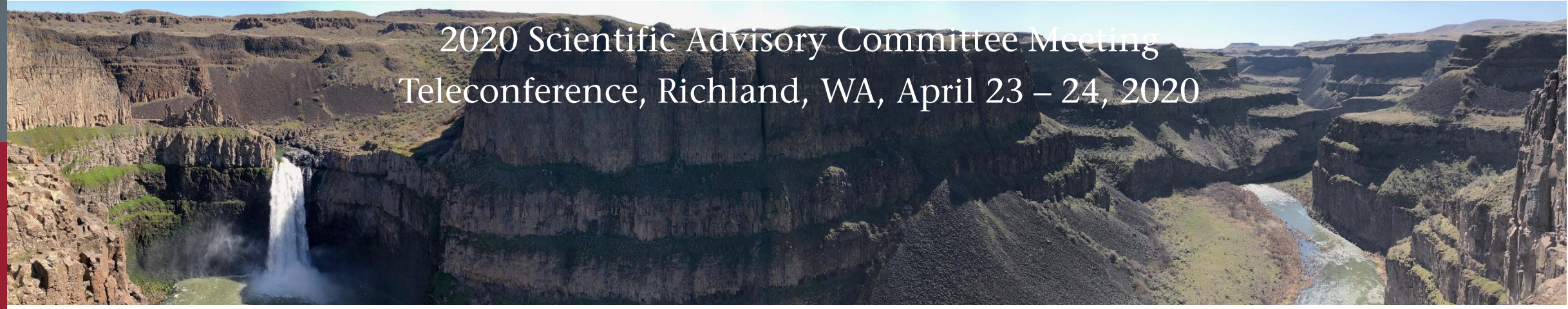

2019 SAC Recommendations and Overview

Sergei Y. Tolmachev, USTUR Director
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Washington State University

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www.ustur.wsu.edu

"Learning from Plutonium and Uranium Workers"

College of Pharmacy and Pharmaceutical Sciences
Washington State University

2019 SAC's Comments and Recommendations

- Following the 2019 Annual Meeting, the SAC made 5 comments and 8 specific recommendations

2019 SAC Comments

i. Pleased with progress in demonstrating value to DOE officials through publication of papers and presentations. Continued progress and expansion are encouraged

ii. Pleased with the development of the confidentiality policy

iii. The USTUR has shown significant effort toward identifying and developing collaboration opportunities with outsiders

iv. DQO needs to be completed with improved links to MQOs

v. Maintaining a high degree of sensitivity for release of samples and use of data is encouraged

2019 SAC Recommendations (I)

1. Continue and increase publication of papers and presentations and work toward improving credentials of the staff
2. Increase interactions with WSU at its several campuses including participation in seminars and lectures. Gain recognition as research professors by units beyond the COP [CPPS] to develop collaborative research projects and student involvement
3. Complete Quality Assurance Plan/Data Quality Objectives Document
4. Complete implementation of an initiative for collecting bioassay monitoring data from living Registrants

2019 SAC Recommendations (II)

5. Develop specific objectives for the goals presented in the 5-y and 10-y plans and establish benchmark completion dates for stated goals
6. Include in the operating procedure for control, release, and potential return of data and tissues a developed policy that provides limitations on use/reuse
7. Review and update policies and procedures for pre-publication review with collaborators to make sure that the USTUR has active involvement in the review and approval of publications and acknowledgement as a co-author
8. Develop written guidelines for managing potential interaction with outside worker advocates representing deceased Registrants

Recommendation #1

Continue and increase publication of papers and presentations and work toward improving credentials of the staff

HPJ Special Issue: 117 (2) 2019

The United States Transuranium and Uranium Registries (USTUR): Five Decade Follow-up of Plutonium and Uranium Workers

- Editorial note
- Nine scientific manuscripts
- Forum article

Journal and Conference Publications

Journal Manuscripts

1. Dumit S, Avtandilashvili M, McComish SL, Strom DJ, Tabatadze G, Tolmachev SY. Validation of a system of models for plutonium decorporation therapy. Radiation and Environmental Biophysics 58: 227–235; 2019
2. Dumit S, Avtandilashvili M, Strom DJ, McComish SL, Tabatadze G, Tolmachev SY. Improved modeling of plutonium-DTPA decorporation. Radiation Research 191: 201–210; 2019

Conference Proceedings

1. Avtandilashvili M, McComish SL, Tolmachev SY. The United States Transuranium and Uranium Registries: Fifty-year history of actinide biokinetic research. BIO Web Conferences 14: 05001; 2019
2. Avtandilashvili M, Tolmachev SY. Biokinetics of soluble plutonium after wound injury treated with Ca-DTPA. BIO Web Conferences 14: 02008; 2019
3. Leggett RW, Tolmachev SY, Boice JD. Case studies in brain dosimetry for internal emitters: Is more detail needed for epidemiology? BIO Web Conferences 14: 03008; 2019
4. Tolmachev SY, McComish SL, Avtandilashvili M. USTUR: Expanding horizons for actinide biokinetics and dosimetry. BIO Web Conferences 14: 08003; 2019

Conference Abstracts

1. Avtandilashvili M, Tolmachev SY. Macrodistribution of plutonium among dosimetric compartments of the human respiratory tract. Health Physics 117 (Suppl to 6): 20–21; 2019
2. McComish SL, Zhou JY, Martinez F, Tolmachev SY. Limitations of cause of death data among autopsied population in the United States Transuranium and Uranium Registries. Health Physics 117 (Suppl to 6): 62; 2019
3. Strom DJ, Dumit S, Avtandilashvili M, McComish SL, Tabatadze G, Tolmachev SY. Cylindrical representations of recycling biokinetic models. Health Physics 117 (Suppl to 6): 78; 2019
4. Tolmachev SY, Leggett RW, Avtandilashvili M, Boice JD. Case studies in brain dosimetry for internally deposited radionuclides Health Physics 117 (Suppl to 6): 80–81; 2019
5. Tolmachev SY, Avtandilashvili M, Kathren RL. Uranium content, distribution, and biokinetics in human body. 74th Northwest Regional Meeting of the American Chemical Society (NORM2019): 211–212; 2019
6. Tolmachev SY, Paunesku T, Woloschak GE, Boice JD, Jr. From autopsies to synchrotrons to mars – why the brain matters. 65th Annual Meeting of the Radiation Research Society: ePage; 2019
7. Tolmachev SY, Leggett RW, Avtandilashvili M, Boice JD. Plutonium in human brain: Is more biokinetic detail needed for dosimetry? 3rd International Conference on Dosimetry and its Applications (ICDA-3): e01.01; 2019
8. Wegge D, Tolmachev SY, Brockman JD. Determination of U, Pu, and Am in human keratinous samples using extraction chromatography and ICP-MS. The Great Scientific Exchange (SciX2019): ePage; 2019

Editorial Publications

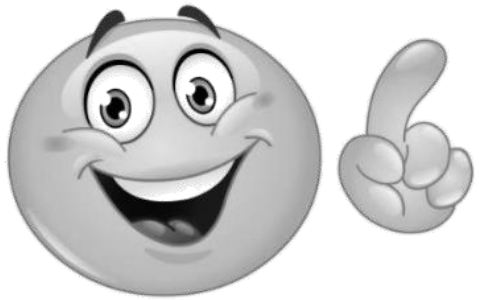
- Dumit S, Breustedt B, Avtandilashvili M, McComish SL, Strom DJ, Tabatadze G, Tolmachev SY. Response to the letter to the editor, 'Comments on "Improved modeling of plutonium-DTPA decorporation" (Radiat Res 2019; 191: 201–210) by Gremy and Miccoli'. Radiation Research 192: 682–683; 2019
- Kathren RL, Tolmachev SY. The US Transuranium and Uranium Registries (USTUR): A five-decade follow-up of plutonium and uranium workers: Erratum. Health Physics 117 (3): 337; 2019

