U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

COMPUTER CODES IN RAMP

Radiological Toolbox

Casper Sun, PhD, CHP, MCP
Radiation Protection Branch
Office of Nuclear Regulatory Research
The United States Nuclear Regulatory Commission

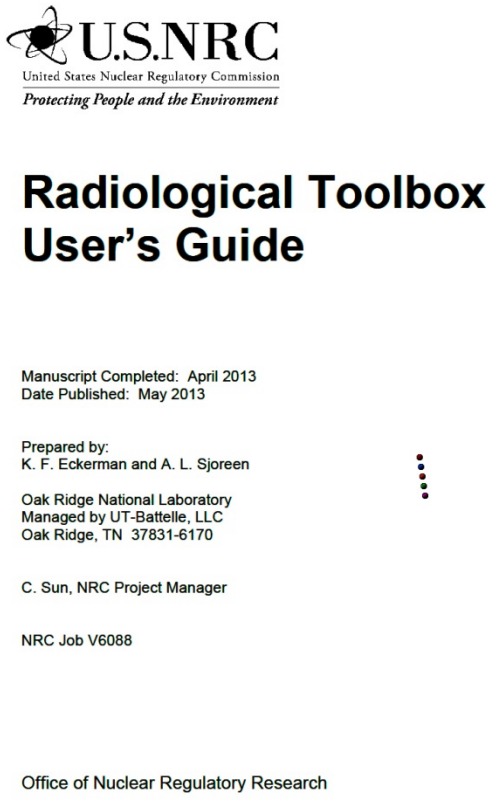
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Timelines

- This “Toolbox” existed for years….
- 2003 – NRC contracted ORNL to shape it.
- 2007 – Radiological Toolbox V2 issued.
- 2013 – Radiological Toolbox V3 issued with NUREG/CR-7166, the user’s manual.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

What's in The Latest


U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Radiological Toolbox User's Guide

NUREG/CR-7166
ORNL/TM-2013/16

Manuscript Completed: April 2013
Date Published: May 2013

Prepared by:
K. F. Eckerman and A. L. Sjoreen

Oak Ridge National Laboratory
Managed by UT-Battelle, LLC
Oak Ridge, TN 37831-6170

C. Sun, NRC Project Manager

NRC Job V6088

Office of Nuclear Regulatory Research

- **Rad-Toolbox V3.0 (April 2013)**
  - Windows 7 and OS 64-bit compatible
  - Code is 27 MB in size and one click to install.
  - TRM certified for NRC workstations
  - ***Forum: Look for your feedback***
- **User's Manual (May 2013)**
  - In color and PDF searchable
  - References are up to date
  - Built-in under "View-Manual" tab

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

ABSTRACT: NUREG/CR-7166

"Toolbox" software developed by ORNL for USNRC is designed to provide electronic access to the vast and varied data…These data represent physical, chemical, anatomical, physiological, and mathematical parameters detailed in various handbooks... This release has been tested on Windows 7…The nuclear decay data has been updated, thermal neutron capture cross sections, and cancer risk coefficients.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Something You Should Know

- The software can be removed by clicking on the unins000.exe that resides in the Toolbox folder
- User's Guide, PDF: Can be highlighted or add note…
- Knowing bugs: The decay chain graphics have not been tested for all potential parent nuclides.
- The default units for dose coefficient is SI units , i.e., the units of the original data.
- A note of caution in Page 9.
- Runtime Error '3051' has been received. Your input and feedback are welcome.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Must Know the Basic!

- http://www.hps1.org/aahp/abhp/exams/formulas.pdf

$$A = \lambda N$$

$$T_{1/2}^{p} = \frac{0.693}{\lambda_p}$$

$$A(t) = A_0 \, e^{-\lambda t}$$

$$\frac{1}{T_{1/2}^{e}} = \frac{1}{T_{1/2}^{p}} + \frac{1}{T_{1/2}^{b}}$$

$$X_2 = X_1 \frac{d_1^2}{d_2^2}$$

$$SA(\mathrm{Ci/g}) = \frac{1.129 \times 10^{13}}{T_{1/2}^{p}(\mathrm{s}) \, AtomicMass}$$

$$\dot{X}(d) = A \frac{\Gamma}{d^2}$$

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

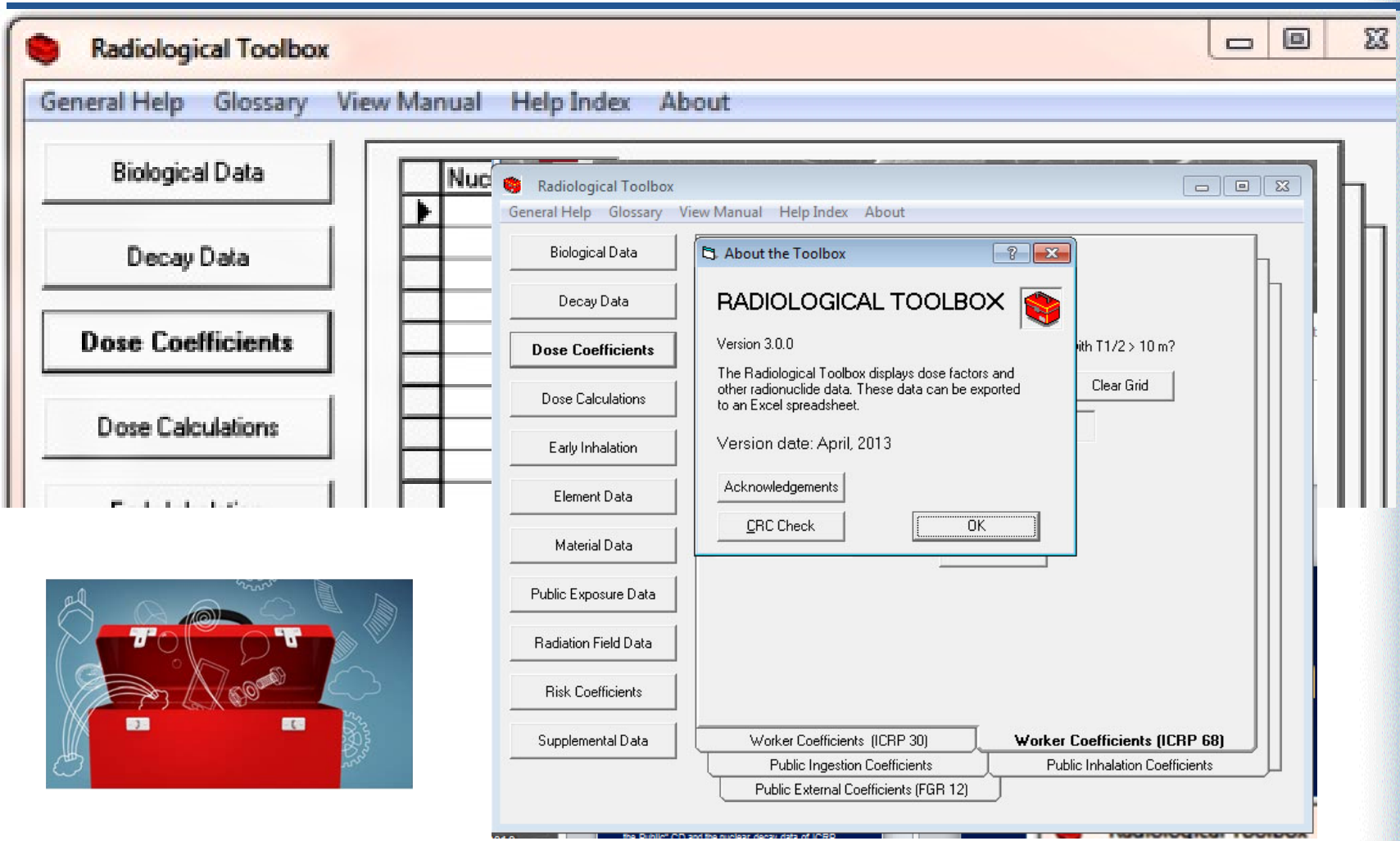
HP Constants

Useful Constants and Conversions

Avogadro's number	6.023×10^{23} mol^{-1}
Planck's constant	6.625×10^{-34} J s
volume of ideal gas (STP)	22.4 L mol^{-1}
charge (e^{-1})	1.602×10^{-19} C
roentgen (STP)	2.58×10^{-4} C kg^{-1}
1 MeV	1.602×10^{-13} J
1 atm	760 mm Hg
w	33.7 eV ion pair^{-1}
rad	6.242×10^{7} MeV g^{-1}
1 m^3	1000 L
1 ft^3	28.32 L
universal gas constant (R)	8.32×10^{7} erg °C^{-1} g^{-1} mol^{-1}
standard temperature	0°C
standard pressure	1 atm
1 barn (b)	10^{-24} cm^2

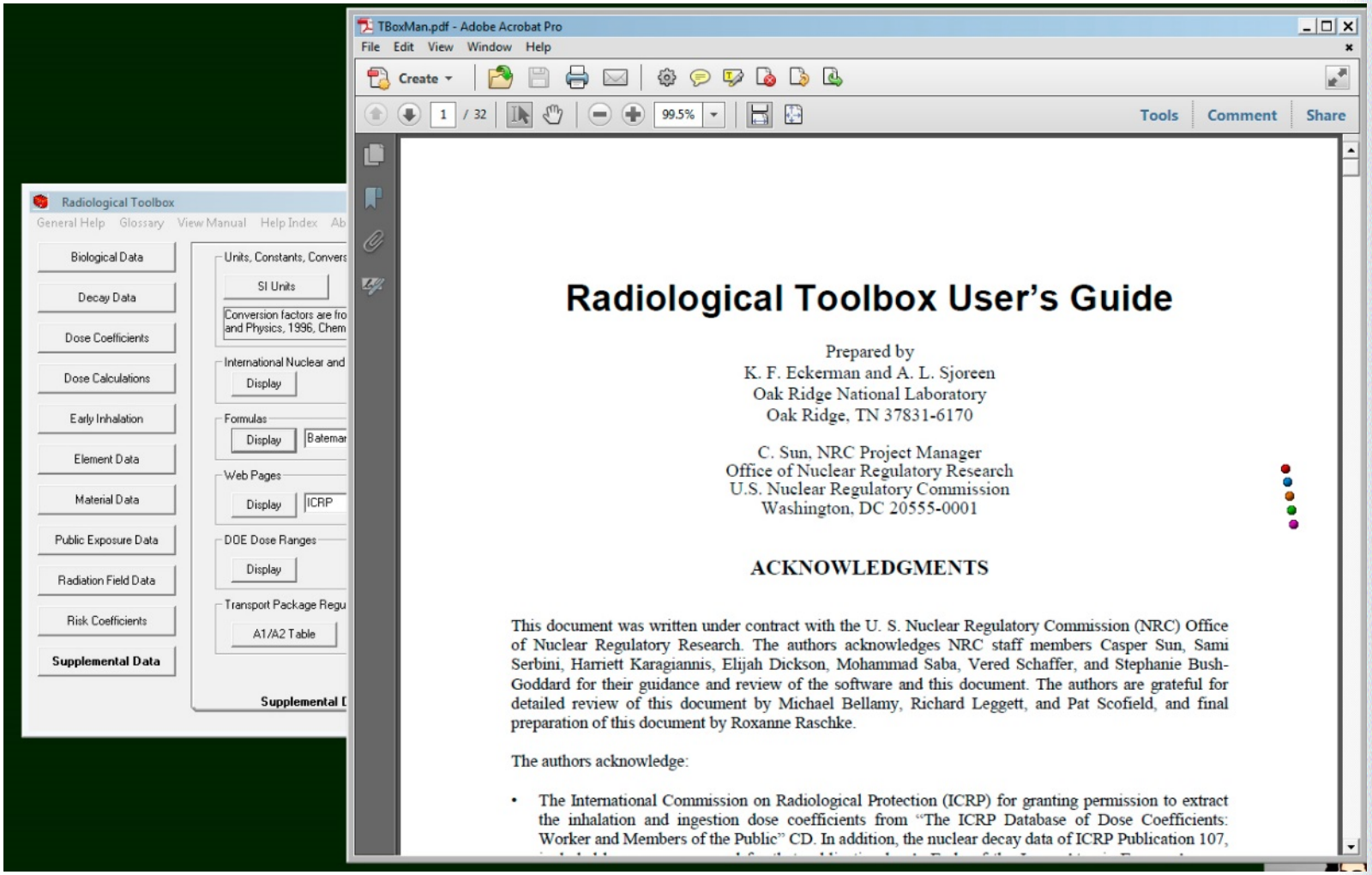
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Menu Bar (About)



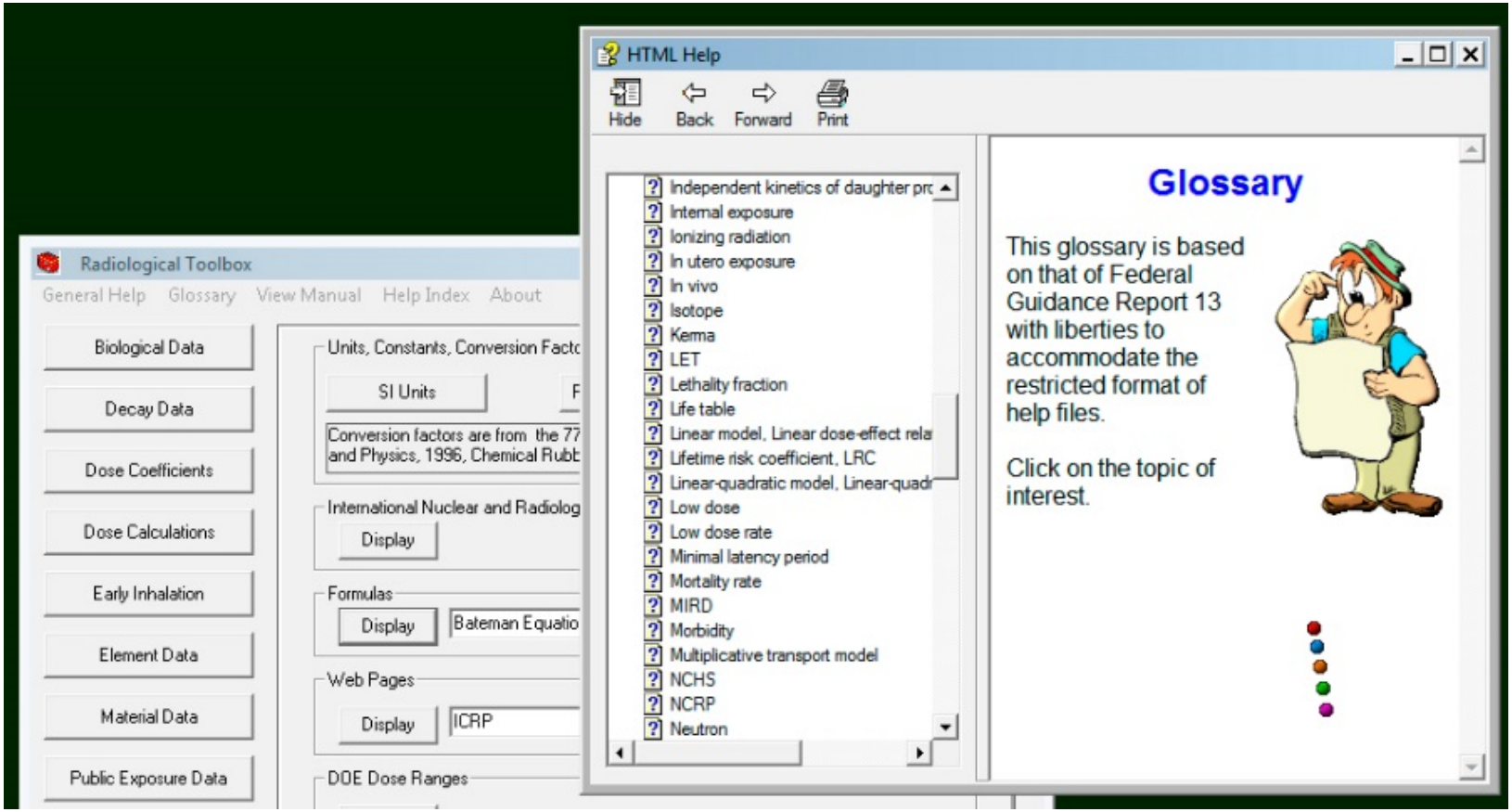
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Menu Bar (View Manual)



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Menu Bar (Glossary)



