

# U.S. Transuranium and Uranium Registries: Beyond Archiving

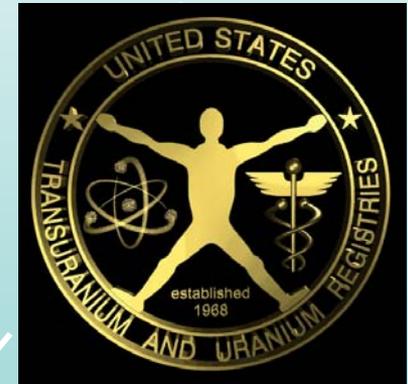
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<http://www.ustur.wsu.edu/>



*“Learning from  
Plutonium and Uranium  
Workers”*

# National Plutonium Registry - The USAEC Vision



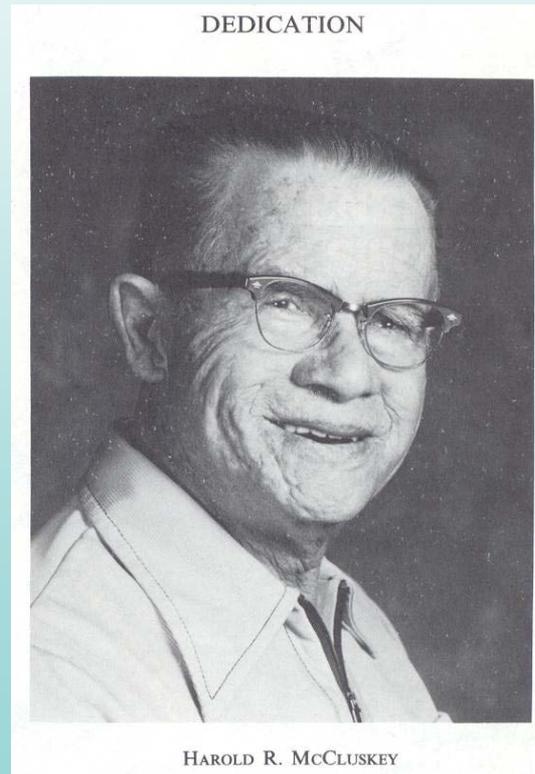
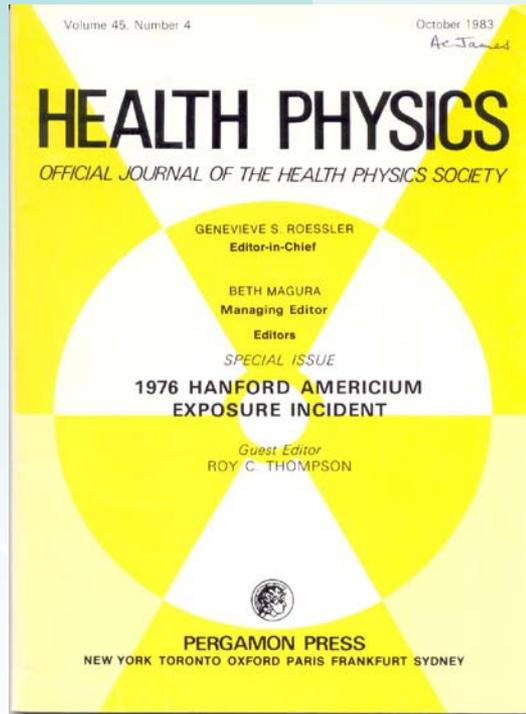
# Pre- USTUR Milestones

- 1949: started Hanford Autopsy Study
- 1968: founded National Plutonium Registry, at the Hanford Occupational Health Foundation
- 1970: name changed to the U.S. Transuranium Registry (USTR)
- 1978: founded the U.S. Uranium Registry (USUR)
- 1979: Stuart Gunn – first whole body donation
- 1983: Harold McCluskey ('Atomic Man') – dedicated issue of Health Physics Journal (October)



# USTR Landmark: (i) 1976 Hanford $^{241}\text{Am}$ Incident

- Explosion of ion-exchange column containing  $\sim 100\text{ g }^{241}\text{Am}$
- Chemical operator injured – acid burns, superficial cuts (face and upper body)
- From 1 to 5 Ci ( $\sim 40 - 200\text{ GBq!}$ ) deposited on injured worker and his clothing



