Introduction to the NRC's "Radiological Toolbox" Software Utility

Ken Sejkora
Entergy Nuclear Northeast – Pilgrim Station

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Radiological Toolbox Utility

- Developed for NRC under contract to Oak Ridge National Laboratory
  - First developed in 2003
  - Second revision issued in 2007
- Software and users' manual available for free download from NRC and ORNL

Radiological Toolbox Utility (continued)

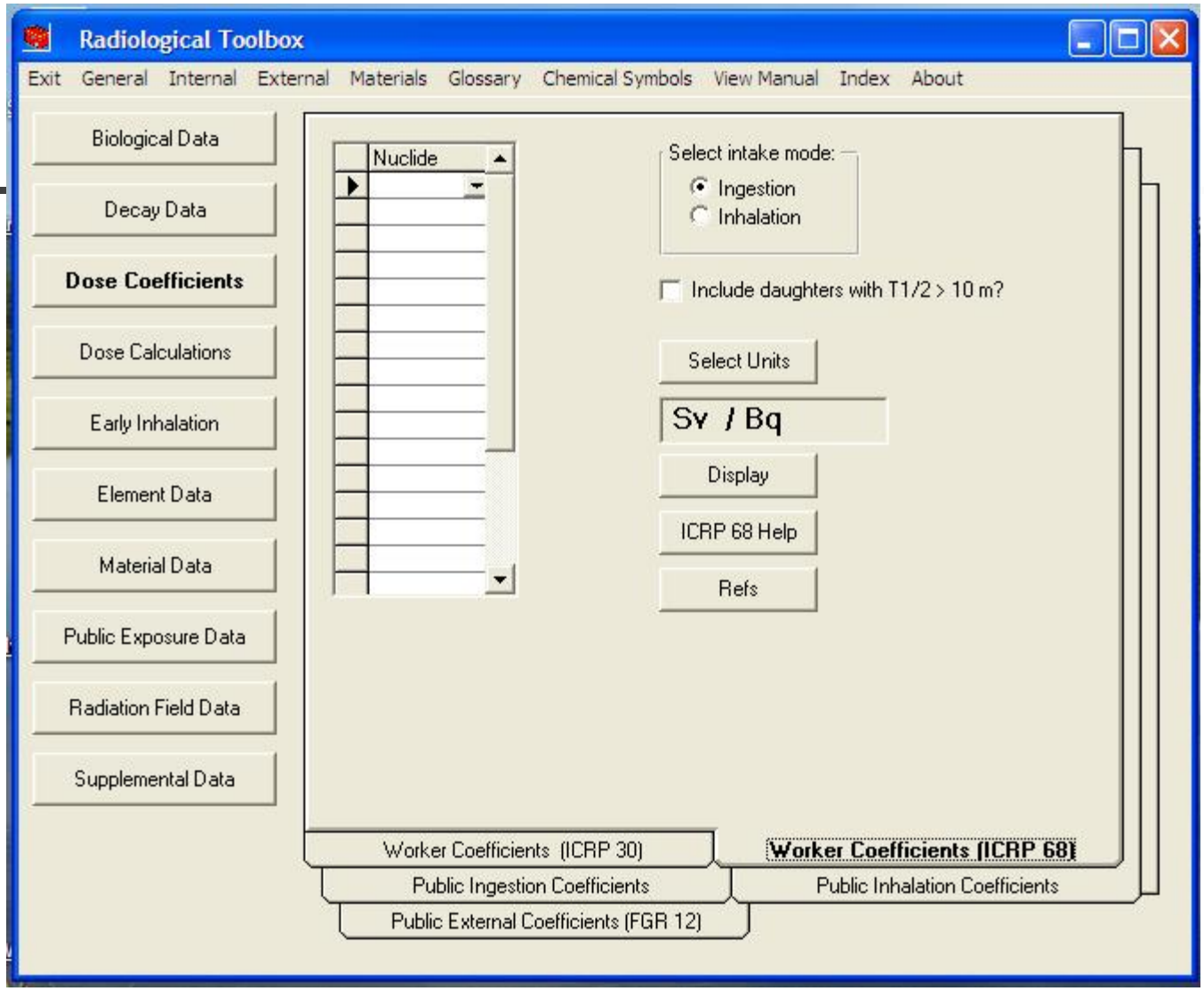
- Contains easily accessible data related to radiation protection, shielding, and dosimetry calculations
  - Radioactive decay data, biokinetic data, internal and external dose coefficients, elemental composition of a large number of materials, radiation interaction coefficients, kerma coefficients, and other tabular data of interest to the health physicist
  - Export the tabular data to an Excel worksheet
- Data available in user-selectable units – xRem, xCi, xSv, xBq, etc.; eliminates need for unit conversion

