europe with less pronounced west wind situations and stronger vertical atmospheric mixing.

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 Germany and Switzerland [1, 2]. Krypton-85 data are also used for studies about the dispersion of air masses, e.g. the inter-hemispheric exchange. The known temporal  $^{85}\text{Kr}$  activity evolution in the atmosphere is also the basis for dating groundwater on timescales of decades [3].

Key words:

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

Collaborating partners/networks:

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Scientific publications and public outreach 2015:

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**Refereed journal articles and their internet access**

[3] Åkesson, M., A. Suckow, A. Visser, J. Sültenfuss, T. Laier, C. Sparrenbom, and R. Purtschert, Constraining age distributions of groundwater from public supply wells in diverse hydrogeological settings by means of environmental tracers and lumped-parameter modelling: a case study from Scania, southern Sweden, *Journal of Hydrology*, **528**, 217-229, doi: 10.1016/j.jhydrol.2015.06.022, 2015. <http://www.sciencedirect.com/science/article/pii/S0022169415004357>

**Data books and reports**

[1] Umweltradioaktivität und Strahlendosen in der Schweiz, Bundesamt für Gesundheit, Abteilung Strahlenschutz, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015 (in preparation).

[2] Umweltradioaktivität und Strahlenbelastung, Deutschland, Jahresberichte 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015 (in preparation); Reihe Umweltpolitik; Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit.

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