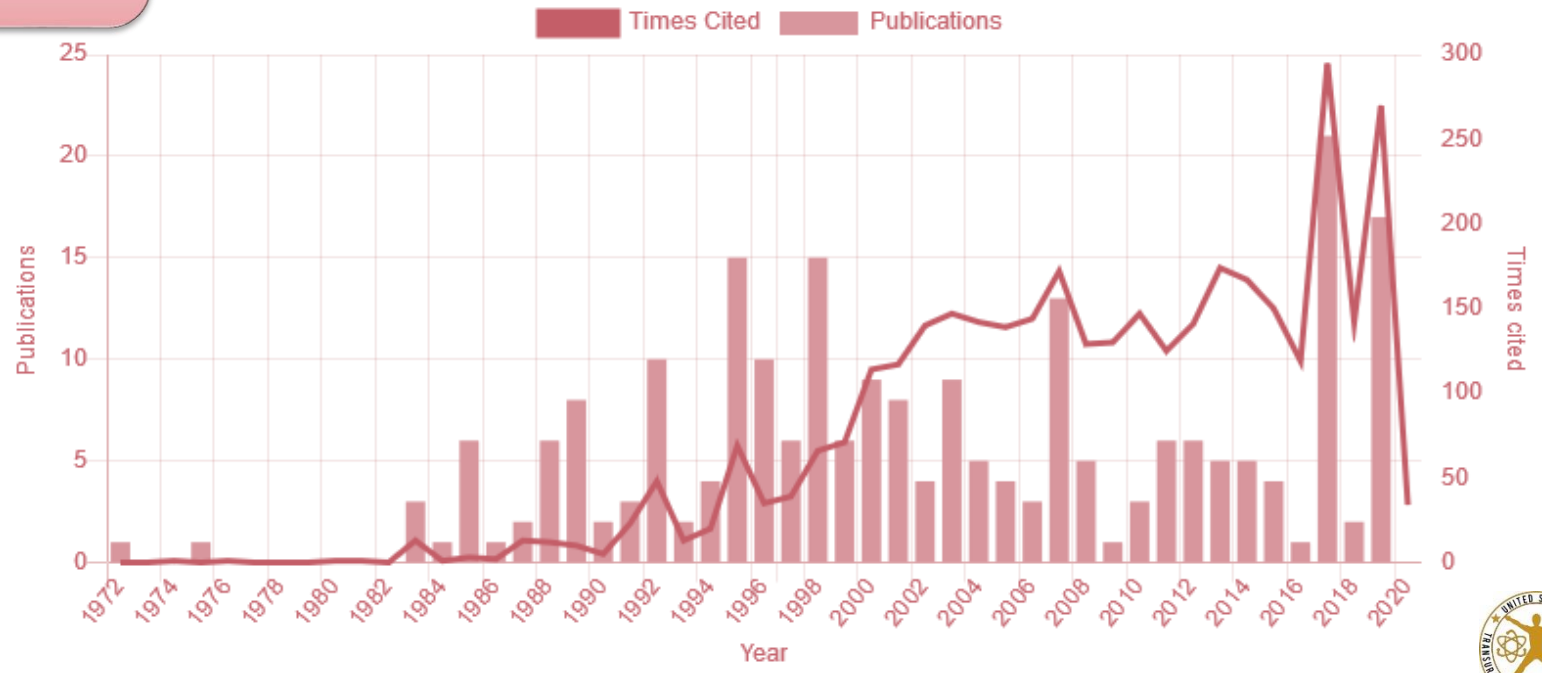
Publication Summary

11 journal manuscripts	8 abstracts
4 conference proceedings	2 editorials

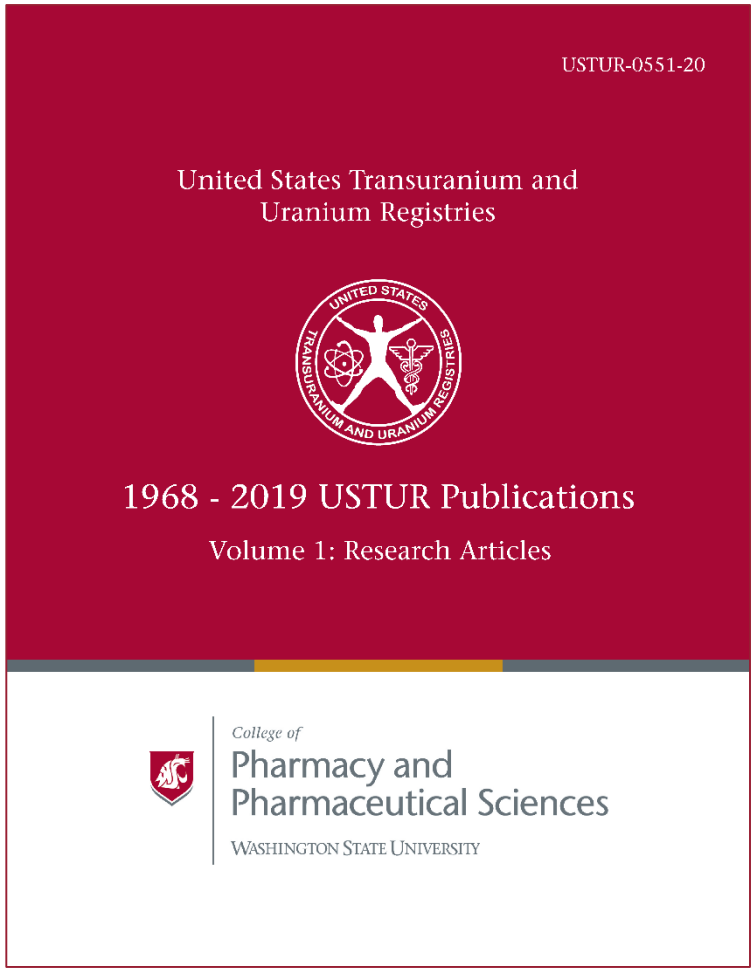
25

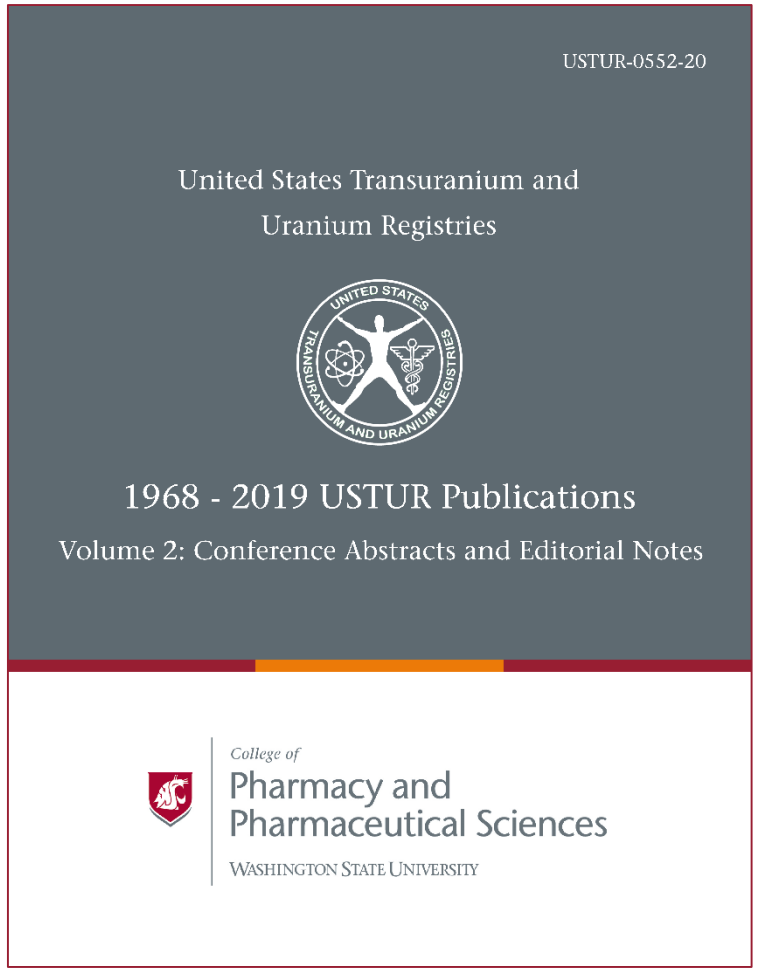
- Publications: 233
- Times cited: 3,585
- Cited in 2019: 270
- *h*-index: 31





50th Anniversary: *1968–2019 eBook of Abstracts*





1968–2019 USTUR Publications: Journal and Proceeding

PREDECISIONAL DRAFT 2020-04-20 — Do Not Distribute – for internal use only

JOURNAL PUBLICATIONS

1972

Norcross JA, Newton CEJ. *US Transuranium Registry: A progress report.*
Health Physics 22 (6): 887–890; 1972.