Acquiring Radiological Toolbox

- Free downloads of software and users' manual available
- Link on NRC Website
  - http://www.nrc.gov/about-nrc/regulatory/research/radiological-toolbox.html
- Link on ORNL Website
  - http://ordose.ornl.gov/downloads.html
- Several other useful programs can be found on ORNL Website
  - EPA Federal Guidance Report 13 Data – ICRP72 risk & dose factors
  - ICRP38 Radionuclide Constants – half-lives, particles, energies, etc.
  - Others

Software Demonstration

- Transition out of PowerPoint to real-time, active demonstration of software…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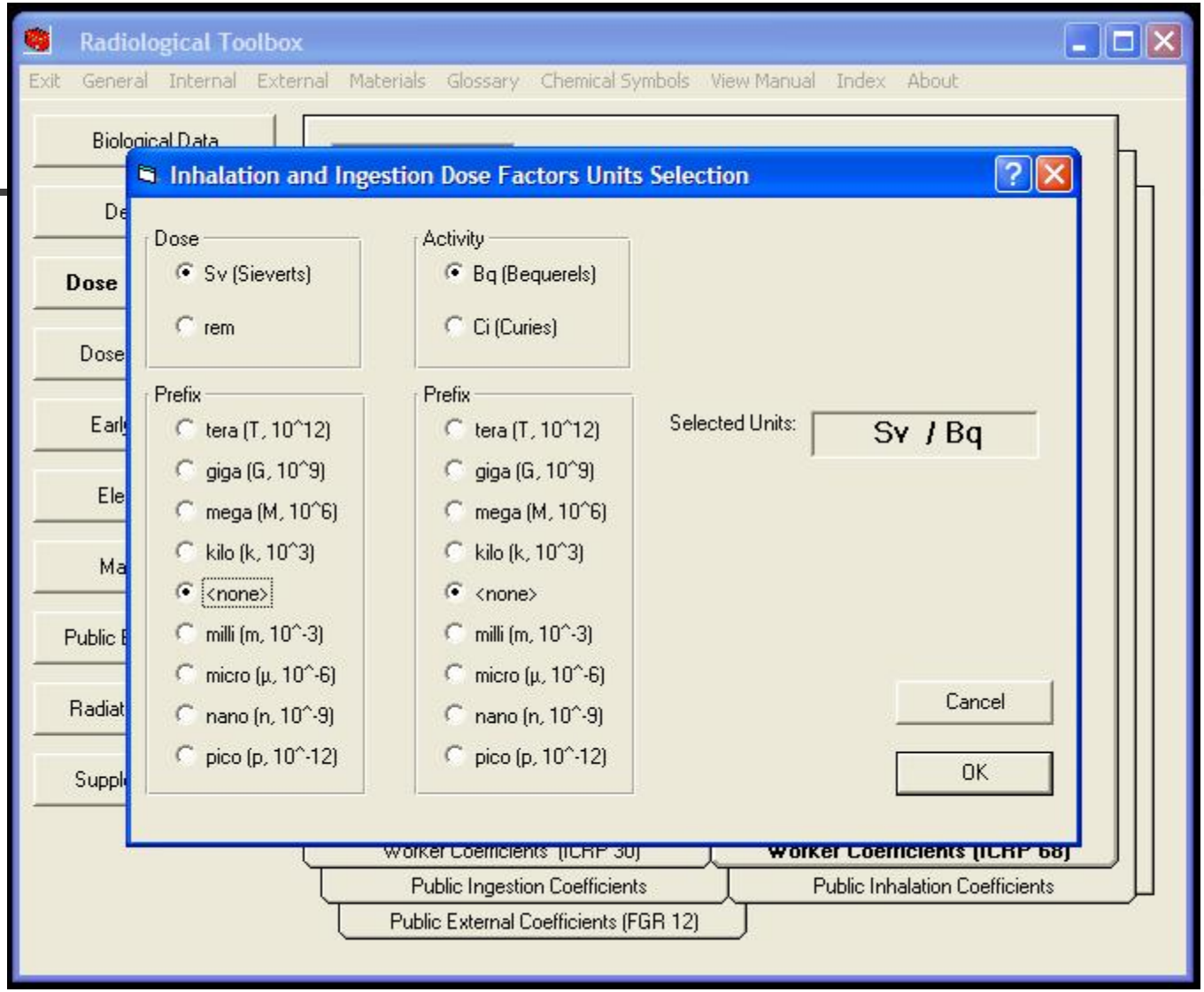
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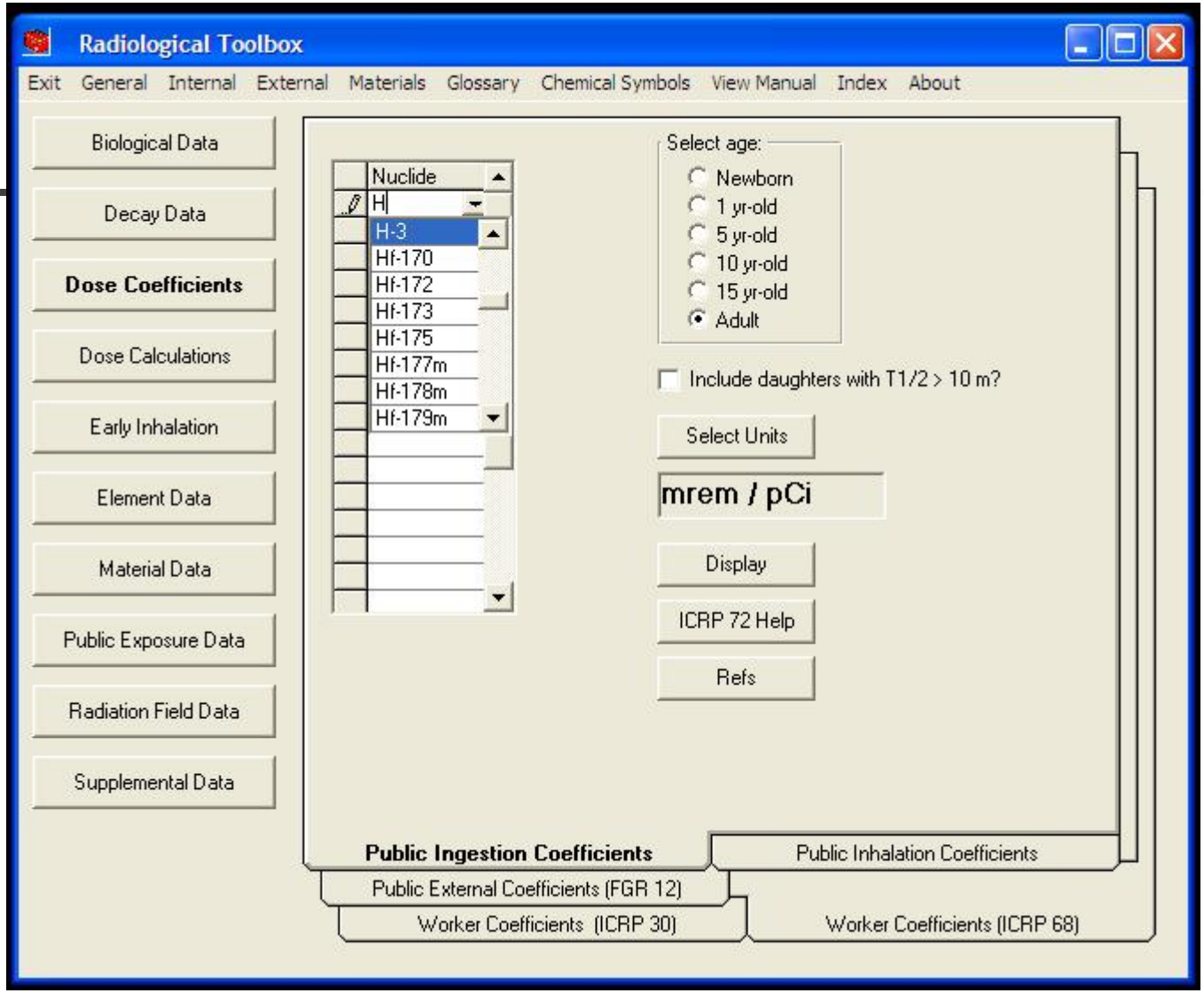
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Public Inhalation Coefficients
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Worker Coefficients (ICRP 30)
Worker Coefficients (ICRP 68)

