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USTUR Whole-body Case 0680: 53-year Follow-up of a Manhattan Project Worker

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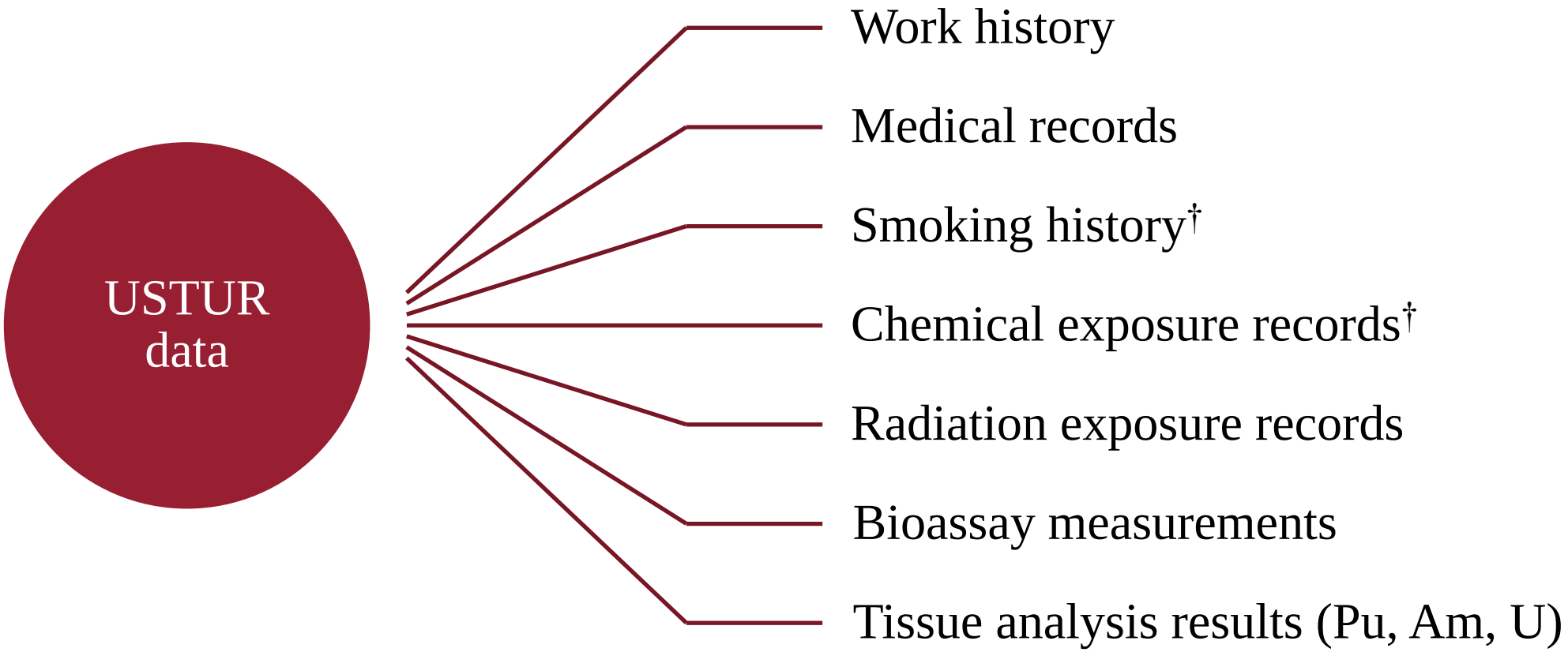
USTUR-0576-21A