U.S.NRC
United States Nuclear Regulatory Commission

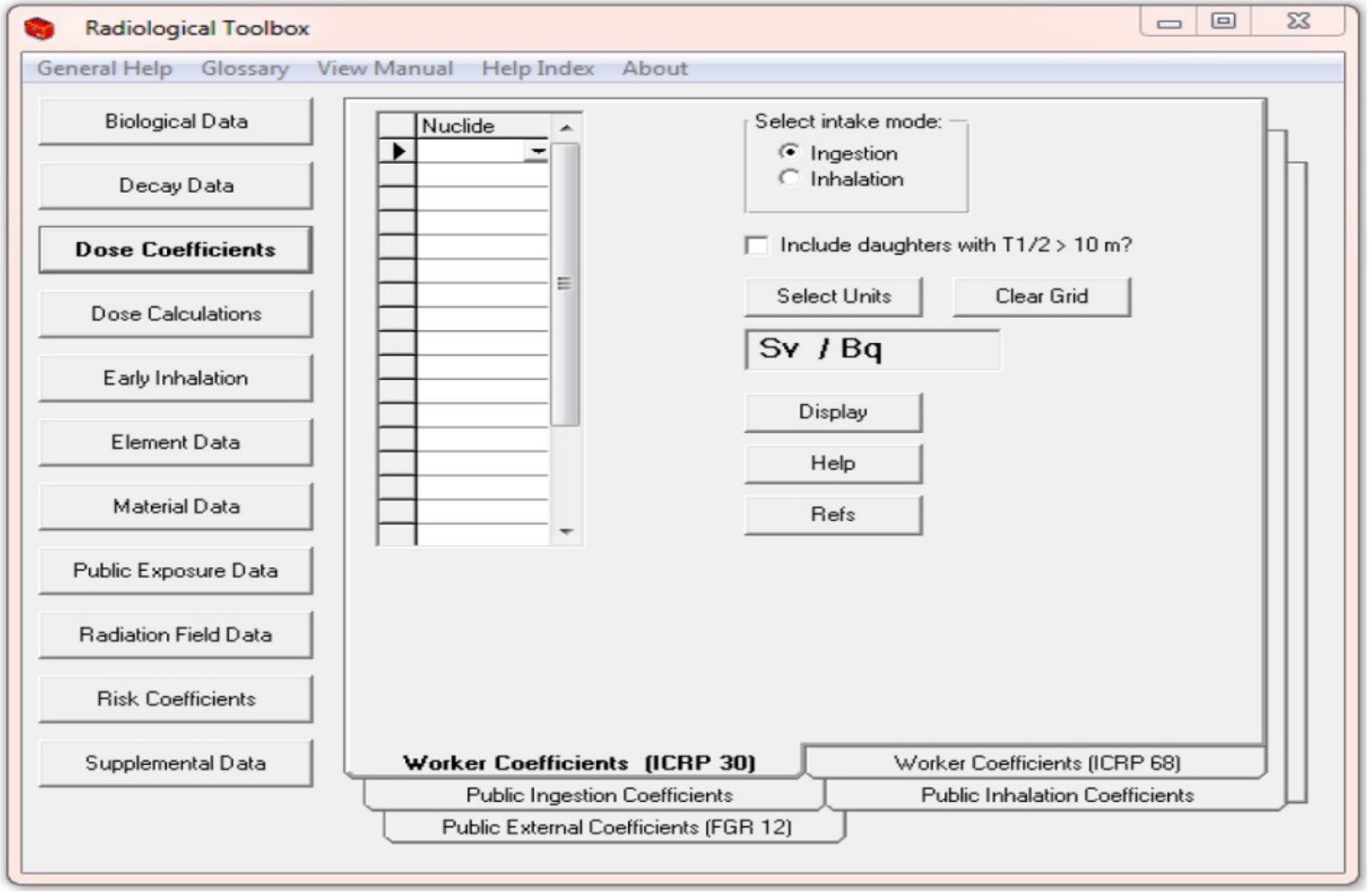
Toolbox's Data Collections

Table 1.1. General Description of the Radiological Toolbox Data Elements

Data Collections	Description of Data Collection
Biological Data	Biokinetic models, reference anatomical data, bioassay data, and summary information on radiation health effects
Decay Data	Detailed information on the radiations emitted by radionuclides and members of serial decay chains
Dose Coefficients	Internal dose coefficients for intakes of radionuclides by workers and members of the public and external dose coefficients for members of the public exposed to radionuclides external to the body
Dose Calculation	Calculation of dose for worker or member of the public exposed to a radionuclide mixture
Early Inhalation	Absorbed dose coefficient integrated over a user-specific time period following an inhalation intake
Element Data	Radiation interaction coefficients with elements for alpha, electron, photon, and neutron radiations
Material Data	Radiation interaction coefficients with materials for alpha, electron, photon, and neutron radiations
Public Exposure Data	Summary information on radiation exposures to natural background radiation and from medical exposure
Radiation Field Data	Organ doses for workers resulting from idealized photon and neutron radiation fields
Risk Coefficients	Nuclide-specific risk coefficients for public exposure
Supplemental Data	Collection of reference information ranging from SI units to numerical limits on the activity content of radionuclides in transport

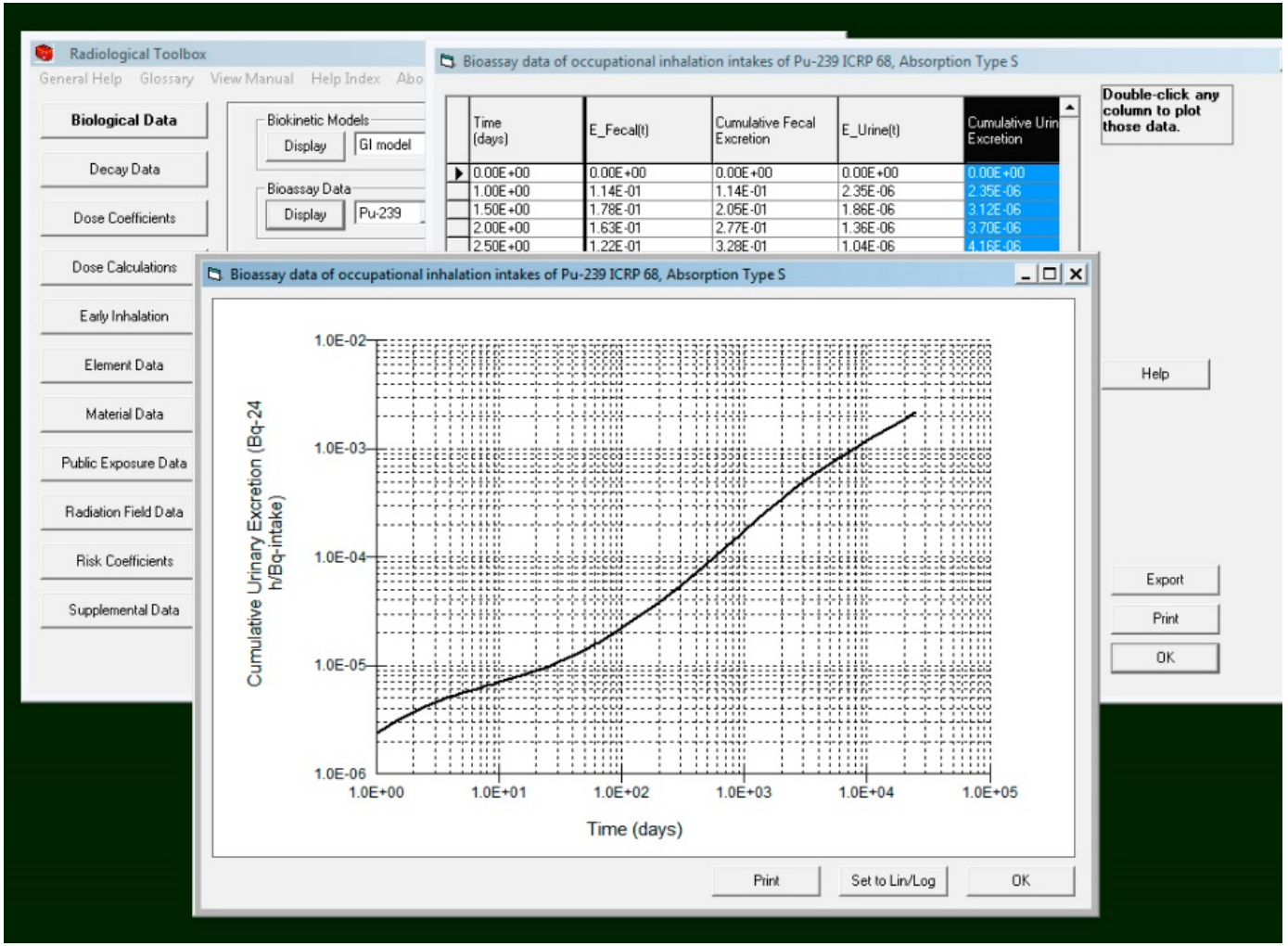
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Rad-Toolbox 11 Database



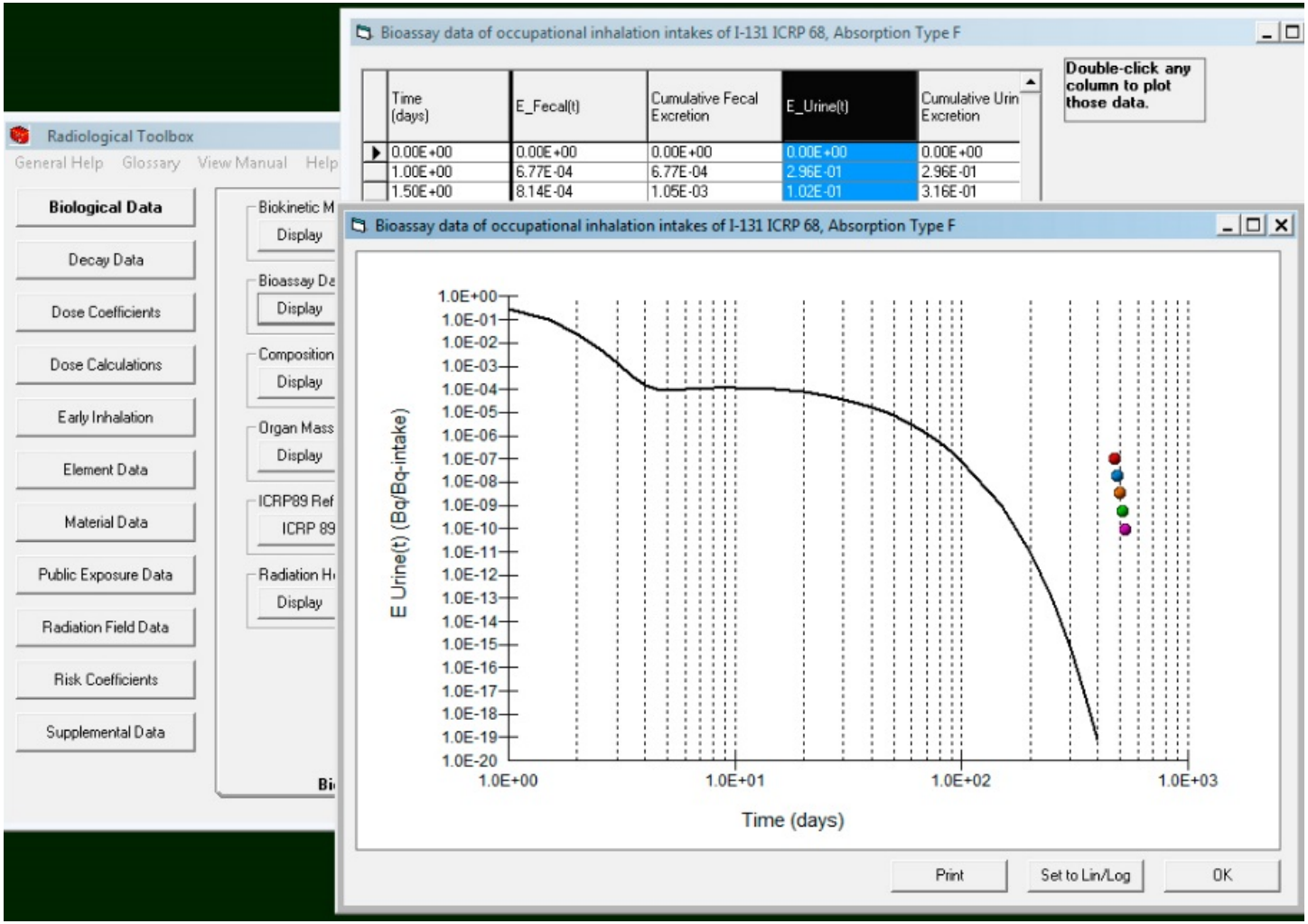
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(1) Biological Data



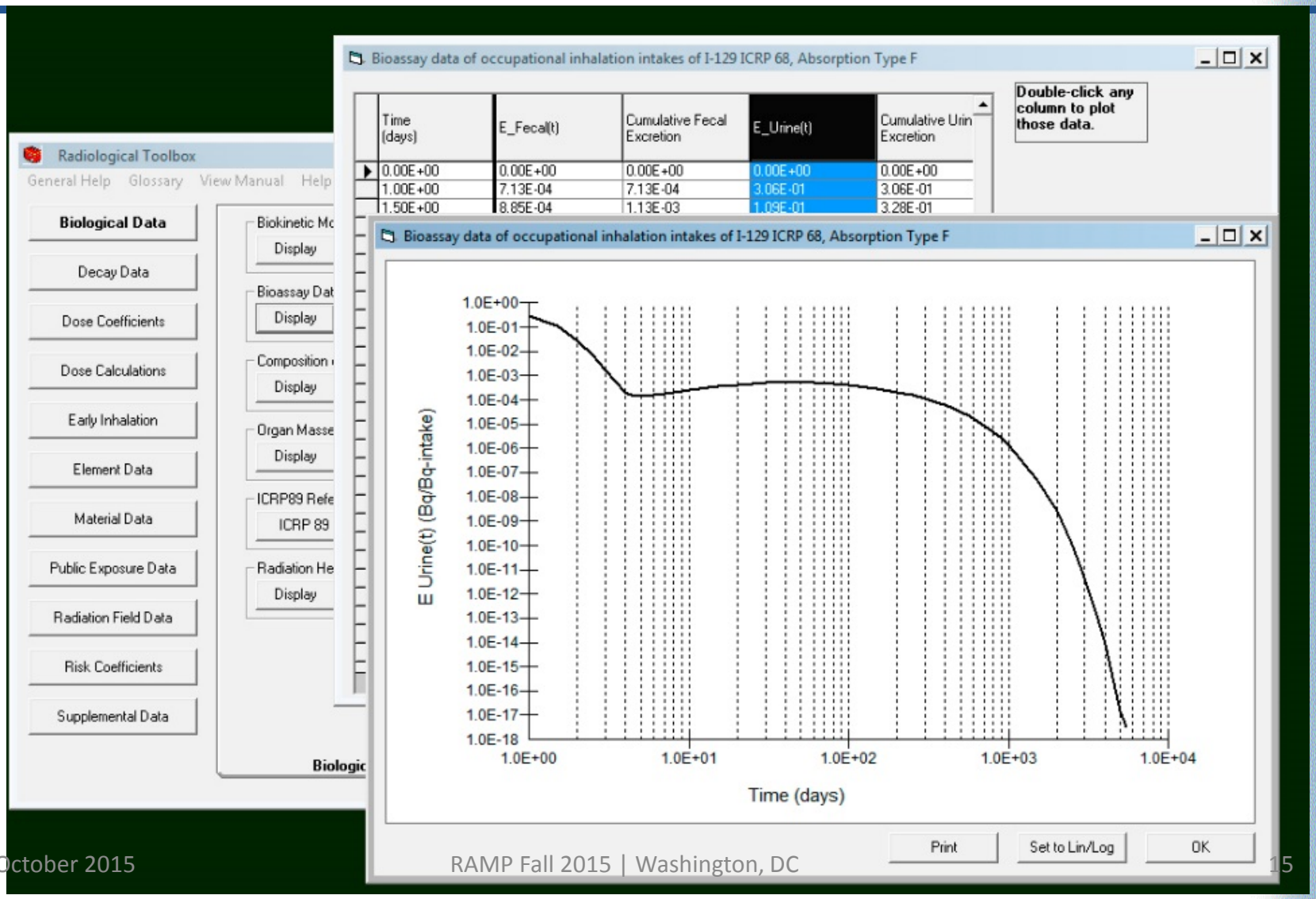
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(1) I-131



