

Preliminary results of Intercalibration of radionuclides measurements on a large volume seawater sample

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Abstract

During the period of 1973-1974, an intercalibration of radionuclide measurements was carried out on a sea water sample contaminated with radionuclides at fallout levels. A preliminary survey of the reported results is presented with the probable concentrations for Strontium-⁹⁰, Cesium-137 and Plutonium-239, 240 of this sea water sample, which were estimated by statistical treatment of the reported results.

Résumé

Durant 1973-1974, une intercomparaison de mesures de radionuclides a été effectuée sur un échantillon d'eau de mer contaminée naturellement par les retombées radioactives. Une étude préliminaire des résultats obtenus est présentée avec les concentrations probables de Strontium-90, Cesium-137 et Plutonium-239, 240 après traitement statistique des données.

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In order to offer the means of analytical quality control to the laboratories engaged in radionuclide measurements on marine environmental samples and, at the same time, to examine the present-day comparability of the current results produced by these laboratories, the Monaco Laboratory began organizing, in 1970, intercalibration exercises on marine samples of various matrices, such as sea water, seaweed, sediments etc. In 1973-1974 a third sea water sample, SW-A-1, collected from the surface layer of the Atlantic Ocean was distributed to 46 laboratories from 22 countries, after the homogeneity of the sample was tested. The sea water sample distributed was contained in 60 litre drums and was expected to have been contaminated with fallout radionuclides, of which those having relatively long-half-lives such as strontium-90, cesium-137 and plutonium-239, 240 etc., are conventionally measurable.

To date 20 laboratories reported the results of their analyses. The overall averages (tentative) of the reported results for strontium-90, cesium-137 and plutonium-239, 240, are as follows :

$$\begin{aligned} 0.22 \pm 0.07 \text{ pCi } ^{90}\text{Sr}/\text{kg} \\ 0.5 \pm 0.2 \text{ pCi } ^{137}\text{Cs}/\text{kg} \\ 1.1 \pm 0.1 \text{ fCi } ^{239,240}\text{Pu}/\text{kg} \end{aligned}$$

In order to obtain overall averages, all available results were arithmetically averaged, regardless of their wide variations. Therefore, these averages have little significance.

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In order to obtain more probable concentrations of these radionuclides in the sample, Chauvenet's Criterion [OVERMANN & CLARK, 1960] and Dixon's criterion [NATRELLA, 1963] were applied in rejecting some widely deviating data. The probable concentrations (tentative) thus estimated are :

$$\begin{aligned} &0.10 \pm 0.01 \text{ pCi } ^{90}\text{Sr/kg} \\ &0.15 \pm 0.02 \text{ pCi } ^{137}\text{Cs/kg} \\ &1.1 \pm 0.1 \text{ fCi } ^{239,240}\text{Pu/kg} \end{aligned}$$

References

- NATRELLA (M.G.), 1963. — *The treatment of outliers*, NBS Handbook 91, Experimental Statistics, **17**, Washington.
- OVERMANN (R.T.) & CLARK (H.M.), 1960. — *Radioisotope Techniques*. McGraw Hill Inc., New York-Toronto-London.