Unique Data Resource

- Registrant acceptance: ≥ 74 Bq (2 nCi) systemic content



† - self-reported data

USTUR Case 0680

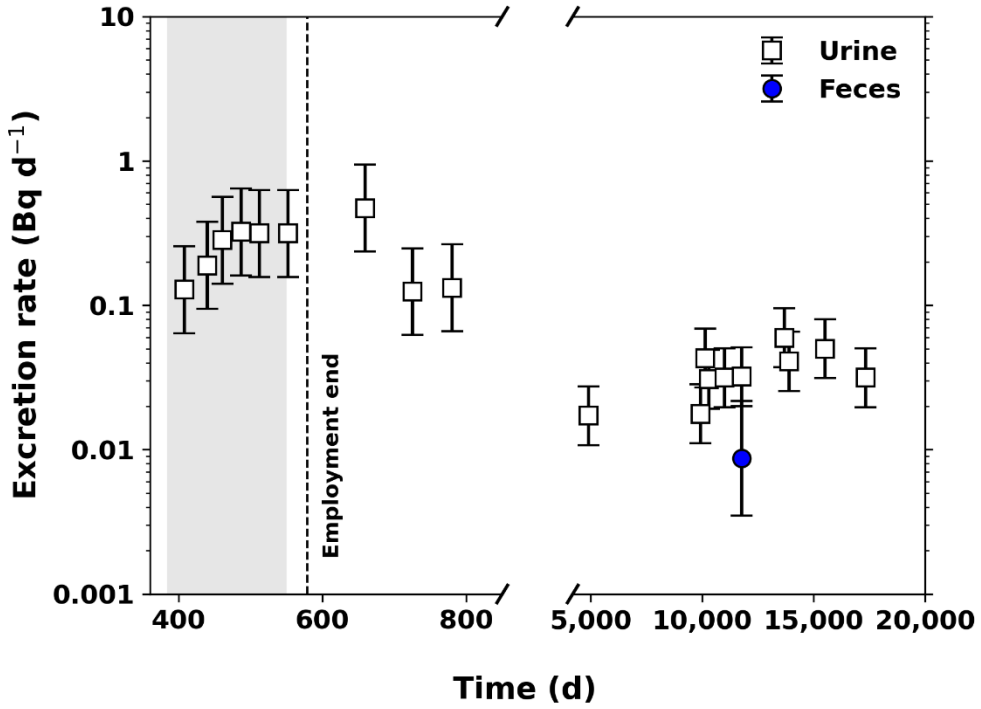
- One of 26 Manhattan Project plutonium workers selected for medical follow-up "*on the basis of the amount of plutonium excreted in the urine assayed by methods available before 1950.*"
- Worked as a chemist on plutonium recovery for 18 months in 1940s
- Died 53 years after exposure at age 90+
- Whole-body tissue donor to the USTUR

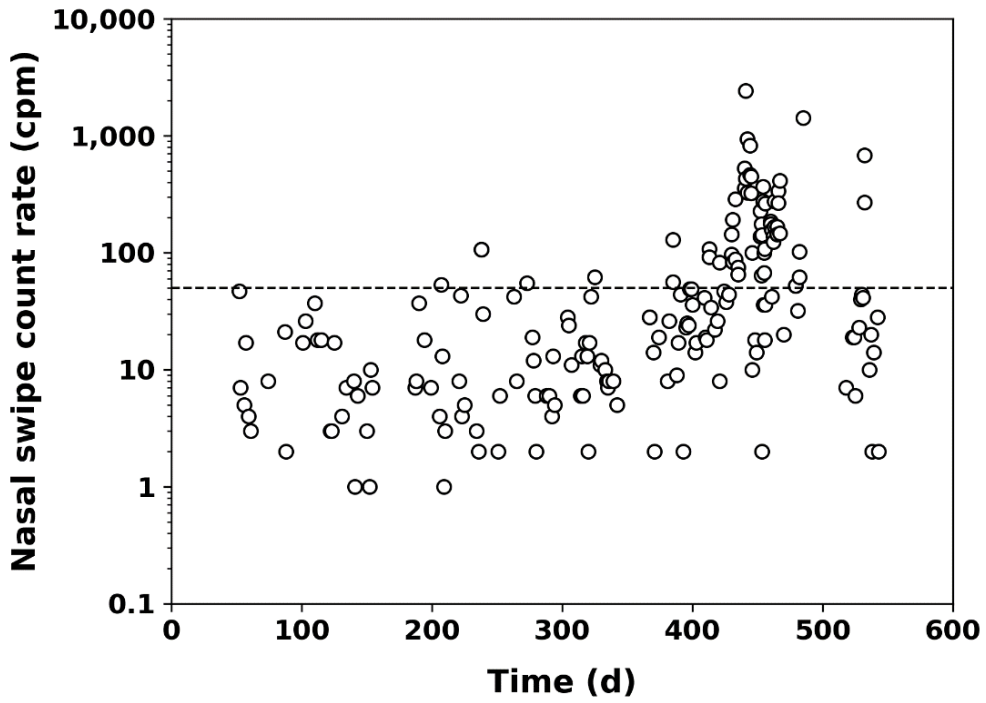
Voelz GL, Hempelmann LH, Lawrence JNP, Moss WD. A 32-year medical follow-up Manhattan Project plutonium workers. Health Phys 37(4): 445–485; 1979.

