European Commission

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Radioactive iodine in Arctic sea ice may have European origin

Ninety-eight per cent of radioactive iodine in Arctic sea ice may come from Europe, new research suggests. The study concludes that atmospheric transport of Iodine-129 from European nuclear fuel reprocessing plants is the most likely source.

Iodine-129 (^{129}I) is a long-lived (half-life of 15.7 million years) radioactive form of iodine that occurs naturally in very small amounts. It is highly soluble and mobile in the environment. The main present day sources of ^{129}I are nuclear fuel reprocessing plants.

Two European plants are together thought to have discharged around 20 kilograms of ^{129}I a year into sea between 1965 and the early 1990s. One is in the UK and discharges into the Irish Sea and the other is in France and discharges into the English Channel. Both are managed according to the EU Radioactive Waste and Spent Fuel Management Directive[1]. More recently, releases have increased to around 300 kg per year, mainly from the French plant. Once in the seas, coastal currents can transport ^{129}I through the North Sea and along the Norwegian coast to the Arctic Ocean.

This study examined levels of ^{129}I and ^{127}I, the only non-radioactive form of iodine (found in high concentrations throughout the world's oceans), in 20 ice samples taken from the top 10 cm of surface sea ice in the Eurasian, Amundsen, Canadian and Makarov basins of the Arctic Ocean in 2007.

The results were compared with measurements for the same substances found in Arctic Ocean seawater, as reported by earlier scientific studies. This comparison showed that the ratio between ^{129}I of ^{127}I in sea ice was much higher than the ratio in seawater. This suggests that the ^{129}I content of sea ice cannot come directly from seawater when it freezes.

The reasons for the higher levels of ^{129}I in sea ice were not immediately clear. However, the scientists identified two possible sources. The first was nearby ocean water, which may release ^{129}I into the air and deposit it onto the ice. The second was long-range atmospheric transport of ^{129}I from European nuclear reprocessing plants.

The researchers were able to determine that the first option only accounted for around 1.6% of the total ^{129}I in sea ice. This suggested that majority (98.4%) of ^{129}I was from nuclear reprocessing plants.

To see if this was indeed possible, the researchers analysed the possible movement of ^{129}I using atmospheric transportation and pollutant dispersion computer models together with meteorological data spanning the relevant sampling period. Using this, they found there were at least five 'air mass pathways' that could carry airborne ^{129}I, originating in the vicinities of the UK and French plants, to the examined area in the Arctic Ocean.

The researchers estimated that, in total, roughly 1.393 nanograms of ^{129}I are deposited per square metre per year on Arctic sea ice (i.e. 1.393 milligrams per square kilometre per year).

These figures represent a fraction of ^{129}I releases to the seas by reprocessing plants. However, the study says that it may pose a growing radiological environmental risk due to its long half-life and continued release from ongoing nuclear energy activities. Its constant accumulation in the environment remains poorly understood.

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1.http://ec.europa.eu/energy/en/topics/nuclear-energy/radioactive-waste-and-spent-fuel