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OVERVIEW:

In the Laboratory of Chemistry and Radiochemistry, research on chemical properties of super heavy elements Rf, Db and Sg, in model systems with their homologs Zr, Hf, Nb, Ta, Mo and W in aqueous solutions, was continued. The main subject of study was sorption of these elements on ion exchange resins, on ferrocyanide sorbents and on liquid anion exchanger Aliquat 336. Simultaneously, experiments on ion exchange behaviour of Tc and Re as homologs of Bh ($Z = 107$) and of Os as that of Hs ($Z = 108$) in the on-line and off-line systems were carried out.

Experiments with Hg and Pb as analogs of elements $Z = 112$ and $Z = 114$, started only in 1999, resulted in elaboration of a very fast continuous method for isolation of short-lived ($t_{1/2} \geq 3$ s) mercury isotopes.

The above studies were performed in cooperation with the Joint Institute of Nuclear Research, Dubna, Russia, the Institute of Geochemistry and Analytical Chemistry of the Russian Academy of Sciences, Moscow, Russia, the Technical University of Dresden, Germany, the University of Mainz, Germany and the GSI Darmstadt, Germany.

The Laboratory of Environmental Radioactivity was continuing two main directions of their activities: weekly reports on continuous monitoring of the ground level air and research on the environmental radioactivity. The results of six years of systematic measurements of long-lived γ -emitters present in the ground level air were the subject of a PhD thesis defended in May 1999.

The main project in the Laboratory in 1999 was that on accumulation of Pu, Am, Cm, Sr and Eu isotopes in bones of wild herbivorous animals. Its major part, devoted to the α -emitters, has been completed.

Another important research (performed in collaboration with the Nuclear Spectroscopy Department of the Institute) concerned development of a method for determination of high-energy pure β^- emitters via measurement of Bremsstrahlung photons produced on a metal absorber of optimised thickness.

The Laboratory was also taking part in the proficiency test on the determination of ^{239}Pu , ^{241}Pu and ^{241}Am in mineral matrix, organised by the IAEA. Ten dust samples, delivered by the University of Bremen (Germany) were analysed for the presence of ^{238}Pu , $^{239+240}\text{Pu}$, ^{241}Pu , ^{241}Am and ^{244}Cm .

In 1999, the equipment of the Environmental Radioactivity Laboratory was enriched with a low-background liquid scintillator spectrometer (Wallac 1414-003 Guardian), which opened a whole new branch of possible work connected with determination of pure beta-emitters. First isotopes of interest were ^{90}Sr and ^{241}Pu , accumulated in animal bones. For ^{90}Sr measurements, an extensive library of scintillation quenching corrections was prepared. The spectrometer was also applied for tests of the purity of ^{32}P for the Laboratory of Physical Chemistry.

A new project on transfer of plutonium from forest soil and litter to fungi and plants has been started. It is a pilot study for a planned in-Lab experiment to be performed during the incoming year at the University of Extremadura, Caceres, Spain. Other projects conducted during 1999 in the Environmental Radioactivity Laboratory are described in short abstracts below.

In the Laboratory of Physical Chemistry, the project on construction of the internal target assembly for isotope production was continued, in cooperation with the Institute's Division of Mechanical Construction and with the Cyclotron Section. At the same time, much investment was made into necessary renovations in the radiochemical laboratory.

Research in the Laboratory was concentrated on preparation and evaluation of ^{32}P sources for intravascular brachytherapy. With the help of the Institute's Health Physics Laboratory, liquid $\text{Na}_2\text{H}^{32}\text{PO}_4$ sources were calibrated by TL dosimetry, and in cooperation with the Department of Nuclear Spectroscopy, some solid state sources containing ^{32}P were prepared. Liquid ^{32}P sources calibrated in the Institute were first applied in pre-clinical intravascular brachytherapy experiments at the Silesian Medical Academy.

Studies on selenium status in healthy or diseased animals and humans were continued, resulting in another PhD defended in 1999. Effects of supplementation of animal diet with a new antitumor drug were studied in cooperation with the Jagiellonian University, Kraków, the Rowett Institute, Aberdeen, Scotland, the Drug Institute, Warsaw, Poland, and the National Institute for Veterinary Research, Puławy, Poland.



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