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$^{129}I/^{127}I$ ratios in the Scottish hydrosphere

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$^{129}I/^{127}I$ isotope ratios of Scottish seawater samples taken in 2003 from seven different locations are presented. These data are compared with the first published $^{129}I/^{127}I$ ratio of Scottish seawater determined in 1992 by Raisbeck et al. [1]. Our data give an overview of $^{129}I/^{127}I$ ratios in Scottish seawater and illustrate the dilution of ^{129}I emitted at Sellafield into the sea with stable iodine on its way around the Scottish coast. The ^{129}I concentrations in seawater are input data to model the sea to land transfer of ^{129}I and to calculate the dose based on that pathway. The iodine isotopic ratios are a better indicator of the pathways of liquid ^{129}I emitted from Sellafield than the radionuclide concentration itself and can be used to trace oceanic currents. The emphasis is on applying ^{129}I as a tracer for oceanic currents, sea to land transfer and atmospheric transfer rather than on carrying out dose calculations for the population of Scotland.

The relative importance of liquid ^{129}I emissions has increased over the last twenty years due to an increase of this kind of emission and a decrease of liquid emissions of some other radionuclides, especially ^{137}Cs and $^{241}Pu/^{241}Am$. Whereas the gaseous ^{129}I emissions, which have been kept about constant over the last five years, have been (and are still) seen as more important for the dose received by humans than the liquid emissions, the importance of the sea to land transfer has increased during the last years.

Until now to our knowledge only one $^{129}I/^{127}I$ ratio of Scottish seawater has been published for a sample taken at Lossiemouth (north coast) in 1992 [1]. Our data show the change in $^{129}I/^{127}I$ ratios and ^{129}I concentrations over the past eleven years, because one of our samples was taken close to Lossiemouth. Moreover, our data give a coarse picture of the distribution of ^{129}I around the Scottish coasts, because all coastlines are included.

^{129}I concentrations were determined with the new 5 MV accelerator mass spectrometer in East Kilbride. ICP-MS was used to analyse the ^{127}I concentrations in the seawater samples. As a quality control measure, standard material of different chemical forms of iodine were exchanged with ETH Zurich.

References

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Magnitude of ^{129}I variability in precipitation over Europe

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The atmosphere represents the most active dynamic system for the surface transport of radioactive waste in the environment. The transport and fallout modes in the atmosphere are clouds and precipitation (wet mode), and aerosols (dry mode). It is now well established that releases to the atmosphere and sea from the nuclear reprocessing facilities at the east coast of the North Atlantic are presently the dominant sources (>90%) of radioactive ^{129}I to the environment. In this study, we focus on estimating distribution and inventory of ^{129}I over Europe that represents the major global atmospheric ^{129}I reservoir. We present data that spread between latitudes 45°N and 70°N (northern Italy to northern Sweden) that show strong dependence of ^{129}I concentration on proximity to release and/or moisture source. Time series data from one of the measured station extending over five years (1998-2003) period indicate relatively constant standing concentration of ^{129}I in the atmosphere. This finding suggests establishment of dynamic equilibrium between input (by evaporation and volatilisation) and output (precipitation) functions. Our data indicate that most of iodine is transported as hydrolysed molecules and that wet fallout is the most important mode for atmospherically dispersed ^{129}I compared to dry fallout or free molecular gas. The total amount of ^{129}I provided annually by precipitation over Europe composes, however, only a tiny portion of the annual marine and/or atmospheric discharge from the nuclear facilities.