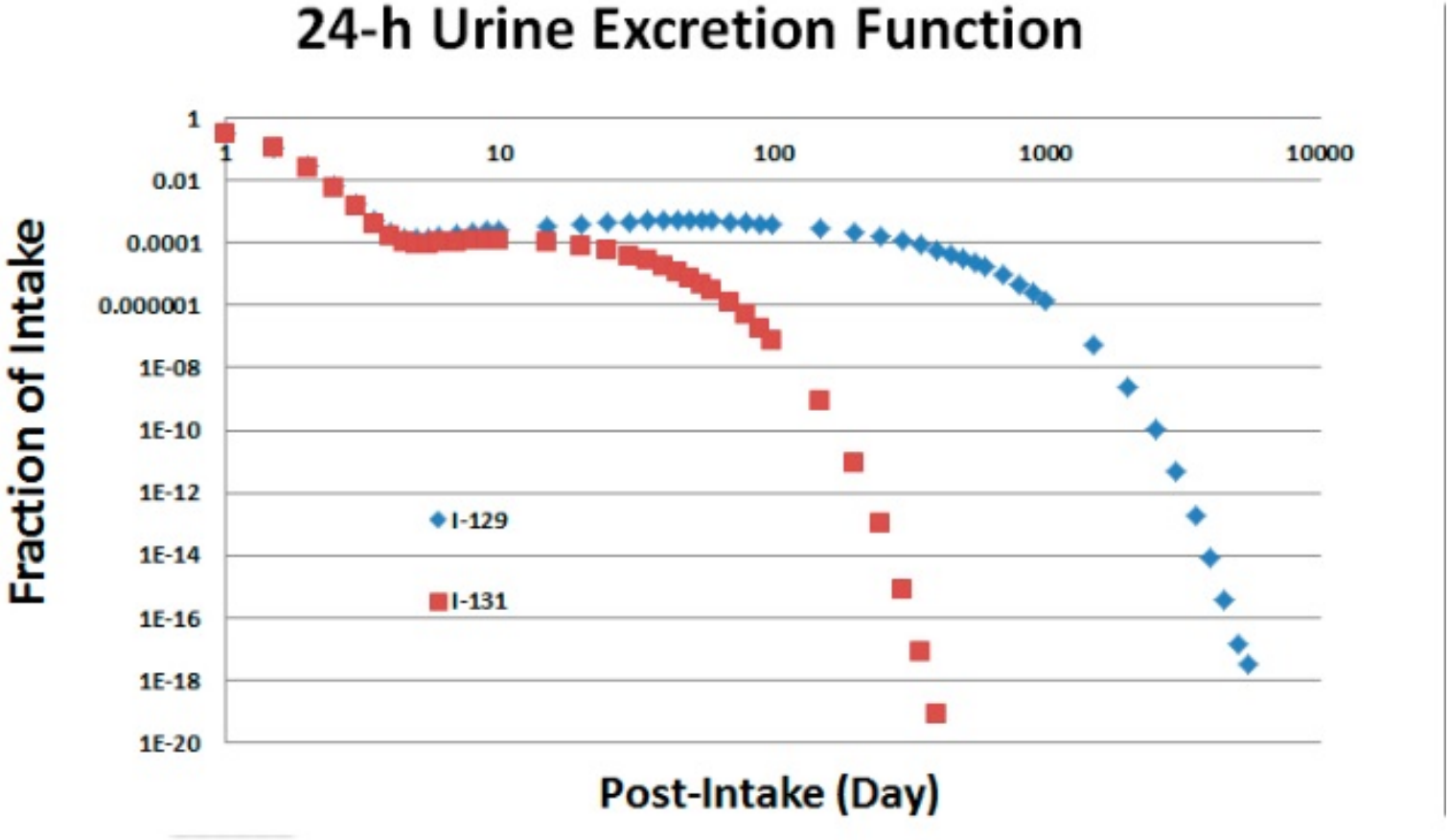
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(1) I-129



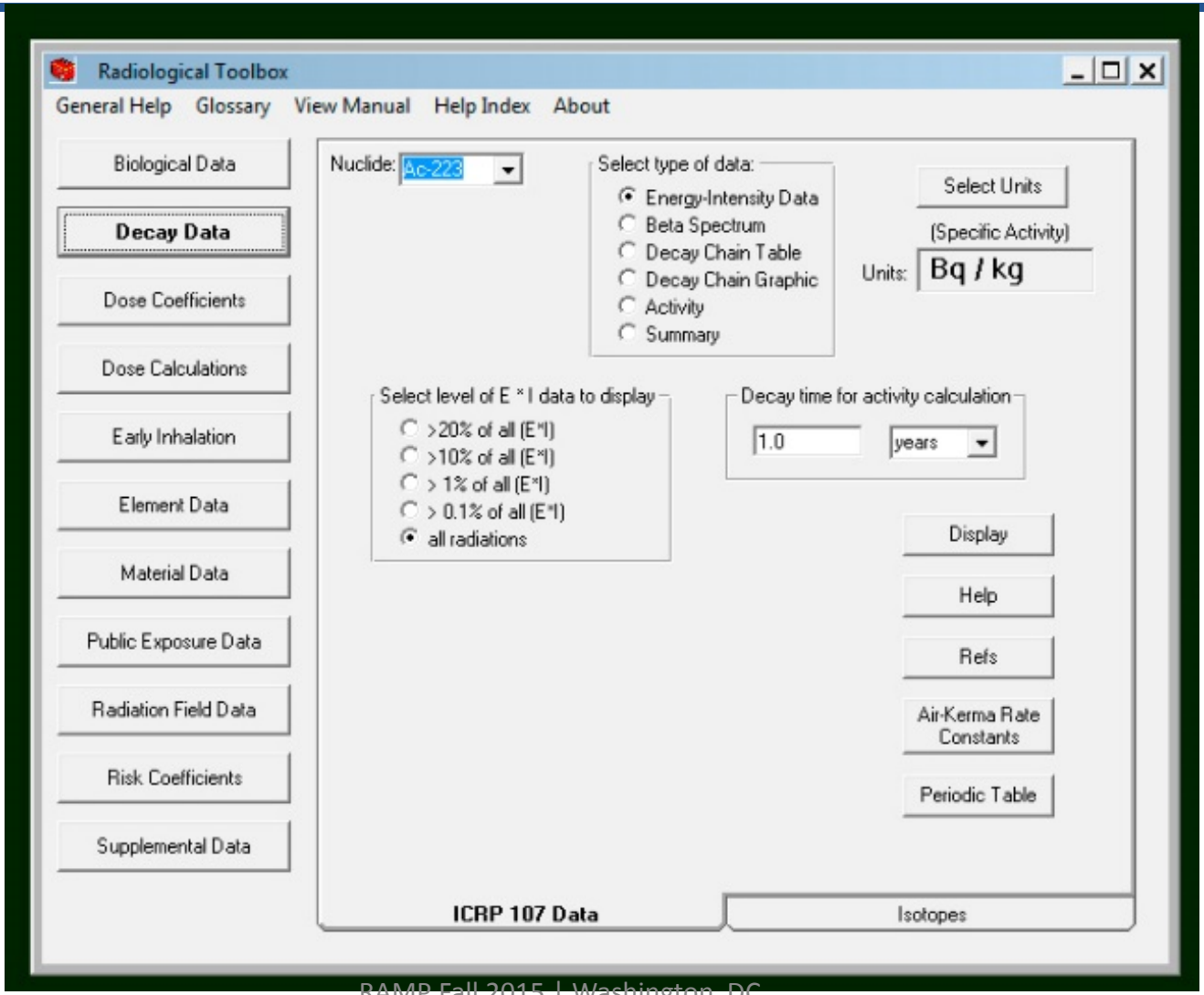
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(1) Bioassay Application



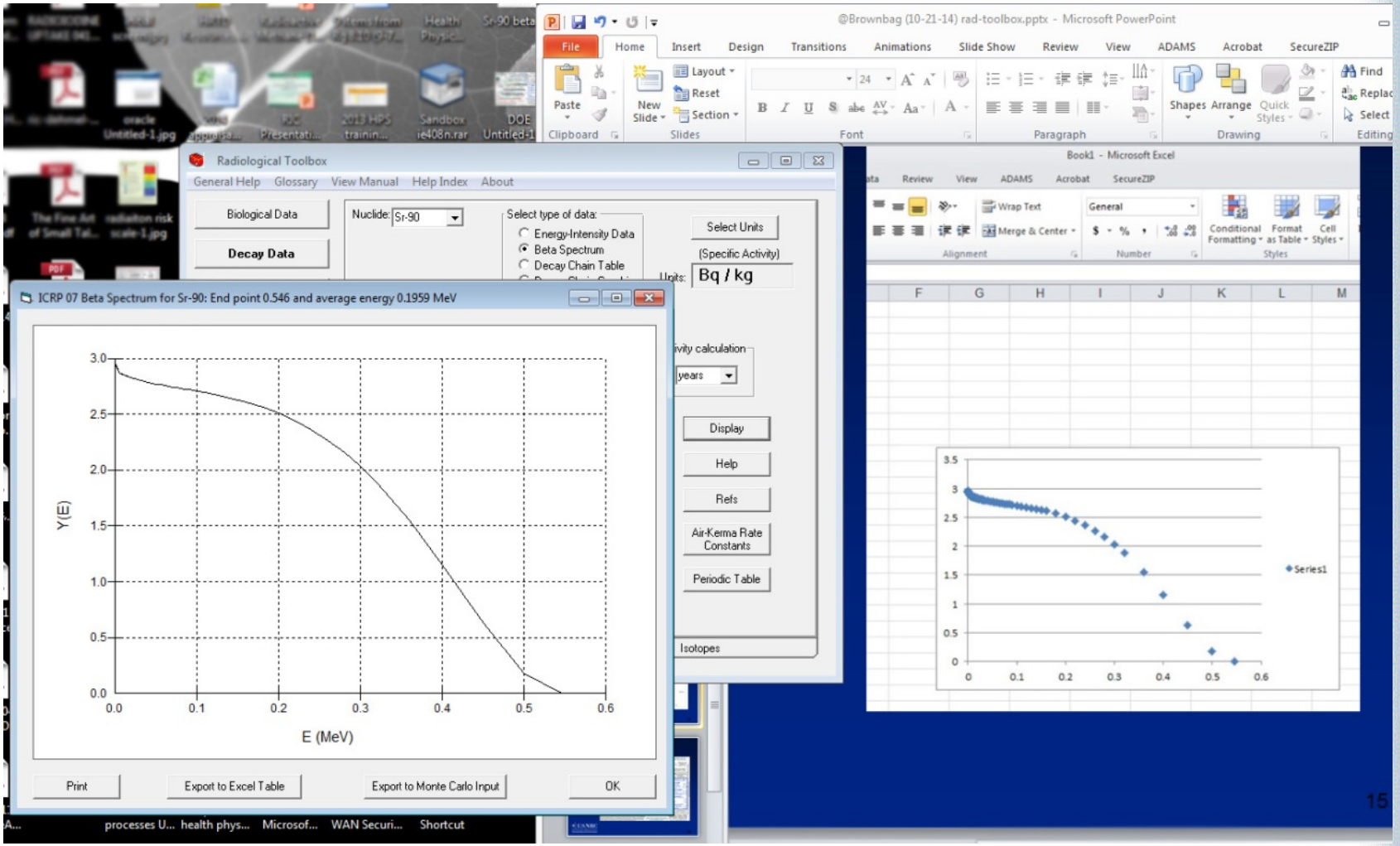
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(2) Decay Data



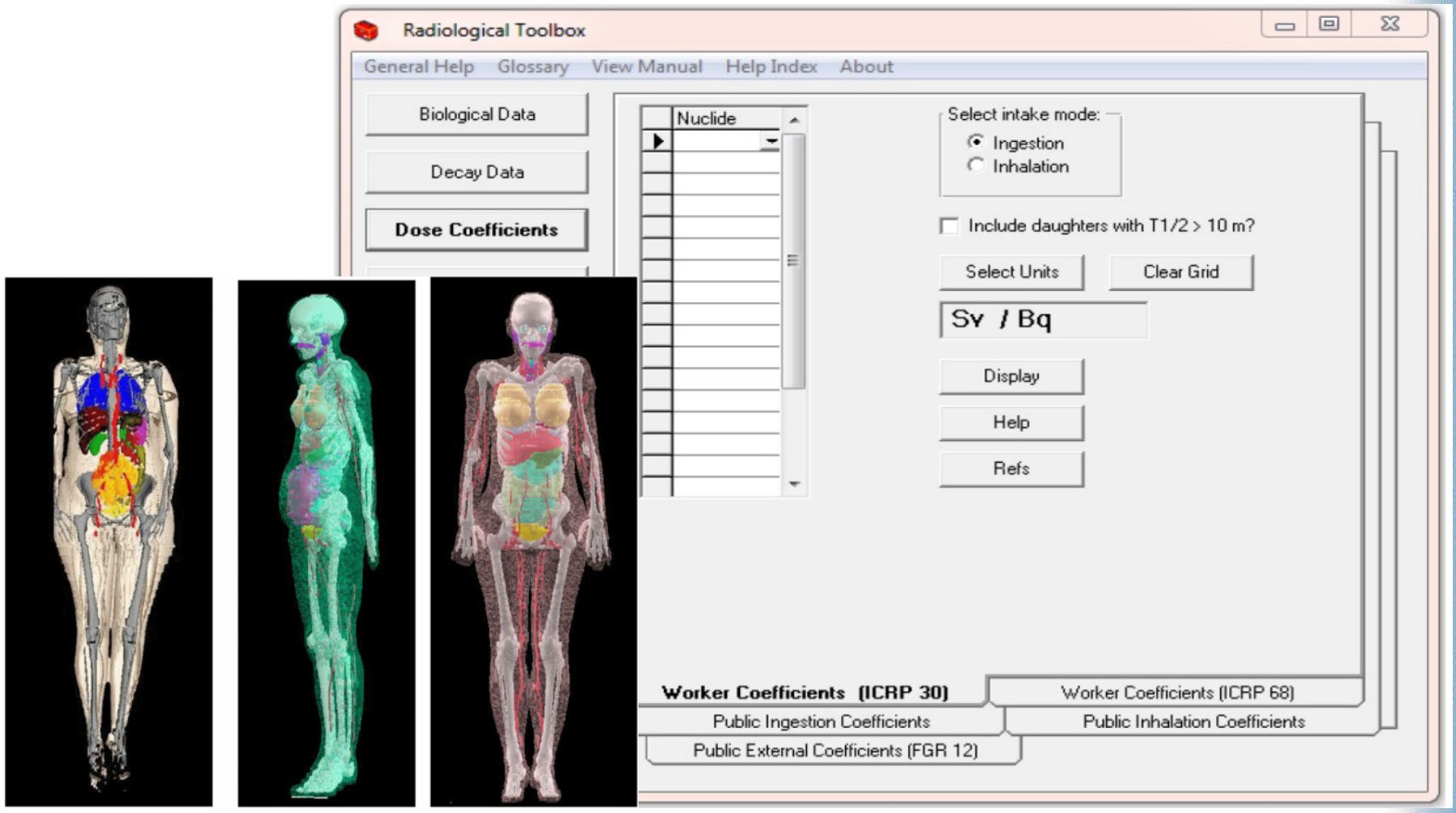
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(2) Sr-90 Beta Spec.



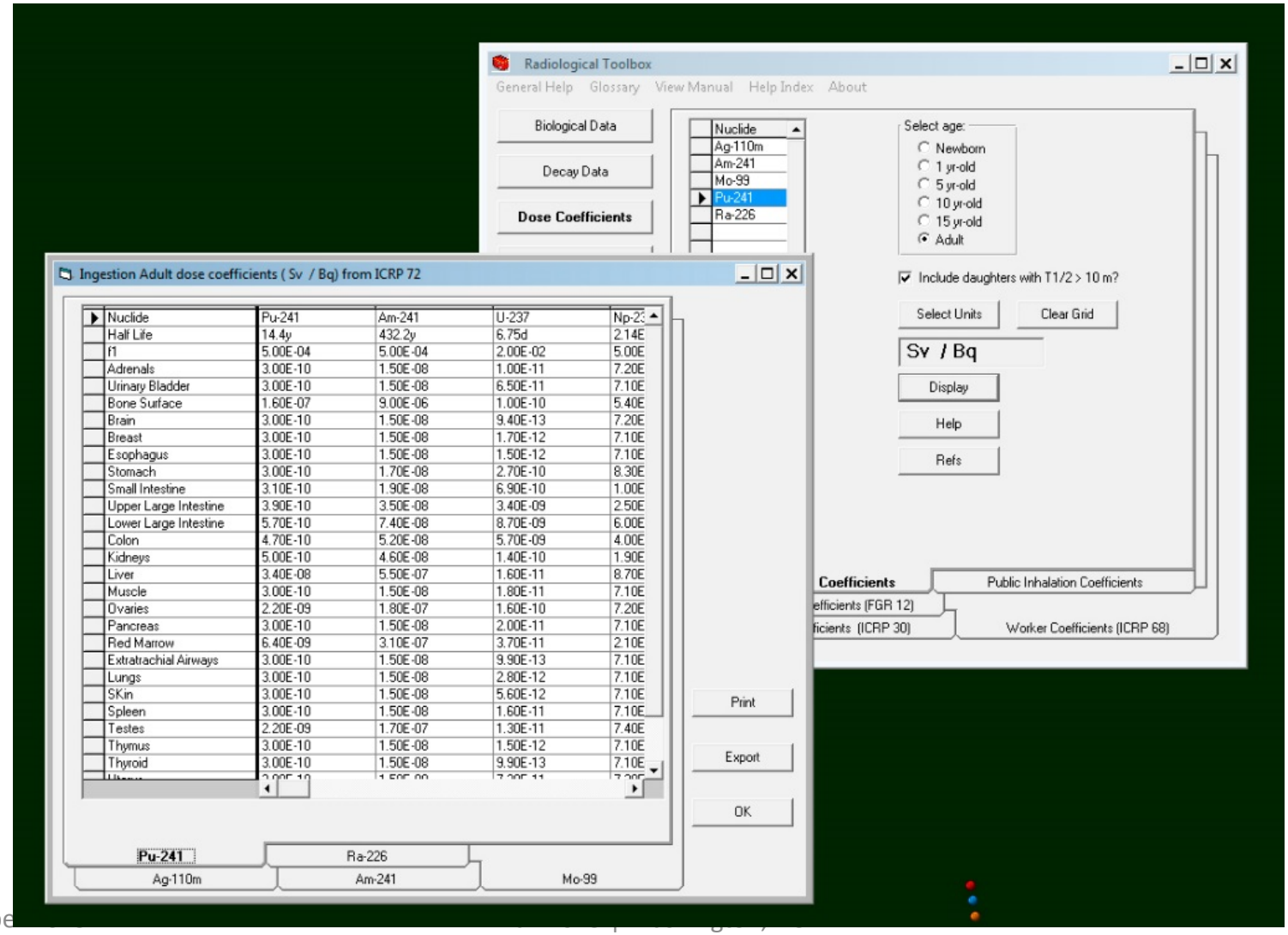
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(3) Dose Coefficients



