



World Class. Face to Face.

2011 USTUR
Scientific Advisory Committee Meeting
July 19 - 20, 2011 On-line Meeting

Research & Operation - Plan for FY2012 -

Sergei Y. Tolmachev, PhD
USTUR Director

Associate Research Professor, College of
Pharmacy, Washington State University

stolmachev@tricity.wsu.edu



***“Learning from Plutonium and Uranium
Workers”***

Research & Operation Concept

USTUR Research Center (Intramural Project)

Sergei Y Tolmachev, PhD, Director, *Associate Research Professor*

Radiochemistry/Mass Spectrometry

Sergei Y Tolmachev, PhD

- Expeditious Analysis of Donated Tissues
- Application of New Actinide Separation Techniques
- Application of Advanced Measurement Techniques

Tissue Repository & Databases

Stacey L McCord, MS

National Human
Radiobiological Tissue
Repository (NHRTR)

Case Narratives, Health
Physics, Radiochemistry,
Pathology

Extramural Projects/Collaborations

- WSU, Pullman (Np, Cm)
- NAU, Flagstaff (U, Pu, Am)
- AREVA, Richland (U; ICP-MS)
- HC, Ottawa (U, Pu, Monte C)
- UMB, Norway (U, Pu, Am)
- U. Ghent, Belgium (Zr; Synchrotron XRF)
- RJL, Richland (Asbestos; SEM)
- U. Laval, Quebec (U, Be)
- KIT, Germany (Actinides)
- JPC, Silver Sprg (DU, toxicology)

PNNL/Radiation Biology
William F Morgan, *Director*
Christopher E Nielsen, *WSU MS Student*
Additional PNNL Staff/Students

Sabbatical Researcher
Bastian Breustedt, PhD, KIT

**WSU, Tri-Cities
Nursing Program**
Phyllis Morris, *Director*

ISU Health Physics
Richard R. Brey, *Director*

EURADOS/WG-7
Maria Lopez, *Chair*

EU/SOLO/HPA
John Harrison, *Coordinator*

“Work for Others”

Key

WSU – Washington State University
NAU – Northern Arizona University
AREVA – AREVA NP Inc
HC – Health Canada
UMB – Norwegian University of Life Sciences

JPC – Joint Pathology Center
RJL – RJ Lee Solutions
KIT – Karlsruhe Institute of Technology
PNNL – Pacific Northwest National Laboratory
ISU – Idaho State University

EURADOS/WG-7 – European Radiation Dosimetry Working Group 7
EU – Euratom
SOLO – Epidemiological Studies of Exposed Southern Urals Populations
HPA – Health Protection Agency (UK)

USTUR Core Functions

- Accept Registrants' Tissue Donations
- Analyze Donated Tissues Expeditiously
- Populate a Searchable, Comprehensive Database of All Case Data
- Publish Results



