

DOSE ASSESSMENTS TO THE BRAZILIAN POPULATION FROM MARINE FOOD RADIOACTIVITY

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Many artificial radionuclides can contribute to the dose from external radiation. Of the fallout radionuclides Cs-137 is the most important contributor to external radiation dose.

This work has the purpose of obtaining results on Cs-137 measurements on marine samples and to provide assessment of doses to the Brazilian population from Cs-137 radioactivity in marine food.

As part of our monitoring programme, marine samples (seawater and fish) from 8 fixed stations of the Brazilian coast from Rio Grande do Sul State to Pará State were collected.

About 100 liters of seawater and 4 kg of fish from the most consumed species by the local population were monthly analysed, as previously described⁽¹⁾.

Cesium-137 levels in seawater samples ranged from 0.5 to 2.2 Bq.m⁻³ and in fish varied from 0.01 to 0.39 Bq.Kg⁻¹, as showed in Table 1. The error of the analysis was of 50% and 40% for seawater and fish, respectively.

Table 1 - Cs-137 levels in seawater and fish samples.

Sampling Site			Cs-137 levels in fish (Bq.Kg ⁻¹)		Cs-137 levels in seawater (Bq.m ⁻³)	
States	Latitude	Longitude	1991	1993	1992	1993
R.G.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	-
R.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

These data were used to calculate the dose received by the population from consumption of fish. The doses were calculated using the formulae⁽²⁾:

$$D_{Cg}(\text{fish}) = C_p \cdot DCF \cdot I_f \cdot g_f$$

where D_{Cg} is the annual committed effective dose equivalent from Cs-137 by consumption of fish (Sv.a⁻¹); C_p is the concentration of Cs-137 in fish sample (Bq.Kg⁻¹); DCF is the dose conversion factor for ingestion exposure of Cs-137 (Sv.Bq⁻¹); I_f is the consumption rate of the fish and g_f is the fraction of the consumed fish arising from the contaminated source. Fish catch for Brazilian areas was calculated using FAO statistics as being 5.8 Kg.a⁻¹. Based on the radioactivity levels of Cs-137 presented at Table 1 and by taking into consideration the DCF recommended by ICRP⁽³⁾, as 1.4.10⁻⁸ Sv.Bq⁻¹ and the default value of g_f as 1, it was possible to estimate the value of D_{Cg} . The results obtained are presented in the Table 2. The data varied from 0.8 to 31.7 nSv.a⁻¹. These values are very

low compared to the value recommended by the ICRP for the limit of annual dose to members of the public (1 mSv.a^{-1}).

Table 2 - Estimative of doses received from consumption of fish (1991-1993)

Sampling Site			Dose by consumption of fish ($10^{-9} \text{ Sv.a}^{-1}$)	
States	Latitude	Longitude	1991	1993
R.G.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	-
R.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

Our results show that the Brazilian coast is not free of artificial radioactivity, and this contamination is due to fallout, where the radionuclide released from different radioactive sources in the northern hemisphere can reach the stratosphere and troposphere, and it is distributed over the terrestrial globe.

Aarkrog et alii⁽⁴⁾ has estimated that the global mean individual dose from Cs-137 in seafood is of $0.03 \mu\text{Sv.a}^{-1}$ and the doses from Cs-137 show a significance geographical variation. The highest doses (one order of magnitude higher than the global mean dose) were received by the populations eating fish from the NE Atlantic Ocean which has received most of Cs-137 from Sellafield and Chernobyl. Our results are in agreement to this value, considering that the radioactivity in Brazil is due to fallout deposition.

This work is part of one research programme, that aims are to study radionuclide transfer through ecosystems as well as to develop radioecological assessment models.

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