During the summer of 1968, the Atomic Energy Commission authorized the establishment of the U.S. Transuranium Registry. The Registry is part of the organizational structure of the Hanford Environmental Health Foundation and is, in essence, a repository for all pertinent information available to identify any radiation hazard to the worker that may exist from exposure to transuranium elements. The major AEC contractors and a few of the licensees using plutonium and other transuranium elements have agreed to endorse and recommend that their affected employees support this program. Cooperation with the Registry is individually voluntary and includes release of medical and health physics data, and permission for postmortem analysis of certain organs.

http://doi.org/10.1097/00004032-197206000-00054

1975

Norwood WD, Newton CEJ. *US Transuranium Registry study of 30 autopsies.*
Health Physics 28 (6): 669–676; 1975.

To aid in the evaluation of biological effects of transuranium radioisotopes in people, some 850 transuranium workers have now agreed to allow autopsies. Many more are expected to cooperate. This paper discusses results of the first 30 autopsies reported to the Registry. Where the estimated systemic body burden of plutonium based on urinalysis was greater than 5% of the permissible (0.04 μCi), this estimate was higher than that obtained by laboratory analysis of whole organs or parts of organs in a large majority of cases. For depositions less than 5% maximum permissible body burden, there was considerable variation depending upon individual AEC contractor reporting practices. Nonuniformity within organs was sometimes great, so whole organs (such as lungs, liver, kidneys, spleen, etc.) were usually obtained in the last 30 cases. In relatively high deposition cases (>0.02 μCi), as many as 40 organs were sampled in an effort to determine validity of applying animal data to man. The number of times that various organs had the highest concentration is tabulated.

http://doi.org/10.1097/00004032-197506000-00002

1983

Breitenstein BD. *1976 Hanford americium exposure incident - medical management and chelation therapy.*
Health Physics 44 (4): 855–866; 1983.

A chronological account is given of the general medical management of a patient involved in an americium exposure incident. http://doi.org/10.1097/00004032-198310000-00003

Page | 1

234 publications

147 publications

Recommendation #2

Increase interactions with WSU at its several campuses including participation in seminars and lectures. Gain recognition as research professors by units beyond the College of Pharmacy and Pharmaceutical Sciences to develop collaborative research projects and student involvement

USTUR – WSU Pullman

- Visit to Nuclear Science Center at WSU in Pullman
- Seminar for Analytical, Environmental, Radiochemical, and Inorganic Chemistry (AER-I) tracks at the Department of Chemistry in Pullman
- Attending AER-I seminars via teleconference
- Serving at Radiation Safety Committee

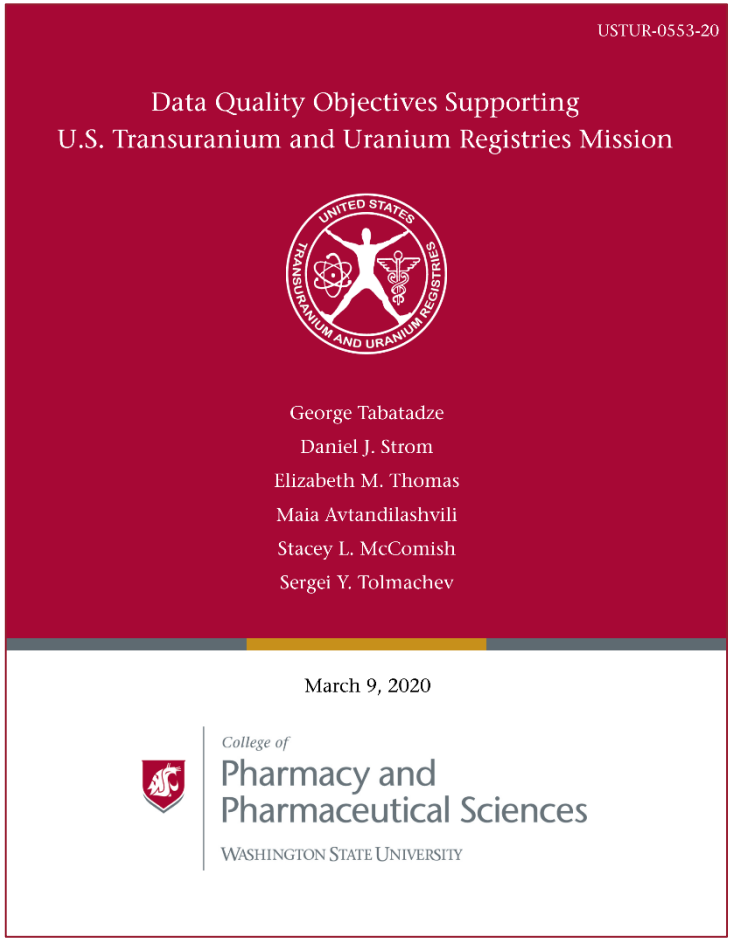
Recommendation #3

Complete Quality Assurance Plan/Data Quality Objectives Document

Data Quality Objectives Document

- 2019 draft was significantly revised by D. J. Strom, E. M. Thomas, and G. Tabatadze





10:15 – 10:30 *Data Quality Objectives* by G. Tabatadze

Recommendation #4

Complete implementation of an initiative for collecting bioassay monitoring data from living Registrants

Sample Collection and Analysis

- GEL – MSA – USTUR conference call to discuss:
  - ✓ USTUR needs and requirements
  - ✓ logistic of sample collection
  - ✓ price for U/Am/Pu analyses
- New quote from GEL for a full service
- Problem: need to share Registrants' names and addresses for bioassay kit delivery/pick-up
- Working on adoption of Hanford Internal Dosimetry Program Manual (PNL-MA-552) for 24-h urine sample collection

Recommendation #5

Develop specific objectives for the goals presented in the 5-year and 10-year plans and establish benchmark completion dates for stated goals

SAC 2019: *Long-term Research Plan*

Five-year:

- ^{239}Pu biokinetic modeling and uncertainty analysis of 20 individual inhalation cases (post-doctoral project)
- Improvement of system of compartmental models for ^{239}Pu decorporation; application to ^{238}Pu
- Effect of chelation on ^{241}Am distribution in the body
- Beryllium analysis and biokinetics

Ten-year:

- Analyses of single intake cases
- Pooled analysis of specific groups: *UPPU, wound, high-fire* $^{239}PuO_2$, ^{238}Pu
- Actinide distribution in the skeleton
- Minor actinides: ^{237}Np *and* ^{244}Cm

Long-term Research Plan: *Specific Objectives*

2019–2023:

- ^{239}Pu biokinetic modeling and uncertainty analysis of 40 individual cases: *evaluate uncertainties in the radiation dose assessment for radiation epidemiology* (2021)
- Pooled analysis of specific groups (*UPPU,* wound): *calculate probability distributions on biokinetic model parameters* (2022)
- Beryllium analysis and biokinetics: *contribute to ICRP Occupational Intakes of Radionuclides series (Part 5)* (2023)

