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ACCUMULATION OF PLUTONIUM IN MAMMALIAN WILDLIFE TISSUES: COMPARISON OF RECENT DATA WITH THE ICRP DISTRIBUTION MODELS

M. Johansen [(1)], D. Child [(1)], E. Davis [(1)], M. Hotchkis [(1)], A. Ikeda-Ohno [(2)], T. Payne [(1)], J. Twining [(3)]

[(1)] Australian Nuclear Science and Technology Org., [(2)] University of New South Wales, [(3)] Austral Radioecology

Text

We examined the distribution of plutonium (Pu) in the tissues of mammalian wildlife to address the paucity of such data under environmental exposure conditions. Pu activity concentrations were measured in *Macropus rufus* (red kangaroo), *Oryctolagus cuniculus* (European rabbit), and *Pseudomys hermannsburgensis* (sandy inland mouse) inhabiting the relatively undisturbed, semi-arid conditions at the former Taranaki weapons test site at Maralinga, Australia.

Of the absorbed Pu (distributed via circulatory and lymph systems) accumulation was foremost in bone (83% ±10% SD), followed by muscle (9% ±10%), liver (7% ±7%), kidneys (0.5% ±0.3%), and heart (0.4% ±0.4%). The bone values are higher than those reported in ICRP 19 and 48 (45–50% bone), while the liver values are lower than ICRP values (30–45% liver). The ICRP values were based on data dominated by relatively soluble forms of Pu, including prepared solutions and single-atom ions produced by decay following the volatilisation of uranium during nuclear detonation (fallout Pu, ICRP 1986). In contrast, the Maralinga data relates to low-soluble forms of Pu used in tests designed to simulate accidental release and dispersal.

We measured Pu in lung, GI-tract and the skin and fur as distinct from the absorbed Pu in bone, liver, muscle, and kidneys. Compared with the mean absorbed activity concentrations, the results for lung tissues were higher by up to one order of magnitude, and those in the GI tract contents and the washed skin/fur were higher by more than two orders of magnitude. These elevated levels are consistent with the presence of low-soluble Pu, including particulate forms, which pass through, or adhere upon, certain organs, but are not readily absorbed into the bloodstream. This more transitory Pu can provide dose to the lung and GI tract organs, as well as provide potential transfer of contamination when consumed in predator-prey food chains, or during human foodstuff consumption. For example, activity concentrations in *O.cuniculus* edible samples prepared according to traditional aboriginal methods were more than two orders of magnitude higher than in muscle alone. The increase was due to inclusion of GI tract components and contents in the traditional method.

Our results provide new insights into the sequestration of Pu in mammalian tissues under environmental exposure conditions. These results contrast with those related to the specific forms of Pu and exposure conditions upon which the ICRP models were based. However, they provide data relevant to the assessment of key environmental legacy waste sites, and of potential release scenarios for the low-soluble oxide forms in the growing worldwide inventory of Pu associated with power production.

Reference:
ICRP 1986. The metabolism of plutonium and related elements. Annals of the International Commission on Radiolgical Protection, vol 16, 2/3, publication 48.