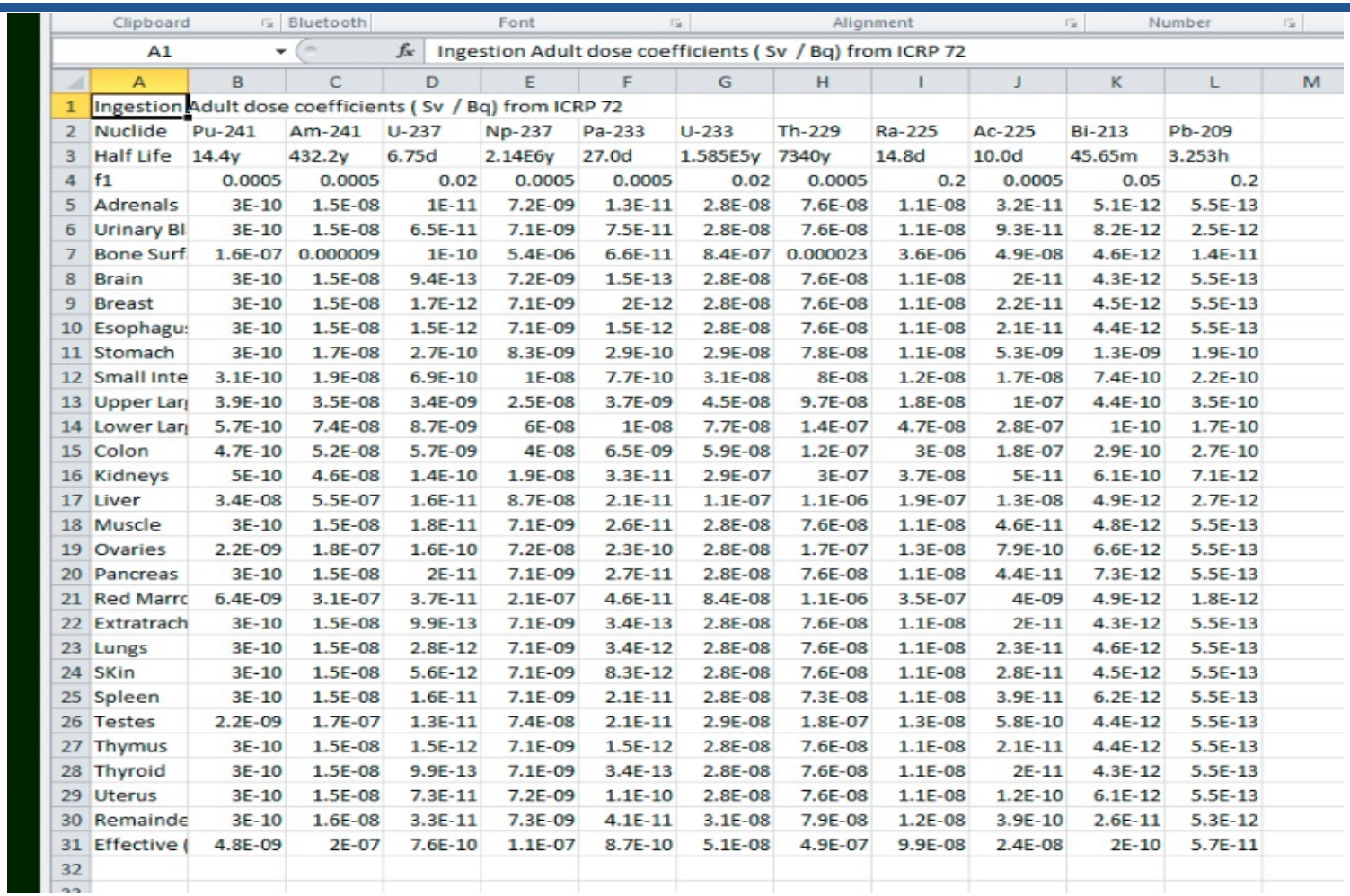
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(3) Pu-241; Adult



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(3) Pu-241



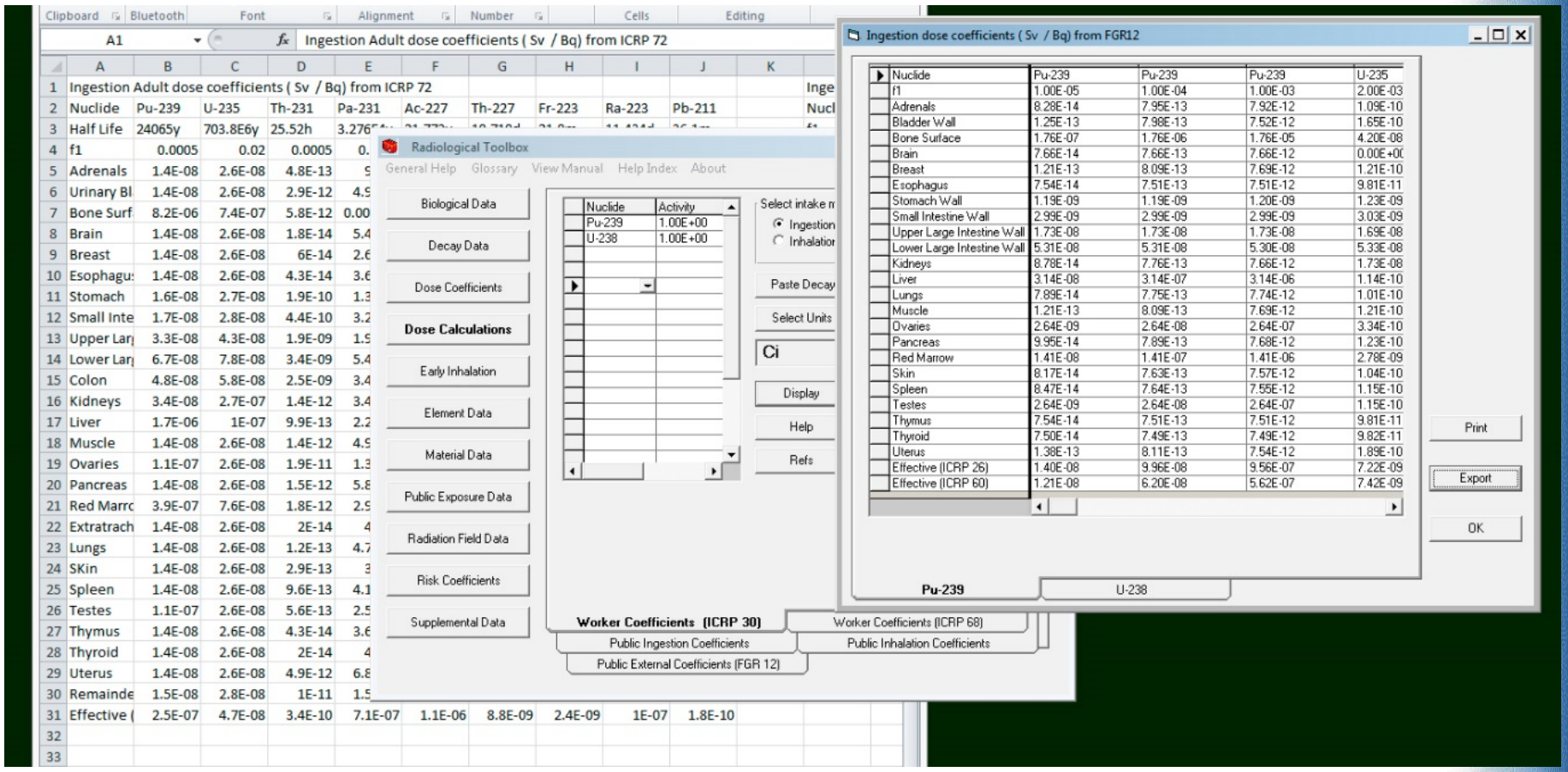
Clipboard | Bluetooth | Font | Alignment | Number

A1 — Ingestion Adult dose coefficients (Sv / Bq) from ICRP 72

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Ingestion Adult dose coefficients (Sv / Bq) from ICRP 72												
2	Nuclide	Pu-241	Am-241	U-237	Np-237	Pa-233	U-233	Th-229	Ra-225	Ac-225	Bi-213	Pb-209	
3	Half Life	14.4y	432.2y	6.75d	2.14E6y	27.0d	1.585E5y	7340y	14.8d	10.0d	45.65m	3.253h	
4	f1	0.0005	0.0005	0.02	0.0005	0.0005	0.02	0.0005	0.2	0.0005	0.05	0.2	
5	Adrenals	3E-10	1.5E-08	1E-11	7.2E-09	1.3E-11	2.8E-08	7.6E-08	1.1E-08	3.2E-11	5.1E-12	5.5E-13	
6	Urinary Bl	3E-10	1.5E-08	6.5E-11	7.1E-09	7.5E-11	2.8E-08	7.6E-08	1.1E-08	9.3E-11	8.2E-12	2.5E-12	
7	Bone Surf	1.6E-07	0.000009	1E-10	5.4E-06	6.6E-11	8.4E-07	0.000023	3.6E-06	4.9E-08	4.6E-12	1.4E-11	
8	Brain	3E-10	1.5E-08	9.4E-13	7.2E-09	1.5E-13	2.8E-08	7.6E-08	1.1E-08	2E-11	4.3E-12	5.5E-13	
9	Breast	3E-10	1.5E-08	1.7E-12	7.1E-09	2E-12	2.8E-08	7.6E-08	1.1E-08	2.2E-11	4.5E-12	5.5E-13	
10	Esophagu:	3E-10	1.5E-08	1.5E-12	7.1E-09	1.5E-12	2.8E-08	7.6E-08	1.1E-08	2.1E-11	4.4E-12	5.5E-13	
11	Stomach	3E-10	1.7E-08	2.7E-10	8.3E-09	2.9E-10	2.9E-08	7.8E-08	1.1E-08	5.3E-09	1.3E-09	1.9E-10	
12	Small Inte	3.1E-10	1.9E-08	6.9E-10	1E-08	7.7E-10	3.1E-08	8E-08	1.2E-08	1.7E-08	7.4E-10	2.2E-10	
13	Upper Lar	3.9E-10	3.5E-08	3.4E-09	2.5E-08	3.7E-09	4.5E-08	9.7E-08	1.8E-08	1E-07	4.4E-10	3.5E-10	
14	Lower Lar	5.7E-10	7.4E-08	8.7E-09	6E-08	1E-08	7.7E-08	1.4E-07	4.7E-08	2.8E-07	1E-10	1.7E-10	
15	Colon	4.7E-10	5.2E-08	5.7E-09	4E-08	6.5E-09	5.9E-08	1.2E-07	3E-08	1.8E-07	2.9E-10	2.7E-10	
16	Kidneys	5E-10	4.6E-08	1.4E-10	1.9E-08	3.3E-11	2.9E-07	3E-07	3.7E-08	5E-11	6.1E-10	7.1E-12	
17	Liver	3.4E-08	5.5E-07	1.6E-11	8.7E-08	2.1E-11	1.1E-07	1.1E-06	1.9E-07	1.3E-08	4.9E-12	2.7E-12	
18	Muscle	3E-10	1.5E-08	1.8E-11	7.1E-09	2.6E-11	2.8E-08	7.6E-08	1.1E-08	4.6E-11	4.8E-12	5.5E-13	
19	Ovaries	2.2E-09	1.8E-07	1.6E-10	7.2E-08	2.3E-10	2.8E-08	1.7E-07	1.3E-08	7.9E-10	6.6E-12	5.5E-13	
20	Pancreas	3E-10	1.5E-08	2E-11	7.1E-09	2.7E-11	2.8E-08	7.6E-08	1.1E-08	4.4E-11	7.3E-12	5.5E-13	
21	Red Marrc	6.4E-09	3.1E-07	3.7E-11	2.1E-07	4.6E-11	8.4E-08	1.1E-06	3.5E-07	4E-09	4.9E-12	1.8E-12	
22	Extratrach	3E-10	1.5E-08	9.9E-13	7.1E-09	3.4E-13	2.8E-08	7.6E-08	1.1E-08	2E-11	4.3E-12	5.5E-13	
23	Lungs	3E-10	1.5E-08	2.8E-12	7.1E-09	3.4E-12	2.8E-08	7.6E-08	1.1E-08	2.3E-11	4.6E-12	5.5E-13	
24	SKin	3E-10	1.5E-08	5.6E-12	7.1E-09	8.3E-12	2.8E-08	7.6E-08	1.1E-08	2.8E-11	4.5E-12	5.5E-13	
25	Spleen	3E-10	1.5E-08	1.6E-11	7.1E-09	2.1E-11	2.8E-08	7.3E-08	1.1E-08	3.9E-11	6.2E-12	5.5E-13	
26	Testes	2.2E-09	1.7E-07	1.3E-11	7.4E-08	2.1E-11	2.9E-08	1.8E-07	1.3E-08	5.8E-10	4.4E-12	5.5E-13	
27	Thymus	3E-10	1.5E-08	1.5E-12	7.1E-09	1.5E-12	2.8E-08	7.6E-08	1.1E-08	2.1E-11	4.4E-12	5.5E-13	
28	Thyroid	3E-10	1.5E-08	9.9E-13	7.1E-09	3.4E-13	2.8E-08	7.6E-08	1.1E-08	2E-11	4.3E-12	5.5E-13	
29	Uterus	3E-10	1.5E-08	7.3E-11	7.2E-09	1.1E-10	2.8E-08	7.6E-08	1.1E-08	1.2E-10	6.1E-12	5.5E-13	
30	Remainde	3E-10	1.6E-08	3.3E-11	7.3E-09	4.1E-11	3.1E-08	7.9E-08	1.2E-08	3.9E-10	2.6E-11	5.3E-12	
31	Effective (	4.8E-09	2E-07	7.6E-10	1.1E-07	8.7E-10	5.1E-08	4.9E-07	9.9E-08	2.4E-08	2E-10	5.7E-11	
32													

