

$^{135}\text{Cs}/^{137}\text{Cs}$ signals from Sellafield reprocessing plant: implications for radiocesium source terms and ^{135}Cs inventory in Northern European Seas

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Isotope ratios of $^{135}\text{Cs}/^{137}\text{Cs}$ have recently become a powerful forensic tool for studying major dynamic mechanisms in the environment. The ratios present in natural samples (e.g., soil, sediments, seawater) record a mixed signal from local sources (e.g., Sellafield and La Hague reprocessing plants), regional sources (e.g., Chernobyl) and diffuse sources such as global fallout.

To investigate the attribution from different source terms of radiocesium in Northern European Seas, here we present the first time-series of $^{135}\text{Cs}/^{137}\text{Cs}$ isotope ratios from a sediment core collected in the direct vicinity of Sellafield, as well as sediment cores collected from remote locations in the North Sea, Greenland Sea and Lake Geneva (Switzerland-France boundary). By coupling the legacy discharge profile of ^{137}Cs from Sellafield with past ^{137}Cs monitoring data observed in the adjacent coastal region, we provide a representative $^{135}\text{Cs}/^{137}\text{Cs}$ ratio during the peak discharge of Sellafield and apply it for source term attribution.

The preliminary results suggest that traces of radiocesium observed in the sediments from the different studied locations of the North Sea are mainly derived from Sellafield. The sediments from Lake Geneva display distinct $^{135}\text{Cs}/^{137}\text{Cs}$ ratios. The Greenland Sea sediments show generally higher $^{135}\text{Cs}/^{137}\text{Cs}$ ratios implying significant contribution from global fallout, though with larger uncertainties due to its ultra-low radiocesium abundance. In this study, we provide a preliminary ^{135}Cs inventory in Northern European Seas and demonstrate the utility of $^{135}\text{Cs}/^{137}\text{Cs}$ isotope ratio to disentangle different contamination source terms in Northern European Seas and its potential for future nuclear forensic and environmental tracer studies.