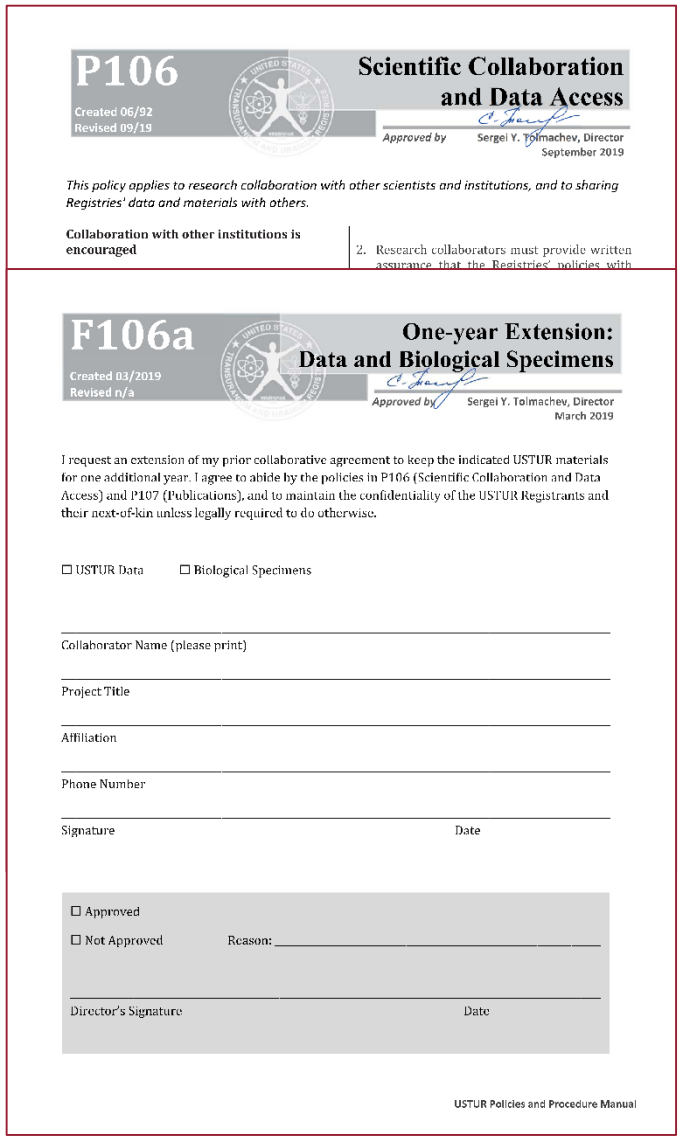
2024–2028:

- Effect of chelation on ^{241}Am distribution in the body: *development of Am decorporation model* (2024)
- Actinide distribution in the skeleton: *bone microdosimetry; improve estimation of skeleton activity from limited bone analyses* (2025)
- Analyses of single intake cases: *parameterization of biokinetic models* (2027)
- Minor actinides (^{237}Np and ^{244}Cm): *improvement of Np and Cm biokinetic models* (2028)

Recommendation #6

Include in the operating procedure for control, release, and potential return of data and tissues a developed policy that provides limitations on use/reuse

Policies and Procedures Update: *P106 and F106a*



P106

Created 06/92
Revised 09/19

Scientific Collaboration and Data Access

Approved by Sergei Y. Tolmachev, Director
September 2019

This policy applies to research collaboration with other scientists and institutions, and to sharing Registries' data and materials with others.

Collaboration with other institutions is encouraged

2. Research collaborators must provide written assurance that the Registries' policies with

F106a

Created 03/2019
Revised n/a

One-year Extension: Data and Biological Specimens

Approved by Sergei Y. Tolmachev, Director
March 2019

I request an extension of my prior collaborative agreement to keep the indicated USTUR materials for one additional year. I agree to abide by the policies in P106 (Scientific Collaboration and Data Access) and P107 (Publications), and to maintain the confidentiality of the USTUR Registrants and their next-of-kin unless legally required to do otherwise.

☐ USTUR Data ☐ Biological Specimens

Collaborator Name (please print)

Project Title

Affiliation

Phone Number

Signature Date

☐ Approved

☐ Not Approved Reason:

Director's Signature Date

USTUR Policies and Procedure Manual

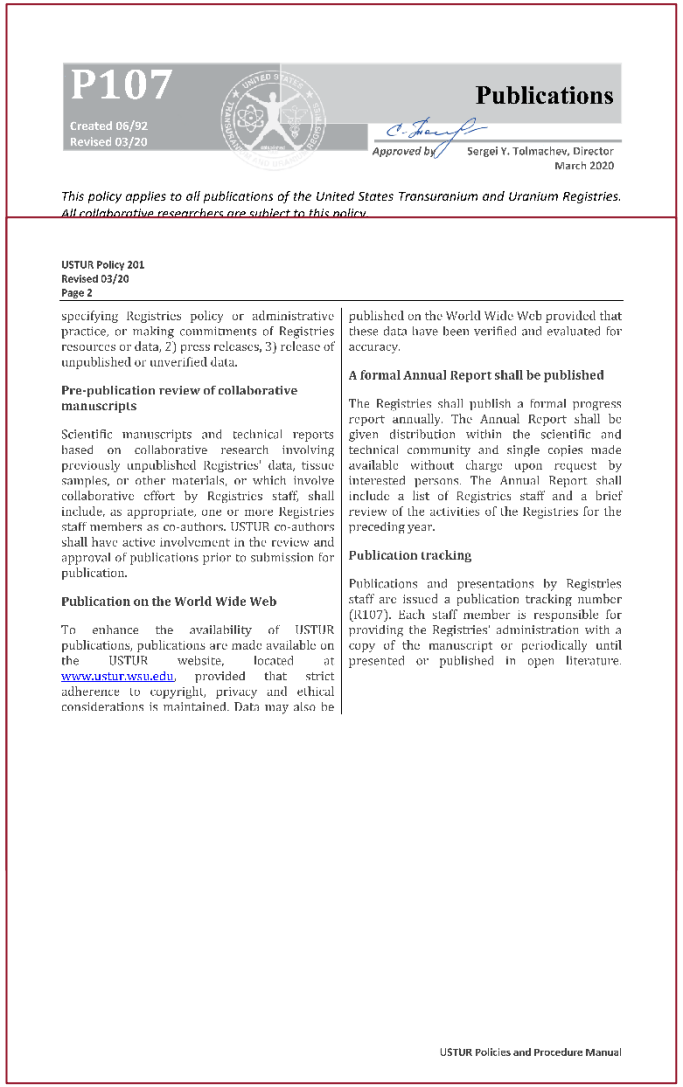
P106: *Tissue materials may not be analyzed for purposes beyond the scope of research agreed upon prior to receipt of specimens. Data recipients may not share the materials with other researchers or perform research outside the agreed upon scope without prior approval from the Registries.*

P106: *Tissue materials that are not destroyed during analysis must be returned to the USTUR within 1 year of analysis or 3 years of receipt, whichever comes first. Extensions can be requested* [F106a] *in 1-yearincrements if additional time is needed.*

Recommendation #7

Review and update policies and procedures for pre-publication review with collaborators to make sure that the USTUR has active involvement in the review and approval of publications and acknowledgement as a co-author

Policies and Procedures Update: *P107*



P107
Created 06/92
Revised 03/20

Publications

Approved by: Sergei Y. Tolmachev, Director
March 2020

This policy applies to all publications of the United States Transuranium and Uranium Registries. All collaborative researchers are subject to this policy.

USTUR Policy 201
Revised 03/20
Page 2

specifying Registries policy or administrative practice, or making commitments of Registries resources or data, 2) press releases, 3) release of unpublished or unverified data.

Pre-publication review of collaborative manuscripts

Scientific manuscripts and technical reports based on collaborative research involving previously unpublished Registries' data, tissue samples, or other materials, or which involve collaborative effort by Registries staff, shall include, as appropriate, one or more Registries staff members as co-authors. USTUR co-authors shall have active involvement in the review and approval of publications prior to submission for publication.

Publication on the World Wide Web

To enhance the availability of USTUR publications, publications are made available on the USTUR website, located at www.ustur.wsu.edu, provided that strict adherence to copyright, privacy and ethical considerations is maintained. Data may also be published on the World Wide Web provided that these data have been verified and evaluated for accuracy.

