

hot regions is dispersion of the metabolic heat produced by the body in a comfortable and efficient manner. Prevention of future harm to Man's health in São Paulo city and in cities with tropical climates will have to begin with properly large sample statistics on morbidity and mortality to establish relationships such as between regional heat and death from cardiovascular diseases.

The use of nuclear techniques in environment

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1 - Introduction.

IPEN - Institute of Nuclear Energy and Researches is a state autarchy attached to the Science and Technology Secretary, associated to the São Paulo University - USP for education purposes and it has technical and administrative support and management through CNEN- National Commission of Nuclear Energy.

IPEN works in the field of Application of Nuclear Techniques in Environment, and it has laboratories and installations, one Nuclear Reactor IEA-R1 for research, one Industrial Electron Accelerator with 1.5MeV and 24mA, one Cyclotron Accelerator with 24MeV and Co-60 Irradiators.

2 - Activities of IPEN in the Environmental Field.

IPEN has been asked by several Institution, either Public and Private, to determine physical or chemical parameters concerning to environmental studies. Among these studies, it is pointed out:

a)- Determination of rain water infiltration in aquifers using artificial tritium as tracer, this parameter being used in ground water pollution studies;

b)- Determination of water flow in rivers, with bromine-82 as radio tracer, for studies of contaminants propagation using mathematical models for simulation;

c)- Weight quantification of immobilized mercury in electrolytic cells of caustic lime industry, with the purpose of detecting eventual leaks, that can cause damage to environment;

d)- Determination of sediment bed load transport in rivers, using gold-198, in order to quantify the degree of capacity lost of reservoirs through length of time, making possible to adopt preventioning measures;

e)- Determination of ground water flow rate, using bromine-82 as radio tracer, in protection studies of aquifers in areas of solid wastes and industrial liquids disposal;

f)- Determination of the distribution of residence times in lakes, water reservoirs and liquid effluents, with radioactive, natural and dye tracers, in order to study the behavior

of these systems during an accidental disposal of a contaminant;

h)- Determination of natural radioactivity, Rn-222, in mineral and ground waters;

3 - Research Projects.

Among the Research Projects that are being performed at IPEN in the field of Environment, it can be pointed out:

a)- Project for the removal of toxical gases SO₂ and NO_x released in the burning of fuels, mainly of fossil origins, through the irradiation with an electron beam from the Industrial Electron Accelerator at IPEN.

The main objective is to develop a pilot plant where it will be possible to burn oil, coal and waste; to irradiate the produced gases and to measure the removal efficiency for these gases.

This project is being carried out with a counterpart: CETESB - Company of Technology of Basic Sanitation;

b)- Project for characterization of Paiva Castro Reservoir, Cantareira System, with a volume of 36,000,000m³ and flow rate of 33m³, that is responsible for the water supply of nearly 67% of the population in the metropolitan region of São Paulo. This project is being carried out with a counterpart, SABESP- Company of Basic Sanitation in São Paulo State, and the objectives are:

. Feasibility study of the implementation of an electron beam accelerator for effluent treatment of ETE-Mairiporã, with a present flow rate of 20 liters/s;

. To determine the sediment bed load transport in the channel of Juqueri river, the main contributor for the Paiva Castro reservoir;

. To measure the concentration of organic products and metals in several sampling points;

. To determine of residence time distribution in the reservoir, in order to establish a mathematical model for the foresight of concentration of eventual contaminants;

. Project for treatment of drinking waters, residual waters, muds and industrial effluents, using an electron beam generated in industrial accelerators. The main objective of this project is to study the removal of toxical pollutants and/or refractories, specially those of industrial origin, and to destroy pathogenic microorganisms in effluents and drinking waters, giving special attention to the degradation of trihalomethanes in supplying waters, the degradation of organic contaminants and color removal in industrial effluents, disinfection of domestic, hospital, airport waste water and disinfection of waste waters originated in waste water treatment stations with the possibility of reusing it as fertilizers;

4 - Other activities of IPEN.

Besides the activities already described, IPEN has important works in several fields, bringing together the nuclear area to industrial and medical areas, as follows:

a)- Production of iridium-192 sources for industrial radiography, gammagraphy;

b)- Production of radioisotopes and radiopharmaceuticals, supplying 38 products for 187 Nuclear Medicine Centers throughout the Country, making possible to examine more than 500,000 patients per year, for the diagnosis and therapy of several diseases;

c)- Modification of polymer properties, improving them through the ionizing radiation.