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

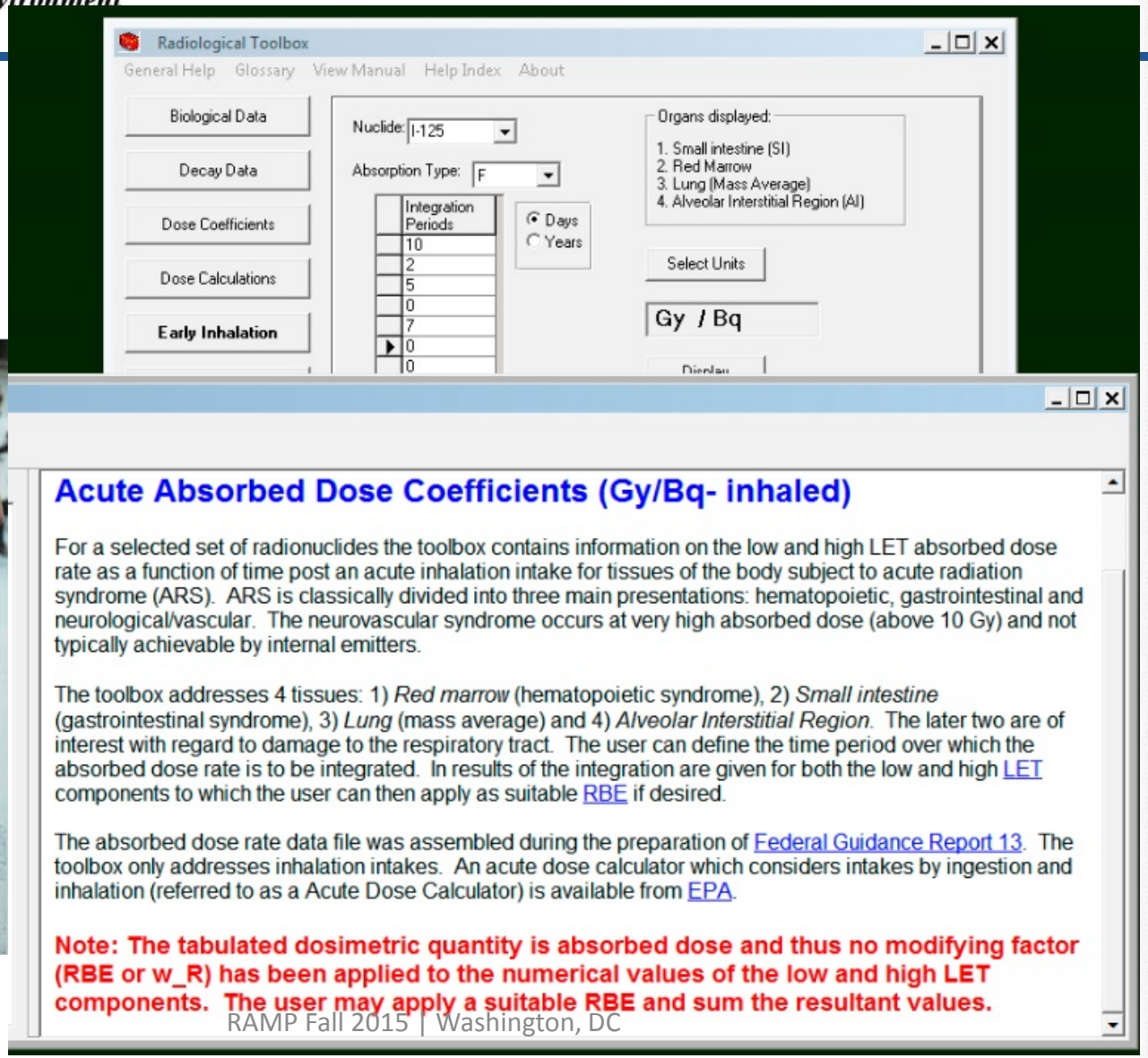
(4) Dose Calculations



Nuclide	Pu-239	Pu-239	Pu-239	U-235
f1	1.00E-05	1.00E-04	1.00E-03	2.00E-03
Adrenals	8.28E-14	7.95E-13	7.92E-12	1.09E-10
Bladder Wall	1.25E-13	7.98E-13	7.52E-12	1.65E-10
Bone Surface	1.76E-07	1.76E-06	1.76E-05	4.20E-08
Brain	7.66E-14	7.66E-13	7.66E-12	0.00E+00
Breast	1.21E-13	8.09E-13	7.69E-12	1.21E-10
Esophagus	7.54E-14	7.51E-13	7.51E-12	9.81E-11
Stomach Wall	1.19E-09	1.19E-09	1.20E-09	1.23E-09
Small Intestine Wall	2.99E-09	2.99E-09	2.99E-09	3.03E-09
Upper Large Intestine Wall	1.73E-08	1.73E-08	1.73E-08	1.69E-08
Lower Large Intestine Wall	5.31E-08	5.31E-08	5.30E-08	5.33E-08
Kidneys	8.78E-14	7.76E-13	7.66E-12	1.73E-08
Liver	3.14E-08	3.14E-07	3.14E-06	1.14E-10
Lungs	7.89E-14	7.75E-13	7.74E-12	1.01E-10
Muscle	1.21E-13	8.09E-13	7.69E-12	1.21E-10
Ovaries	2.64E-09	2.64E-08	2.64E-07	3.34E-10
Pancreas	9.95E-14	7.89E-13	7.68E-12	1.23E-10
Red Marrow	1.41E-08	1.41E-07	1.41E-06	2.78E-09
Skin	8.17E-14	7.63E-13	7.57E-12	1.04E-10
Spleen	8.47E-14	7.64E-13	7.55E-12	1.15E-10
Testes	2.64E-09	2.64E-08	2.64E-07	1.15E-10
Thymus	7.54E-14	7.51E-13	7.51E-12	9.81E-11
Thyroid	7.50E-14	7.49E-13	7.49E-12	9.82E-11
Uterus	1.38E-13	8.11E-13	7.54E-12	1.89E-10
Effective (ICRP 26)	1.40E-08	9.96E-08	9.56E-07	7.22E-09
Effective (ICRP 60)	1.21E-08	6.20E-08	5.62E-07	7.42E-09

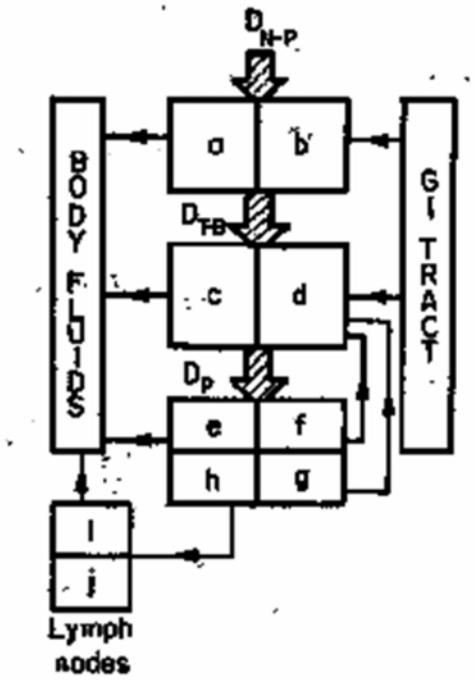
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

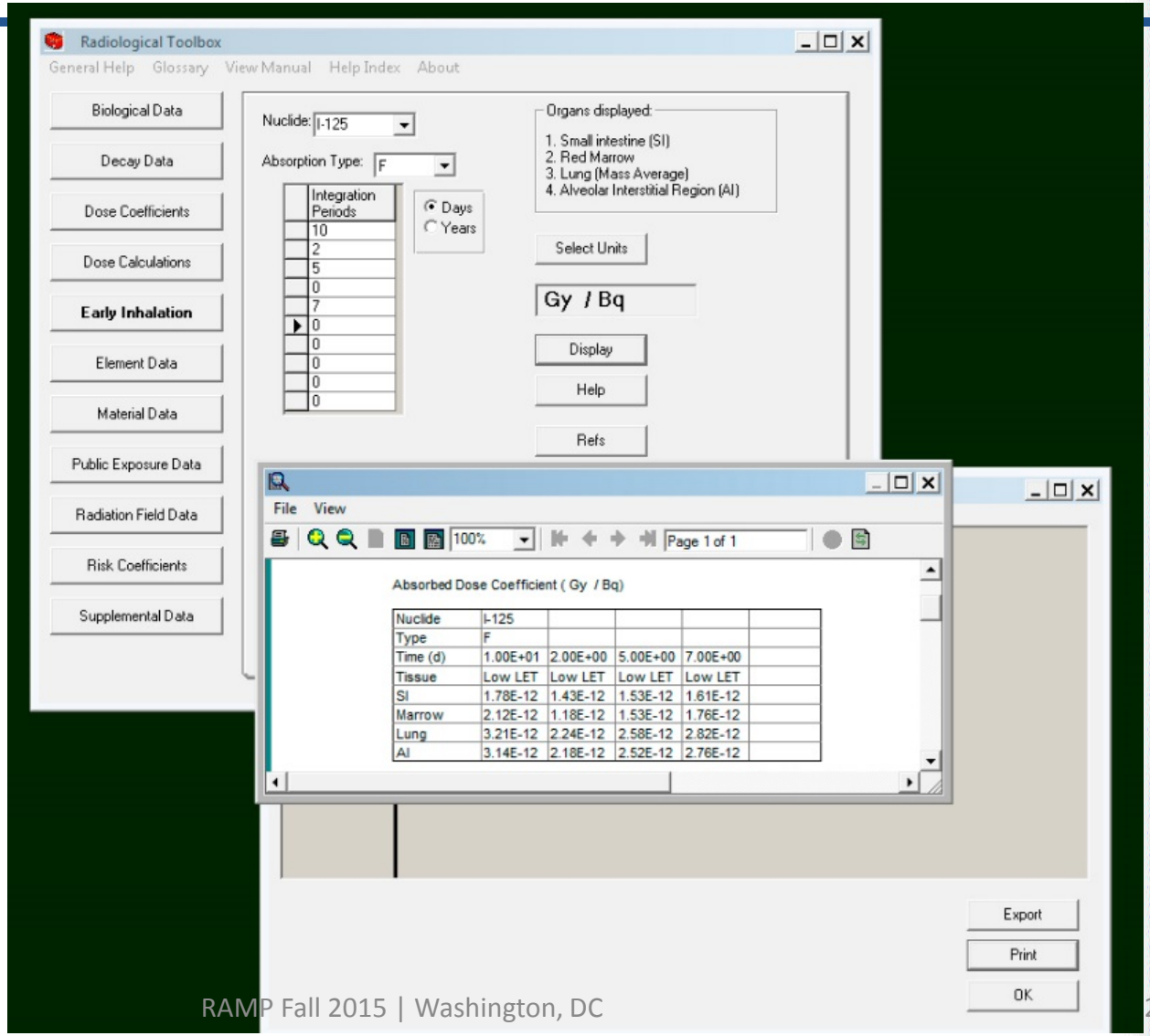
(5) Early Inhalation



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

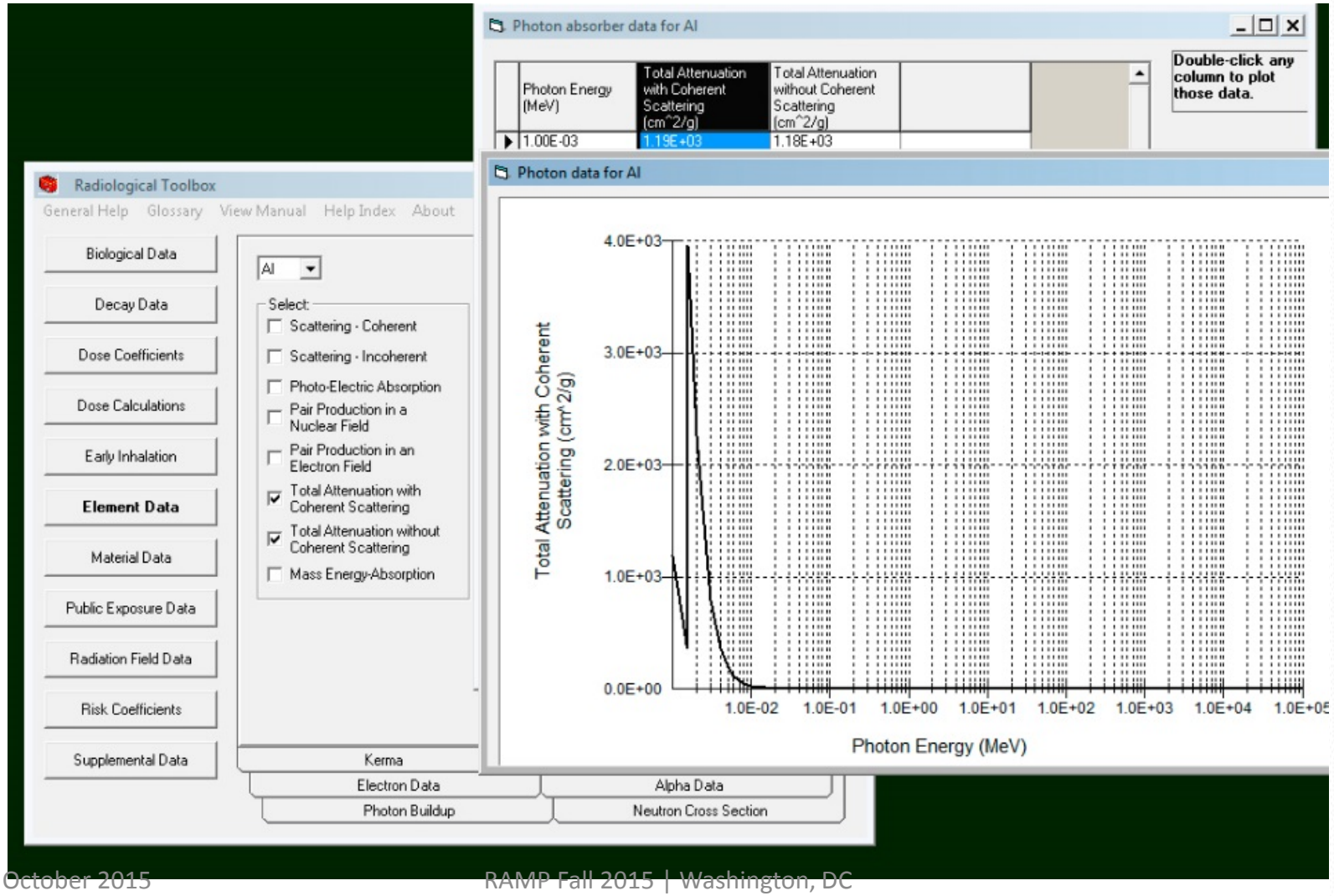
(5) I-125





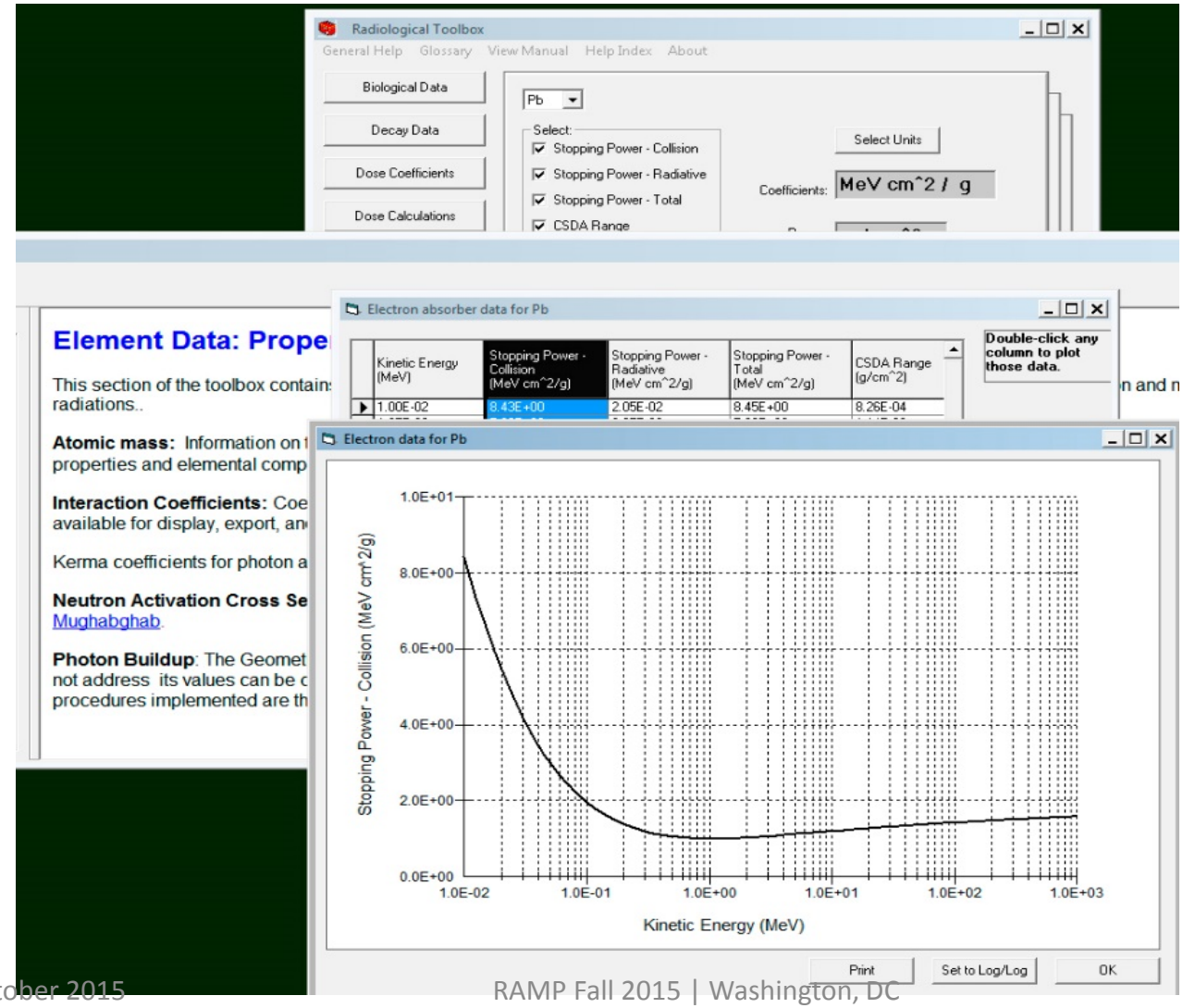
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(6) Element Data (Al)



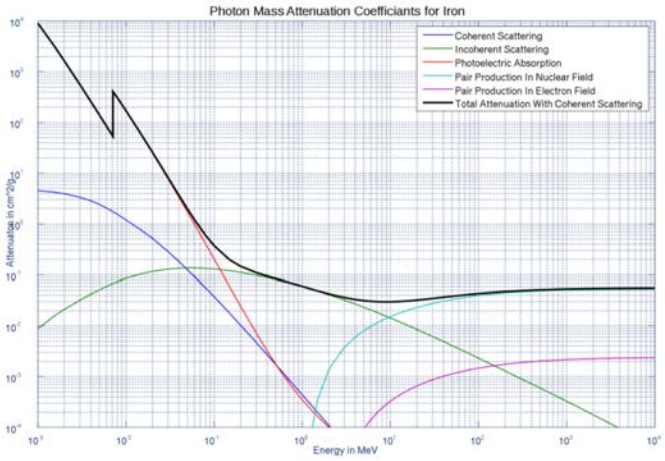
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