A formal Annual Report shall be published

The Registries shall publish a formal progress report annually. The Annual Report shall be given distribution within the scientific and technical community and single copies made available without charge upon request by interested persons. The Annual Report shall include a list of Registries staff and a brief review of the activities of the Registries for the preceding year.

Publication tracking

Publications and presentations by Registries staff are issued a publication tracking number (R107). Each staff member is responsible for providing the Registries' administration with a copy of the manuscript or periodically until presented or published in open literature.

USTUR Policies and Procedure Manual

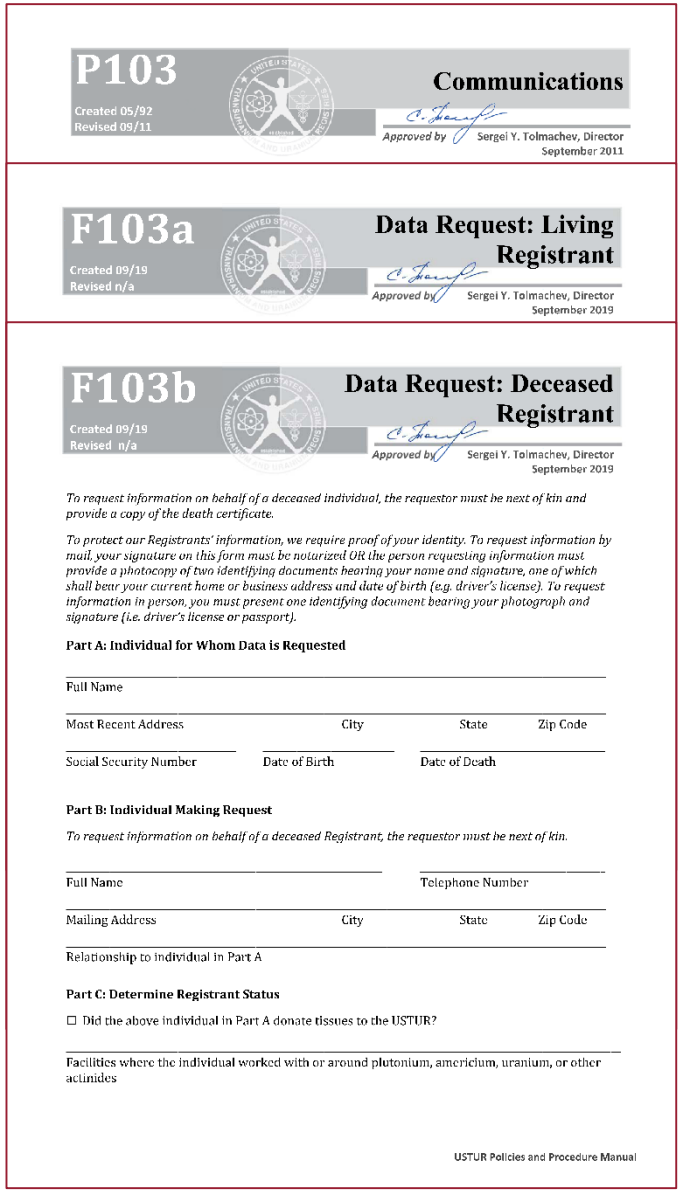
P107: *Pre-publication review of collaborative manuscripts*

Scientific manuscripts and technical reports based on collaborative research involving previously unpublished Registries' data, tissue samples, or other materials, or which involve collaborative effort by Registries staff, shall include, as appropriate, one or more Registries staff members as co-authors. USTUR co-authors shall have active involvement in the review and approval of publications prior to submission for publication.

Recommendation #8

Develop written guidelines for managing potential interaction with outside worker advocates representing deceased Registrants

Policies and Procedures Update: *P103, F103a & F103b*



P103 — **Communications**
Created 05/92
Revised 09/11
Approved by Sergei Y. Tolmachev, Director
September 2011

F103a — **Data Request: Living Registrant**
Created 09/19
Revised n/a
Approved by Sergei Y. Tolmachev, Director
September 2019

F103b — **Data Request: Deceased Registrant**
Created 09/19
Revised n/a
Approved by Sergei Y. Tolmachev, Director
September 2019

To request information on behalf of a deceased individual, the requestor must be next of kin and provide a copy of the death certificate.

To protect our Registrants' information, we require proof of your identity. To request information by mail, your signature on this form must be notarized OR the person requesting information must provide a photocopy of two identifying documents bearing your name and signature, one of which shall bear your current home or business address and date of birth (e.g. driver's license). To request information in person, you must present one identifying document bearing your photograph and signature (i.e. driver's license or passport).

Part A: Individual for Whom Data is Requested

Full Name

Most Recent Address City State Zip Code

Social Security Number Date of Birth Date of Death

Part B: Individual Making Request

To request information on behalf of a deceased Registrant, the requestor must be next of kin.

Full Name Telephone Number

Mailing Address City State Zip Code

Relationship to individual in Part A

Part C: Determine Registrant Status

☐ Did the above individual in Part A donate tissues to the USTUR?

Facilities where the individual worked with or around plutonium, americium, uranium, or other actinides

USTUR Policies and Procedure Manual

F103a & F103b: *To protect our Registrants' information, we require proof of your identity. To request information by mail, your signature on this form must be notarized OR the person requesting information must provide a photocopy of two identifying documents bearing your name and signature, one of which shall bear your current home or business address and date of birth (e.g. driver's license). To request information in person, you must present one identifying document bearing your photograph and signature (i.e. driver's license or passport).*

F103a: *To request information on behalf of a living individual, the requestor must have an appropriate medical power-of-attorney authorizing such an action, and provide a copy of the signed power-of attorney document.*