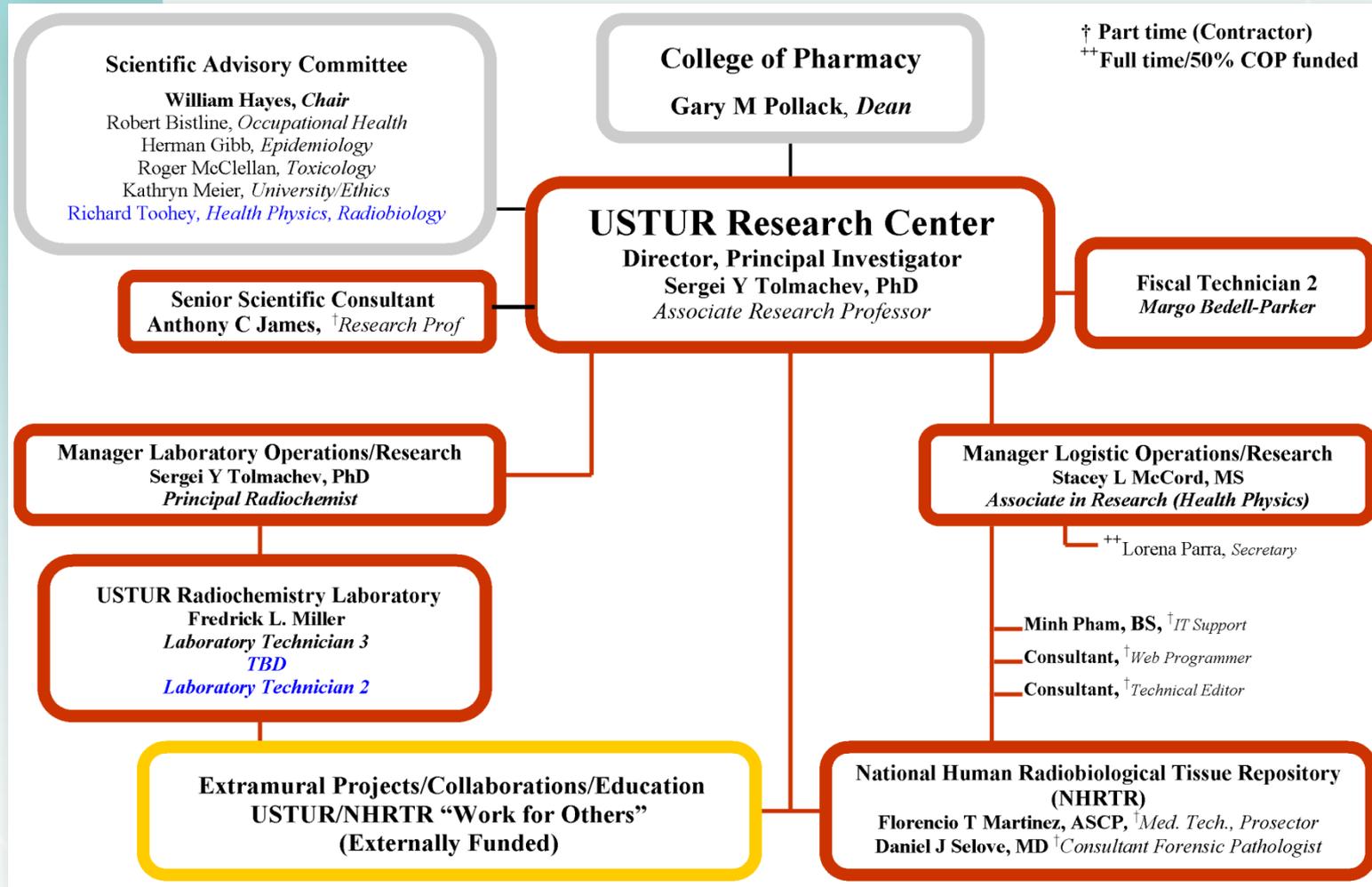
FY2012 Budget

FY2012 (October 1, 2011 – September 31, 2012) is the 2nd year of a 5-year DOE grant to “Manage and the operate U.S. Transuranium and Uranium Registries”

