Preface

D-VORBEMERK-MWASS

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Procedures Manual for monitoring of radioactive substances in the environment and of external radiation
(Messanleitungen für die „Überwachung radioaktiver Stoffe in der Umwelt und externer Strahlung")

Preface

The determination of activity concentrations of radioactive substances in seawater serves the following purposes:

a) recording of radioactive contamination from unexpected releases;
b) large-scale and long-term monitoring of the activity level to estimate trends from its changes;
c) studies on the whereabouts of radioactive contaminations at sea;
d) studies on distribution mechanisms and drifting velocities to take action on time to warnings or possible protective measures in case of increased emissions;
e) measurements in deep-sea areas where packaged nuclear waste was dumped.

Monitoring of radioactive substances in seawater is characterised by the specificity of the marine milieu in contrast to fresh water. The salinity of seawater, for example 35 grams of salt per litre of seawater in the German Bight, leads to significantly higher activity concentrations of naturally occurring radionuclides compared to fresh water. Potassium-40 by itself provides an activity concentration of 12000 $Bq \cdot m^{-3}$; rubidium-87 as well as uranium and thorium isotopes together with their decay products also contribute substantially to the natural activity level of seawater. In comparison, the activity concentrations of artificial radionuclides are orders of magnitude below that. Therefore, screening methods for gross-alpha or gross-beta in vaporised seawater samples have no significance. The activity of natural radionuclides covers the amount of the artificial ones completely. So, enrichment processes like co-precipitation or ion exchange are necessary to determine the nuclide-specific activity concentrations of artificial radionuclides.

Artificial radionuclides in the North Sea originate predominantly from discharges of the European reprocessing plants in Sellafield (Great Britain) and La Hague (France). They either are carried by seawater or are absorbed in sediments. The direct discharges have markedly reduced in the last decades. Therefore, the amount of resuspended radionuclides from sediments are dominant nowadays. A part of these radionuclides is conveyed into German coastal areas by sea currents and leads there to higher activity concentrations compared to estuaries and river courses, except for tritium.

Contributions from other sources of contamination, e. g. atmospheric fallout from nuclear weapons tests in the 1950s and 1960s as well as nuclear or rather nuclear medicine facilities, are almost negligible relating to radioactive contamination of the North Sea.

However, the activity concentrations of artificial radionuclides in the Baltic Sea are predominantly defined by atmospheric fallout as a result of the Chernobyl reactor accident in 1986.

Within the environmental monitoring, radiocaesium, tritium, strontium-90, technetium-99, americium-241, plutonium and curium isotopes are determined in seawater. Among these radionuclides, caesium-137 holds a special position because of being found generally in higher activity concentrations in seawater, being conveyed over long distances by sea currents and contributing considerably to the contamination of the marine food chain. Therefore, caesium-137 is used as a reference nuclide in environmental monitoring.

Additionally, the surface seawater of the German Bight and western Baltic Sea is monitored by a network of continuously registering gamma probes to be able to recognize unusual increases of activity concentrations of radioactive substances and react on them quickly.