

Project 2.1

Metabolism and Dosimetry of Plutonium Industrial Compounds

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Executive Summary

The long-term collaborative research project between the United States Transuranium and Uranium Registries (USTUR), operated by Washington State University, and the Dosimetry Registry of the Mayak Industrial Association (DRMIA), operated by Branch No. 1 of the Federal Research Center, Institute of Biophysics (FIB-1) officially began on 1 February 1997. The first semi-annual progress report by the project was submitted in October, 1997. This report is a summary of progress for the period between 1 October 1997 and 10 March 1998.

Intercomparison of the radiochemical analytical methods used by each laboratory for autopsy tissue analyses, both past and present, remains a high-priority task of this project. Comparisons of the actinide detection systems used by each laboratory by exchange of samples were discussed in the previous progress report. The USTUR has used surface-barrier detectors for alpha spectrometry for many years; the DRMIA uses two types of detectors, the alpha radiometer which works on a ZnS(Ag) scintillation principle and the alpha spectrometer which is based on an ionization chamber design. In the first comparison, the results from measurements; however, some difficulty was experienced with measurement of americium with the DRMIA alpha spectrometer.

The second round of comparisons was by an exchange of dehydrated acid-dissolved tissue solution. This exchange was designed to compare radiochemical separation methods as well as the actinide =detection instrumentation and results of these comparisons are reported in this report. There were occasional statistical significant differences between pairs of measurements made by the two laboratories; however, there was no consistent systematic bias between laboratories or methods. These results indicate the potential of combining USTUR and DRMIA tissue actinide concentration data for study of actinide metabolism in occupationally-exposed workers of both countries. The format for a database to contain such data from both Registries, for use in this collaborative project has been determined and the data entry process in underway.

The DRMIA has modified their wet-chemical analytical procedures to include reagents and methods used by the USTUR radiochemistry laboratories. They have recently purchased an EG&G OCTETE alpha spectrometry system. Two DRMIA scientists have visited the USTUR laboratories to gain experience with USTUR actinide separation and analytical methods, including the setup, operation, and maintenance of the hardware and software associated with the OCTETE system. These changes are expected to improve

the uniformity of methods used by the two laboratories for analyses of samples collected in the future.

The FIB-1 has entered into an agreement with the Mayak Production Association to continue their investigation of the “transportability”, or in-vitro solubility, of workplace aerosols containing alpha activity. During this reporting period, they performed their “dialysis” technique on workplace aerosols collected from three sites within the Mayak facility. The results of their tests led them to conclude that the personnel in the workplace sampled were exposed to relatively soluble forms of plutonium-containing additional cascade impactors with which to incorporate particle size analyses with the dialysis method.

During this reporting period, the FIB-1 took initial steps toward improving their in vivo counting facility. A reasonably modern in vivo detection system at the U.S. Rocky Flats Plant was no longer in use and was to be excessed. The system is complete with a specially shielded room, high-purity germanium detectors, and associated electronics as well as phoswich detectors to be installed as backup detectors. David Hickman of Lawrence Livermore National Laboratory is responsible to oversee the refurbishment of the equipment and installation site the FIB-1 site. Calibration of the system, a task of this project, will begin when the equipment is operational, expected to be July or August, 1998. Existing in vivo detection equipment will be calibrated simultaneously for verification of in vivo measurement data already collected.

A U.S National Council on Radiation Protection and Measurements (NCRP) Committee on Radionuclide Dosimetry Models for Wounds requested USTUR and DRMIA personnel translate, into English, two Russian documents dealing with intake of actinides through skin injuries. This was initiated during the visit of DRMIA scientists to USTUR facilities in 1997 and reports will be prepared for submission for publication, in English, in the scientific literature.

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