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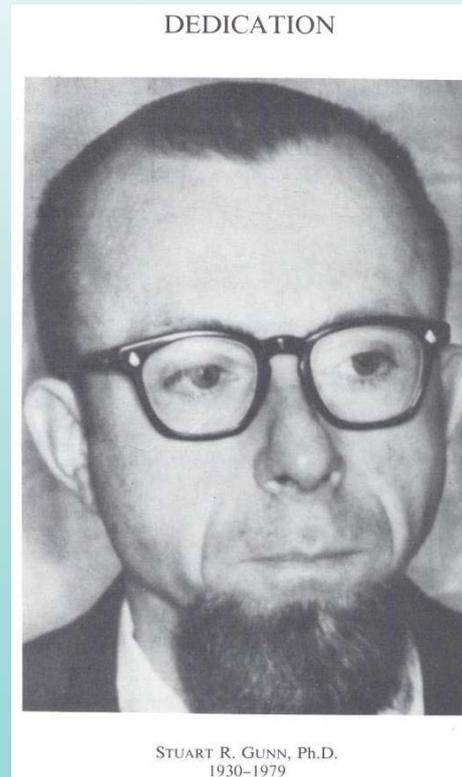
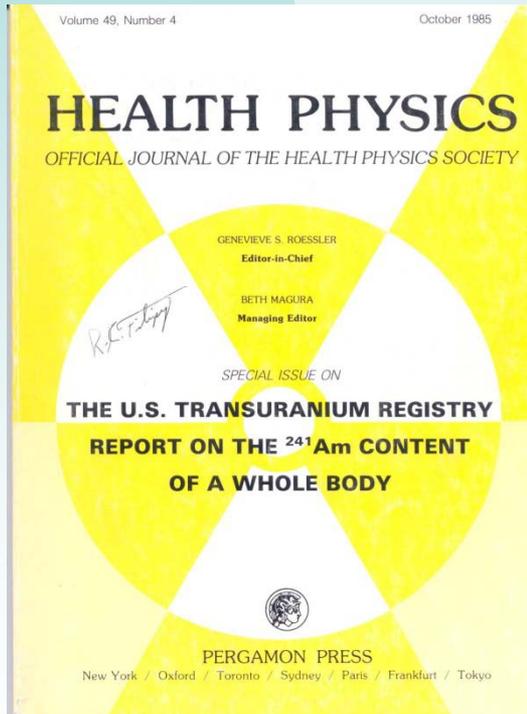
## Papers

Overview and Dosimetry of the Hanford Americium Accident Case R. E. Toohey and R. L. Kathren	310
Postmortem Tissue Contents of $^{241}\text{Am}$ in a Person with a Massive Acute Exposure J. F. McInroy, R. L. Kathren, R. E. Toohey, M. J. Swint, and B. D. Breitenstein, Jr.	318
Bone Surface Concentrations and Dose Rates 11 Years after Massive Accidental Exposure to $^{241}\text{Am}$ R. A. Schlenker, R. E. Toohey, E. G. Thompson, and B. G. Oltman	324
Histopathology and $^{241}\text{Am}$ Microdistribution in Skeletal USTR Case 246 N. D. Priest, A. Freemont, J. A. H. Humphreys, and R. L. Kathren	330
Deterministic Effects of $^{241}\text{Am}$ Exposure in the Hanford Americium Accident Case R. E. Filipy, R. E. Toohey, R. L. Kathren, and S. E. Dietert	338



# USTR Landmark: (ii) 1979 Whole Body Donation

- Donor (radiochemist) worked with unsealed  $^{241}\text{Am}$  source in his ***doctoral research*** (1952-54)
- First indication of intake was detection of  $^{241}\text{Am}$  in urine sample (1958 routine surveillance program) – ***No chelation therapy***
- Contemporary estimate of ***intake*** 0.23 – 1.1  $\mu\text{Ci}$  (~ 8 – 40 kBq!)



# USTUR Milestones

- 1987: USTR and USUR administratively merge into USTUR
- 1992: a 3-y DOE grant to Washington State University for the management and operation of the Registries
- 1992: USTUR expansion - creation of National Human Radiobiological Tissue Repository (NHRTR)
- 1996: the U.S. National Radiobiology Archives (NRA) transferred from PNNL to USTUR
- 2009: Laboratory Facilities moved to Richland, WA
- 2010: NRA collection transferred to Northwestern University



# USTUR Mission

...to follow up **occupationally exposed workers**, from exposure through full lifespan, by studying the biokinetics (uptake, translocation and retention), and tissue dosimetry of the actinides (Pu, Am and U).

