ENVIRONMENTAL RADIOACTIVE ANALYSIS INVOLVING PUBLIC IN THE NEIGHBORHOOD OF A ^{131} I PRODUCTION FACILITY

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ABSTRACT

The IPEN has a production plant,where elemental tellurium is processed to obtain iodine.The gaseous effluents produced in the three hot cells are filtered in a batch system before being discharged to the environment through a stack.This paper is mainly concerned with the definition of the critical group,the evaluation of the annual individual and collective effective dose due to the iodine release to the environment.This result obtained are discussed taking into account new concepts (Safety Series Standards 979 : "International Basic Safety Standard for Protection Ionization Radiation and Safety of Radiation Source ", 1995 such as exemption levels and the levels where is necessary to apply the quantitative decision aiding techniques to optimize the environmental delivery or the introduction of a new filter batch system.

INTRODUCTION

The IPEN has a swimming pool research reactor operating at a nominal power of 2 MW where elemental tellurium is irradiated. Radioactive tellurium and iodine radioisotopes are produced and ^{131} I is chemically separeted in a production plant. This chemical processing involves three hot cells and gaseous effluents are produced and filtered in a batch system before being discharged to the environment through a 25 m stack.

This paper is mainly concerned with the definition of the critical group,the evaluation of the annual individual and collective effective dose due to the iodine release to the environment in the last year (1994).

METHODOLOGY

The gaseous effluents are continuously monitored by using a air sampler coupled to a flux meter. This system is conected off line in the stack. The effluents are collected through a filter system arranged after the pump. The filters are routinely measured by using a hyperpure germanium detector with 15% efficiency coupled to a 4096 multi-channel analyser. The results are corrected for the air flux in the stack. The spectrum obtained is analised using the Omnigam software version 3.4 (EG&E ORTEC) .In order to evaluate the impact due to this effluents release the average meteorological data collected in a meteorological tower far 200m from the radioisotope processing plant have been used as input to one generic models for assessing the environmental transfer of radionuclides [1,2] .These data were collected during ten years. These were the more advantageous metereological data we have until the present moment to perform our calculation. Although we have installed since August 1995 some metereological instruments, we have not enough data. The average wind speed and frequency distribution were determined sharing the compass card in 8 sectors. The most time the wind blows in the southeast direction having an average frequency of 39 % and an average speed of 3.6 m/s.The major exposure pathway considered in the external radiation exposure were:beta and gamma submersion dose from the plume,gamma dose over contamined ground .In the internal radiation exposure we considered the intake by inhalation.There are not farming activities around 60 km of the IPEN site so doses due to the food ingestion pathway are assumed negligible.the annual effective dose have been carried out by using the AIEA transfer model [2] and by applying the proper dosimetric factors [3] . The critical group was obtained and is formed by the people living 3000m away from the discharged point in the southeast diffusion section and was obtained from the "Instituto Brasileiro de Geografia e Estatistica" data and was determined the fraction of the number of persons living in the area delimited by a circular section with one kilometer of radius and the 8 compass card sectors. This Institute is encharged by the Federal Brazilian Government of the National Census. The data is a population estimation for 1991 from 1980 because we have not calculated the population distribution around IPEN from 1991 census. The main exposure pathway is the gamma external irradiation due to the deposition of radionuclides on the ground

INDIVIDUAL AND COLLECTIVE DOSE CALCULATION

The individual dose was calculated using the methodology above described. As was pointed, the critical group was formed by the people living 3000 meters away from the discharge point in the southeast diffusion section and received an effective dose of 1.9×10^{-6} Sv per year and so is below the exemption level to be considered radioactive[4] and the collective dose calculation is not necessary. In this case we can increase the plant production five times, maintaining the present environmental discharge system and we continue in the exemption level. During the last four years [5] no considerable change was observed in the operation condition of the IPEN discharge. Nevertheless the IEA-R1 reactor is being upgraded to operate at higher power (5MW) on a full-time (24 h per day) in order to attend the demand for radioisotopes in Brazil and other countries of South America. In this case, even the production increase until fifty times the present production is not necessary to record the source term because the individual dose in the critical group remains below 1/10 of the pertinent annual limit (100 μSv/year). If we consider the estimation for the future demand approximately year 2000, we can suppose an increasing of production of 150 times the present production and we need record the source term but we do not need to accomplish the environment monitoring around the IPEN facilities. Above 50 times the present production becomes necessary to evaluate the collective dose because if the value exceeds 1 person-Sv than we need to apply the ALARA principle. The collective efffective dose was calculated multiplying the population in each area by the dose calculated in the middle point of the same area. We obtained a value of 61.1 person-Sv. This value suppose that one increase of the production above the exemption level probably we need to introduce the ALARA principle and determine the different radiation protection options to reduce the collective dose. This result reflect the great number of person that live near IPEN facilities.

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