DOSIMETRIC MATERIALS AND METHODS

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Introduction The Dosimetric Materials Laboratory of IPEN develops materials and methods for application in beta, gamma, X, electron, neutron, UV and laser radiation dosimetry. These materials can be used in environmental, area and personal monitoring; clinical, accident, retrospective and industrial applications dosimetry. Laser beam dosimetry The method of phototransferred thermoluminescence (PTTL) using CaSO4:Dy pellets produced at IPEN was used to detect spread laser radiation inside the operation room (OR) during refractive surgical procedures using ArF excimer Laser. The detectors positioned as far as 4m from the laser source were sensitised by the laser radiation, making the UVR detection feasible at large source-detector distances. The absorbed energy was detected in the range from 40 ⌠J to 30 mJ during a surgery. This result indicates that the studied method can be successful for UVR monitoring. Radioprotection The analysis and statistics of the effective doses received by the professionals that perform medical procedures of cardiac catheterism in two great hospitals of São Paulo State were carried out. The individual doses of 279 professionals were analysed from 1991 to 2002.

The statistics and interpretation of the data were considered in terms of the profession and the individual equivalent dose accumulated in the period. The main obtained results were:
(1) The physicians received annual doses lower than 10mSv.
(2) The resident physicians and the high level trainees received annual doses higher than the physicians.
(3) The physician's and resident physician's doses are the highest because they are the professionals that stay closer the patient and of the source of X-rays for a long period of time during the procedure. Diagnostic Computation systems are being applied to simulate new ceramic compounds suitable to improve the radiodiagnosthic rooms shielding. Different ceramic compounds are being formulated theoretically. The most interesting materials with attenuation properties studied are SiO2, Fe2O3, Al2O3, BaO, PbO e Ti2O3, that are mixed in different concentrations . The shielding properties are being simulated to choose the sample with best shielding properties. Radiotherapy The application of EPR dosimetry for low doses, including the radiotherapy dose range, presents some difficulties.

A computer program to increase the detection range of this dosimetry system was developed. The mathematical tools to the treatment of EPR signals were evaluated and best procedures for dosimeter preparation and measurement techniques were explored, with the objective of automatizing the process .The software incorporates the main techniques of data analysis of EPR spectrum and the usual procedures in dosimetry laboratories for high dose evaluation, including the uncertainty calculation of the method. The standardization of the procedures allows to obtain results with better quality and enhanced precision and accuracy.

High Doses and Accident Dosimetry Potassium nitrate (KNO3) in the pellet form has been used as dosimetric material for high gamma dose measurements. To increase the detection dose range, retarding the decomposition of the nitrate ions (NO3-) in nitrite ions (NO2-), a sensitizing compound (MnO2) was mixed with pure KNO3 and the dosimetric properties of the new compound was evaluated. Using this method the dose range could be extended from 150 kGy to the pure KNO3 to 600 kGy, or to higher doses, using MnO2 (40%). A sensitive, useful, practical and cheep dosimeter, based on dyed Polymethylmethacrylate (PMMA) using yellow, red, blue and green coloring compounds, commercially available in Brazil, was developed and the dosimetric properties related to ionizing radiation were evaluated. The obtained results show the viability of using these detectors for dose evaluation in industrial gamma radiation process. Aiming to standardize a method to dose retrospective, the ESR response of tooth enamel irradiated with low energy X-rays and 60Co gamma radiation was evaluated and compared with the ESR response of synthetic hidroxyapatite in the dose range between 0.2 - 10 Gy. To improve the dose evaluation special care procedures in the sample obtaining and preparation are being taken. In this regard, practical considerations of tooth selection, sample preparation and ESR spectrometer parameters settings are being studied.

Microdosimetry The purpose of this work is the application of the theoretical-experimental model of the microdosimetry, mainly in radiobiology, that is a branch of fundamental importance to subsidize the theoretical fundaments in radiotherapy, radiation protection, radiation quality and others. The effects of the ionizing radiation in epithelial tissue at microdosimetric level are being studied. The PENELOPE Code, a Monte Carlo simulation method, is being applied to subsidize the experimental research.