Ingestion Adult dose coefficients (mrem / pCi) from ICRP 72

Nuclide	H-3	H-3
Half Life	12.35y	12.35y
f1	1 OBT	1.00E+00
Adrenals	1.52E-07	6.67E-08
Urinary Bladder	1.52E-07	6.67E-08
Bone Surface	1.52E-07	6.67E-08
Brain	1.52E-07	6.67E-08
Breast	1.52E-07	6.67E-08
Esophagus	1.52E-07	6.67E-08
Stomach	1.74E-07	6.67E-08
Small Intestine	1.52E-07	6.67E-08
Upper Large Intestine	1.56E-07	6.67E-08
Lower Large Intestine	1.63E-07	6.67E-08
Colon	1.59E-07	6.67E-08
Kidneys	1.52E-07	6.67E-08
Liver	1.52E-07	6.67E-08
Muscle	1.52E-07	6.67E-08
Ovaries	1.52E-07	6.67E-08
Pancreas	1.52E-07	6.67E-08
Red Marrow	1.52E-07	6.67E-08
Extratrachial Airways	1.52E-07	6.67E-08
Lungs	1.52E-07	6.67E-08
SKin	1.52E-07	6.67E-08
Spleen	1.52E-07	6.67E-08
Testes	1.52E-07	6.67E-08
Thymus	1.52E-07	6.67E-08
Thyroid	1.52E-07	6.67E-08
Uterus	1.52E-07	6.67E-08
Remainder	1.52E-07	6.67E-08
Effective (ICRP 60)	1.56E-07	6.67E-08

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Inhalation 1 yr-old dose coefficients (mrem / pCi) from ICRP 72

Nuclide	H-3	H-3	H-3	H-3
Half Life	12.35y	12.35y	12.35y	12.35y
Type	V	V	V	V
AMAD	1.00E+00	1.00E+00	1.00E+00	1.00E+0
f1	1 OBT	1 HT	1 CH3T	1 HTO
Adrenals	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Urinary Bladder	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Bone Surface	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Brain	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Breast	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Esophagus	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Stomach	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Small Intestine	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Upper Large Intestine	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Lower Large Intestine	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Colon	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Kidneys	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Liver	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Muscle	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Ovaries	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Pancreas	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Red Marrow	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Extratrachial Airways	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Lungs	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Skin	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Spleen	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Testes	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Thymus	4.07E-07	1.78E-11	1.78E-09	1.78E-07
Thyroid	4.07E-07	1.78E-11	1.78E-09	1.78E-07

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Inhalation 1 yr-old dose coefficients (mrem / pCi) from ICRP 72

Nuclide	Co-60	Co-60	Co-60
Half Life	5.271y	5.271y	5.271y
Type	F	M	S
AMAD	1.00E+00	1.00E+00	1.00E+00
f1	3.00E-01	1.00E-01	1.00E-02
Adrenals	8.89E-05	1.00E-04	2.78E-04
Urinary Bladder	7.04E-05	3.41E-05	2.41E-05
Bone Surface	7.41E-05	5.56E-05	1.19E-04
Brain	6.30E-05	2.85E-05	2.26E-05
Breast	5.19E-05	7.78E-05	2.63E-04
Esophagus	7.41E-05	8.52E-05	2.52E-04
Stomach	7.41E-05	6.30E-05	1.44E-04
Small Intestine	8.89E-05	5.56E-05	6.30E-05
Upper Large Intestine	9.26E-05	7.04E-05	8.52E-05
Lower Large Intestine	1.00E-04	9.63E-05	1.04E-04
Colon	9.63E-05	8.15E-05	9.26E-05
Kidneys	8.15E-05	5.93E-05	1.15E-04
Liver	1.56E-04	1.07E-04	2.11E-04
Muscle	7.04E-05	5.19E-05	1.11E-04
Ovaries	8.52E-05	4.81E-05	4.44E-05
Pancreas	9.63E-05	8.52E-05	2.07E-04
Red Marrow	6.30E-05	4.81E-05	9.63E-05
Extratrachial Airways	3.07E-04	3.70E-04	8.15E-04
Lungs	7.04E-05	5.93E-04	1.81E-03
Skin	5.19E-05	3.33E-05	5.93E-05
Spleen	7.78E-05	7.78E-05	1.96E-04
Testes	6.30E-05	2.70E-05	1.22E-05
Thymus	7.41E-05	8.52E-05	2.52E-04
Thyroid	7.78E-05	5.93E-05	1.30E-04
Uterus	8.52E-05	4.44E-05	3.63E-05