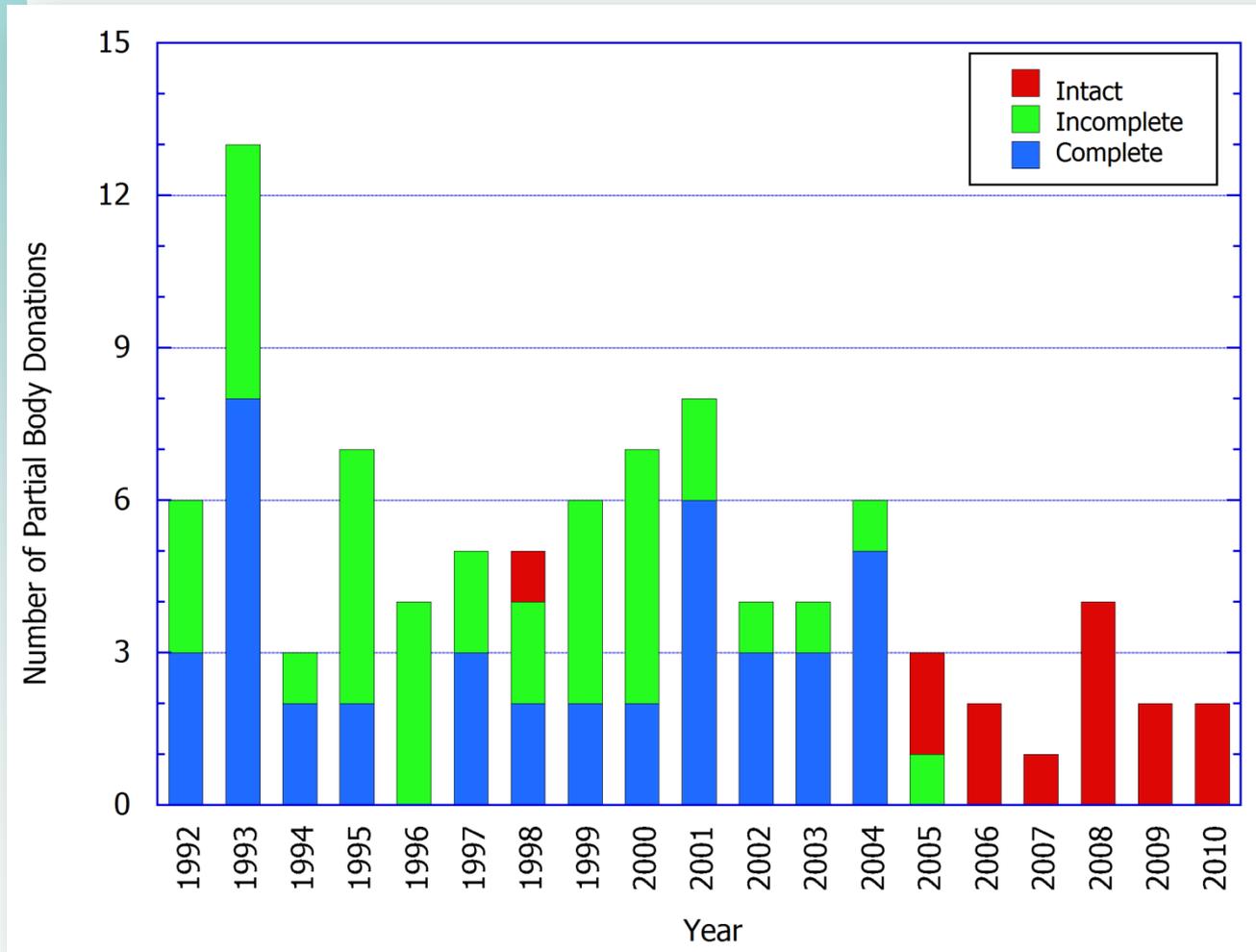
Requested budget for FY12:	\$1,319,770
Expected budget for FY12:	\$900,000



