

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

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Project description:

Monitoring of tropospheric Kr-85 activity concentrations at Jungfrauoch (JFJ) continued in 2012. Krypton is separated from about 10 m³ 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.

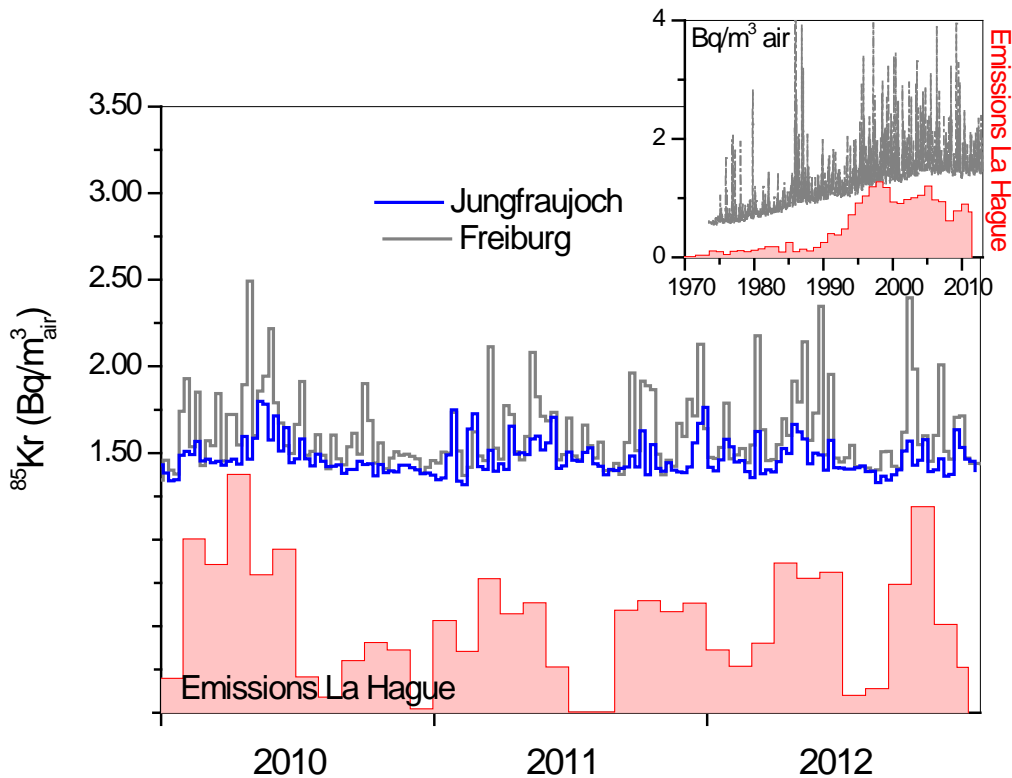


Figure 1: Measured atmospheric ⁸⁵Kr activity concentrations in weekly air samples, collected at Jungfrauoch (3500 m asl) and Freiburg i.Br. (280 m asl), during the last three years. Inset: Values for Freiburg i.Br. over the last 40 years. The red columns represent the monthly emissions from La Hague in arbitrary units (the order of magnitude is 10¹⁶ Bq Kr-85 per month).

The major sources of atmospheric Kr-85 are nuclear reprocessing plants which are characterized by pulsed releases. The resulting plumes can be detected at sampling stations located in downwind direction even at distances of a few hundred kilometres (spikes in

Figure 1). The frequency and amplitude of spikes measured at the observation stations Freiburg and JFJ correlate therefore with the monthly emissions of the closest reprocessing facility in La Hague (Figures 1+2). However, above the planetary boundary layer, as the case for the JFJ station, amplitude and frequency of such spikes are reduced and the correlation with La Hague is weaker ($R^2=0.20$) compared to stations at lower altitude (Freiburg $R^2=0.47$; Figure 2). Due to a half life of 10.76 years Kr-85 accumulates in the atmosphere. Since the start of massive reprocessing it had created a baseline which was characterized by a continuous mean increase rate of about 0.03 Bq/m^3 per year during the past four decades. It has reached a maximal value of about 1.50 mBq/m^3 at the stations located at mid northern latitudes (Figure 1, inset). Over the last 5 years almost steady state emission-decay equilibrium was established. The slopes of the averaged baseline activities in Freiburg and at JFJ are zero within statistical uncertainties. This implies that the world wide reprocessing activities do not increase any longer as reflected in the release data of La Hague (Figure 1, red areas).

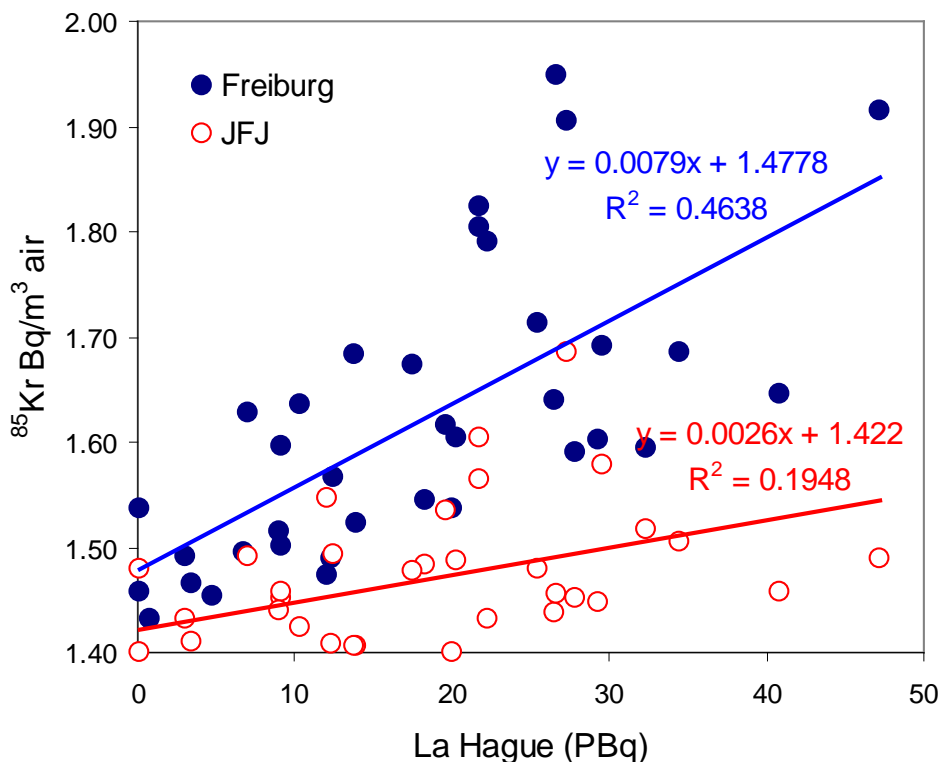


Figure 2: Relation between monthly averaged emissions at the reprocessing facility in La Hague (France) and the activity concentrations measured in Freiburg and at JFJ. A reduced (factor ~2) slope and correlation factor is observed at JFJ due to the high altitude location above the planetary boundary layer.

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.

Key words:

Krypton, ⁸⁵Kr, radioactivity in air, reprocessing plants

Collaborating partners/networks:

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Scientific publications and public outreach 2012:

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 (in preparation).

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

[3] Aktueller Bericht der Leitstellen: Umweltradioaktivität in der Bundesrepublik Deutschland Stand 2011, ISSN 1864-2810, März 2012.

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