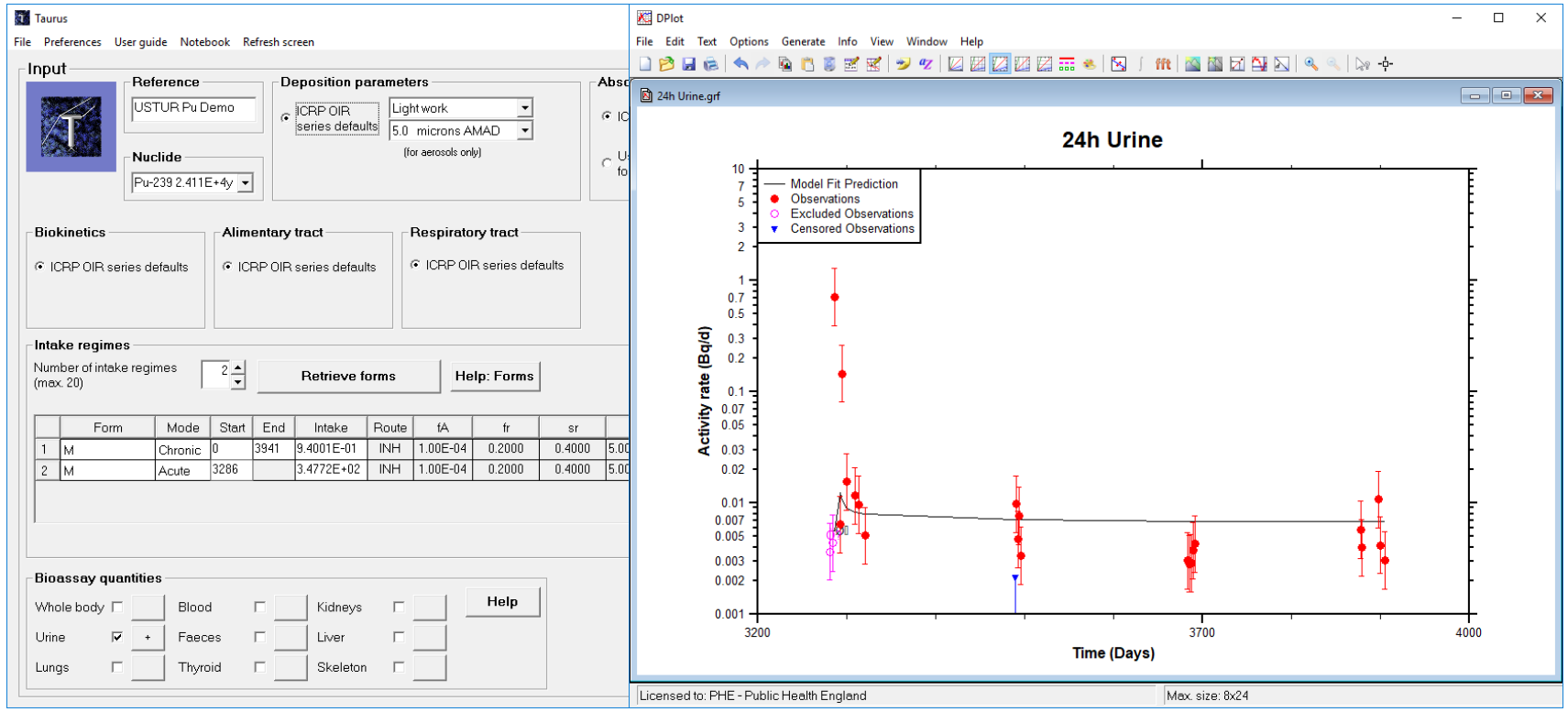
FY2020 Activities Overview

April 1, 2019 – March 31, 2020

New Adjunct Member

Anthony E Riddell
Internal Dosimetry Group Leader
Radiation Hazards and Emergencies Department

Public Health England



Taurus® suite for internal dosimetry

New Face!

- Martin Šefl, PhD in Radiological Physics, Czech Technical University in Prague (2019)
- Post-doctoral Researcher, August 2, 2019 – March 31, 2022

Tasks

- Evaluating uncertainty in radiation dose assessment and its impact on risk projection in radiation epidemiology studies
- Calculating probability distributions on biokinetic model parameters

Data

- Exposure records, bioassay and post-mortem tissue analyses results

Public Health England

Registrant Donations

- One whole-body donation: Hanford
- Two partial-body donations: Hanford and Rocky Flats

10:30 – 10:45 *Registrant Statistics and IRB* by S. L. McComish

FY2020 Health Physics Database

Progress

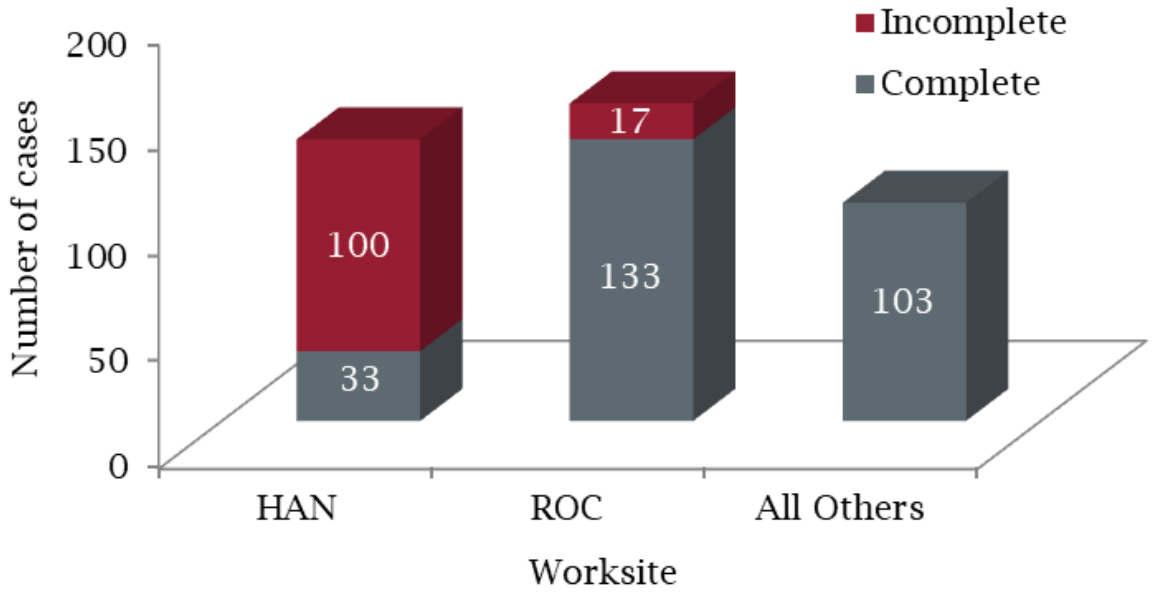
27 partial-body cases completed (1982–1989, 1993–1994, 1999–2000)

- HAN: 1 living + 1 deceased
- ROC: 25 deceased

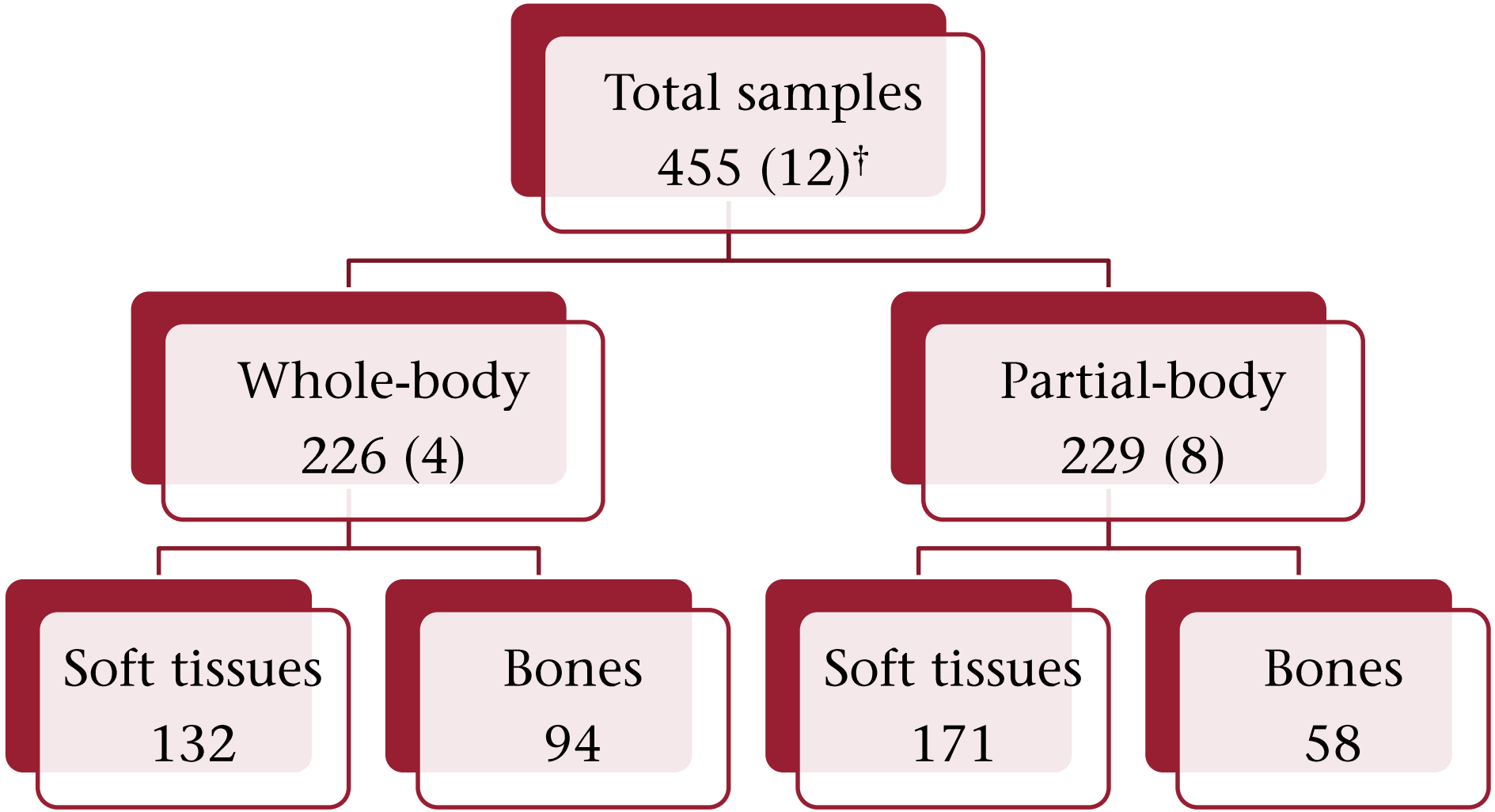
Status

269 of 386 (70%) cases completed

- Whole body: 52 (100%)
- Partial body: 217 of 334 (65%)