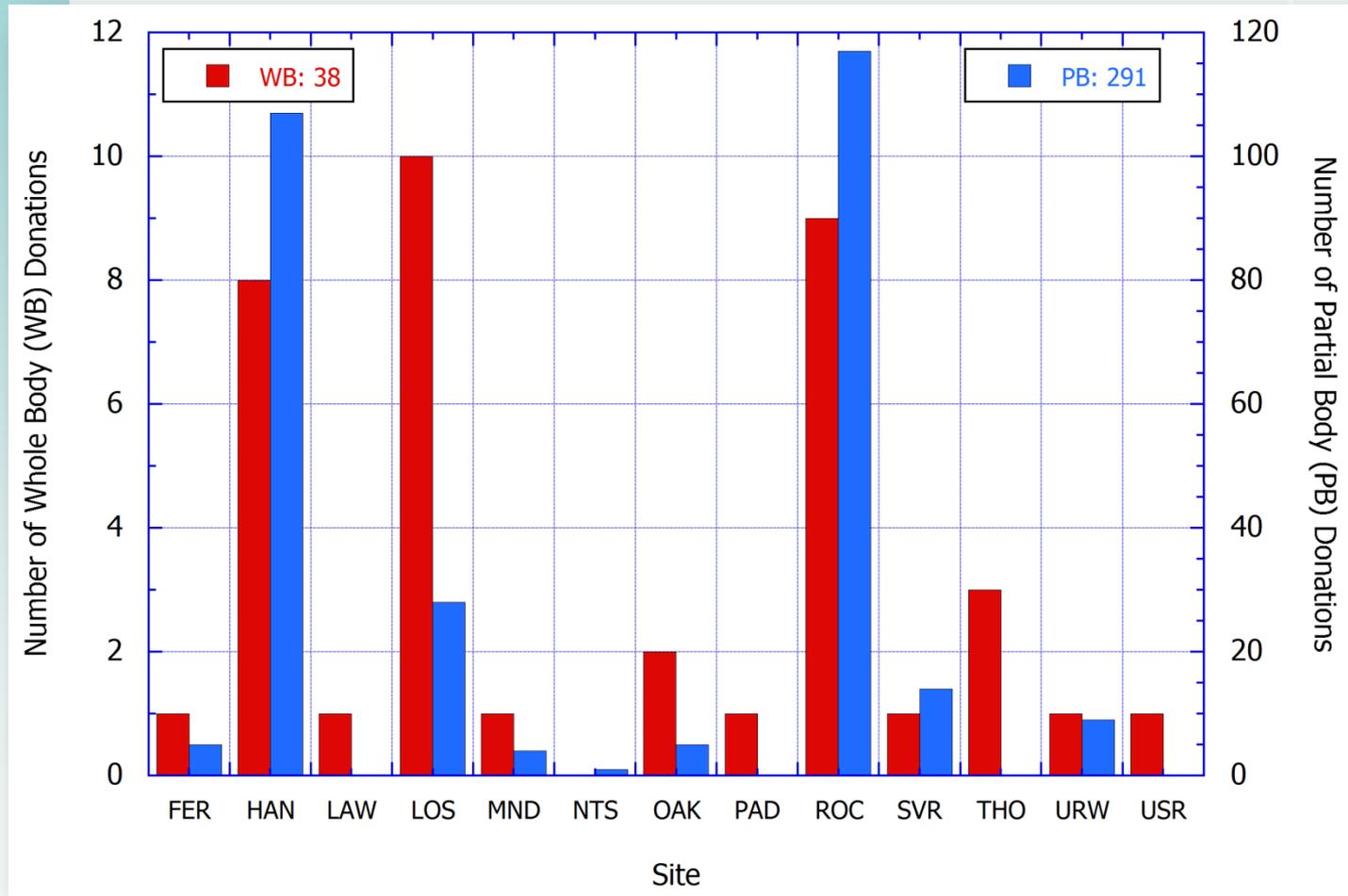
<http://www.ustur.wsu.edu/Mission/index.html>

# USTUR Registrants

...to date, **330 former nuclear workers** mostly from DOE-owned or leased facilities with known history of exposure to actinides **voluntarily donated** their entire bodies (39) or tissues (291) for **scientific research**.



