

Project 2.1 Metabolism and Dosimetry of Plutonium Industrial Compounds

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Executive Summary

The long-term collaborative research Project between the Dosimetry Registry of the Mayak Industrial Association (DRMIA), operated by BranchN1 of the SRC Institute of Biophysics, and the U.S. Transuranium and Uranium Registries (USTUR), operated by Washington State University, under the sponsorship of the U.S. Department of Energy (DOE) continues into its second year.

The main purpose of the Project is to combine materials accumulated by both Registries, create a joint database, and perform a mutual analysis of this unique information regarding metabolism and Dosimetry of Transuranium nuclides, specifically plutonium and americium, in the human body.

The primary focus of the first year of this collaborative research program (April 1997 – April 1998) was to conduct a laborious, but very important task which was an intercomparison of radiochemical analytical methods and instrumentation currently in use by both Registries for determination of plutonium and americium in autopsy samples (Task A). The intercomparison was a necessary prelude to the combination and mutual use of assurance of previously accumulated data. This intercomparison of radiochemical and instrumental methods for Pu and Am determination include the radiochemical analysis of 20 samples prepared by each laboratory. There were no overall statistically significant differences between the results of plutonium and americium determination in soft tissues or in bones samples. The results of the intercomparison allow the conclusion that the data accumulated by the both Registries are valid, correct, and can be used in the joint investigations of actinide metabolism.

The last stage of the laboratory intercomparison was to have included an analysis of the isotopic composition of Standard Reference Materials (SRM), certified by the U.S. National Institute of Standards and Technology (NIST). However, this stage has been delayed because of changes in the import regulations of Russia. To obtain state licenses for the import of SRM and plutonium, thorium, and uranium isotopes which were purchased in April 1998, additional funds will be needed by the DRMIA. This problem was discussed with representatives from DOE during their visit to Ozersk in September, 1998 and they are currently exploring possible solutions.

During the first year of this project, a database to be jointly used by both Registries was formatted and Russian and American investigators began entering their respective data.

At present time, the joint database is in use for collaborative research on actinide metabolism (Task F, G, and H)

Another high-priority task included coordination of radiochemical analytical procedures for plutonium and americium separation and detection in low activity biosamples (Task D). The DRMIA has significantly modernized their radiochemical methods for plutonium and americium analysis in biosamples by application reagents currently in use by the USTUR, such as Bio-rad resins and the DDCP extractant. To further increase the sensitivity and efficiency of the methods, the DRMIA has acquired a 16 chamber alpha-spectrometry system (EG&G Ortec OCTETE), purchased in June, 1998. However, the calibration of the alpha-spectrometry was delayed because of the above mentioned changes in regulations of State Customs Committee (RF) regarding the import of radioactive materials. Calibration of the alpha-spectrometry is expected to be delayed until the end of 1998.

During the current reporting period, studies of the physico-chemical properties of alpha active workplace aerosols (Task E) have continued. The method for determination of the transportability coefficient are presented, current results were analyzed and results of the former research were summarized in this report to establish the value of this the value of this coefficient for studying metabolism of inhaled plutonium. The data on the value of this coefficient for investigation of plutonium distribution between the lung: system plutonium concentration ratios and the transportability coefficient (solubility), as measured by the DRMIA, of aerosols collected in actual workplaces of the workers.

Three tasks involving biokinetic modeling were initiated during this reporting period. Data relating plutonium concentrations in the skeleton and liver suggest that disease conditions involving the liver have an effect on the exchange of plutonium between the two organs when compared to liver and skeleton concentrations in healthy individuals. There was a slight increase in skeletal concentration relative to that of liver in those individuals with severely diseased livers, which included cirrhosis, primary and metastasis cancers in the liver and marked fatty degeneration of the liver.

The modernization of the whole-body counter (WBC), currently in use by FIB-1, was initiated during this year by moving a excess WBC from the Rocky Flats site to Ozersk (Task I). the WBC was disassembled, packed and shipped to Russia on 1 September 1998. the construction of a WBC room at FIB-1 was finished by September 15, 1998. it was decided to construct a temporary roof over the room until after the WBC installation. For the construction of a permit, roof some additional funds will be required. Estimates indicated that the approximate price of the WBC transportation from destination to place of assembling, mounting and installation will be \$25,000. the assembling and installation of the complex equipment will be performed by D. Hickman, LLNL, jointly with Russian specialists in the DRMIA laboratory, Ozersk in October-November 1998.

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