Data: Bioassay Measurements

- 19 urine samples
- 1 fecal sample
- 1 blood sample

- 212 nasal swipes
- 14 chest counts < MDA

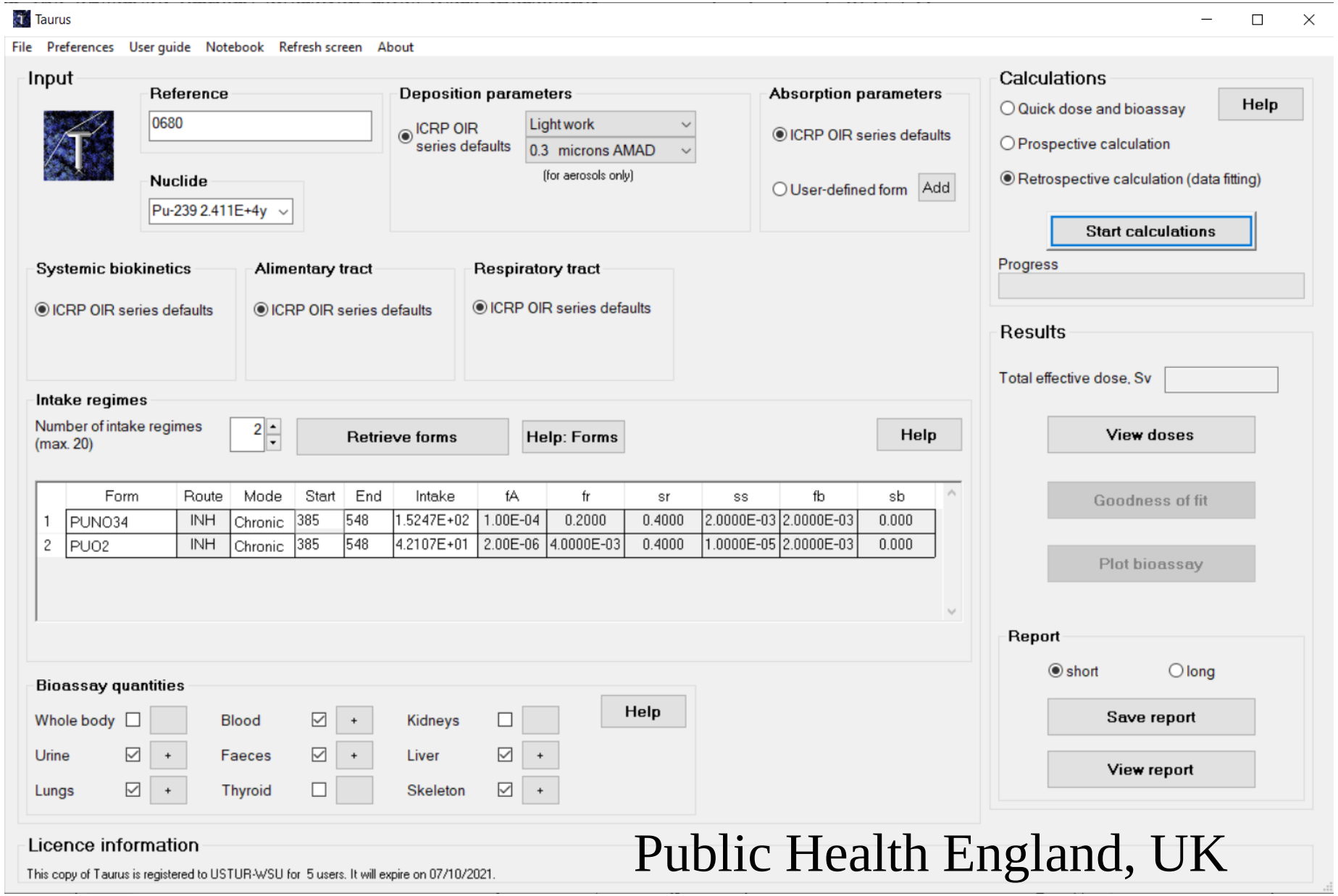




Data: Post-mortem Tissue Analyses

- Tissues analyzed: 82 bone samples and 13 soft tissues
- Total body: 1,765±12 Bq