# USTUR Donations by Site



# USTUR vs. General Public

Tissue	$^{239+240}\text{Pu}$ concentration, $\text{Bq kg}^{-1}$				Activity ratio, USTUR:GP	
	<i>e.g.</i> Case 0209		General public (GP)		USTUR:GP	
	Value	$\pm\text{SD}$	Average <sup>†</sup>	$\pm\text{SD}$	Value	$\pm\text{SD}$
<u>Soft Tissues:</u>						
Lung	1.34E+00	3.00E-02	3.75E-03	3.01E-03	356	287
Lymph Node	7.37E+01	2.23E+00	3.11E-03	1.36E-03	23,729	10,412
Liver	1.59E+00	3.47E-02	1.91E-02	3.89E-03	83.3	17.1
Kidney	1.61E-02	1.83E-03	1.48E-03	5.23E-04	10.9	4.1
Spleen	9.45E-02	7.59E-03	2.96E-03		31.9	2.6
<u>Bones:</u>						
Vertebrae	2.04E-01	3.59E-02	6.26E-03	2.72E-03	32.7	15.3
Rib	3.29E-01	5.55E-02	2.70E-03		122.0	20.5
Sternum	2.17E-01	1.54E-02	2.96E-03		73.2	5.2

<sup>†</sup> - from 4 studies in Japan, USA, Germany and Kazakhstan

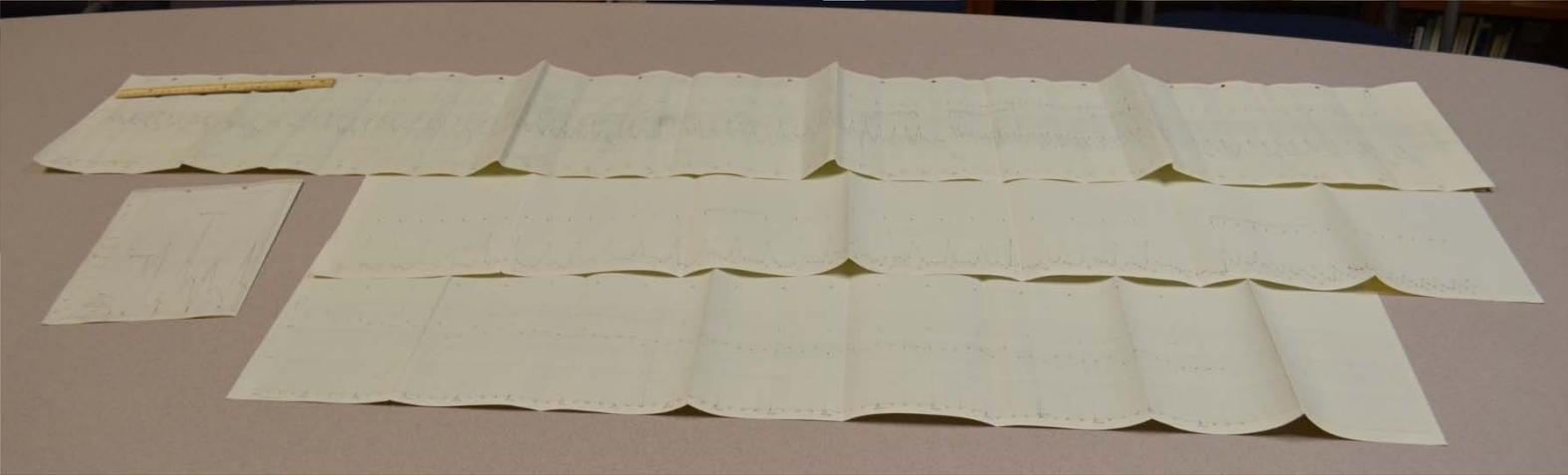
# USTUR Registrant Statistics

<b>Total Active (Living) and Deceased Registrants† : 416</b>	
Living Registrants:	81
Potential Partial-body Donors:	61
Potential Whole-body Donors:	13
Special Studies:	7
Deceased Registrants:	335
Partial-body Donations:	291
Whole-body Donations:	39
Special Studies:	5
Inactive Registrants:	459
<b>Total Number of Registrants:</b>	<b>875</b>

† - as of January 12, 2012



# File Room - 'Gold Mine'



# Health Physics Database

Case No.

