Improving the Validity of Am and Pu Bone Burden Estimation from Bone Samples taken at Autopsy

Travis Matthews, Dr Richard Brey (Idaho State University), Dr. Antony James (USTUR)
The United States Transuranium and Uranium Registry (USTUR) is a resource of human tissue samples donated by workers occupationally exposed to actinides.

The USTUR studies the retention, relocation and final fate of actinides in the human body using tissue samples obtained at autopsy of occupationally exposed workers.

The USTUR receives two types of donations:
- Whole body
- Partial body
Tissue Samples

USTUR autopsy protocol often includes tissue samples from:

- Lung
- Tracheobronchial lymph nodes
- Liver
- Bone

Bone samples are taken from:

- Sternum
- Ribs
- Lumbar
- Vertebral bodies
- Patella
Estimation of Bone Burden

The samples are radiochemically analyzed for americium and plutonium to determine the activity concentration.

The average activity concentration in these bone samples are then used to extrapolate to the total skeletal mass of reference man assuming a uniform skeletal distribution or, applying a correction factor.
How Good are these Estimations?

Because the distribution of Am and Pu in the skeleton is not well known, the accuracy of such estimations is unclear.

- It is known that actinide concentrations are greater in trabecular bone than cortical bone.
- Very little is known about the variations in concentration in individual bones.
Skeletal Actinide Distribution

In order to improve the estimates and their credibility a better understanding of Am and Pu concentrations in the skeleton is needed.

The best way to improve our understanding of these distributions is to study whole or half skeleton cases.
Skeletal Actinide Distribution

Analysis from thirteen skeletons provide an opportunity to determine the ratio of skeletal concentration in individual bone to the average skeletal concentration.

We are considering the consistency of the ratio of the concentration within an individual bone to that of the skeleton.
Skeletal Actinide Distribution

- Using the USTUR database, we hope to improve estimation techniques
- We are considering a determination/reaffirmation of which bones samples are best suited for making these estimates of bone burdens
- There are also plans to apply these techniques to MAYAK worker data.
References

- International Commission Radiological Protection 1986 The Metabolism of Plutonium and Related Elements ICRP48
- Lynch, 1988 Macrodistribution of plutonium and americium in four human skeletons
- Fillipy, 2003 Estimation of Actinide skeletal content in humans based on Bone Samples Collected at Autopsy
- Kathren, 1989 Distributions of Plutonium and Americium in Whole Bodies Donated to the United States Transuranium Registry
- Kathren 1987 Actinide Distribution in the Human Skeleton
Disclaimer

This presentation was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.