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NRPA Bulletin

Technetium-99 Contamination in the North Sea and in Norwegian Coastal Areas 1996 and 1997

In 1994, the Enhanced Actinide Reprocessing Plant (EARP) began operation, treating the back-log and continuous throughput of liquid wastes from MAGNOX reprocessing at Sellafield. This led to a significant increase in the levels of ^{99}Tc discharged from Sellafield compared to the early 1990s (Figure 1).

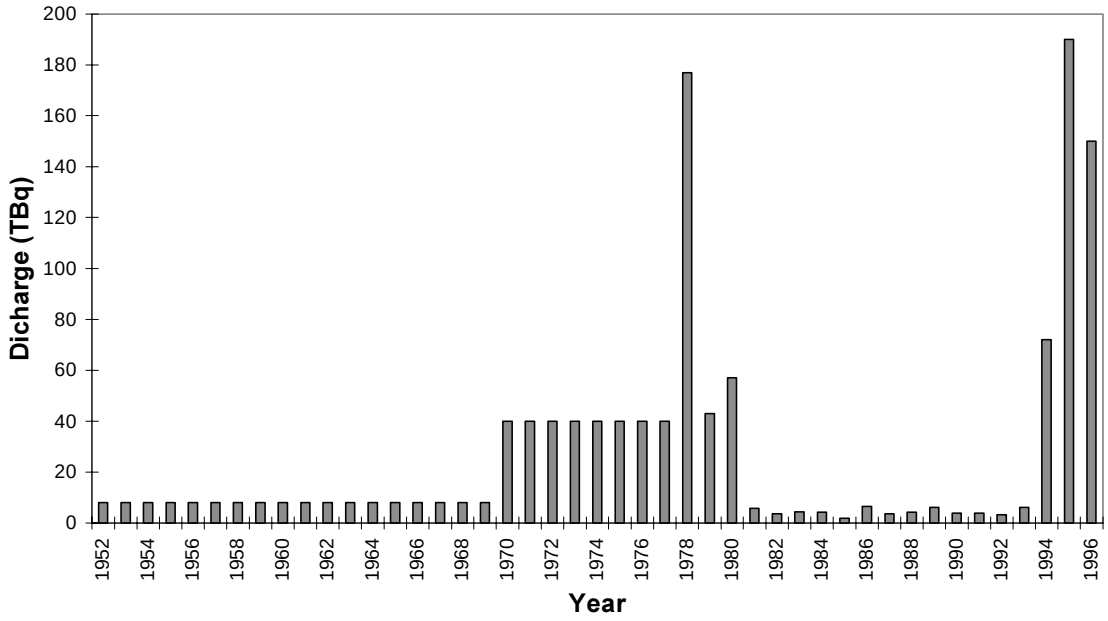

Figure 1 : *Discharge chronology of ^{99}Tc from BNFL Sellafield.*

Previous studies had shown that conservative radionuclides, such as technetium-99, could be carried by the prevailing currents in the north east Atlantic and North Sea, reaching Norwegian coastal waters just a few years after discharge. Concern arose owing to the fact that uptake to certain marine species can be high and little is known about the biological behaviour of ^{99}Tc for certain species at remote locations from the source.

Two comprehensive seawater sampling surveys were undertaken in 1996 and 1997 allowing an assessment of the spatial distribution of ^{99}Tc in the North Sea and Norwegian coastal areas to be made. Seafood and other biota samples were also collected from selected sites on the Norwegian coast between 1996 and 1998.
Preliminary results show that levels of ^{99}Tc in seawater from the North Sea and Norwegian coastal waters varied between 0.9-8.5 Bq m^{-3} in November 1996 (Figure 2). The levels in November 1997 were in the range of 1.7-3.4 Bq m^{-3}.

