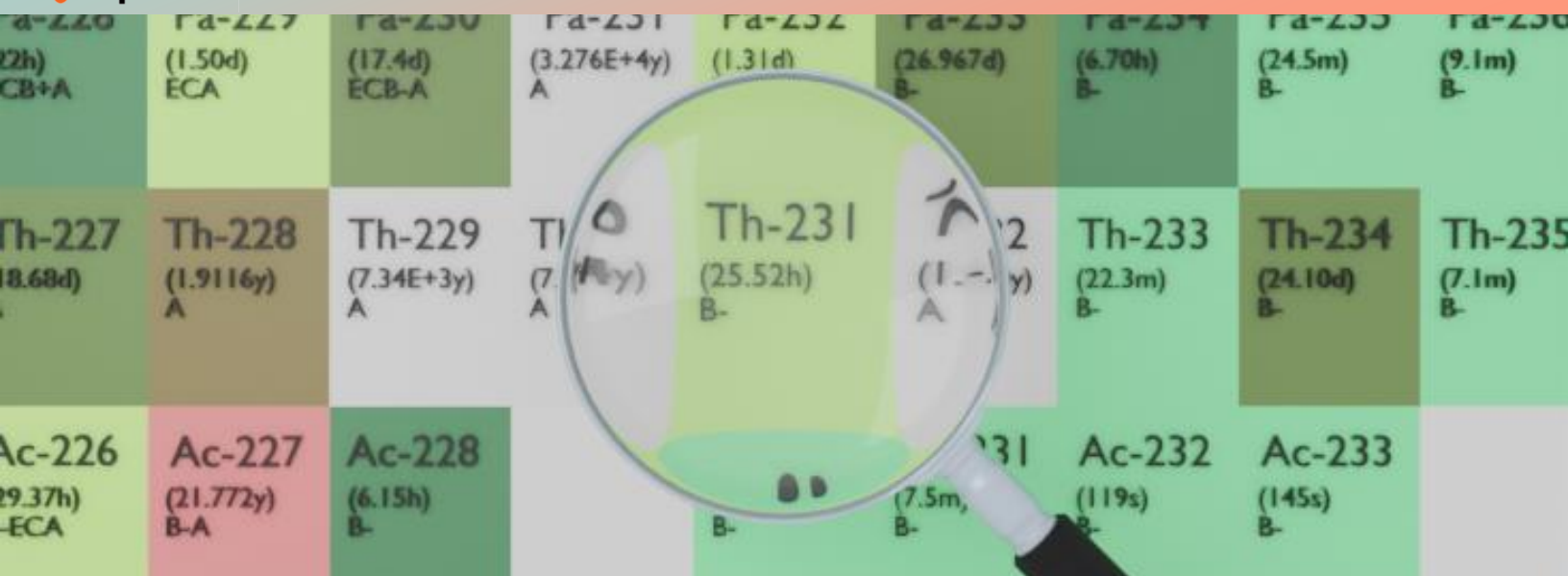




The image shows a grid of radionuclides. A magnifying glass is positioned over the cell for Thorium-231 (Th-231). The grid includes elements like Pa, Th, and Ac with various mass numbers and their respective half-lives and decay modes.

Pa-228	Pa-227	Pa-230	Pa-231	Pa-232	Pa-233	Pa-234	Pa-235	Pa-236
(2h) CB+A	(1.50d) ECA	(17.4d) ECB-A	(3.276E+4y) A	(1.31d) B-	(26.967d) B-	(6.70h) B-	(24.5m) B-	(9.1m) B-
Th-227	Th-228	Th-229	Th-230	Th-231	Th-232	Th-233	Th-234	Th-235
(18.68d) A	(1.9116y) A	(7.34E+3y) A	(7.54E+4y) A	(25.52h) B-	(1.4E+10y) A	(22.3m) B-	(24.10d) B-	(7.1m) B-
Ac-226	Ac-227	Ac-228	Ac-229	Ac-230	Ac-231	Ac-232	Ac-233	Ac-234
(29.37h) ECA	(21.772y) B-A	(6.15h) B-	(6.13E+3y) A	(5.01E+3y) A	(7.5m) B-	(119s) B-	(145s) B-	(136d) B-

THORIUM-231

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Th-231
Atomic number (Z): 90
Mass number (A): 231
Neutron number (N): 141

RADIOACTIVE DECAY

Decay modes: β^-
Half-life: 25.52 [h]
Decay constant: $7.5447\text{e-}06$ [1/s]
Daughters: Pa-231 (100.0%)
Radioactive daughters: Pa-231

DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]
Mean electron energy: 0.1622 [MeV]
Mean photon energy: 0.02686 [MeV]
Air kerma rate constant, Γ_{10} : $1.902\text{e-}17$ [$\text{Gy} \cdot \text{m}^2/\text{Bq} \cdot \text{s}$]
Air kerma coefficient, K_{air} : $1.902\text{e-}17$ [$\text{Gy} \cdot \text{m}^2/\text{Bq} \cdot \text{s}$]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : $2.599\text{e-}14$ [$\text{Gy} \cdot \text{kg}/\text{Bq} \cdot \text{s}$]
Equilibrium dose constant for alphas, Δ_{α} : $0.000\text{e+}00$ [$\text{Gy} \cdot \text{kg}/\text{Bq} \cdot \text{s}$]

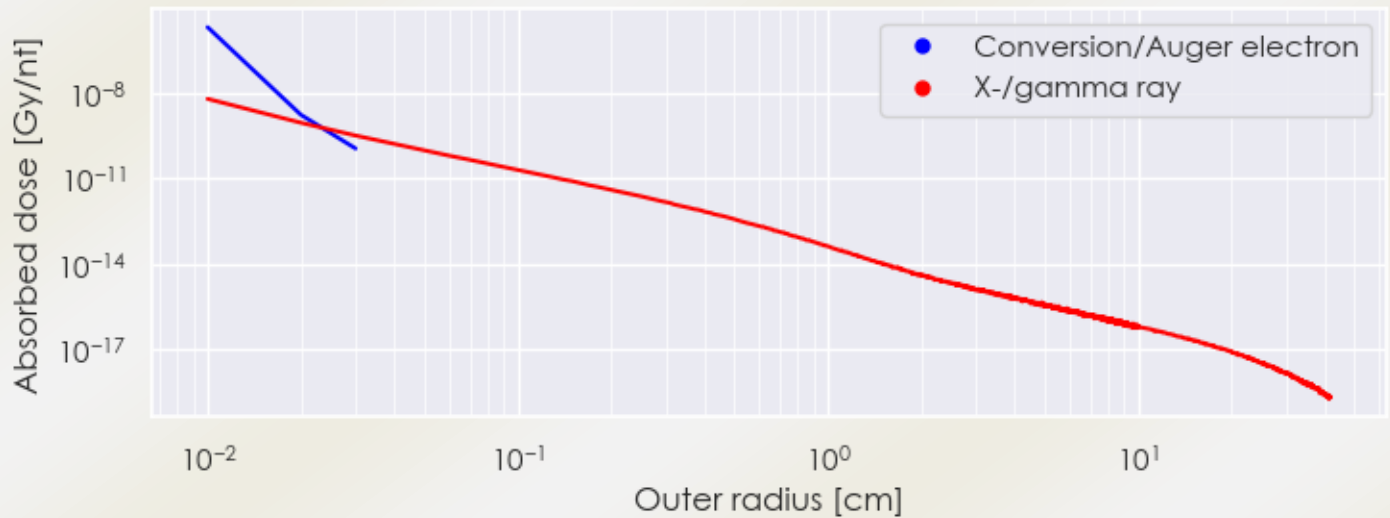
Equilibrium dose constant for betas/electrons, $\Delta_{\beta, \beta^+, e^-}$: 2.599×10^{-14} [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : 4.303×10^{-15} [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

Dose point kernel source: **Graves, et al. Medical Physics. 2019 Nov.; 46(11):5284-5293.**

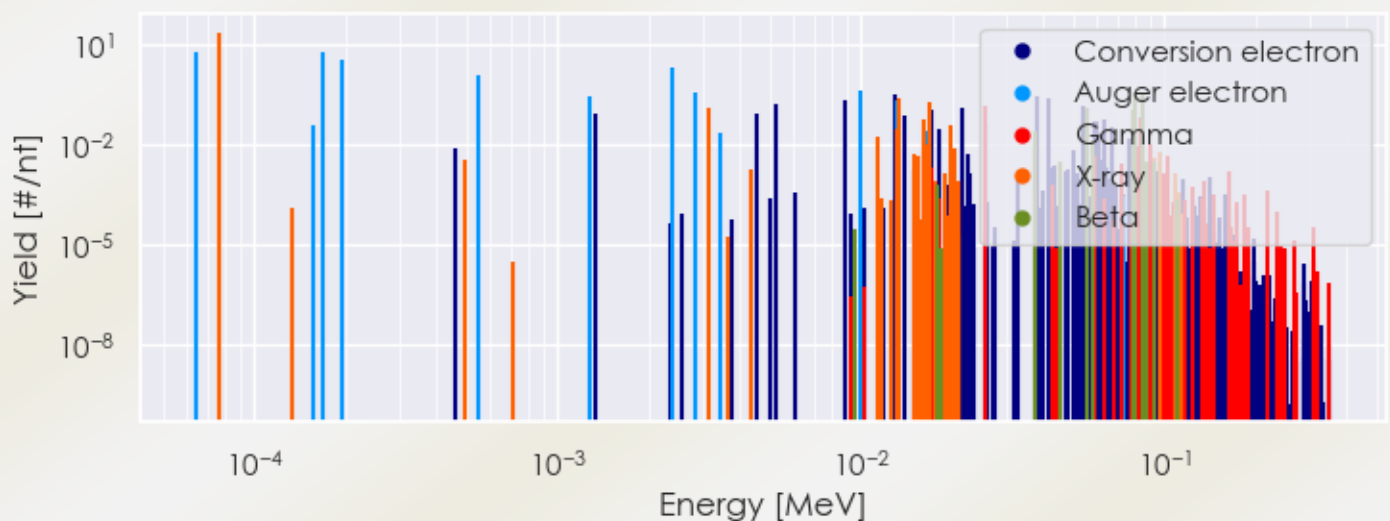
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/Th-231 DPK.csv