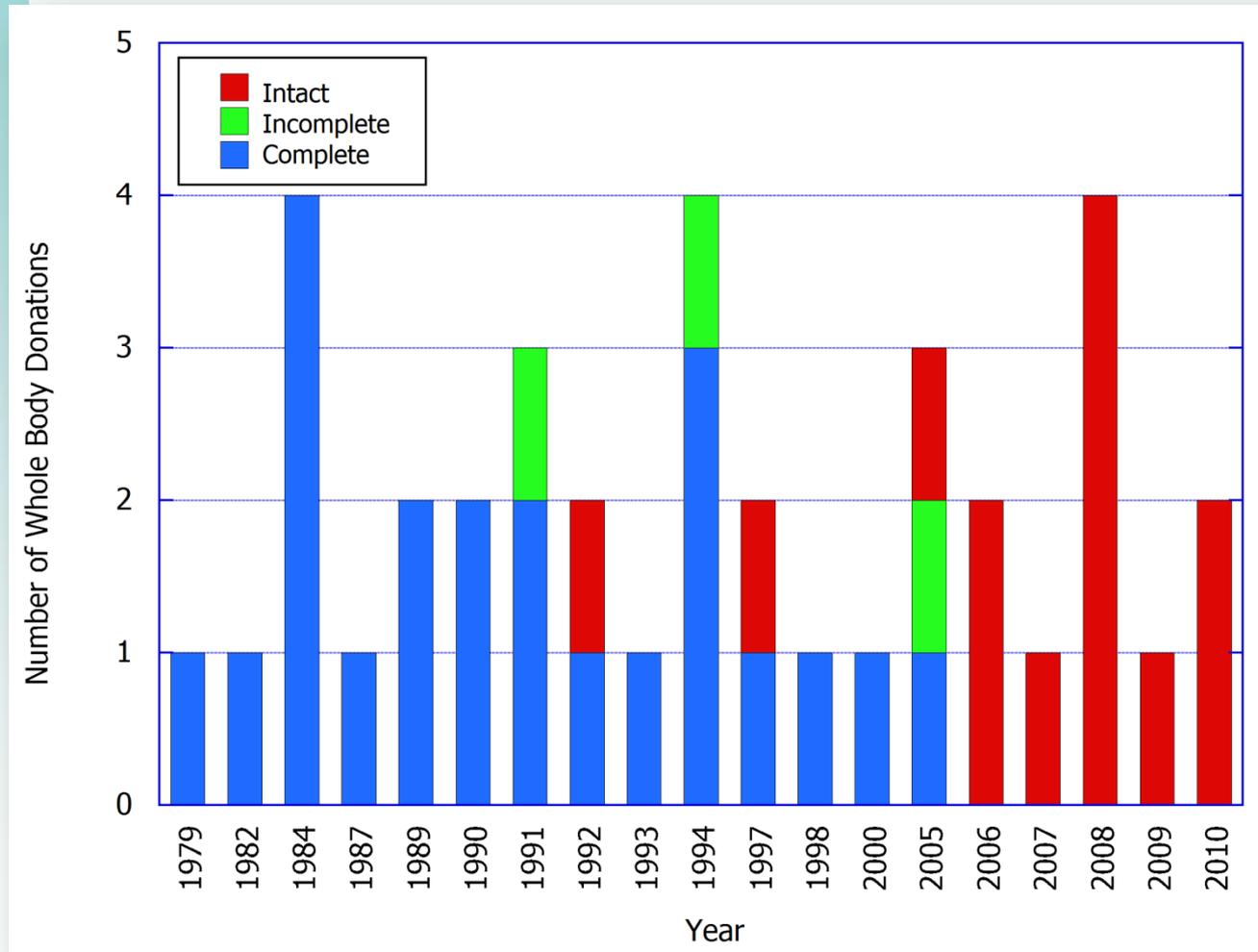
Organization Structure



Radiochemistry Status – Partial Bodies



Radiochemistry Status – Whole Bodies



Status of Intact Cases

Type of Donation	# of Cases for Primary Exposure Nuclides		
	^{241}Am	^{239}Pu	^{238}U
Partial Body	----	13	1
Whole Body	1	7	3

Type of Donation	# of Samples for Primary Exposure Nuclides		
	^{241}Am	^{239}Pu	^{238}U
Partial Body	----	195	15
Whole Body	90	630	270

Total: 1200 tissue samples



Priority: Elimination of Intact Cases

Survey analysis – analysis of 10 soft tissue and 5 bone samples to obtain key initial scientific information

Type of Donation	# 'Surveys' for Primary Exposure Nuclides		
	^{241}Am	^{239}Pu	^{238}U
Partial Body	----	195	15
Whole Body	15	105	45

Total: 370 tissue samples



Sample Analysis

- Tissue sample dissection
- Sample dissolution
- Actinide separation
- Measurements (α -spectrometry)
- QA/QC of results
- Reporting results



Expedite Sample Dissolution

- Drying: conventional oven vs microwave assisted
- Ashing: 500 °C vs 500°C with N₂-purging or 800 °C
- Dissolution: hot plate vs hot-block or microwave digestion



Microwave Digestion Equipment



Rotor 1DRY for Multiwave 3000



UltraCLAVE :
large samples
digestion

Expedite Measurements

Alpha spectrometry (AS)

VS

Inductively Coupled Plasma Mass Spectrometry (ICP-MS)



Benefits of ICP-MS

- Rapid analysis: 10 min
- Multi-elemental (isotopic) analysis
- Sensitive: 10^{-12} g g⁻¹ (actinides)
- Precise: 1 – 3 %
- Simple or none (*'dilute and shoot'*) sample preparation
- Inexpensive analysis



ICP-MS at USTUR

Scheduled for FY2013 at a 'dream budget' of 1.3M\$:

- Purchasing ICP-MS instrument (~180 k\$)
- Hiring new staff



ICP-MS in FY2012

Access to ICP-MS

- Extramural collaborations
- Commercial laboratories

ICP-MS for U analysis

- Case 1060 (collaboration with AREVA)
- Case 1031 (collaboration with Health Canada)
- DU cases (Armed Forces Institute of Pathology)
- Commercial laboratories \$50 - \$90 per sample (60 'surveys': \$3,000 - \$5,400)

Apply for external funding



Radiochemistry: FY2012 Tasks

- Obtaining full license for RAM usage
- Hiring new radiochemistry staff
- Finalizing development and publishing of microwave-assisted procedures (SOPs) for tissue samples dissolution
- Method (SOP) update for electrodeposition
- Analysis of 300 - 400 tissue samples for ^{241}Am and $^{238,239+240}\text{Pu}$ with AS
- LIMS in radiochemistry laboratory



THEMIS to LIMS

Updating THEMIS inventory system to fully customized a Laboratory Information Management System (LIMS)