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Inhalation 1 yr-old dose coefficients (mrem / pCi) from ICRP 72

Nuclide	Co-60	Co-60	Co-60
Half Life	5.271y	5.271y	5.271y
Type	F	M	S
AMAD	1.00E+00	1.00E+00	1.00E+00
f1	3.00E-01	1.00E-01	1.00E-02
Adrenals	8.89E-05	1.00E-04	2.78E-04
Urinary Bladder	7.04E-05	3.41E-05	2.41E-05
Bone Surface	7.41E-05	5.56E-05	1.19E-04
Brain	6.30E-05	2.85E-05	2.26E-05
Breast	5.19E-05	7.78E-05	2.63E-04
Esophagus	7.41E-05	8.52E-05	2.52E-04
Stomach	7.41E-05	6.30E-05	1.44E-04
Small Intestine	8.89E-05	5.56E-05	6.30E-05
Upper Large Intestine	9.26E-05	7.04E-05	8.52E-05
Lower Large Intestine	1.00E-04	9.63E-05	1.04E-04
Colon	9.63E-05	8.15E-05	9.26E-05
Kidneys	8.15E-05	5.93E-05	1.15E-04
Liver	1.56E-04	1.07E-04	2.11E-04
Muscle	7.04E-05	5.19E-05	1.11E-04
Ovaries	8.52E-05	4.81E-05	4.44E-05
Pancreas	9.63E-05	8.52E-05	2.07E-04
Red Marrow	6.30E-05	4.81E-05	9.63E-05
Extratrachial Airways	3.07E-04	3.70E-04	8.15E-04
Lungs	7.04E-05	5.93E-04	1.81E-03
Skin	5.19E-05	3.33E-05	5.93E-05
Spleen	7.78E-05	7.78E-05	1.96E-04
Testes	6.30E-05	2.70E-05	1.22E-05
Thymus	7.41E-05	8.52E-05	2.52E-04
Thyroid	7.78E-05	5.93E-05	1.30E-04
Uterus	8.52E-05	4.44E-05	3.63E-05

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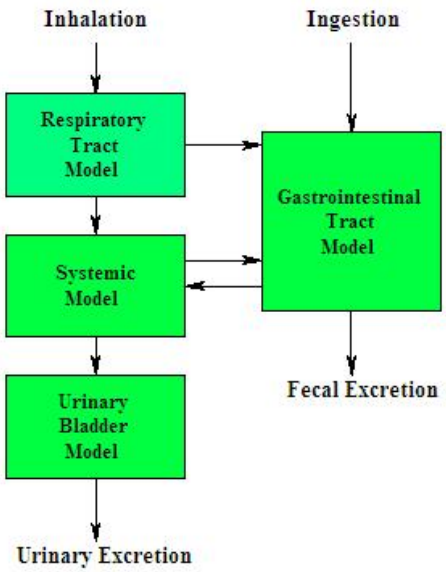
Kinetic models and elemental data

This help file summarizes the models and elemental data describing the behavior of inhaled or ingested radionuclides. These models were used in the calculations of the risk coefficients of FGR-13. The data files of the DCAL System are included in archival folders on the FGR13 CD. To view the element-specific data click on the element's symbol in the periodic table. With two exceptions, the systemic biokinetic models used in FGR-13 are those applied in ICRP Publication 72 and are reference below to the appropriate ICRP Publication. In FGR-13, the generic model structure introduced in ICRP Publication 67 is extended to the actinide elements actinium (***Ac***) and protactinium (***Pa***). Specifically, parameter values for americium are assigned to actinium and parameter values for thorium are assigned to protactinium. See FGR-13 for further details.



Thanks is extended to Tracy Silk and Alan Phipps of the UK National Radiological Protection Board for sharing the text of their biokinetic help file. Their assistance greatly facilitated the development of this file.

Click to go back.

Summary

- Invaluable resource for internal and external dose coefficients; occupational and public
- Up-to-date dose coefficients based on ICRP30, ICRP60, and ICRP72
- Well-documented with users' manual and help/information screens internal to program
- User-selectable units for data
- Export to Excel for further calculations

Questions?