Admin | Medical | Rad Chem | Health Physics | Clinical | Pathology | Registrant's Next of Kin

Name	<input type="text" value="Fake Registrant"/>	First Name	<input type="text" value="I"/>
Address	<input type="text" value="123 1st Avenue"/>	<input type="text" value="Anytown"/>	<input type="text" value="WA 99999"/>
Sex	<input type="text" value="M"/>	Birth Date	<input type="text" value="1/1/1910"/>
		Site	<input type="text" value="HAN"/>
SSN	<input type="text" value="not shown"/>	Autopsy Type	<input type="text" value="RO"/>
Reg_No	<input type="text"/>	Telephone	<input type="text" value="not shown"/>
Comment	<p>Comment</p> <p>This record for case 0000 is a fake for documentation purposes only. This memo field contains a synopsis of the program administrator's notes about the registrant. This is where information from the most recent telephone contact can be found.</p>		

Deceased	<input type="text" value="Y"/>
Deceased Date	<input type="text" value="1/1/2000"/>
Renew Date	<input type="text"/>
Med History	<input type="text" value="Y"/>
	<input type="text" value="1/1/2000"/>
Exposure History	<input type="text" value="Y"/>
	<input type="text" value="1/1/2000"/>
HP Completed	<input type="text" value="Y"/>
IH Received	<input type="text"/>
Radchem	<input type="text" value="Y"/>
	<input type="text" value="1/1/2000"/>
Category	<input type="text" value="1"/>
Autopsy Report:	<input type="text" value="Y"/>
Death Certificate::	<input type="text" value="N"/>

# Health Physics Database

Case No.

Admin Medical Rad Chem Health Physics Clinical Pathology Registrant's Next of Kin

N: Case No.

Add Admin Medical Rad Chem Health Physics Clinical Pathology Registrant's Next of Kin

Reg. Comm

MEDIUM	DATE	ISOTOPE	NUM	INEQUALITY	VALUE	UNIT	VOLUME	VOLUME
Urine	12/5/1955	U			0	d/m		
Urine	12/27/1955	U			0	d/m		
Cum. Extrem. E	12/31/1955				0	mrem		
Ann. Shallow	12/31/1955				60	mrem		
Ann. Deep	12/31/1955				0	mrem		
Urine	2/3/1956	U			0	d/m		
Urine	3/5/1956	U			0	d/m		
Urine	4/2/1956	U			0	d/m		
Urine	5/3/1956	U			0	d/m		
Urine	5/28/1956	U			0	d/m		
Urine	7/2/1956	U			0	d/m		
Urine	8/31/1956	U			0	d/m		

Record:  of 132

# Health Physics Database

Case No.

Admin Medical Rad Chem Health Physics Clinical Pathology Registrant's Next of Kin

N: Case No.

Add Admin Medical Rad Chem Health Physics Clinical Pathology Registrant's Next of Kin

Case No.

Reg. Comm

	Lab	Nuclide	Tissue	Residence Time	Type	Autopsy Wt	Wet_wt	Ash_wt	Conc_v
Urin	LANL	Am-241	BRAIN	20.7	C	1400	1215		-0.000
Urin	LANL	Am-241	KIDNEY	20.7	C	310	214		0.0127
Cur	LANL	Am-241	LIVER	20.7	C	1800	1142		0.0095
Ann	LANL	Am-241	LN TRACH BRONC	20.7	C		3.5		0.7831
Ann	LANL	Am-241	LUNG L	20.7	C		443		0.0100
Urin	LANL	Am-241	LUNG R	20.7	C		403		0.01
Urin	LANL	Am-241	SKEL VERT	20.7	C		109		0.0042
Urin	LANL	Am-241	SPINAL CORD	20.7	C		5.6		0.0238
Urin	LANL	Am-241	SPLEEN	20.7	C	180	160		0.0020
Urin	LANL	Am-241	THYROID	20.7	C	20	9.8		0.6
Urin	LANL	Am-241	TUMOR	20.7	C		0.1		
Urin	LANL	Pu-238	BRAIN	20.7	C	1400	1215		0.0002

Record:   1    of 39



# Actinide Tissue Analyses

- $^{239+240}\text{Pu}$ ,  $^{238}\text{Pu}$ ,  $^{239}\text{Pu}$ ,  $^{240}\text{Pu}$ ,  $^{241}\text{Pu}$
- $^{241}\text{Am}$
- $^{234}\text{U}$ ,  $^{235}\text{U}$  and  $^{238}\text{U}$ ,  $^{236}\text{U}$
- $^{232}\text{Th}$



