P/223 EVALUATION OF SOME PARAMETERS FOR FISSION-PRODUCT RETENTION IN THE SOIL. Elias Palacios, *Gian Maria A. A. Sordi,* Laura Sakiko Endo (Instituto de Pesquisas Energéticas e Nucleares, São Paulo, Brasil) and J. E. Turner (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830)

In this study the cesium and strontium retention capacity of soil in the vicinity of the Institute for Energy and Nuclear Research in São Paulo was investigated. Distribution coefficients (Kd) in the soil for both elements were determined as functions of their concentrations in the waste solution, pH, and the presence of K^+ and Na^+ ions. Soil parameters such as density, permeability, and porosity were measured in the laboratory. X-ray diffraction analysis showed the presence of Kaolinitic argil in the soil of this region, and the observed retention capacity for both elements was found to be between 0.7 and 2.0 milliequivalents/100 g soil. Evaluation of ground-water speed and ion migration rates was based on laboratory measurements. Estimates were made of the amounts of cesium-137 and strontium-90 which, if discharged into the ground, would result in the dose equivalent limit set by the ICRP for the critical group. It was concluded that the heat dissipation capacity of the ground-water table limits the maximum amounts of the radionuclides that may be discharged. A conservative estimate indicated that the maximum beta-gamma activity for long-lived fission-product retention in the type of soil studied is 3.6×10^6 Ci/year. (Research sponsored in part by the Office of Health and Environmental Research, U.S. Department of Energy, under contract W-7405-eng-26 with the Union Carbide Corporation.)

P/224 A CRYOGENIC AIR SAMPLER FOR RADON. *F. F. Haywood* and P. T. Perdue (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830)

Recently, a modified version of the cryogenic sampler was developed (for the purpose of trapping radon) and tested at the Oak Ridge National Laboratory. This sampling device operates as follows: a 500-ml flask is immersed in a 4.7-liter Dewar filled with liquid nitrogen. The flask is sealed at its mouth with a rubber stopper containing a stainless steel needle with a 1.5-mm orifice. Air inside the flask is liquefied, thus creating a subatmospheric pressure in the flask which allows outside air to be sampled. The sampler is not selective; therefore, all the air including water vapor and airborne gases enter the flask (a filter is used to remove particulates). Flow rates for this sampler vary with the orifice diameter and range from 0.1 liter/m to 3 liter/m. The maximum volume of air which can be liquefied in the 500-ml flask is 210 liters. All three naturally occurring isotopes of radon can be sampled with this device. For analysis, the liquefied air is transferred to a vacuum-insulated counting vessel (1.6-liter capacity) in the shape of a Marinelli beaker. The latter is placed on a vertical-mounted Ge(Li) detector for analysis. Gamma rays from daughters of the radon isotopes are analyzed thus allowing an estimation of the radon concentrations. The system is calibrated by sampling radon from standard calibration cells containing ^{226}Ra, ^{224}Ra, and ^{223}Ra. Results of tests reveal that the system is capable of detecting ^{222}Rn concentrations as low as .05 Bq/liter. (ORNL is operated by Union Carbide Corporation under contract W-7405-eng-26 with the U.S. Department of Energy.)

P/225 A TIME-AVERAGE TRACK ETCH WL MONITOR. *H. L. Pai,* D. A. Marsden and J. H. Aitken (Radiation Protection Service, Ontario Ministry of Labour, Toronto, M7A IT7, Canada)

In order to meet the increasing need for monitoring of radon daughter concentrations in private houses, an inexpensive time-averaging track etch WL monitor has been developed and tested by the Ontario Ministry of Labour. The monitor is an active device using a CEA-type detecting head along with a modified aquarium pump. For the CEA-type detecting heat being used, the time-averaged WL for radon daughters can be calculated from the definition of WL as

$$\text{WL (radon daughters)} = \frac{n_A\times6+n_{C'}\times7.68}{1.3\times10^5\times V\times\Sigma}$$

where n_A and $n_{C'}$ are number of readable tracks registered for RaA and RaC′ respectively, V the total flow of air through the filter paper in liters throughout the time of monitoring and Σ the detecting efficiency of the system. Thoron daughter WL is determined simultaneously using the same principle and the same monitor. It will be seen that the precision of the measurement depends only upon how precisely the total flow and efficiency can be determined. After laboratory and field testing, it has been found that both flow and efficiency can be determined to 10%. Details of the development work will be reported.

P/226 A MODEL FOR DETERMINING THE OVERALL RADON RELEASE RATE AND ANNUAL SOURCE TERM FOR A COMMERCIAL IN-SITU LEACH URANIUM FACILITY. Steven H. Brown (Wyoming Mineral Corporation, Lakewood, CO) and *Richard Smith* (Westinghouse Electric Corporation, Pittsburgh, PA

Commercial scale in-situ leach uranium facilities (i.e., solution mining) have operated since late 1975 and have begun to appear in increasing numbers in the last few years. Solution mining involves the pumping of ground water, fortified with oxidizing and complexing agents, into an ore body, leaching and solubilizing the uranium in-situ, and then pumping the solutions to the surface where they are fed to a mill. Milling is by conventional means, involving ion-exchange, precipitation, calcining and packaging processes. This paper presents an overview of the solution mining process and discusses an empirical method that has been used to determine the radon gas release rate (curies/year) for the overall operation of the facility including well fields, milling processes and waste storage reservoirs. In addition to radon generation on the surface from radium decay, it has been determined that the major