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A RADIATION ACCIDENT WITH A X-RAY DIFRACTOMETER

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Introduction - Diffractometers are in many instances considered of low occupational risk, but we describe an accident with three workers who suffered localized radiation overexposure to their hands while working at a diffractometer in State of Bahia, Brazil, on September 1995.

Cases Reports - Patient one referred a burning sensation on the dorsum of his left hand on his fourth working shift at the equipment. Evolution consisted of mild pain and progressive extensive edema and bullae formation on the dorsum of both hands. Patient two assisted patient one work during two shifts. He presented a lesion on the tip of the 2nd right finger that evolved to a punctual area of necrosis. Patient three aligned the collimator's screws of the device on a 2nd attempt to reconstitute the accident. He presented with erythema and bullae on his right hand and on the 4th and 5th left fingers.

Doses Estimations - Doses were estimated clinically and by reconstructing the accident. A 2nd attempt, using ionizing chambers, thermoluminescent dosimeters and hand simulators disclosed doses rates that correlated with the lesions. Doses to the hands varied anatomically, probably from 12 to 25 Gy. The localized nature of the exposure was confirmed by the finding of a cell with a tricentric and another one with a dicentric and three fragments in excess, in patient's one blood chromosome analysis.

Conclusion - The delay to identify the etiology of the lesions is a common fact with other accidents and highlights the need of informing occupational and health personnel in general on the clinical manifestations of radiation accidents. A false sense of security, caused maintenance personnel not to use personal dosimeters and for years blocking the interlocks during calibration. That did not cause a similar accident only because the diffractometer's back window had not yet been damaged, as detected on the 2nd accident reconstruction. Overexposures were caused by poor maintenance, but lack of training and information are important facts too. Evolutions were favorable, demanding conservative treatments, specially because the low energy of the X-ray that spared the deeper layers of the tegument of significant doses.

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A DOSIMETRIC SYSTEM FOR PERSONAL MONITORING IN MIXED BETA AND GAMMA FIELD

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Introduction A dosimetric thermoluminescent system for the determination of strongly and weakly penetrating radiation dose Hp(10) and Hp(0.07), respectively, was developed. The system consists of CaSO₄:Dy pellets of different thickness as TL active material, a polyethylene badge and different metallic filters used for radiation attenuation.

Materials and Methods To the system development and calculation of design parameter different computer codes were used. After the definition of the dosimeter an experimental validation of the whole system was performed.

The research was directed towards the optimization of the design parameters. The determination of the deposited energy by beta and gamma radiations in the dosimetric material as a function of chemical composition and densities was calculated using computer codes that simulate those process.

The dosimeters calibration was performed in standard fields. The angular dependence of TL response and its behavior in a mixed field was studied.

The validation of the dosimetric system was performed for beta and gamma radiation doses between 0.1 mSv and 200 mSv.

Results An analysis of associated uncertainties shows that the developed dosimeters are in accordance with the ICRP-35 requirements of energetic and angular dependence for personal monitoring.