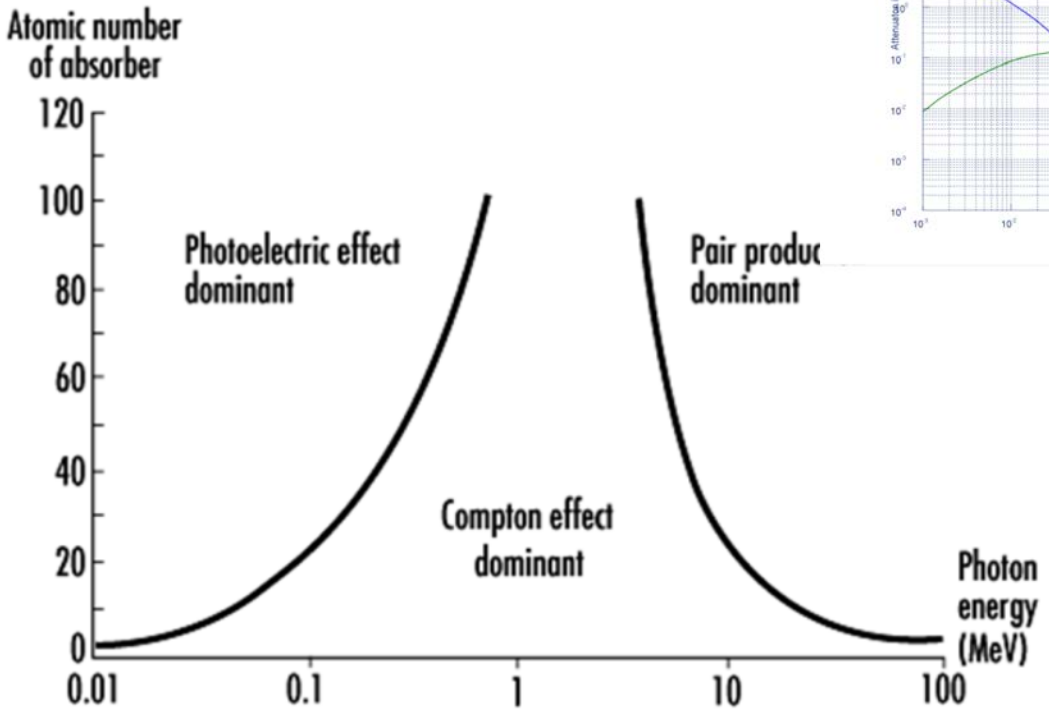
(6) Element Data (Pb)



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

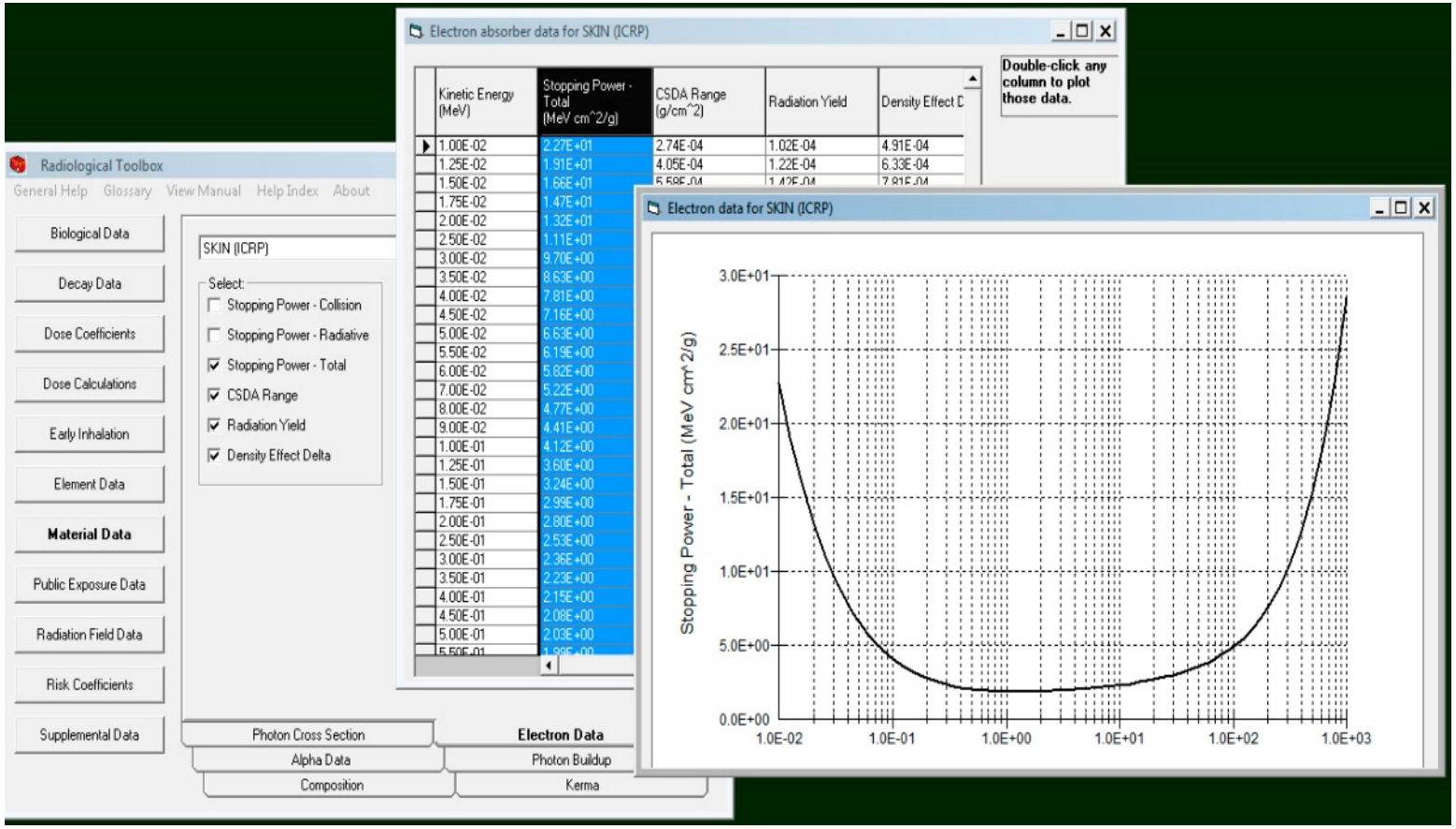
(6) Element Data (Fe)



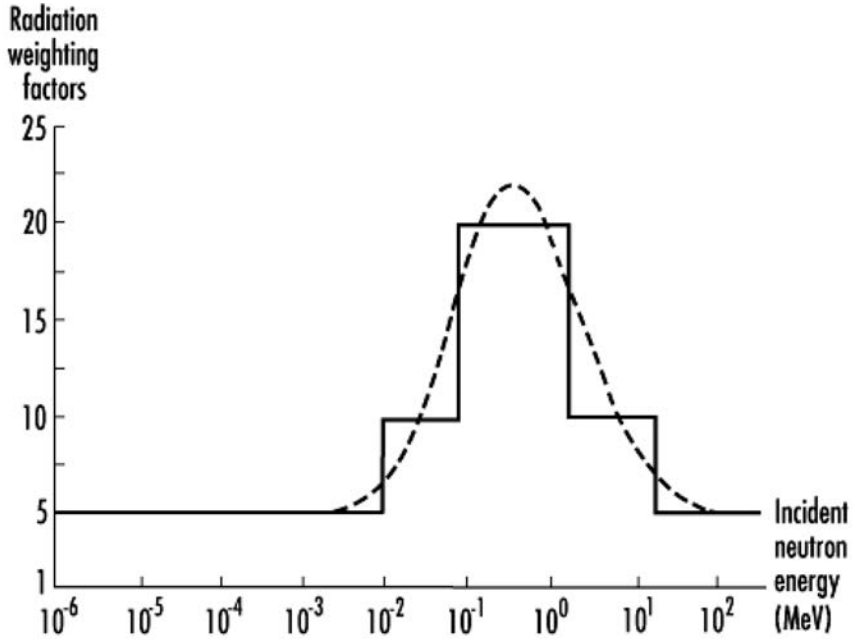


U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(7) Material Data (Skin)



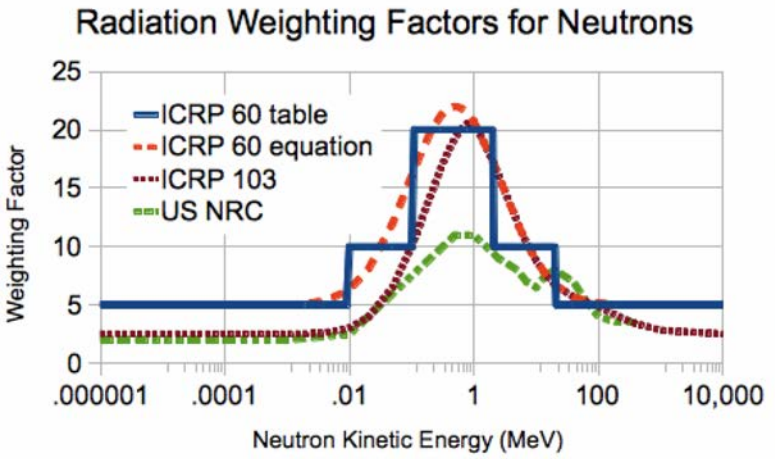
(7) Neutron "w_R"



$$w_R = \begin{cases} 2.5 + 18.2e^{-[\ln (E_n)]^2/6}, & E_n < 1 \text{ MeV} \\ 5.0 + 17.0e^{-[\ln (2E_n)]^2/6}, & 1 \text{ MeV} \leqslant E_n \leqslant 50 \text{ MeV} \\ 2.5 + 3.25e^{-[\ln (0.04E_n)]^2/6}, & E_n > 50 \text{ MeV} \end{cases}$$

ICRP 60 Radiation Weighting Factors

Radiation type and energy	Weighting Factor w_R
Photons, all energies	1
Electrons, all energies	1
Neutrons, energy < 10 keV	5
10 - 100 keV	10
100 - 2000 keV	20
2 - 20 MeV	10
> 20 MeV	5
Protons, energy > 2 MeV	5
Alpha, fission fragments	20



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(8) Public Exposure Data

Radiological Toolbox

General Help Glossary View Manual Help Index About

- Biological Data
- Decay Data
- Dose Coefficients
- Dose Calculations
- Early Inhalation
- Element Data
- Material Data
- **Public Exposure Data**
- Radiation Field Data
- Risk Coefficients
- Supplemental Data

- Natural Background Radiation
- Background Radiation in the Body
- Radionuclides in Materials
- Radionuclides in Devices
- Primordial Radionuclides
- Typical Exposures during Medical Procedures
- Typical Exposures during CT Examinations
- DOE Ionizing Radiation Dose Graphic

Public Exposure Data

Natural Background Radiation

Natural Background Radiation

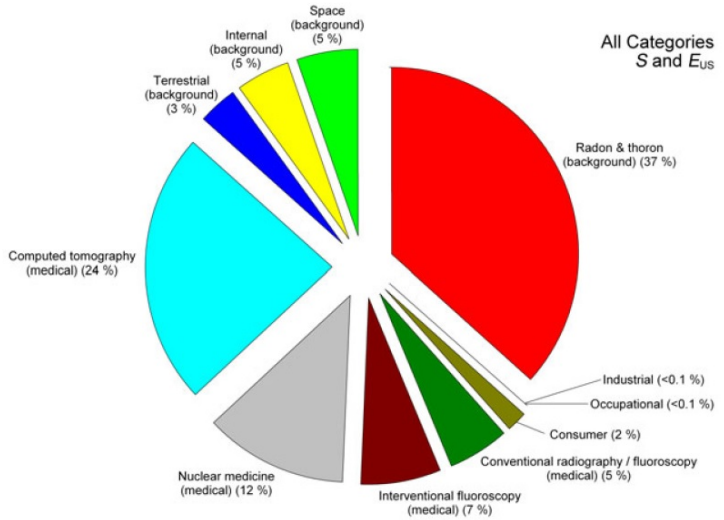


Fig. 1.1. Percent contribution of various sources of exposure to the total collective effective dose (1,870,000 person-Sv) and the total effective dose per individual in the U.S. population (6.2 mSv) for 2006. Percent values have been rounded to the nearest 1 %, except for those <1 % [see Table 1.1 for the values of S (person-sievert) and E_{US} (millisievert)].

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(8) Basic NORM

Natural Occurring Radionuclides in Body		
Nuclide	**Mass**	**Activity**
Uranium	90 µg	1.1 Bq
Thorium	30 µg	0.11 Bq
Potassium 40	17 mg	4.4 kBq
Radium	31 pg	1.1 Bq
Carbon 14	22 ng	3.7 kBq
Tritium	0.06 pg	23 Bq
Polonium	0.2 pg	37 Bq

Radionuclides in Oceans	
Nuclide	**Concentration**
Uranium	33 mBq/L
Potassium 40	11 Bq/L
Tritium	0.6 mBq/L
Carbon 14	5 mBq/L
Rubidium 87	1.1 mBq/L

Radionuclides in Food		
Food	**K-40 (pCi/kg)**	**Ra-226 (pCi/kg)**
Banna	3520	1
Brazil nuts	5600	1000-7000
Carrots	3400	0.6 - 2
Potatoes	3400	1 - 2.5
Beer	390	-
Red meat	3000	0.5
Lima beans	4640	2 -5
Drinking water	-	0 - 0.17

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(8) Medical Exposures

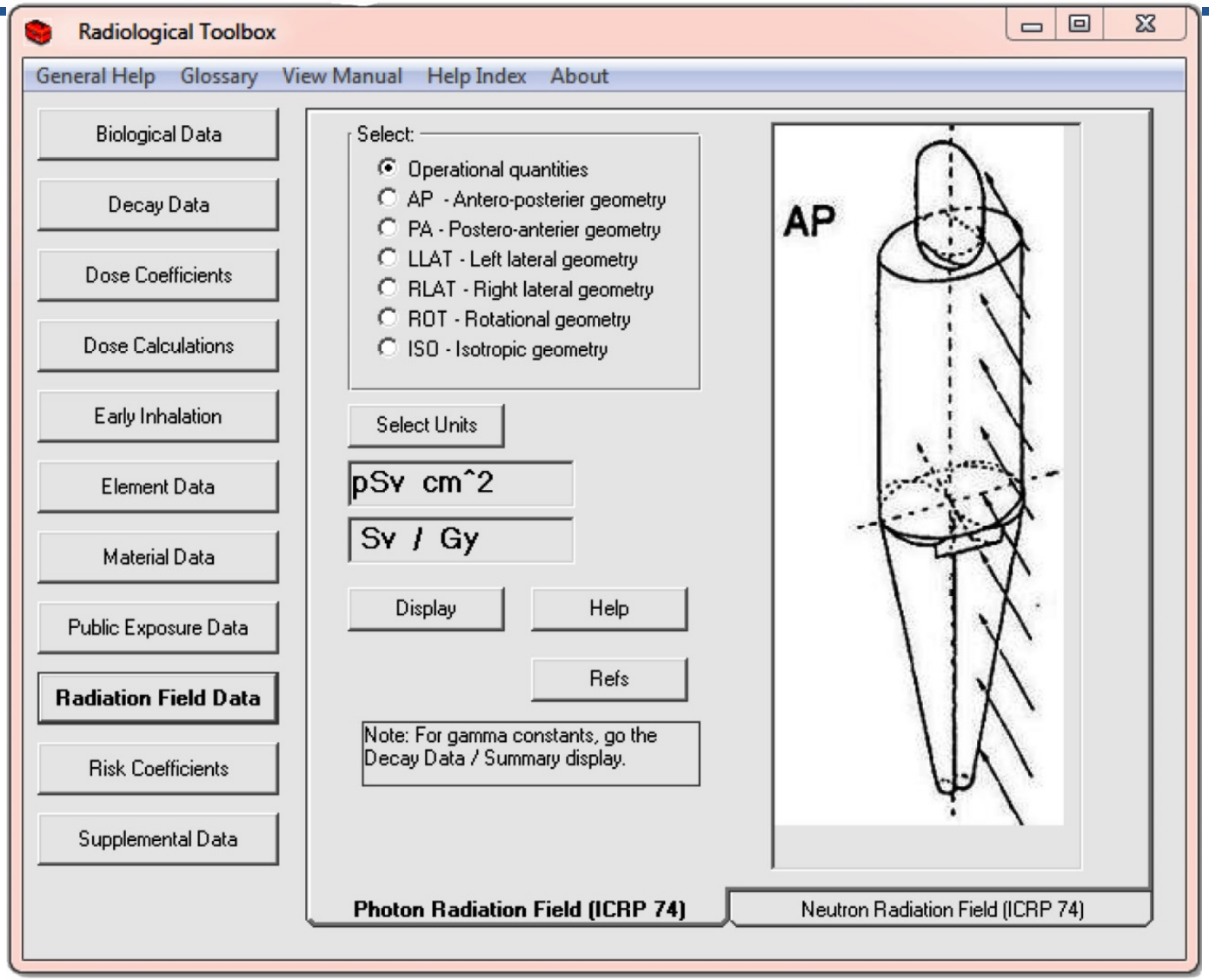
Dose from Medical Diagnostic Procedures		
Procedure	**Dose (rem)**	**Dose (mSv)**
Chest x-ray (1 film)	0.01	0.1
Dental x-ray	0.16	1.6
Mammogram	0.25	2.5
Lumbosacral spine	0.32	3.2
Bone scan (Tc-99m)	0.44	4.4
Cardiac (Tc-99m)	0.75	7.5
Cranial CT	5	50
GI fluoroscopy (barium)	8.5	85
Spiral CT	3-10	30 - 100