Major benefits

- Tracking sample weight and physical form changes
- Tracking history of sample weight and status changes
- Flexibility when adding future samples
- Elimination of intermediate radiochemistry analysis forms
- Integration with alpha spectrometric software



Health Physics Database Population

Continuing the expansion of USTUR HP database

- Entering data on Case 0846
- Entering extra 3 – 5 cases



Extramural Collaborations

Continuing current collaborations

- PNNL: Pu-nitrate study
- Laval University: Be determination
- Health Canada: U determination
- EURADOS WG7: Chelation therapy and Monte Carlo modeling

Establishing new collaborations

- AFIP: Depleted Uranium (DU)
- KIT: Actinide distribution study/analysis
- AREVA: U analysis and dosimetry
- RJLee: asbestos characterization in lung



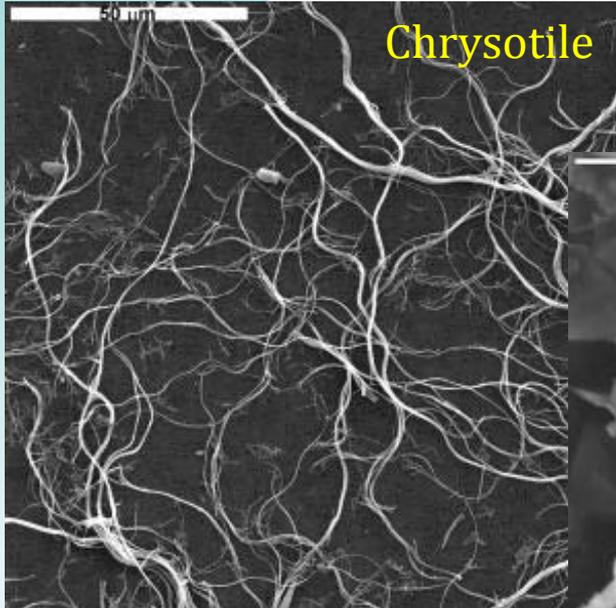
Type of Asbestos

- Actinolite $\text{Ca}_2\text{Fe}_5[\text{Si}_8\text{O}_{22}](\text{OH})_2$
- Tremolite $\text{Ca}_2\text{Mg}_5[\text{Si}_8\text{O}_{22}](\text{OH})_2$
- Amosite (brown asbestos) $\text{Fe}_7[\text{Si}_8\text{O}_{22}](\text{OH})_2$
- Anthophyllite $\text{Mg}_7[\text{Si}_8\text{O}_{22}](\text{OH})_2$
- Crocidolite (blue asbestos) $\text{Na}_2\text{Fe}_5[\text{Si}_8\text{O}_{22}](\text{OH})_2$
- Chrysotile (white asbestos) $\text{Mg}_3[\text{Si}_2\text{O}_5](\text{OH})_4$