Methods: Taurus Internal Dosimetry Software



Public Health England, UK

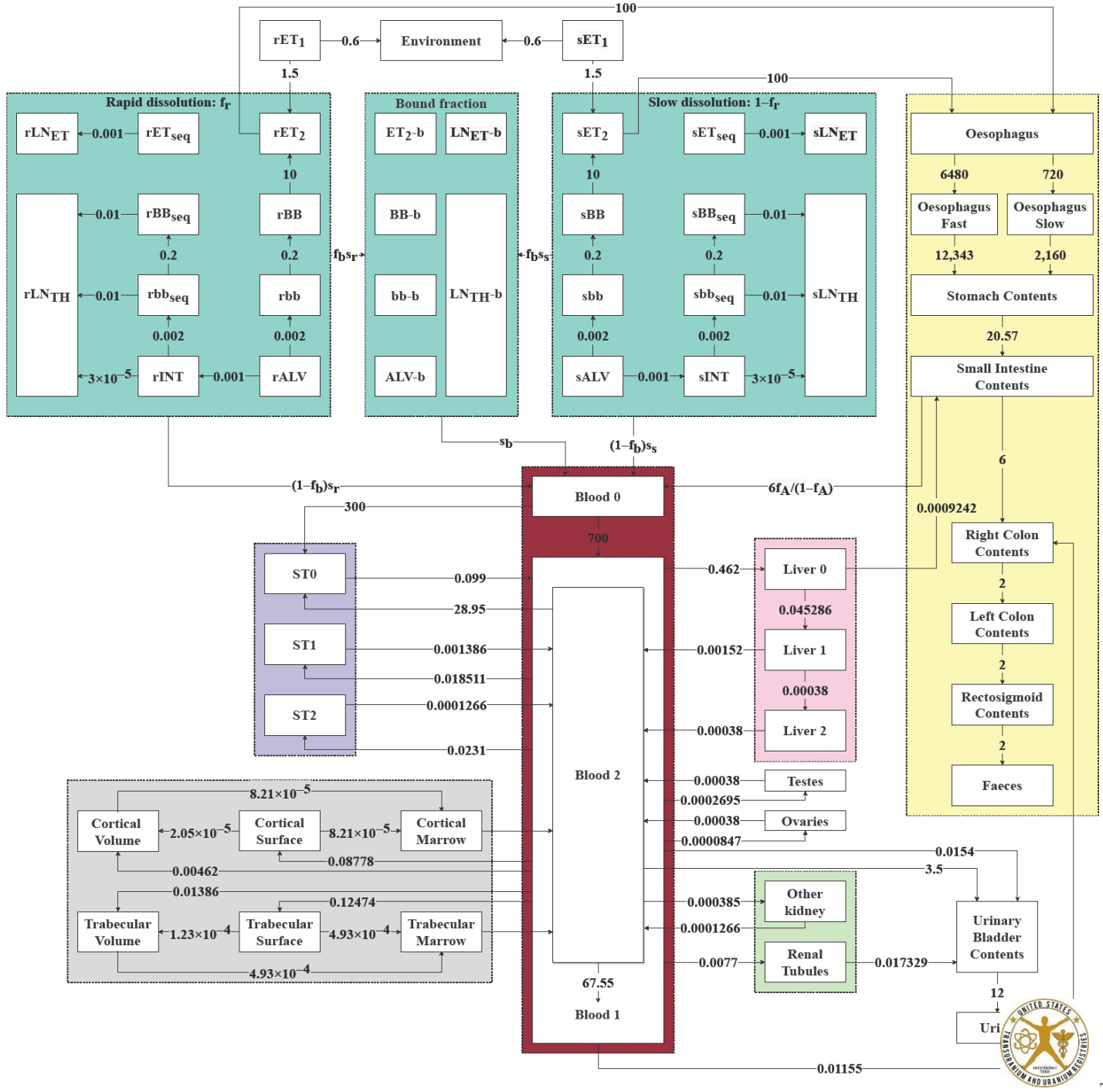
Methods: Intake Scenario

Chronic inhalation

- Pu-nitrate
- PuO_2