# Analytical Measurement Techniques

- Alpha Spectrometry (AS):  $^{239+240}\text{Pu}$ ,  $^{238}\text{Pu}$ ,  $^{241}\text{Am}$ ,  $^{234}\text{U}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{232}\text{Th}$
- Inductively Coupled Plasma Mass Spectrometry (ICP-MS):  $^{239}\text{Pu}$ ,  $^{240}\text{Pu}$ ,  $^{240}\text{Pu}/^{239}\text{Pu}$ , ( $^{241}\text{Pu}$ ,  $^{241}\text{Am}$ ),  $^{234}\text{U}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{236}\text{U}$
- Kinetic Phosphorescence Analysis (KPA): total U
- Autoradiography (AR): total  $\alpha$ -Pu
- Neutron Activation Analysis (NAA):  $^{228}\text{Th}$ ,  $^{232}\text{Th}$



# USTUR Laboratory Facility



- Total laboratories and warehouse space: 555 m<sup>2</sup>

# Autopsy Room



# Autopsy Room



# National Human Radiobiological Tissue Repository (NHRTR)



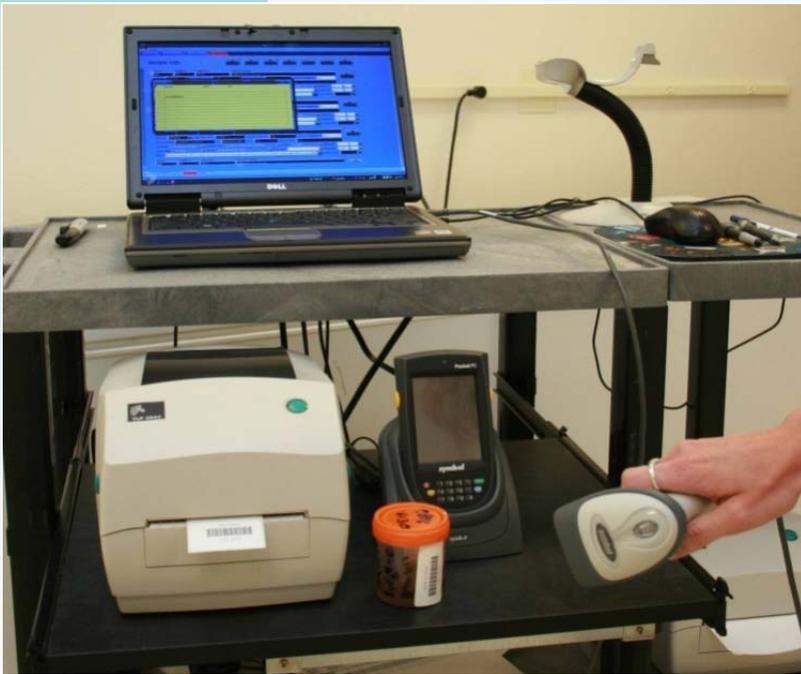
# NHRTR Sample Storage



- Vacuum sealed tissues: at  $-30^{\circ}\text{C}$  or  $-70^{\circ}\text{C}$

- 10 % buffered formalin-fixed tissues

# THEMIS Inventory System



# THEMIS Inventory System



Main Menu Inventory Menu Selection Criteria Container Info

## Container Info

Delete Previous Next Attach

Double-Click Container # to preview Container Receipt

Container # **C11000120** Date Entered **12/13/2011 5:18:50 PM** Entered By **David McLain** Collection **USTUR** Received From **n.a.** Source Class **n.a.**

