



Dose in biota due to alpha radionuclide emitters in a dam associated with a uranium mining

Pereira, W. S.^{a,b}, Kelecom.^c, A. Carmo, A. S.^d, A. Campelo, E. L. C.^b, Charles-Pierre, M.^a, Padilha Filho, L. G.^d, Lopes, J. M.^d

^a Universidade Veiga de Almeida, Rio de Janeiro, RJ, Brasil, 20.271-020.

^b Industrias Nucleares do Brasil, Resende, Rj, Brasil, 27.510.080

^c Universidade Federal Fluminense, Niterói, RJ, Brasil, 24021-141.

^d Universidade Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brasil, 21945-970.

pereiras@gmail.com

Introduction: Radioprotection focuses on the protection of human beings and their descendants and the protection of the environment. Environmental protection has always been done indirectly through the protection of human being in the environment. This anthropocentric approach has several shortcomings. In its 2007 recommendation, the International Commission on Radiological Protection – ICRP [1] points to the need for radioprotection to be made in the environment, which was endorsed in 2014 by the International Atomic Energy Agency - IAEA [2–4], with a focus on biota. The ICRP has set up a theoretical framework to support the dosimetry of biota as a form of environmental radioprotection, developing the concept of Reference Animals and Plants (RAPs) through the relationship between exposure and dose, and dose and effect for some types of plants and animals of different environments [5].

Methodology: Two samples of Traíra fish and two species of Lambari fish were collected. Then, the activity concentrations (AC) of U-238, Ra-226 and Th-230 (in Bq/kg) were measured and then, based on the dose conversion factors from ICRP Publication 136 [6], estimate the absorbed dose rates (in $\mu\text{Gy/h}$), see Table 01.

Table 01. Dose Coefficients for studied radionuclides in (Bq/kg)/($\mu\text{Gy/h}$), according to [6].

Radionuclide	U-238	Th-230	Ra-226
Dose Coefficients[(Bq/kg)/($\mu\text{Gy/h}$)]	2.50E-03	2.70E-03	1.50E-02

Results: For U-238, ACs ranged from 0.20 to 1.60 Bq/kg. For Th-230, the variation was between 0.02 and 0.30 Bq/kg. Finally, for Ra-226, the variation was between 0.07 and 1.40 Bq/kg (see Table 02, Figure 01). In terms of absorbed dose rate, the average value was around $10\text{e-}2 \mu\text{Gy/h}$ for the four samples (see Table 03, Figure 02).

Table 2. Activity concentration of alpha emitting radionuclides in studied fishes in Bq/kg.

Fish	U-238	Th-230	Ra-226
Traíra	2.09E-01	3.50E-02	6.38E-02
Traíra	1.72E-01	1.94E-02	7.94E-02
Lambari	6.35E-01	4.06E-02	5.82E-01
Lambari	1.57E+00	2.88E-01	1.42E+00

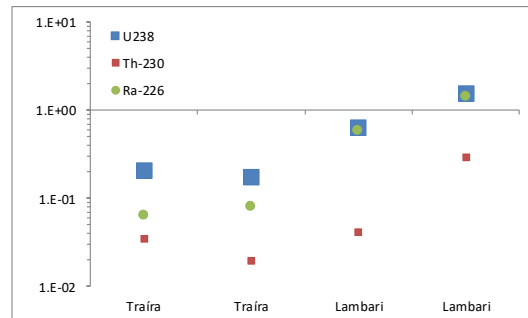


Figure 01. Activity concentrations of alpha emitting radionuclides, in log₁₀ (Bq/kg).

Table 03. Dose rate, in μGy/h, due to the alpha emitters, in the studied fishes.

Fish	U-238	Th-230	Ra-226	total
Traíra	5.23E-04	9.45E-05	9.57E-04	1.57E-03
Traíra	4.29E-04	5.24E-05	1.19E-03	1.67E-03
Lambari	1.59E-03	1.10E-04	8.73E-03	1.04E-02
Lambari	3.93E-03	7.78E-04	2.13E-02	2.60E-02
Dose rate average				9.92E-03

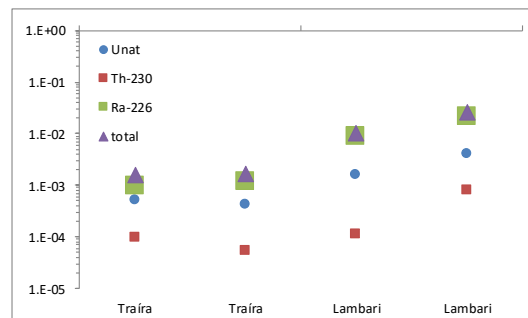


Figure 02. Dose rates of alpha emitting radionuclides, in log₁₀ (μGy/h).

Conclusion: The activity concentration values were within the variations found for alpha emitters in the literature [7-9] and, with the estimated dose rates, no relevant biological effects were expected [6].

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