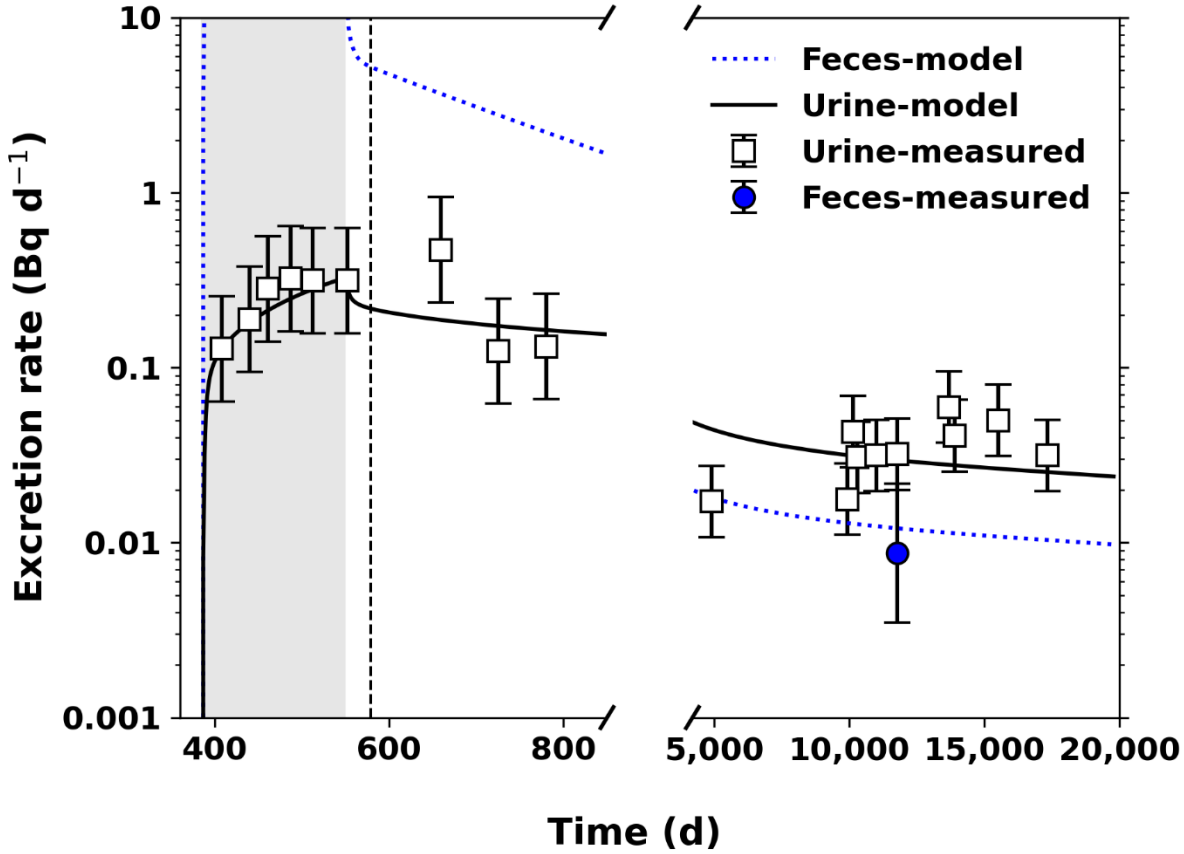
ICRP models

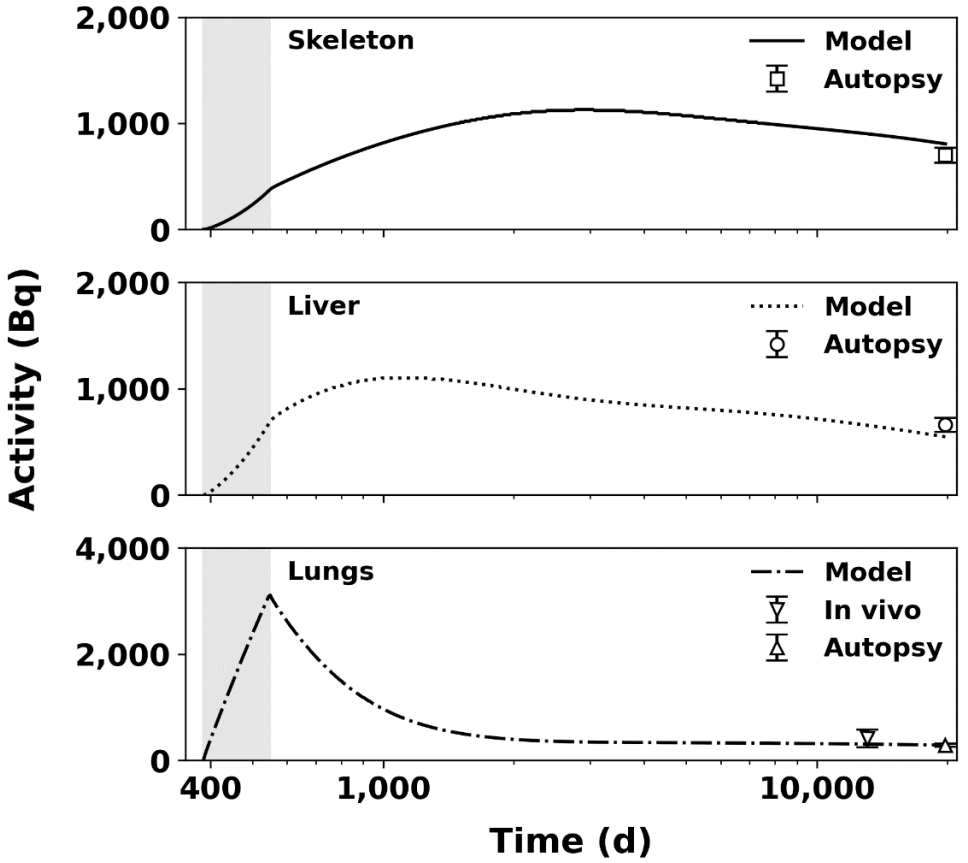
- 130 Human Respiratory Tract
- 100 Human Alimentary Tract
- 141 Plutonium Systemic