Facility: **LAB** Room: **AREA 111** Detail: **SHELF 01B**

Carrier: **N.A.** Condition: **GOOD** Container Type: **Cardboard Box: brown**

Notes: 0846 fixed samples

Container Samples

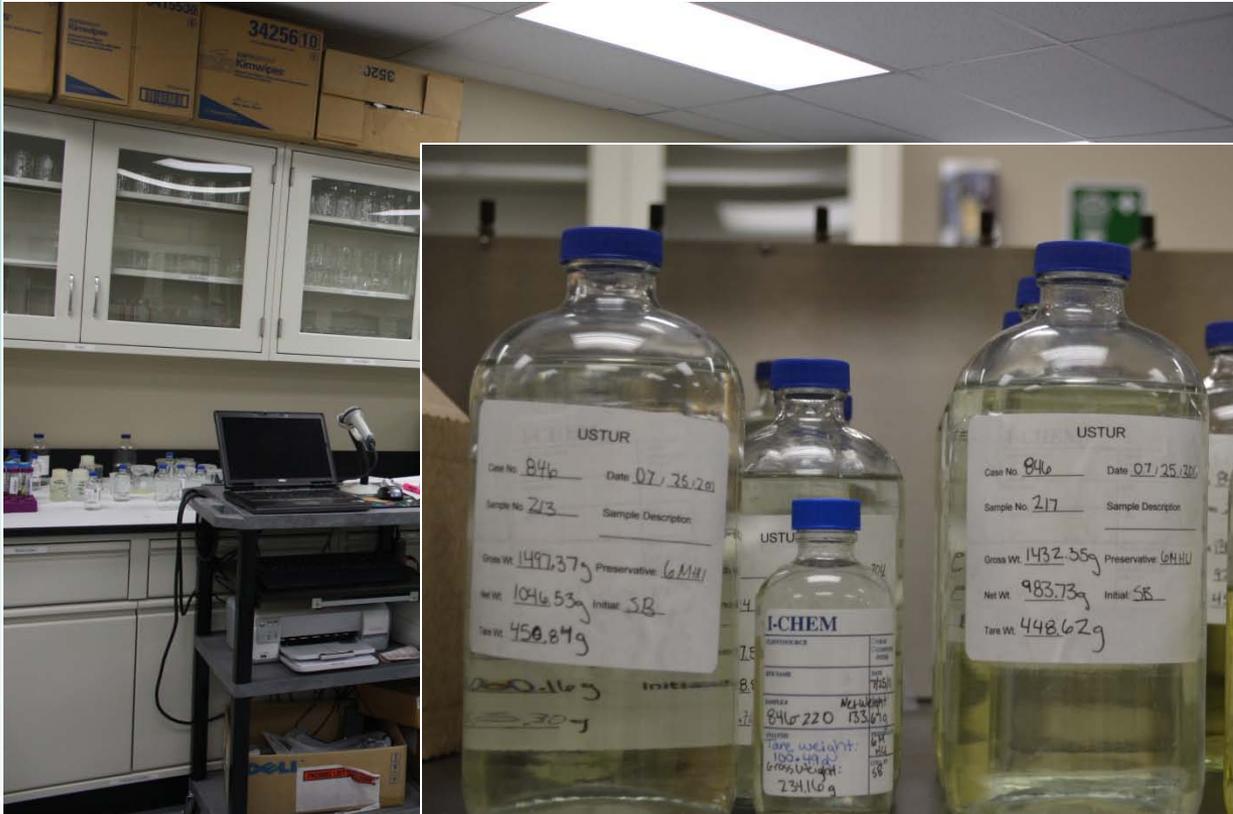
Case #	Sample #	Barcode	Date Received	Received By	Received From	Parent
0846	130	11003404	12/14/2011 11:05:59 AM	David McLain	n.a.	
TissueType: Skeletal: Vertebrae		Tissue: Thoracic 2 - Arch		Sample Type: Bone - Formalin 10% Buffer		
0846	131	11003405	12/14/2011 11:08:22 AM	David McLain	n.a.	
TissueType: Skeletal: Vertebrae		Tissue: Thoracic 2 - Body		Sample Type: Bone - Formalin 10% Buffer		
0846	758	11003406	12/14/2011 11:12:31 AM	David McLain	n.a.	
TissueType: Skeletal: Vertebrae		Tissue: Lumbar 4		Sample Type: Bone - Formalin 10% Buffer		
0846	982	11003408	12/14/2011 11:18:33 AM	David McLain	n.a.	
TissueType: Skin: Buttock		Tissue: Buttock Skin: (L)		Sample Type: Bone - Formalin 10% Buffer		
0846	992	11003410	12/14/2011 11:27:40 AM	David McLain	n.a.	
TissueType: Muscle: Buttock		Tissue: Buttock: L		Sample Type: Tissue - Formalin 10% Buffer		

