Radiation Fallout Levels in Coastal Marine Environment Insights from the IAEA-RCA-7028 Project

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The Asia-Pacific region's vast marine coastlines are essential to the livelihoods and economies of its nations, heavily relying on ocean resources like seawater, sediments, and marine life. While natural radioactivity is always present, human-made radionuclides from nuclear testing or accidents can pose significant risks. Continuous monitoring of these radionuclides is crucial for tracking their movement and understanding the impact of human activities on marine ecosystems. Supported by IAEA's technical cooperation, regional efforts have focused on harmonizing protocols, assessing climate change impacts, sharing knowledge, and building local capacity for radiological monitoring. IAEA RCA-TC projects RAS7021 and RAS7028 have provided benchmark data on radionuclide fallout levels, contributing to the Asia-Pacific Marine Radioactivity Database (ASPAMARD), which feeds into the global marine database (MARIS).

India has actively participated in these IAEA projects to assess and benchmark the radioactivity levels along the marine coastlines, required to evaluate the possible impact of the Fukushima radioactive releases in the Asia-Pacific region. Fallout levels of ^{137}Cs in seawater were previously documented in the RAS7021 project and submitted to ASPAMARD. In the present study, conducted under the IAEA RAS7028 project, the focus shifted understand the temporal variation of long-lived fallout radionuclides like ^{137}Cs and ^{90}Sr in seawater and sediments over the period from 2022 to 2024.

Seawater and sediment samples (around 200-300 litres of seawater and 1 kg of sediment) were collected approximately 500 meters off the coast, at a depth of 1 meter. These samples were analyzed using standard protocols. The activity concentration of ^{137}Cs in seawater ranged from 0.6 to 1.1 Bq/m³, with an average of 0.8±0.2 Bq/m³, consistent with earlier studies conducted in 2012. The ^{90}Sr activity concentration, which requires tedious radioanalytical protocol and had been sparsely reported before, varied from 0.7 to 1.3 Bq/m³, with a mean value of 0.9±0.2 Bq/m³ which is in the same range as global fallout levels. In sediments, the activity concentrations for ^{137}Cs and ^{90}Sr ranged from 0.4 to 2.2 Bq/kg and 1.1 to 1.2 Bq/kg (dry weight), respectively. Notably, the concentration of ^{137}Cs in sediment was slightly higher than that of ^{90}Sr, possibly due to the stronger tendency of cesium to adhere to clay minerals commonly found in coastal sediment. The average ^{137}Cs/^{90}Sr ratio in seawater was 0.9±0.1, and in sediment, it was 1.3±0.7, both aligning closely with global fallout patterns, indicating the predominantly fallout nature of the radionuclides.

These projects and the study conducted under their aegis provide vital data for the understanding of fallout radionuclide behavior in the coastal marine environment and contributes to the global database on marine radioactivity, reinforcing the importance of continued monitoring to safeguard marine ecosystems and public health.