Computed tomography examinations

Effective dose per CT scans	
Examination	**Dose (mSv)**
Head	2
Chest	7
Abdomen/pelvis	10
Extremity	0.1
CT angiography: heart	20
CT angiography: head	5
Spine	10
Interventional	0.1
Whole-body screening	10
Calcium scoring	2
Cardiac	20
Virtual colonography	10
Miscellaneous	5

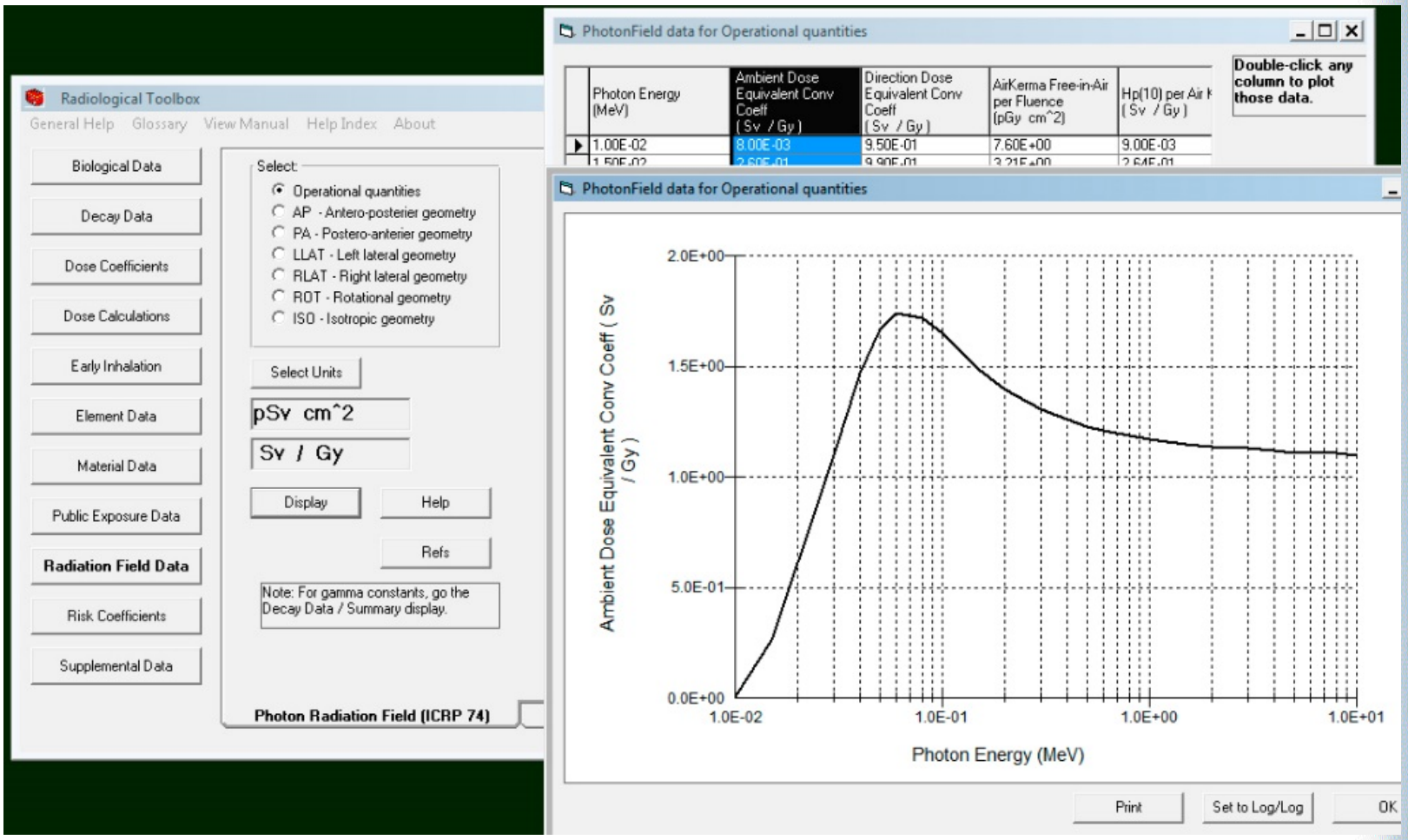
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(9) Radiation Field Data



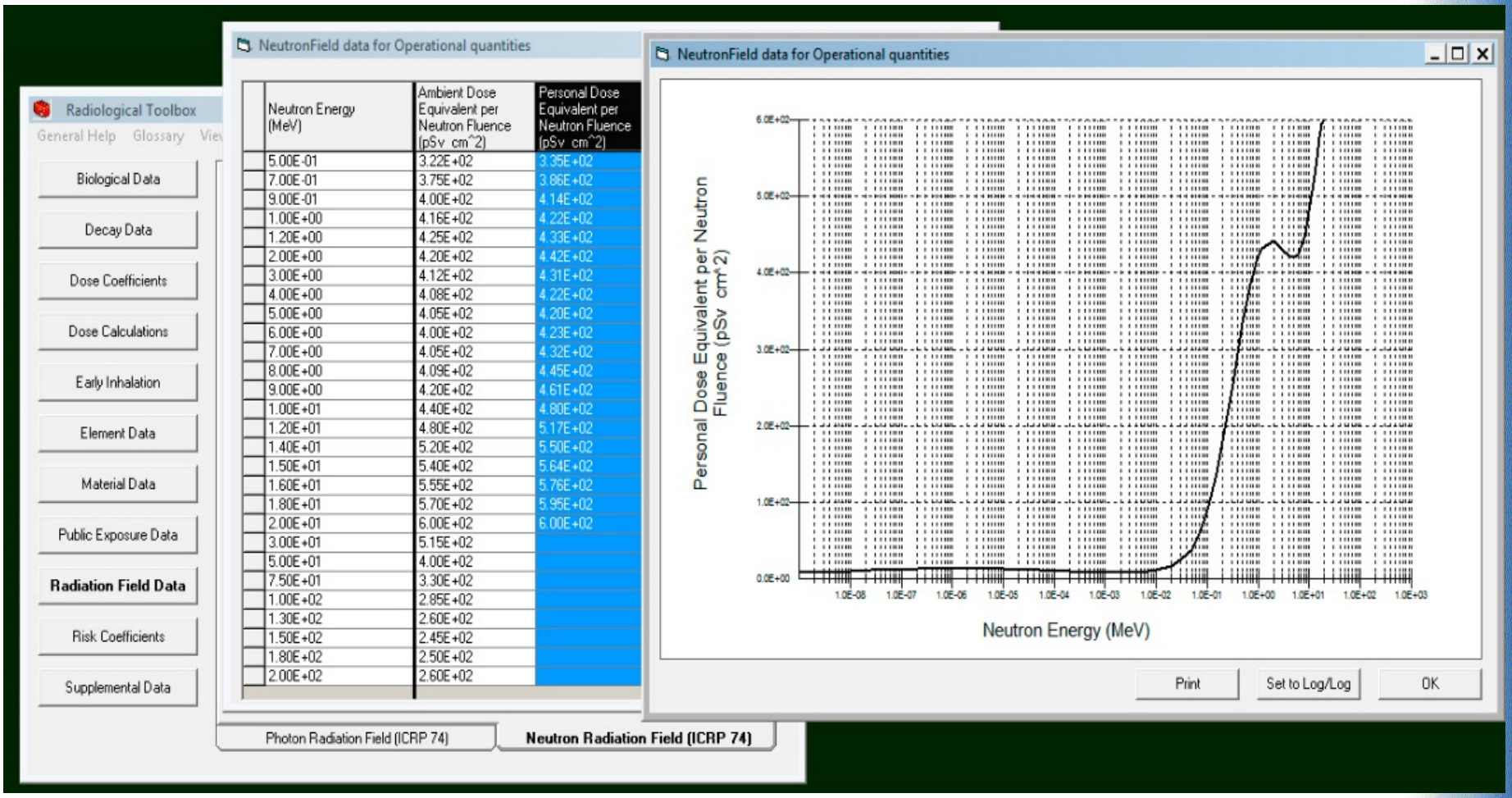
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(9) Operational (γ)



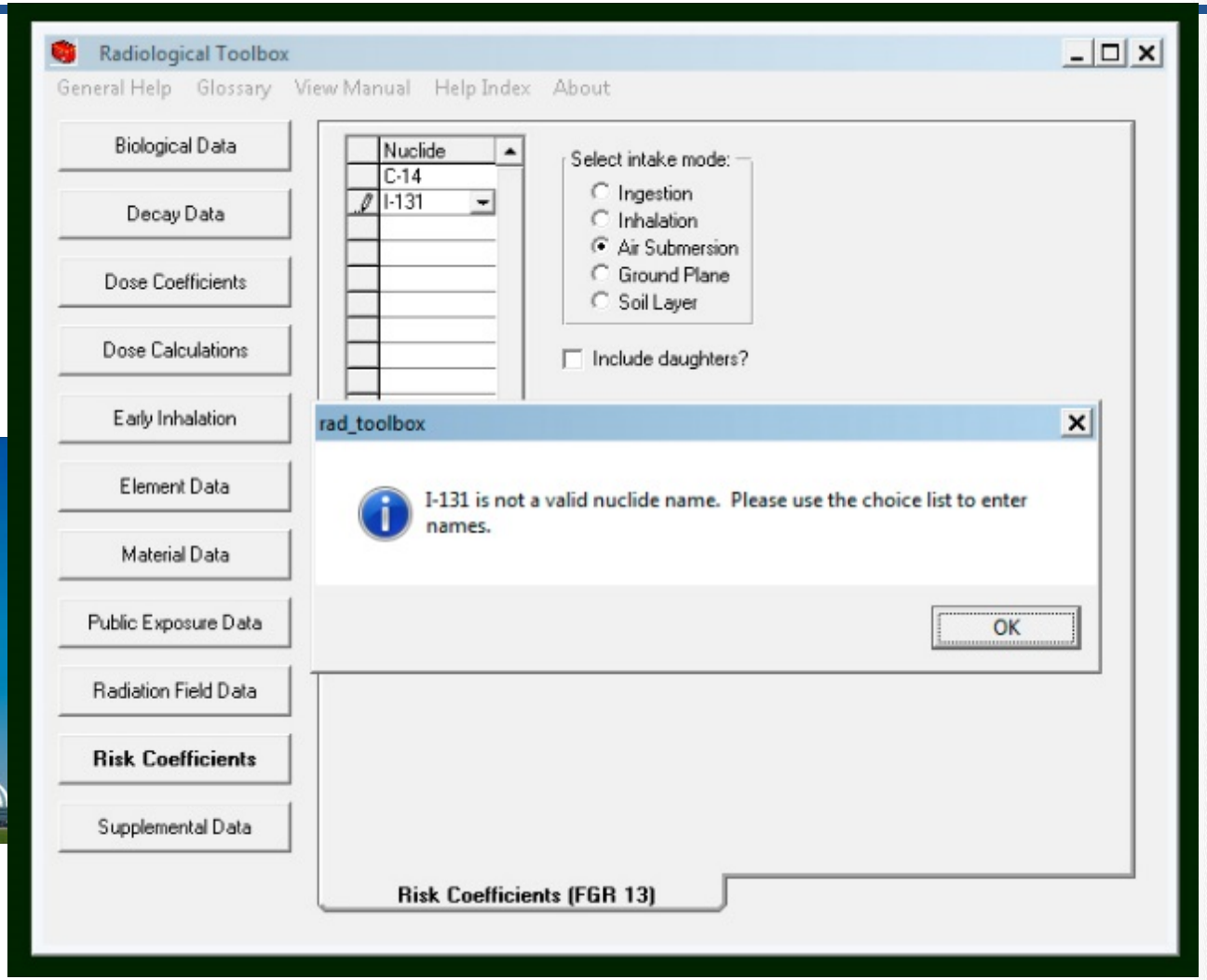
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(9) Operational (n)



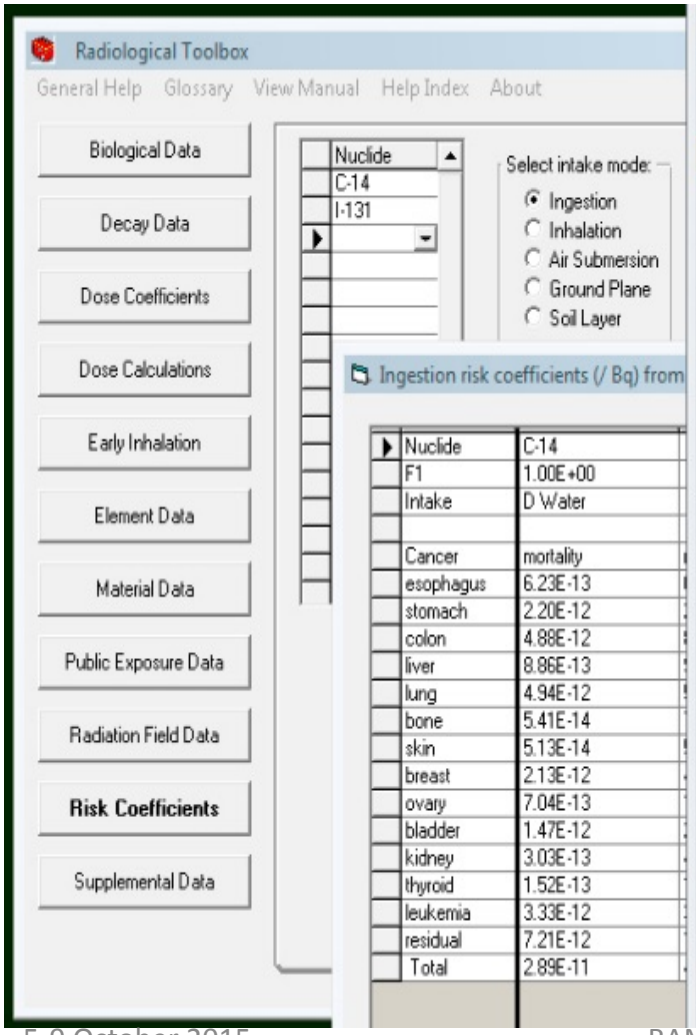
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(10) Risk Coefficients



