RADIONUCLIDES

IN RECENT DECADES, RADIOACTIVE CONTAMINATION OF THE ARCTIC OCEAN FROM DUMPED MATERIALS AND SUNKEN SUBMARINES HAS RAISED MAJOR CONCERNS. CLIMATE CHANGE MAY INFLUENCE THE SOURCES AND TRANSFER OF THIS RADIOACTIVITY. NUCLEAR TESTS ON NOVAYA ZEMLYA (1957–1963) DEPOSITED LONG-LIVED RADIONUCLIDES ON GLACIERS - THE MELTING OF WHICH COULD RELEASE THESE SUBSTANCES INTO THE SEA, ENDANGERING HUMAN AND ENVIRONMENTAL HEALTH.

RESEARCH

Under PolarRES, 3D Lagrangian radionuclide particle tracking model was used to simulate radionuclide transport in the Arctic Ocean based on high resolution simulations of the ocean with NEMO. A novel probabilistic approach for transforming particles' states, including radioactive decay, adsorption-desorption in bed and suspended sediments, erosion, and deposition was developed. We considered 4 scenarios based on historical and projection storylines. In these scenarios, potential contamination of water and sediments due to releases of Caesium-137 (137Cs) in 4 locations of sunken submarines K-159 and "Komsomolets", dumped K-27, and Novaya Zemlya coast are considered.

RESULTS

- The transport pathways of 137Cs in the Arctic Ocean was highly influenced by the depth of the radioactive outflow; Other factors influencing the pathway included the source locations and changes in ocean circulation.
- The portion of 137Cs ending up in the bottom sediments is less than 1% for the submarine in deep water while it was more than 85% for the shallow water submarine fjord of Abrosimov in the Kara Sea.
- Under future climate projections, the transport pathways change little but amount of radioactivity ending up in the bottom sediment change by more than 50%.

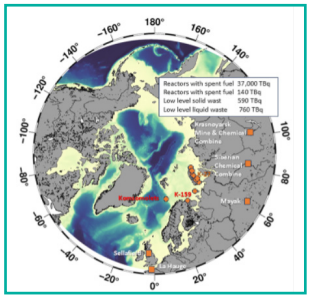

Figure: Locations of sunk submarines and dumped wastes (crosses), and reprocessing plants (squares

POLICY ACTIONS NEEDED

Currently, no significant radioactive leaks from locations of dumped materials and sunk submarines have been detected in the Arctic Ocean. However, such sources may emerge in the future, particularly as a result of melting coastal glaciers on Novaya Zemlya. Therefore, **monitoring of these locations, including bottom sediments, is necessary in the next decades**.

IMPORTANCE

Melting glaciers due to global warming could release long-lived radionuclides into the sea, posing risks to human health and the environment. The greatest threat to fisheries arises from shallow releases of radionuclides in the Barents Sea, such as the scenario involving the K-159 sunken submarine.

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Funded by the European Union

The PolarRES project has received funding from the European Union's Horizon 2020 research and innovation programme call H2020-LC-CLA-2018-2019-2020 under grant agreement number 101003590