

"A STUDY ON THE CONCENTRATION OF MIXED FISSION PRODUCTS AND ^{137}Cs IN THE
GREEK MARINE ENVIRONMENT"

Susan DANALI-COTSAKI* and Helen FLOROU**

*Greek Atomic Energy Commission/NRC DEMOCRITOS, Agia Paraskevi, Athens Greece

**Institut of Oceanografic and Ficheries Research, Hellinikon, Athens Greece

Abstract

Based on data from the years 1975-1983, it is concluded that there is a clear difference between levels of radioactivity in samples collected from different areas of Greece. This difference is more notable during years where the level of the world-wide fall-out is higher. Furthermore, determination of mixed fission products concentrations in sea water seems to be a sensitive method for examining differences in the radioactivity level.

Résumé

Les résultats de cette étude, qui couvrent les années 1975-1983, conduisent à la conclusion qu'il existe une différence au niveau de la radioactivité des échantillons selon le site d'échantillonnage. Cette différence est d'autant plus marquée durant l'année où les retombées sont plus importantes. De plus, la détermination de la concentration des produits de fission, par comptage de la radioactivité beta totale, est une méthode plus sensible pour constater la moindre différence au niveau de la radioactivité.

To determine appropriate places for collecting surface sea water samples, we have taken into account the general circulation of surface sea water currents, as well as other local factors. In this respect we have chosen the islands of Rodos and Lemnos and the harbor of Kavala as permanent sampling points. We have also chosen a gulf in Lavrio as a reference sampling point. The frequency of sampling was once per month.

Sea water samples are examined for mixed fission products (MFP) concentrations while fish and sea plants were analyzed for ^{137}Cs . The applied methodology for MFP in sea water is based on the coprecipitation and absorption of these radionuclides on yttrium hydroxide in a basic medium. For determination of ^{137}Cs in fish and sea plants the samples were dissolved by wet ashing. During ashing Cs carrier is added. Finally Cs is purified by absorption on a cation exchange resin.

For counting the samples, a low BKG (less than 1 cpm) beta anticoincidence system is used, and low level counting methodology is applied. The efficiency of the system is about 40%. The counting time was 100 min and the radioactivity (A_s) of the samples was calculated based on the statistical

mean value of counting rate (\bar{R}), corrected for chemical yield, decay factor and counting efficiency. The accuracy of the calculations is about 3%.

Results and Discussions

The results are expressed in quarterly and mean yearly values (MYV) of radioactivity. From the quarterly values, those corresponded to the 2nd quarter of each year present a slight increase, due probably to seasonal variation in radioactivity. This increase is more noticeable for 1976 because of the high level of the world wide fall out which occurred during this year. The MFP concentrations in sea water samples present strong fluctuations for all the areas examined, except for Lavrio. This happens, most likely, because the sampling station in Lavrio is a small gulf physically protected from large waves which carry additional radioactive material from the open sea. The MFP concentrations in samples collected from Kavala in 1976 are the highest. This is due not only to local fall-out but probably to the fact that sea water currents from the Black sea enter the Aegean sea and then, following the north Aegean coast flow into the gulf of Kavala carrying additional radioactive material. This high concentrations of MFP in sea water result in correspondingly high concentrations of ^{137}Cs in fish and sea plants. The MYV of ^{137}Cs in fish from different areas show a similar change from year to year for all the sampling areas. Generally it is concluded that the more sensitive as well as simple method for checking radioactive contamination of the marine environment from fall-out, is the determination of MFP concentrations in sea water samples.

Bibliography

1. HASL-300 EML Procedures Manual. US Dept. of Energy (Ed. Dr. J. Harley) NY 1978..
2. S. Danali "Measurements in Nuclear Physics." GAEC, Athens 1963 (2nd Ed.)
3. "Reference Methods for Marine Radioactivity Studies" IAEA, Vienna 1970
4. "A Handbook of Radioactivity Measurements Procedures" NCRP Report No 58 Washington, 1978
5. S. Danali-Cotsaki and H. Florou-Gazi: "Radioecological Studies in Marine Environment" GAEC, DEMO 82/14, Athens-Greece, 1982.

Discussion

S. FOWLER: Why do you call Lavrio a reference station? Since all you are measuring is fallout, what is it a "reference" station for?

S. DANALI-COTSAKI: Because, according to the National Hydrological Service of Greece, Lavrio is relatively free from surface sea water currents coming from other areas into the Aegean Sea. Therefore at Lavrio, the only source of radioactive contamination is fallout from nuclear weapon tests.