The ^{129}I anthropogenic budget: Sources and sinks

A. ALDAHAN[1], V. ALFIMOV[2] AND G. POSSNERT[2]

[1]Department of Earth Sciences, Uppsala University, SE-758 36 Uppsala, Sweden
[2]Tandem Laboratory, Uppsala University, SE-751 21 Uppsala, Sweden

There has been considerable interest in utilizing anthropogenic ^{129}I as a geochemical tracer in a wide range of natural reservoirs. Consequently, large numbers of data are now generated with respect to the distribution of the isotope in the hydrosphere and atmosphere and to a lesser extent in the lithosphere and biosphere. In this report, a summary of ^{129}I data sets from our group and others are used to elucidate the expected concentration levels and inventory in the Earth's surface environments. These data are further evaluated in terms of ^{129}I releases from the different anthropogenic sources. The results show dependence of ^{129}I distribution on distance from the sources and from the sea. The European atmosphere contains much higher concentration of the isotope than in other continents. Apart from the Irish Sea and the English Channel, the North Sea, the Nordic Seas and the Eurasian basin of the Arctic Ocean show the highest concentration of ^{129}I compared to other marine waters. Distribution of anthropogenic ^{129}I in the lithosphere is not well constrained and the available data suggest strongly localized concentration patterns. The data on ^{129}I content in the biosphere is rather scarce, but a link to distance from sources can be inferred. A simple budget calculation indicates some discrepancy between the released amounts of ^{129}I and inventory in the natural reservoirs. This situation may relate to lack of complete environmental coverage or fate of releases from the sources, and to other unknown parameters.

^{129}I/^{127}I ratios in surface waters of the English Lake District

M. ATARASHI-ANDOH[1], C. SCHNABEL[2], G. COOK[2], A. DOUGANS[2], R. ELLAM[2], S. FREEMAN[2], A.B. MACKENZIE[2], C. MADEN[2], V. OLIVE[2], H.-A. SYNAL[3] AND S. XU[2]

[1]Japan Atomic Energy Research Institute, Tokai, Ibaraki 319-1195, Japan (mariko@popsvr.tokai.jaeri.go.jp)
[2]Scottish Universities Environmental Research Centre, Scottish Enterprise Tech. Park, East Kilbride G75 0QF, United Kingdom (c.schnabel@suerc.gla.ac.uk)
[3]Inst. Particle Physics, ETH Zurich, CH-8093 Zurich, Switzerland

^{129}I concentrations in surface reservoirs have increased by anthropogenic release since the beginning of the nuclear age. At present, the main sources of ^{129}I are the two nuclear fuel reprocessing facilities (Sellafield and La Hague) in western Europe. ^{129}I/^{127}I ratios were measured in surface sea, lake and river water taken in 2004 in the area near the Sellafield nuclear fuel reprocessing plant in northern England, including the Lake District and southern Scotland. The ^{129}I/^{127}I ratio is a better tracer than ^{129}I concentration to determine the pathways of iodine emissions from the reprocessing plants and this is the first observation of the ^{129}I/^{127}I ratio in lake water in the Lake District. About 112 kg and 4 kg of ^{129}I were discharged from Sellafield into the Irish Sea and atmosphere, respectively, in 2002. Iodine is transferred from sea to land. The lakes in the Lake District receive ^{127}I from the sea and ^{129}I from both the sea and gaseous emission from Sellafield. Thus, ^{129}I/^{127}I in the water of these lakes depends on the distance from the sea and Sellafield, the geological character of the catchment area and the meteorological conditions.

The ^{127}I concentration was measured by ICP-MS. The ^{129}I concentration was measured using AMS at SUERC and/or ETH. The ^{129}I/^{127}I in samples was derived from ^{127}I and ^{129}I concentrations.

The ^{129}I/^{127}I ratio in sea water collected from the sea shore in Parton, 17km north of Sellafield, was 8.1×10^{-6}. This ratio is one order of magnitude higher than that in sea water collected from Maryport, 16 km north-east of Parton, in 1992 by Raisbeck *et al*. (1995). The ^{129}I/^{127}I ratios in lake water in the Lake District were lower but in the same order of magnitude as the ratio in sea water from Parton.

Reference

Raisbeck G.M., Yiou F., Zhou Z.Q., Kilius L.R., (1995), *Journal of Marine Systems* **6**, 561-570