FY2020 Radiochemistry: *Tissue Analyses*



†- number of analyzed cases

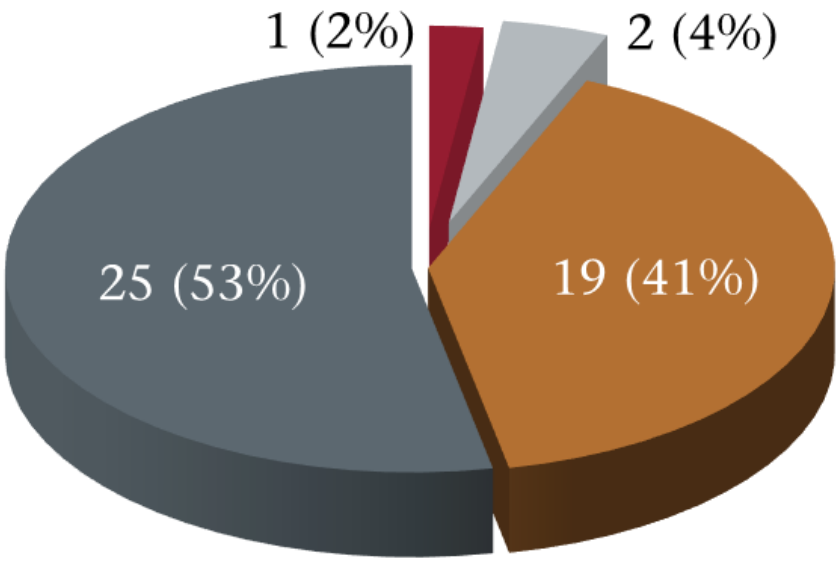
FY2020 Radiochemistry: *Case Analyses*

Status	Whole body		Partial body	
	FY2019	FY2020	FY2019	FY2020
Total	46	47	310	312
Complete	25	25	301	305
Surveyed	16	19	n/a	n/a
Incomplete	5	2	7	5
Intact	0	1†	2	2†

