

## Microdistribution and Long-Term Retention of $^{239}\text{Pu}(\text{NO}_3)_4$ in the Respiratory Tracts of an Acutely Exposed Plutonium Worker and Experimental Beagle Dogs

Christopher E. Nielsen<sup>1</sup>, Dulaney A. Wilson<sup>1</sup>, Antone L. Brooks<sup>1</sup>, Stacey McCord<sup>2</sup>, Gerald E. Dagle<sup>3</sup>, Anthony C James<sup>4</sup>, Sergei Y. Tolmachev<sup>2</sup>, Brian D. Thrall<sup>1</sup> and William F. Morgan<sup>1</sup>

<sup>1</sup>Biological Sciences Division, Pacific Northwest National Laboratory, Richland, WA; <sup>2</sup>United States Transuranium and Uranium Registries, Washington State University, Richland, WA; <sup>3</sup>Retired; <sup>4</sup>Deceased.

The long-term retention of inhaled soluble forms of plutonium raises concerns as to the potential health effects in persons working in nuclear energy or the nuclear weapons program. The distributions of long-term retained inhaled plutonium-nitrate [ $^{239}\text{Pu}(\text{NO}_3)_4$ ] deposited in the lungs of an accidentally exposed nuclear worker (case 0269) and in the lungs of experimentally exposed beagle dogs with varying initial lung depositions were determined. Autoradiographs of selected histological lung, lymph node, trachea, and nasal turbinate tissue sections were made to determine the location of plutonium within the tissues. These studies showed that both the human and dogs had a non-uniform distribution of Pu throughout the lung tissue. Fibrotic scar tissue effectively encapsulated a portion of the plutonium and prevented its clearance from the body or translocation to other tissues. Alpha radiation activity from deposited plutonium in human case 0269 was observed primarily along the sub-pleural regions while no alpha activity was seen in the tracheobronchial lymph nodes of this individual. However, relatively high activity levels in the tracheobronchial lymph nodes of the beagle dogs indicated the lymphatic system was effective in clearing deposited plutonium from the lung tissues. In both the human case and beagle dogs, the appearance of bound plutonium within the respiratory tract was inconsistent with current biokinetic models of clearance for soluble forms of plutonium. Bound plutonium can have a marked effect on the dose to the lungs and the potential increase in cancer risk.

USTUR-0336A-12