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(10) C-14 and I-131



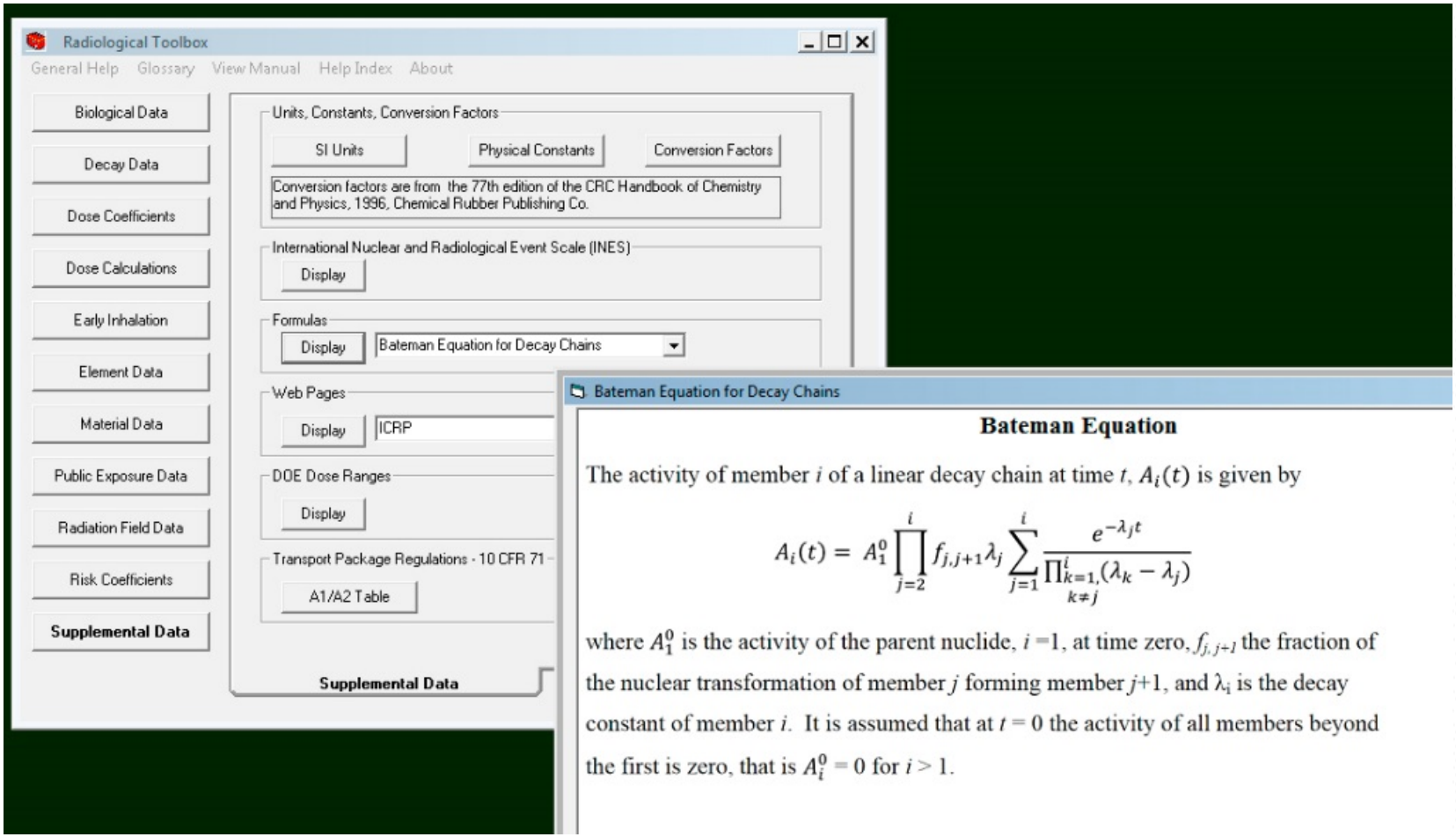
Workbook Views | Zoom | Window

A1: Ingestion risk coefficients (/ Bq) from FGR 13

	A	B	C	D	E	F	G	H	I	J
1	Ingestion risk coefficients (/ Bq) from FGR 13									
2	Nuclide	C-14		C-14		I-131		I-131		
3	F1	1.00E+00		1.00E+00		1.00E+00		1.00E+00		
4	Intake	D Water		Diet		D Water		Diet		
5										
6	Cancer	mortality	morbidity	mortality	morbidity	mortality	morbidity	mortality	morbidity	
7	esophagu	6.23E-13	6.92E-13	7E-13	7.78E-13	2.22E-13	2.47E-13	2.75E-13	3.06E-13	
8	stomach	2.2E-12	2.45E-12	2.93E-12	3.25E-12	1.28E-12	1.42E-12	1.75E-12	1.95E-12	
9	colon	4.88E-12	8.87E-12	6.85E-12	1.25E-11	1.83E-12	3.32E-12	2.76E-12	5.01E-12	
10	liver	8.86E-13	9.32E-13	9.89E-13	1.04E-12	8.67E-14	9.12E-14	1.02E-13	1.07E-13	
11	lung	4.94E-12	5.2E-12	6.08E-12	6.4E-12	1.13E-12	1.18E-12	1.47E-12	1.54E-12	
12	bone	5.41E-14	7.73E-14	6E-14	8.56E-14	1.3E-14	1.86E-14	1.46E-14	2.09E-14	
13	skin	5.13E-14	5.13E-14	6.43E-14	6.43E-14	7.08E-15	7.08E-15	9.18E-15	9.18E-15	
14	breast	2.13E-12	4.27E-12	2.86E-12	5.71E-12	3.24E-13	6.48E-13	4.58E-13	9.16E-13	
15	ovary	7.04E-13	1.01E-12	7.97E-13	1.14E-12	7.46E-14	1.07E-13	8.91E-14	1.27E-13	
16	bladder	1.47E-12	2.94E-12	1.58E-12	3.17E-12	2.01E-12	4.01E-12	2.18E-12	4.35E-12	
17	kidney	3.03E-13	4.67E-13	3.41E-13	5.25E-13	2.76E-14	4.25E-14	3.25E-14	5.01E-14	
18	thyroid	1.52E-13	1.52E-12	1.99E-13	1.99E-12	1.22E-10	1.22E-09	1.73E-10	1.73E-09	
19	leukemia	3.33E-12	3.36E-12	3.62E-12	3.66E-12	6.17E-13	6.23E-13	6.83E-13	6.9E-13	
20	residual	7.21E-12	1.02E-11	9.74E-12	1.37E-11	1.27E-12	1.78E-12	1.77E-12	2.49E-12	
21	Total	2.89E-11	4.2E-11	3.68E-11	5.4E-11	1.31E-10	1.23E-09	1.85E-10	1.75E-09	
22										
23										
24										

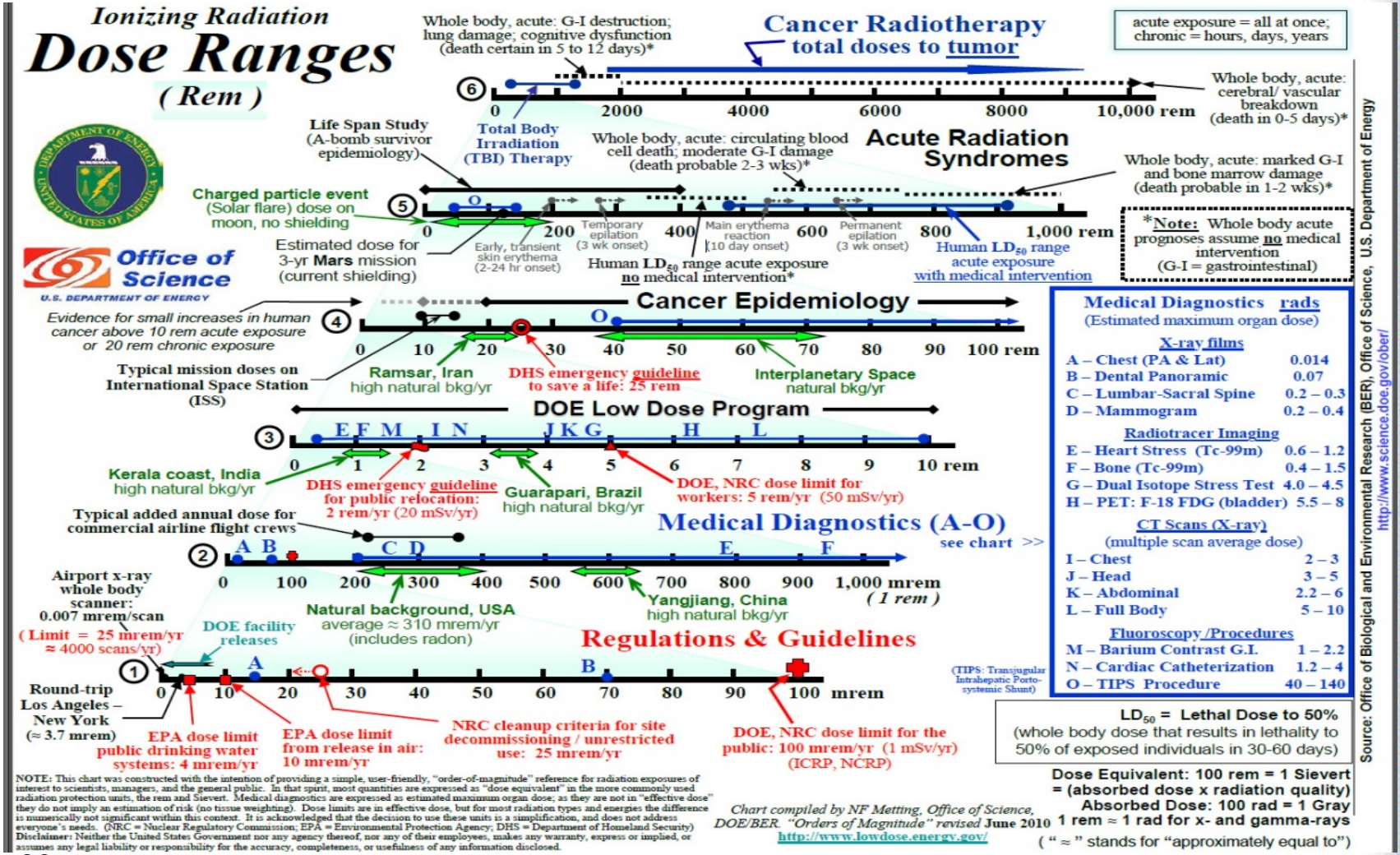
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(11) Supplemental Data



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

(11) Supplemental Data



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG/CR-7166: Ch.3. HOW TO ACCESS RAD TOOLBOX FEATURES

1. Use Of The Nuclide Input Grid In Requesting Dose Coefficients
2. Use Of The Choice Lists In Requesting Nuclide, Element, And Material Data
3. How to Export Data
4. Use The Activity Feature In Dose Calculations For A Decay Chain
5. How to Define a Material and Calculate its Interaction Coefficients
6. How to Generate Histogram Representation of Beta Spectra
7. How to Check the Integrity of the Rad Toolbox Data Files

lucational CD Downloads

Free Educational CD Downloads

The following files are downloadable installation files for CDs of dose coefficients available here at no cost. They can be used by teachers, students, and those interested radiological protection together with their parent ICRP Publications. Please note that while we encourage you to download and use these CDs, ICRP retains copyright and you must not edit or attempt to repackage these materials for sale.

These downloads replace ICRP CD1, CD2 and CD3 which are now out of print. These free downloads are for Windows operating systems, including Win 7, on 32 and 64 bit machines.

ICRP Database of Dose Coefficients: Workers and Members of the Public; Ver. 3.0
Available as a Windows setup file named ICRPDOSE_setup.exe.

ICRP Database of Dose Coefficients: Embryo and Fetus; Ver. 2.0
Available either as a Windows setup file named ICRPCD2_setup.exe or as a selfextracting file named ICRPCD2_SelfExtract.exe.

ICRP Database of Dose Coefficients: Radionuclides in Mother's Milk; Ver. 2.0
Available either as a Windows setup file named ICRPCD3_setup.exe or as a selfextracting file named ICRPCD3_SelfExtract.exe.

If the Help utility is not available for CD2 and CD3 it maybe necessary to download from a program from Microsoft. See the ReadMe.txt file in the installation folder after installing these databases.

Please note that the dose coefficients in the first of the downloadable CDs listed above are the same as those in ICRP Publication 119 "Compendium of Dose Coefficients based on ICRP Publication 60". Although the downloadable CDs will be of practical use, the above-noted ICRP Publication will be the definitive and reference able compendium of these coefficients.

ICRPDOSE Copyright Notice

Copyright © International Commission on Radiological Protection. All Rights Reserved.

The copyright on these CDs is held by the International Commission on Radiological Protection. However permission is granted to anyone obtaining a copy of the installation files to use, copy and distribute these materials and their documentation for educational, research and not-for-profit

ned licensing agreement provided their copyright notices is

Internet | Protect

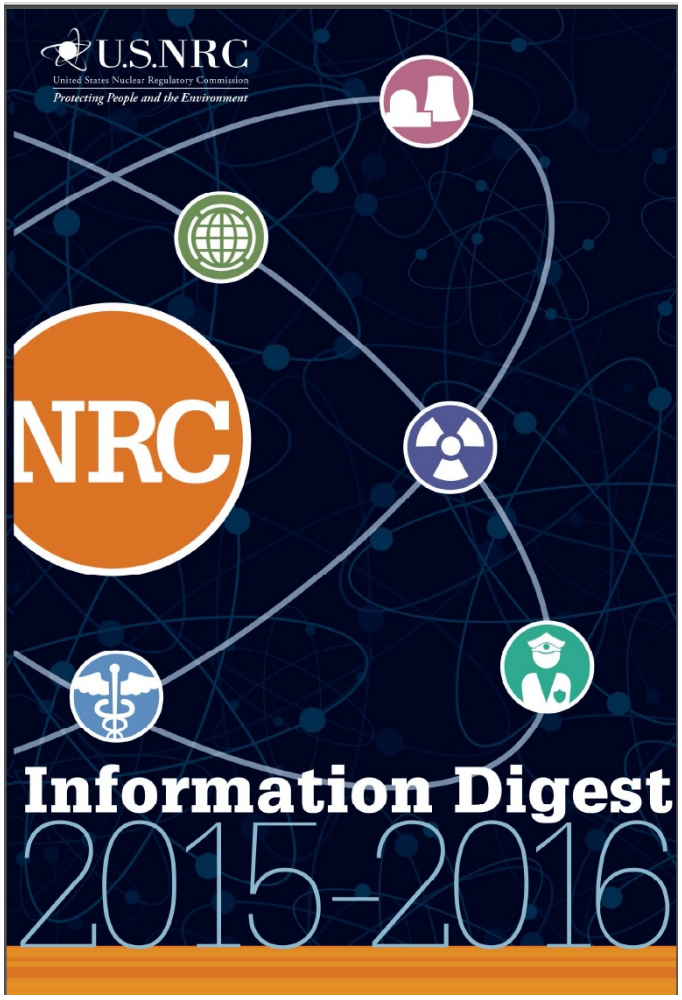
Freebie:

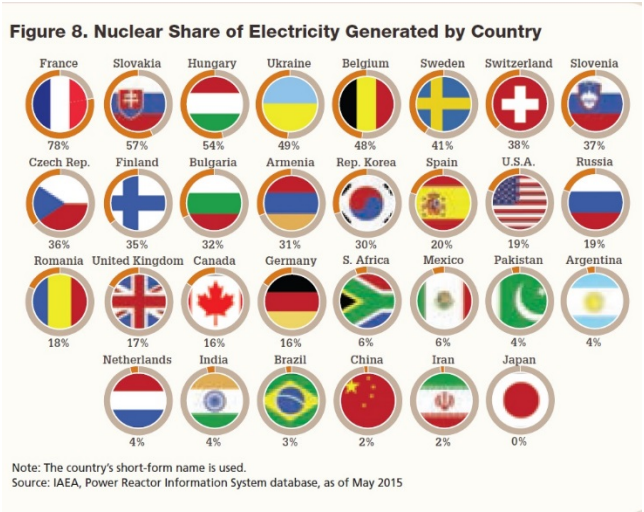
In footnote of Page 9:
"The numbers of nuclides differ between FGR 12 and **ICRP Publications 30, 68, and 72** as the latter set of publications do not consider the intake of radionuclides of **half-life less than 10 minutes.** The ICRP Database of Dose Coefficients: Workers and Members of the Public; Ver. 3.0 is now available as a free educational download; http://www.icrp.org/page.asp?id=145.

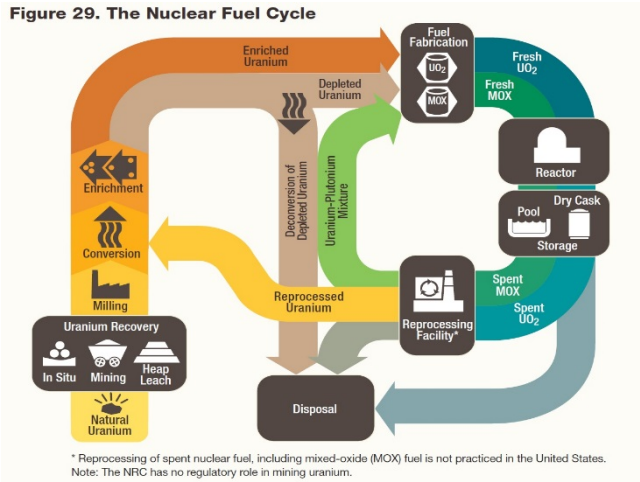
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Freebie:

NUREG-1350: ML15254A321.pdf

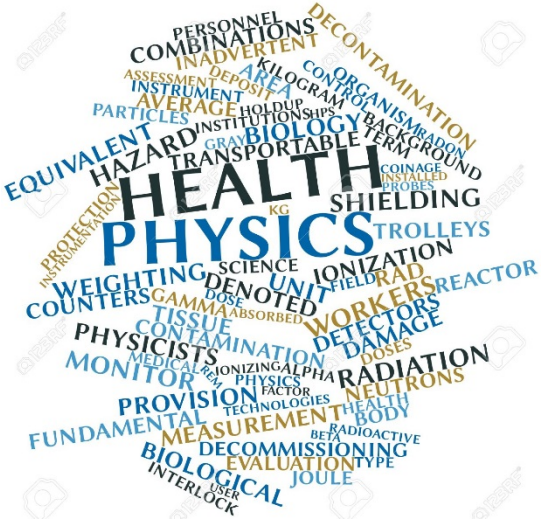


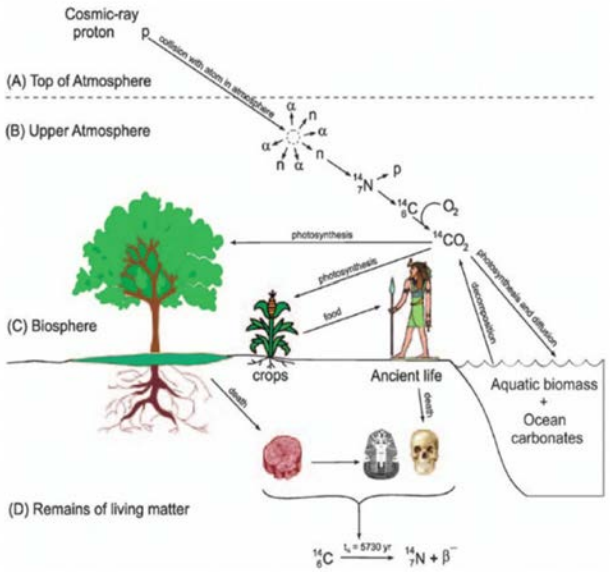




U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

More Database?





$$C(x,y,z,t) = \frac{Q}{2\pi u \sigma_y \sigma_z} \cdot \exp\left(-\frac{y^2}{2\sigma_y^2}\right)\left[\exp\left(-\frac{(z-H_e)^2}{2\sigma_z^2}\right) + \exp\left(-\frac{(z+H_e)^2}{2\sigma_z^2}\right)\right]$$

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Please Join Forum & Provide Feedback

Casper.Sun@NRC.gov