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ASSESSMENTS OF DOSES TO THE BRAZILIAN POPULATION FROM RADIOACTIVE MARINE FOOD

I.I.L. CUNHA
Instituto de Pesquisas Energéticas e Nucleares
(IPEN-CNEN/SP)

O. RODRIGUES, Jr., R.C.L. FIGUEIRA
Coordenadoria para Projetos Especiais
(COPESP-SP)

São Paulo, Brazil

Many artificial radionuclides can contribute to the dose from external radiation. Among the fallout radionuclides, ^{137}Cs is the most important contributor to the external radiation dose.

The purpose of the present work was to obtain results of ^{137}Cs measurements of marine samples and to assess the doses to the Brazilian population from ^{137}Cs radioactivity in marine food.

As part of our monitoring programme, marine samples (sea water and fish) from eight stations on the Brazilian coast, from Rio Grande do Sul to Pará, have been collected. About 100 L of sea water and 4 kg of fish from species most commonly consumed by the local population have been analysed monthly, as described in Ref. [1].

The levels of ^{137}Cs in seawater samples ranged from 0.5 to 2.2 Bq/m^3, and those in fish varied from 0.01 to 0.39 Bq/kg (see Table I). The error of the analysis was 50% and 40% for sea water and fish, respectively.

The data given in Table I have been used to calculate the dose received by the population from the consumption of fish. The doses have been calculated using the formula (see Ref. [2])

$$D_{Cs}\ (\text{fish}) = Cp\ DCF\ I_f\ g_f$$

TABLE I. LEVELS OF ^{137}Cs IN SEAWATER AND FISH SAMPLES

Sampling site			Levels of ^{137}Cs in fish (Bq/kg)		Levels of ^{137}Cs in sea water (Bq/m^3)	
States	Latitude	Longitude	1991	1993	1992	1993
Rio Grande do Sul	32°11′ S	52°02′ W	0.11–0.19	0.014–0.028	0.7–1.4	0.6–1.1
Paraná	25°37′ S	48°16′ W	0.10–0.18	0.035–0.048	0.9–1.7	0.9–1.6
São Paulo	23°50′ S	45°25′ W	0.10–0.30	—	0.9–1.5	—
Rio de Janeiro	22°57′ S	43°55′ W	0.15	0.022–0.053	0.7–1.3	1.1–1.4
Bahia	12°57′ S	38°32′ W	0.12	—	0.7–1.9	1.3–1.9
Pernambuco	08°02′ S	34°52′ W	0.22–0.39	0.063–0.22	0.7–2.0	1.2–1.7
Ceará	03°42′ S	38°29′ W	0.10	—	1.1–2.2	1.2–1.6
Pará	00°26′ S	47°49′ W	0.01–0.21	0.021–0.076	0.5–1.5	0.8–1.4

where D_{Cs} is the a
consumption of fish
(Bq/kg), DCF is the
(Sv/Bq), I_f is the cor
arising from a cont
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TABLE II. ESTIM
(1991–1993)

States
Rio Grande do Sul
Paraná
São Paulo
Rio de Janeiro
Bahia
Pernambuco
Ceará
Pará

where D_{Cs} is the annual committed effective dose equivalent from ^{137}Cs due to consumption of fish (Sv/a), Cp is the concentration of ^{137}Cs in the fish sample (Bq/kg), DCF is the dose conversion factor for exposure to ^{137}Cs from ingestion (Sv/Bq), I_f is the consumption rate of fish and g_f is the fraction of the consumed fish arising from a contaminated source. The fish catch in Brazilian areas has been calculated, using FAO statistics, as 5.8 kg/a. On the basis of the radioactivity levels of ^{137}Cs presented in Table I and taking into consideration the DCF recommended by the International Commission on Radiological Protection (ICRP) [3], 1.4×10^{-8} Sv/Bq, and a default value of $g_f = 1$, it has been possible to estimate the value of D_{Cs}. The results obtained are presented in Table II. The data vary from 0.8 to 31.7 nSv/a. These values are very low compared to the value recommended by the ICRP for the limit of the annual dose to members of the public (1 mSv/a).

Our results show that the Brazilian coast is not free of artificial radioactivity; this contamination is due to fallout, and the radionuclides released from different radioactive sources in the Northern hemisphere can reach the stratosphere and the troposphere, and is distributed over the whole globe.

It has been estimated that the global mean individual dose from ^{137}Cs in seafood is 0.03 μSv/a and the doses from ^{137}Cs show a significant geographical variation [4]. The highest doses (one order of magnitude higher than the global mean dose) have been received by populations eating fish from the north-east Atlantic Ocean, which has received most of the ^{137}Cs from Sellafield and Chernobyl. Our results are in agreement with this value, considering that the radioactivity in Brazil is due to fallout deposition.

TABLE II. ESTIMATED DOSES FROM CONSUMPTION OF FISH (1991–1993)

Sampling site			Dose from consumption of fish (10^{-9} Sv/a)	
States	Latitude	Longitude	1991	1993
Rio Grande do Sul	32°11′ S	52°02′ W	8.9–15.4	1.1–2.3
Paraná	25°37′ S	48°16′ W	8.1–14.6	2.8–3.9
São Paulo	23°50′ S	45°25′ W	8.1–24.4	—
Rio de Janeiro	22°57′ S	43°55′ W	12.2	1.8–4.3
Bahia	12°57′ S	38°32′ W	9.7	—
Pernambuco	08°02′ S	34°52′ W	17.8–31.7	5.1–17.8
Ceará	03°42′ S	38°29′ W	8.12	—
Pará	00°26′ S	47°49′ W	0.8–17.0	6.2

This work is part of a research programme which aims at studying radionuclide transfer through ecosystems and developing radioecological assessment models.

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RETROSPECTIVE A
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L. JOHANSSON[1], E.
J. LAZUTKA[3], G. RI

[1] Department of Radi
Lund University Ho
Lund, Sweden

[2] Department of Phys
Vilnius University,
Vilnius, Lithuania

[3] Department of Bota
Vilnius University,
Vilnius, Lithuania

[4] Chernobyl Medical
Vilnius, Lithuania

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