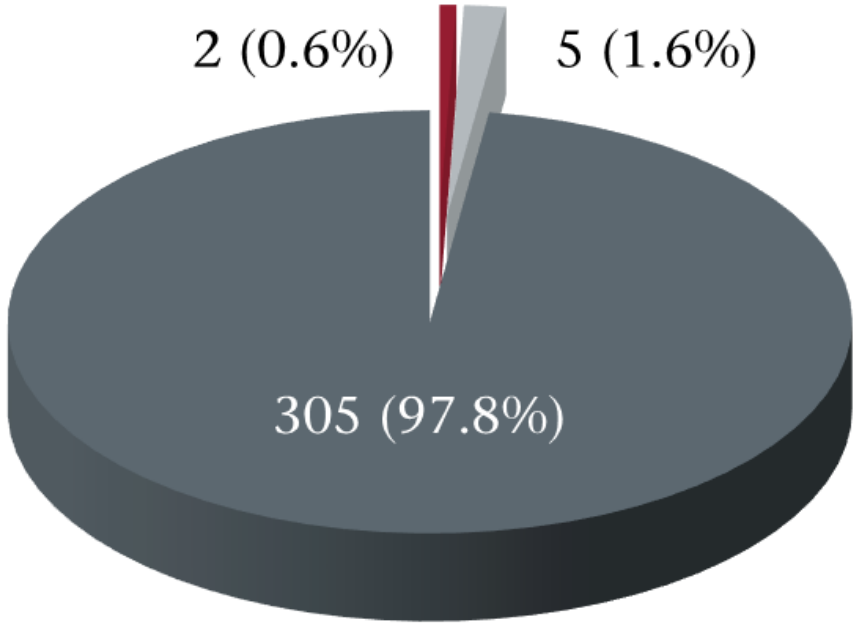
†2019 – 2020 donations

FY2020 Radiochemistry: *Case Status*

Whole body: 47

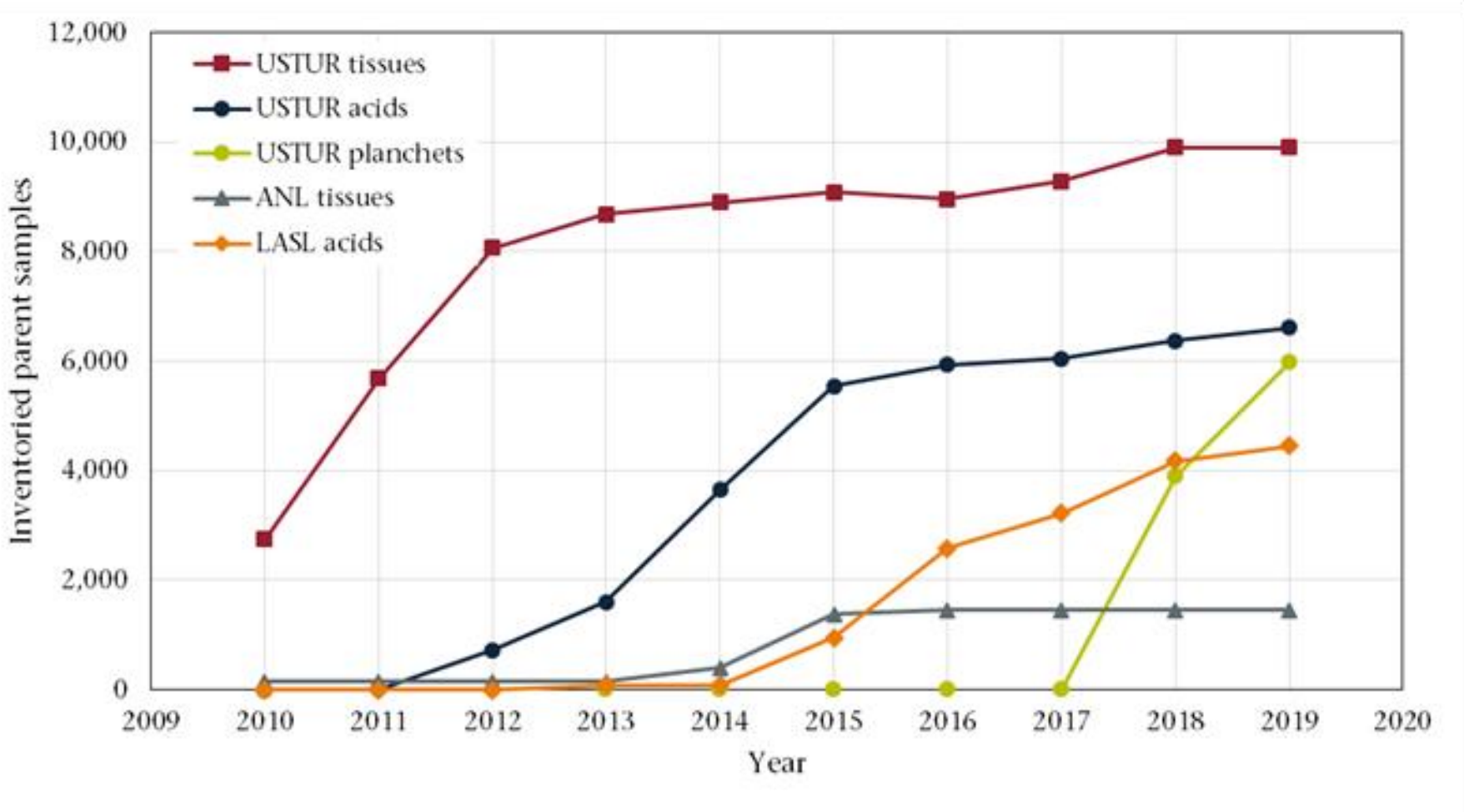


Partial body: 312

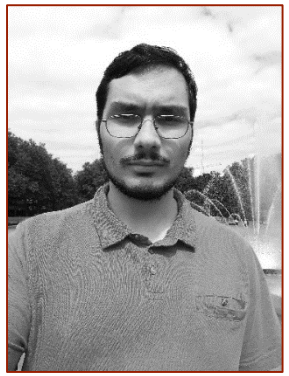


Intact Incomplete Surveyed Complete

National Human Radiobiology Tissue Repository: *Inventory*



Database Harmonization



Alex Tabatadze

Tissue inventory

THEMIS®

Measurement results

Alpha Vision®

Radiochemistry

Tissue analysis results

Personal and employment records

Administrative

Health Physics

Exposure and bioassay records

Planchets

Radioactivity inventory

10:45 – 11:00 *Database Harmonization* by S. L. McComish

Internal Research Projects

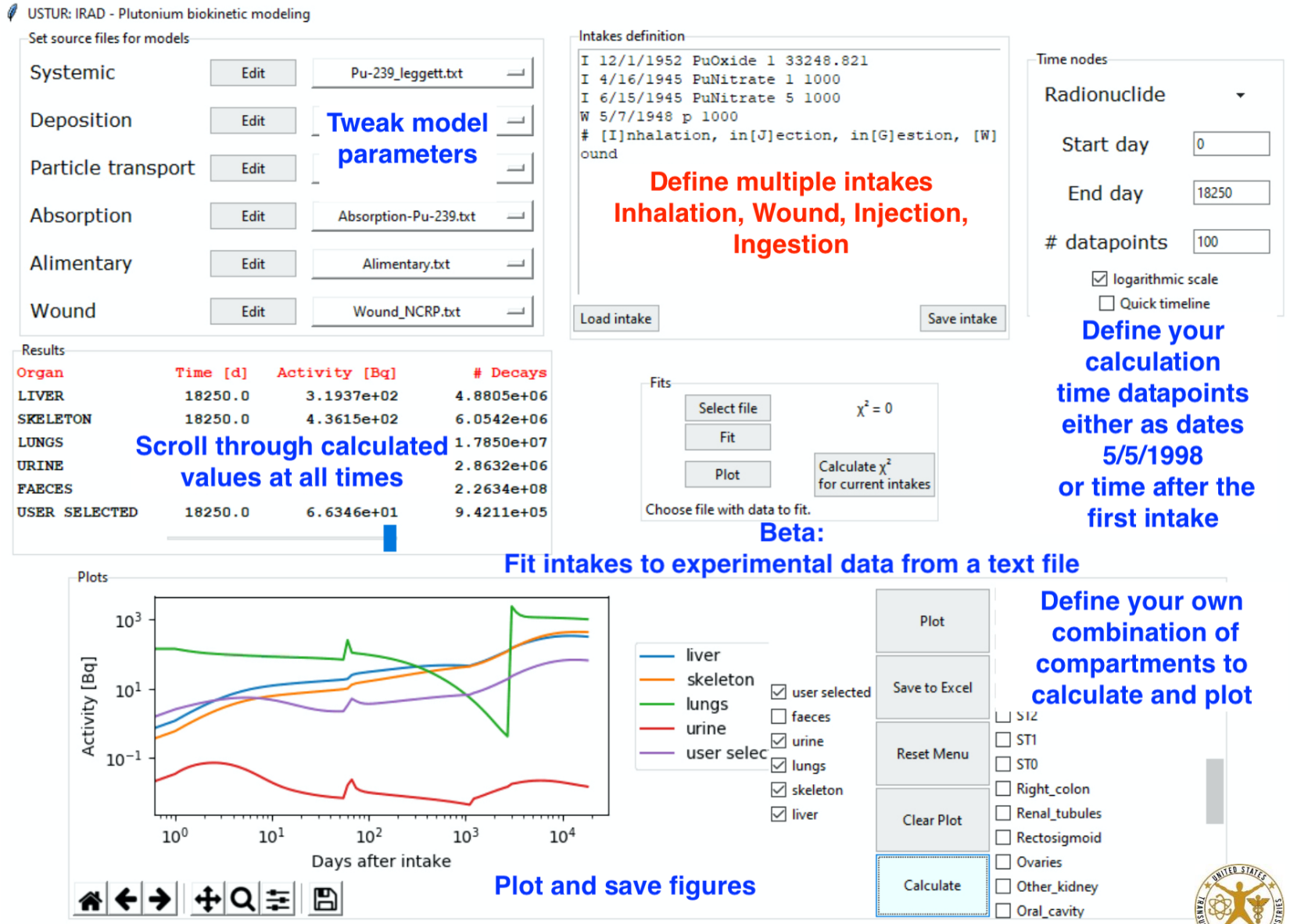
- Evaluating uncertainty in radiation dose assessment: *liver and skeleton*
- Long-term retention, distribution, and biokinetics of enriched uranium in a female donor
- Biokinetics of soluble plutonium after wound injury
- Actinides in the skeleton: C_{bone}/C_{skel} *bone scaling factor*
- Beryllium retention and distribution in human body

Do We Need a 'new IMBA'?

Software features / capabilities	IMBA PP®	Taurus®	USTUR
Open source code	✗	✗	✗
Future update and development	✗	✓	✓
Implements current biokinetic models:			
ICRP HRTM	✓	✓	✓
ICRP HATM	✗	✓	✓
NCRP wound model	✓	✗	✓
ICRP systemic models	✓	✓	✓
Allows user to:			✓
Change default model parameters	✓	=	✓
Modify existing model structure	✓	✗	✓
Build new models	✓	✗	✓
Run batch calculations	✗	✗	✓
Easy data input and output options	✓	✓	✓
Professional graphical output	✗	✓	✓

USTUR In-house Code

- Object-oriented based on Python 3.7
- GUI based on *tkinter – tcl* gui library
- Multiple intakes – unlimited number
- Forward computation tested against IMBA
- Adjustable parameters
- Backward computation still in development
- Fitting still not reliable for multiple intakes



Collaborative Research Network

Modeling Actinide Decorporation Therapy

Bastian Breustedt: Sabbatical (2011)

Sara Dumit: PhD Research (2015–2018)

- Breustedt *et al.* (2019) Health Physics 117 (2): 168–178
- Dumit *et al.* (2019) Radiation Research 191 (2): 201–210
- Dumit *et al.* (2019) Radiation and Environmental Biophysics 58 (2): 227–235
- Dumit *et al.* (2019) *Response to Gremy and Miccoli*. Radiation Research 192 (6): 682–683

U.S. Million Person Study

- Brain dosimetry: ^{239}Pu, ^{226}Ra
- Development and validation of site-specific biokinetic models for plutonium

Plutonium Binding in the Respiratory Tract

- Case 0269: ICRP Publication 141 (2019)
- Analysis of three additional cases from USTUR
  (Poudel et al. 2020 submitted to Health Physics)

Data and Materials Request

Million Person Study:

- Post-mortem radiochemical analysis results (lungs, liver, skeleton) and bioassay data for 25 Rocky Flats cases: *>10 Bq kg^{-1} (lung) and minimal number of intakes*

Naval Dosimetry Center, Armed Forces Radiobiology Research Institute

- Molar or pre-molar teeth: *known exposure to external radiation*

Institute of Analytical Sciences and Physico-Chemistry for Environment and Materials, University Pau (France) through Laval University (Canada)

- Teeth from Radium Dial Painter study
- Paraffin-embedded lung tissues: *known exposure to beryllium*

Thank you!