

GAMMA RAY SPECTROMETRY

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Keywords: internal contamination; gamma spectrometry; whole body counter.

The In Vivo Monitoring Laboratory performs measurements in order to provide data for internal dose calculations. During 2002-2004, the Laboratory carried out occupational monitoring of workers involved in radioactive waste management, radioisotope production, research, students and visitors. Table 1 shows the number of thyroid and whole body measurements carried out in the period. Table 1. Number of in vivo measurements performed during 2002-2004 Type 2002 2003 2004 Thyroid 505 402 430 Whole body 468 407 430 Bone - 16 - Total 973 825 860 The In Vivo Monitoring Laboratory has been developing efficiency calibrations for the measurements of gamma emitters deposited in the knee bones region. A new counting system to measure ²⁴¹Am in lungs is being installed and calibrated and is expected to be in operation in 2005.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM AT IPEN FACILITIES

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The environmental monitoring program is carried out by measuring *in loco* samples of ground water, rainwater and filters for air sampling in the influence area of IPEN, by using gamma and alpha spectrometry, total alpha and beta counting, instrumental neutron activation analysis and liquid scintillation. The external exposure is determined by thermoluminescence dosimeters, that can integrate exposures over long period with no attention. The aim of this monitoring is to assess the effectiveness of the discharge control, as well as to detect any non-planned release (above the pre-selected operational limits). The radiation levels for 2002, 2003 and 2004 are below the environmental background levels, attesting that the control of the radioactive effluents discharges is effective, as shown by the source-terms and that there is no radiological impact in the environment around the IPEN facilities.

IN VITRO OCCUPATIONAL MONITORING

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The In Vitro Bioassay Laboratory (LRT) routinely performs the analysis of biological samples from people occupationally exposed to radionuclides with risk of internal contamination. The most frequently requested radionuclides, the technique used and the total number of analyses carried out by the LRT during the period 2002-2004 is presented in the Table: Radionuclide Technique Performed Analyses 2002 2003 2004 U-nat. Fluorimetry 670 305 255 U (isotopes) spectrometry 55 56 75 ²³²Th NAA 46 42 45 ³H Liquid scint. 59 94 54 ¹⁴C Liquid scint. 16 15 - emitters spectrometry 07 07 07 Actinides spectrometry 24 24 35 Total 877 543 471 In addition to bioassay measurements, the Laboratory has participated in national (Brazilian Intercomparison Program) and international intercomparison (Promotion du Controle de Qualite des Analyses de Biologie Medicale en Radiotoxicologie) programs during the period 2002-2004. The analyzed radionuclides and the frequency of these assessments are shown in the following Table: Program Radionuclide Frequency PROCORAD U (mass) Yearly PROCORAD U (activity) Yearly PROCORAD emitters Yearly PROCORAD Actinides Yearly PROCORAD ³H Yearly PNI U (mass) Half-yearly PNI emitters Half-yearly PNI ³H Half-yearly The maintenance of the quality assurance program has been carried out over the years (2002/2004) with the implementation of the Quality System. Additionally, the LRT has requested periodic internal audits, at least once per year, to identify possible problems and for the measurement reliability.