^{129}I Measurements for Reconstruction of the ^{131}I Releases in the FSU

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In the early fifties the plutonium production facility Mayak (PA Mayak, Russia) has been the main contributor to releases of man-made radioactivity in the Former Soviet-Union (FSU). For radiological reasons the short-lived radioactive effluents - like ^{131}I ($T_{1/2}$= 8.02 d) - are now in the focus of interest [2].

The long-lived ^{129}I ($T_{1/2}$= 15.7 Myr) can be used for reconstruction of the ^{131}I emissions of the PA Mayak. Therefor the ^{129}I/^{131}I isotopic ratio at the time of emission has to be known.

This ratio has been determined by the thermal power of the producing reactors, the mean exposure time of the fuel [3] and the subsequent hold times before reprocessing [3]. Thus a ^{129}I/^{131}I isotopic ratio at time of emission closed to 70 has been obtained.

Background level

Several additional sources of ^{129}I have to be distinguished from the early PA Mayak releases to render the reconstruction of the ^{131}I releases. These are (Fig.1):

- In the late 50-ies the gasous ^{131}I emissions of the PA Mayak decreased for several orders of magnitude [1] while the ^{129}I emissions probably still increased.
- Routine releases by reprocessing of nuclear fuels for civil and military purposes in Europe. These were dominated by the emissions of the Windscale plant (UK, start in 1952), the plant closed to Marcoule (F, start in 1958) and later on also the La Hague reprocessing plant (F, start in 1967).
- The surface and on air nuclear bomb tests at the Semipalatinsk test site (Kazakhstan).

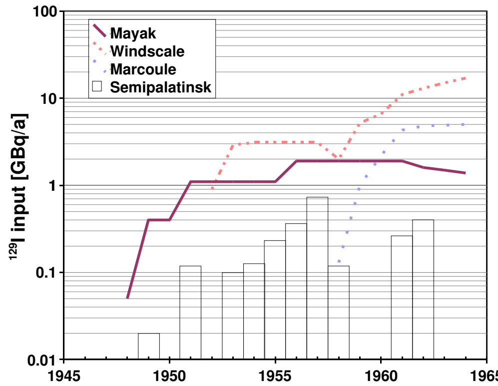

Fig. 1: Estimated annual releases of gasous ^{129}I of PA Mayak, the european reprocessing facilities and the tropospheric bomb produced ^{129}I input at the Semipalatinsk test site.

These additional ^{129}I sources make it necessary to measure the time resoluted ^{129}I deposition fluxes.

Time resolution

A usable ^{129}I inventory seems to be an ice core from the Belukha glacier in the Sibirian Altai. This ice core was recovered in July 2001 by a swiss-russian expedition group and is already dated by means of ^{3}H and ^{210}Pb [4]. The Belukha glacier is situated about 1800 km east of the PA Mayak, but only 500 km east of the Semipalatinsk nuclear test site, thus a considerable input of ^{129}I by the bomb tests at the Semipalatinsk test site are expected.

The iodine of some first samples of the ice core was extracted and the ^{129}I contents of the samples were analyzed at the Maier-Leibnitz-Laboratorium by AMS. The chemical treatment of the samples and the AMS measurement was formerly described [5].

Results

The measured ^{129}I contents in the ice samples yield the ^{129}I deposition flux in the late 60-ies to be $(4.4\pm1.5)\cdot10^{10}\ \frac{1}{m^2 a}$. Fig.2 shows the measured ^{129}I deposition fluxes at the Belukha glacier (assumed is a mean annual precipitation of 530 $\frac{mm}{a}$ [4]) compared to the expected ^{129}I deposition fluxes. The latter assumed PA Mayak as the dominant source of ^{129}I at the Belukha glacier.

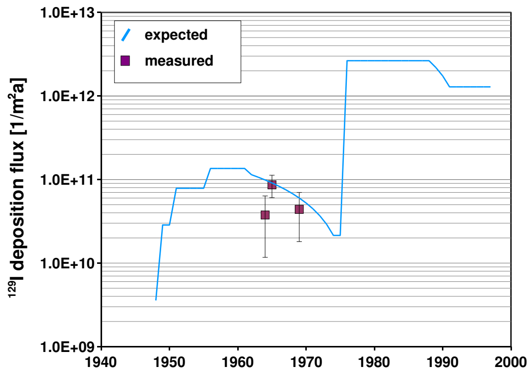

Fig. 2: Measured ^{129}I deposition fluxes at Mt. Belukha compared to expected ^{129}I deposition fluxes originating from PA Mayak.

The ice samples from the outer part of the core do not show elevated ^{129}I contents thus a ^{129}I contamination by the drilling can be excluded.

Outlook

The ice core from Mt. Belukha, corresponding to the time range between 1945 and 2000, is planed to be measured to get the ^{129}I deposition fluxes in the Altai region. For standardization purposes of the ^{129}I deposition fluencies soil samples of the Altai region have to be measured.

References

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