cord: 1 of 1 Filtered Search

# Radiochemistry Laboratory



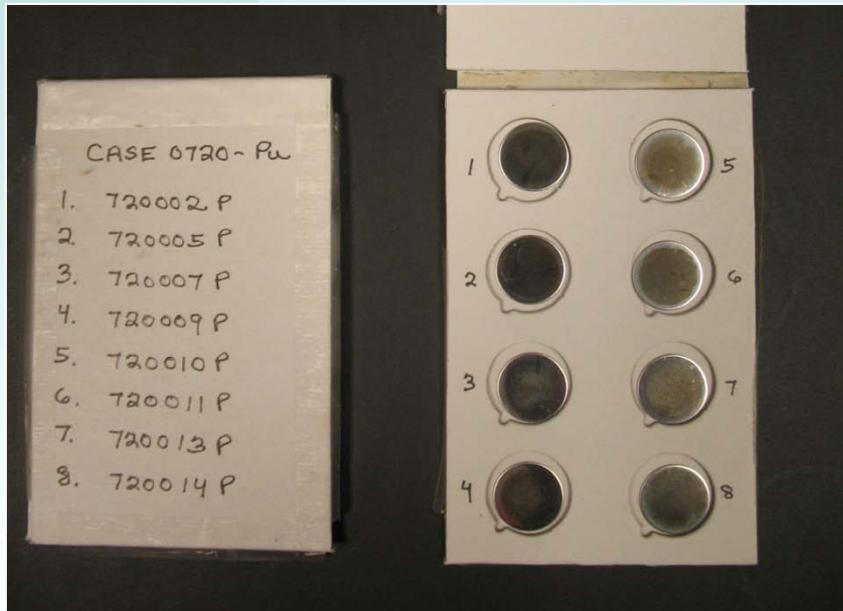
# Radiochemistry Laboratory



- Dissolved in 6M HCl tissue samples ready for analyses

# Counting Room

- ORTEC alpha spectrometric system
- Electrodeposited  $\alpha$ -sources (planchets)



# Storage Area: Acid Solutions



10,000+ dissolved tissue samples are available for future research

# USTUR: <http://www.ustur.wsu.edu/>

## De-identified Data:

- Case Narratives
- Radiochemistry
- Health Physics
- Pathology

Washington State University College of Pharmacy  
United States Transuranium & Uranium Registries

Washington State University  
World Class. Face to Face.

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USTUR  
De-identified Data  
Case Narratives  
Radiochemistry  
Health Physics  
Pathology  
NHRTR  
National Human Radiobiological Tissue Repository  
NRA  
National Radiobiology Archives  
Links

Washington State University  
United States Transuranium & Uranium Registries

Washington State University College of Pharmacy  
United States Transuranium & Uranium Registries

USTUR Mission About Us Registrant Login

LEARNING FROM PLUTONIUM & URANIUM WORKERS

Dr. Anthony James retires and Dr. Sergei Tolmachev is promoted to USTUR director.

Read More »

Dr. Tolmachev Dr. James

Advisory Committee Policy/Procedures Faculty/Staff  
Graduate Projects Conferences/Symposia Publications

» View Dr. James presentation to NIAID/NIH entitled "What We Should Learn from Lifetime Follow-up of U.S. Former Plutonium Workers".

» Run streaming video presentation "USTUR: The Fifth Decade of Worker Follow-up"

» WSU/USTUR receives commendation from DOE's Chief Health Safety and Security Officer

» 2011 Scientific Advisory Committee Meeting

USTUR Lab a Unique Facility for WSU Students

WSU's Office of Marketing and Creative Services identified the USTUR Laboratory as a unique facility that is available to the students at WSU. We expect to be included on the College Board website in a few months.

» Accessing the College Board website

Google Custom Search

Search

Visitors

2,537	55
166	38
148	35
102	32
97	27
75	25

You: Newtest: (since May 17, 2010)

Public Outreach

» USTUR in the Community

USTUR in the News

The USTUR was featured in a front-page Tri-City Herald article on Sunday, October 24, 2010.

» Read the article online

Sabbatical Researcher to Study Ca-DTPA Therapy at the USTUR Research Center

Dr. Breustedt of the Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany - will be modeling the effects of...

# Other Available for Research Materials

- Thorotrast Cases – acid solutions and frozen tissues
- Los Alamos ‘Environmental Study’ – acid solutions
- Radium Dial Painters – dry bones and frozen tissues
- WHO
- Pu injections study – dry and plastic-embedded bones



# Other Available for Research Materials

- Thorotrast Cases – acid solutions and frozen tissues
- Los Alamos ‘Environmental Study’ – acid solutions
- Radium D
- WHO
- Pu injectio



# Active Collaborations

- Pacific Northwest National Laboratory, Low Dose Program
- Idaho State University, Health Physics Program
- Joint Center of Pathology, Division of Biophysical Toxicology
- Laval University, Department of Chemistry
- Health Canada, Radiation Protection Section
- EURADOS, Internal Dosimetry Group (WG-7)
- Karlsruhe Institute of Technology, In Vivo Counting Facility
- Gent University, Department of Analytical Chemistry



# Active Collaborations

- Pacific Northwest National Laboratory, Low Dose Program
- Idaho State University
- Joint Center of Nuclear Energy, Beijing
- Laval University, Quebec
- Health Canada, Ottawa
- EURADOS, International
- Karlsruhe Institute of Technology
- Gent University, Belgium



**Thank you for your  
attention!**



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