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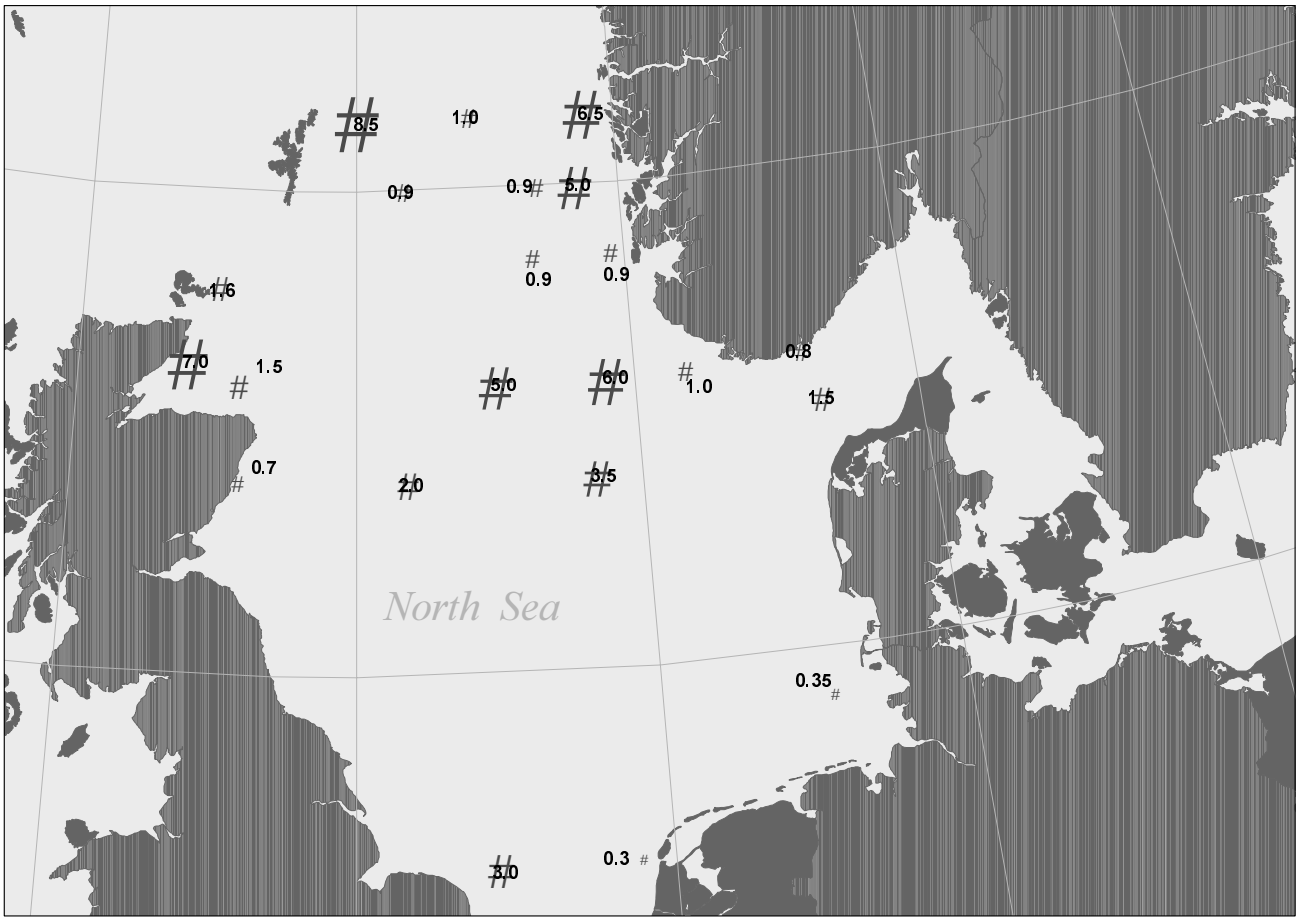

Figure 2 : *Levels of ^{99}Tc in seawater for the North Sea and Norwegian coastal waters in November 1996.*

A clear increase was observed in seaweed samples in Outer Oslo Fjord from 36 Bq kg^{-1} (dry weight - d.w.) in 1996 to 170 Bq kg^{-1} (d.w.) in 1997. Highest levels of ^{99}Tc were observed in seaweed and lobsters (maximum levels of 271 Bq kg^{-1} (d.w.) and 173 Bq kg^{-1} (d.w.) respectively) with lower levels in shrimp and mussels. The ^{99}Tc plume from Sellafield had clearly caused increased contamination levels in biota samples in Norwegian coastal waters including locations as far North as Troms. Although, committed effective dose factors for ^{99}Tc may be low compared to other radionuclides such as ^{137}Cs, the many uncertainties that remain make it important not to trivialise the situation by assuming that doses will be insignificantly low. Uncertainties still exist relating to the uptake of ^{99}Tc and concentration factors at equilibrium, the geochemical behaviour of ^{99}Tc in Norwegian coastal waters (including low-oxygen environments) and the pathways leading to doses to man. Further monitoring and assessment is required before a full dose assessment can be implemented.

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