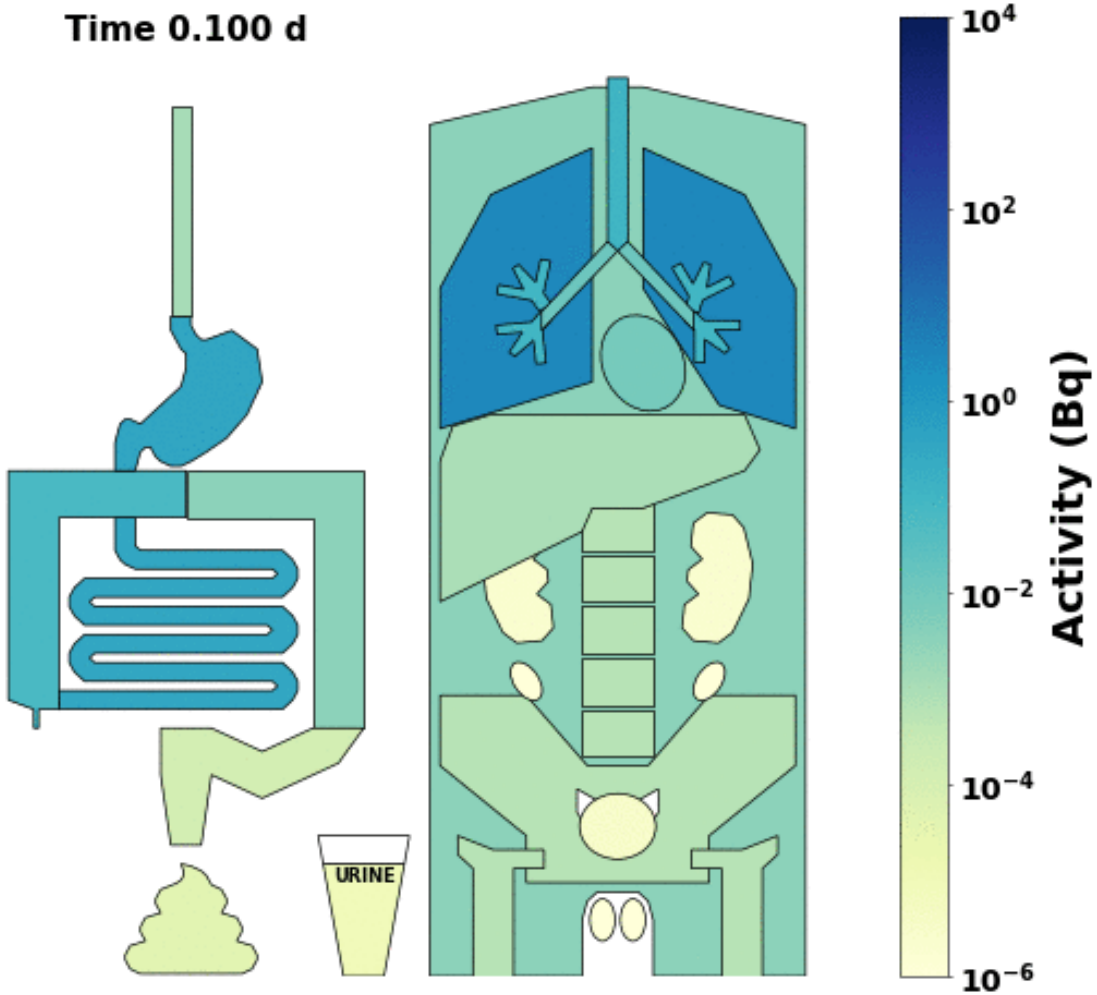
Results: Estimated Intake

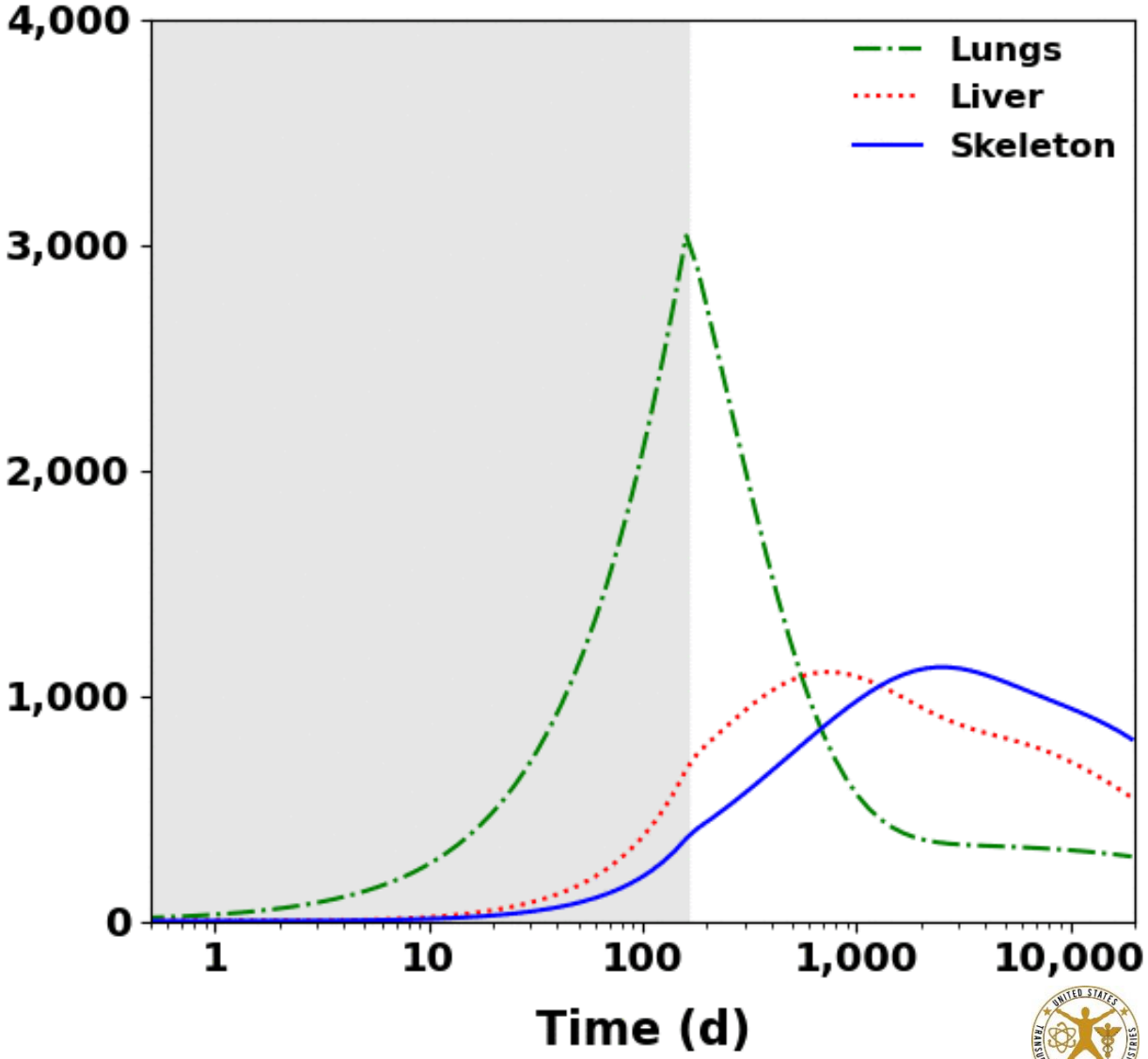
Days	Material	Intake		Goodness of fit χ^2 p-value
		Rate (Bq d^{-1})	Cumulative (Bq)	
385 – 548	Pu-nitrate	152.5	25,570	0.808
	PuO_2	42.1	9,485	