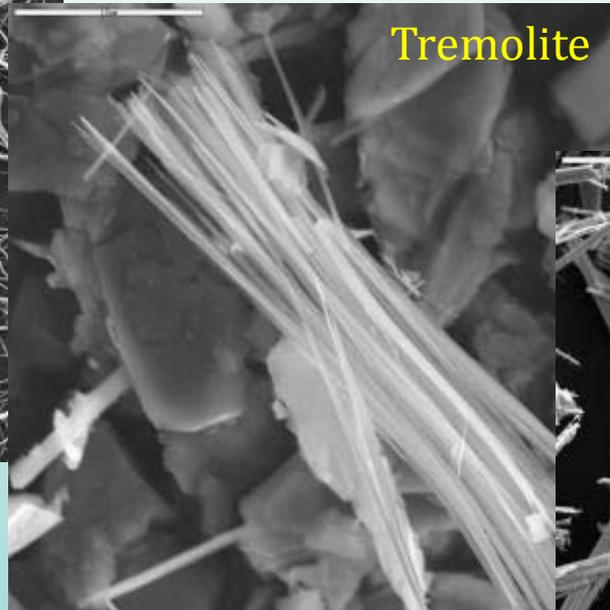


Asbestos Fibers

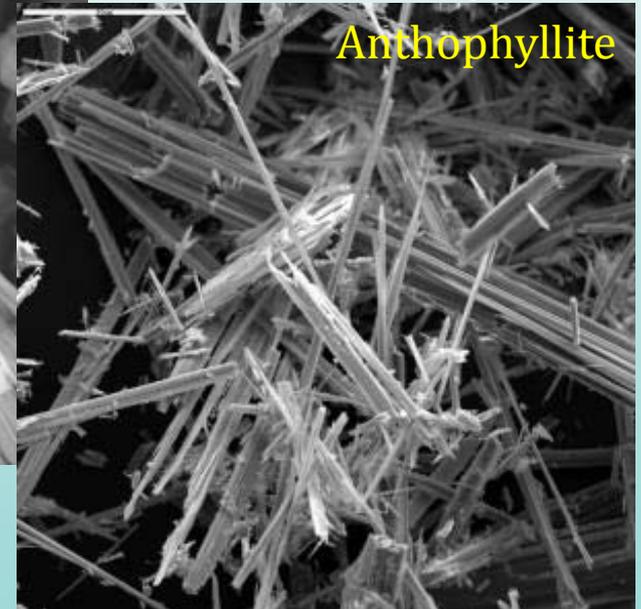
Chrysotile fibers form bundles of very fine fibrils.



Tremolite usually forms smaller fiber bundles than the other asbestos minerals.



Anthophyllite forms either straight fibers that split in the ends, or fiber bundles.



Asbestos and Mesothelioma

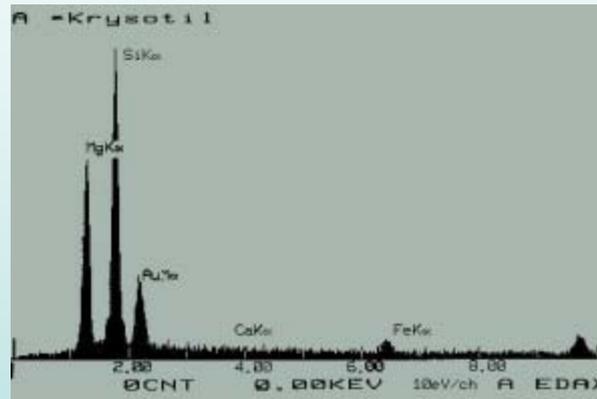
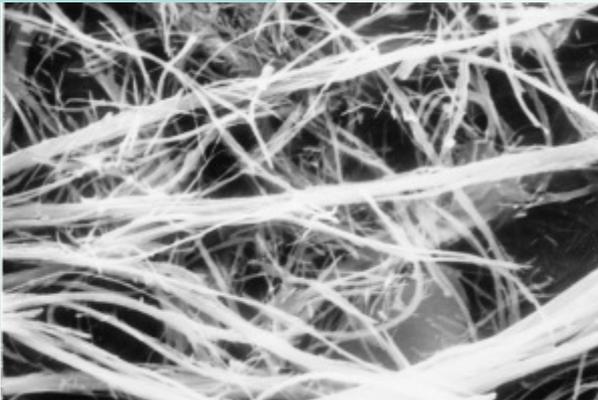
- Chrysotile (white asbestos) 1
- Amosite (brown asbestos) 100×
- Crocidolite (blue asbestos) 500×
- Actinolite
- Anthophyllite
- Tremolite



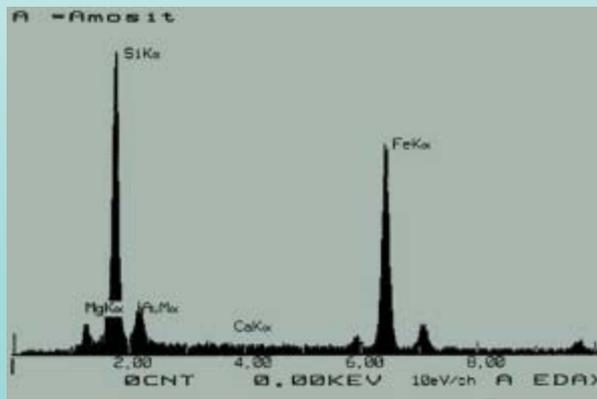
SEM/EDS for Asbestos Characterization

SEM - Scanning Electron Microscopy

EDS - Energy-Dispersive X-Ray Spectroscopy



***Chrysotile** is rich in magnesium (Mg) but has a low content of iron (Fe).*



***Amosite** is an iron-rich amphibole with a low magnesium content.*

Importance to USTUR

- Radiation-asbestos synergetic effect on mesothelioma?

An Evaluation of Causes of Death in the United States Transuranium and Uranium Registries

*Herman Gibb, Sumitha Nagarajan, Keri Fulcher, Stacey McCord,
Anthony James, Sergei Tolmachev*





THANK YOU