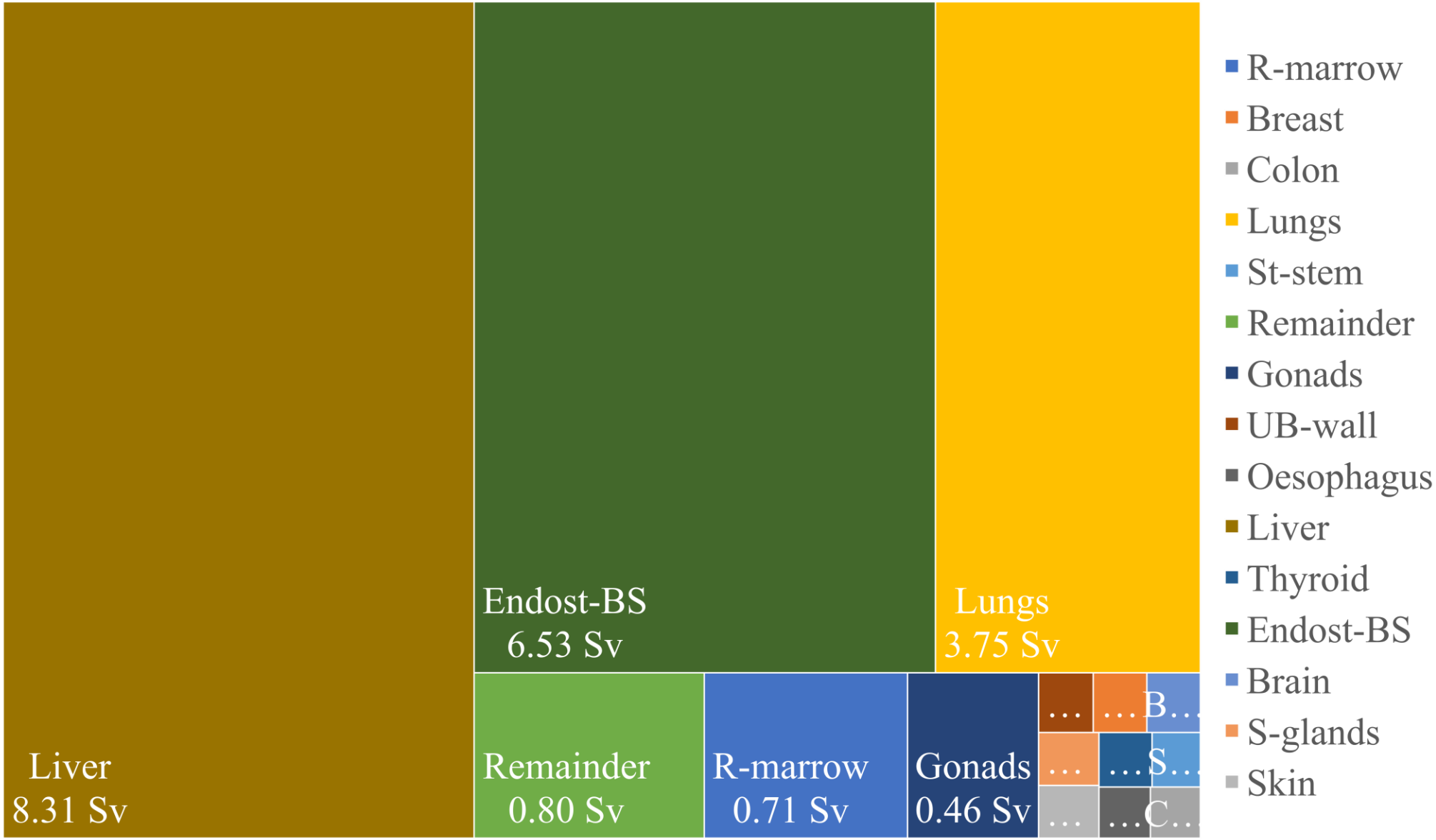


Results: Plutonium Organ Distribution over Time



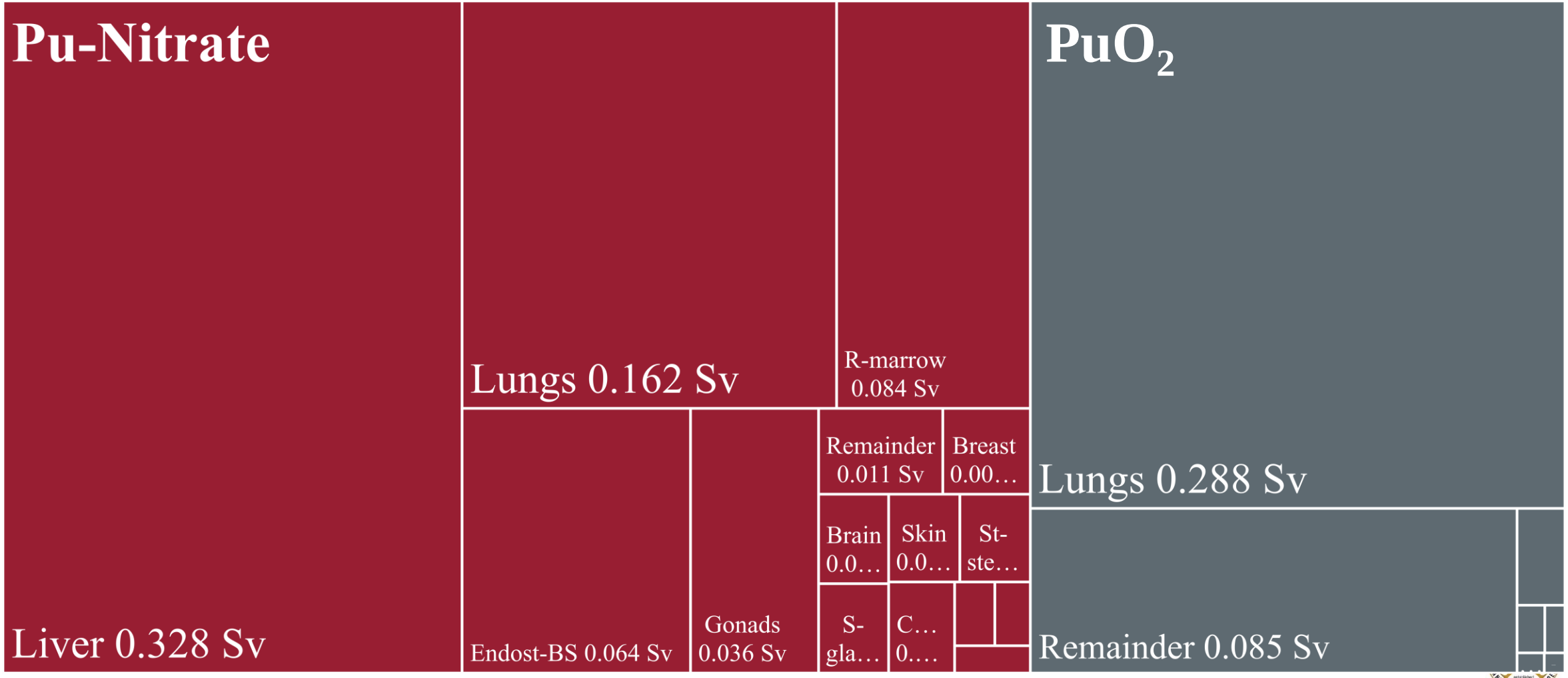


Results: Organ Equivalent Doses



Results: Organ Contributions to Effective Dose

- Committed effective dose: 1.22 Sv



Summary

- ICRP reference biokinetic models adequately described the long-term plutonium retention and excretion for this individual
- Chronic inhalation of 78% Pu-Nitrate and 22% PuO_2
- 53 years post intake total body activity: 1,765 Bq
- Total body distribution: systemic organs 84%, respiratory tract 16%
- Systemic distribution: skeleton 47%, liver 45%, other 8%

Šefl, M, Avtandilashvili, M, Tolmachev, SY. Inhalation of Soluble Plutonium: 53-year Follow-up of Manhattan Project Worker, Health Physics 2021:120(6); 661-670.

Acknowledgements

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Thank you!