SUMMARY SPECTRA (PLOT)

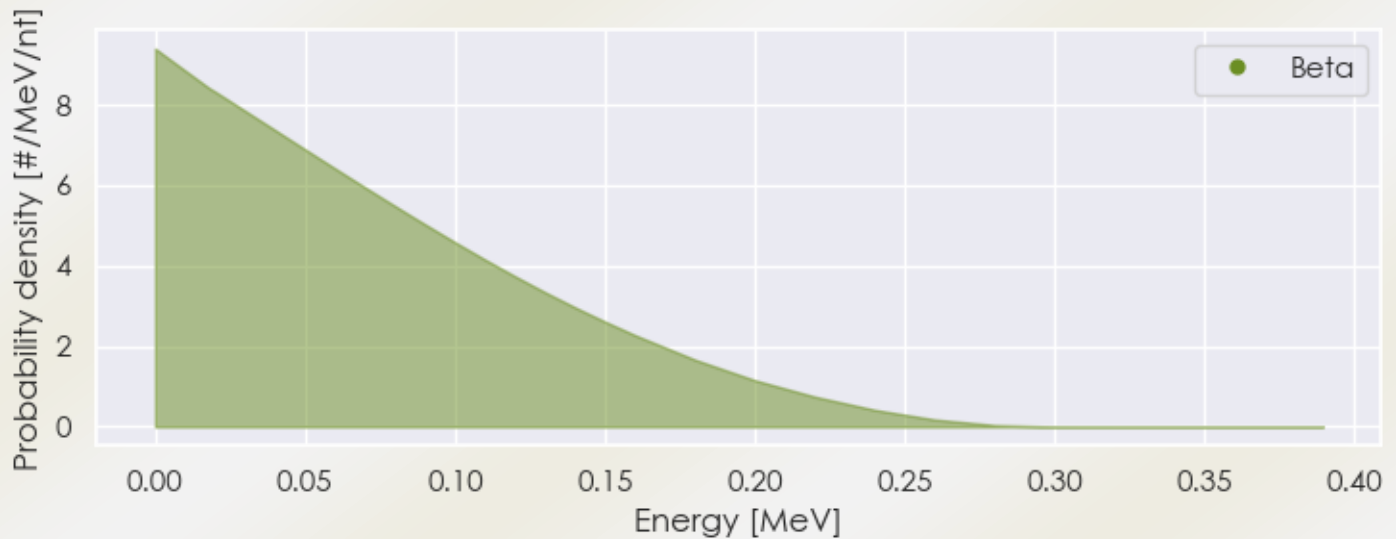
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/Th-231 Summary Spectrum.csv

BETA SPECTRA (PLOT)

Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated beta spectra file here: [www.mirdsoft.org/products/MIRDspecs/Th-231 Beta Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Th-231%20Beta%20Spectrum.csv)

TABULATED DATA

SUMMARY SPECTRA (TABLE)

Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**

Note: Radiations with yield < 0.01 are excluded from the table, but are available in the linked *.csv data.

Download tabulated summary spectra file here: [www.mirdsoft.org/products/MIRDspecs/Th-231 Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Th-231%20Summary%20Spectrum.csv)

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
7.65093e-05	2.443e+01	X-ray
3.17063e-03	1.348e-01	X-ray
1.14081e-02	1.832e-02	X-ray
1.31269e-02	3.021e-02	X-ray
1.32994e-02	2.655e-01	X-ray
1.60398e-02	5.526e-02	X-ray
1.61112e-02	1.183e-02	X-ray
1.66446e-02	1.024e-02	X-ray
1.67859e-02	1.826e-01	X-ray
1.69536e-02	1.056e-02	X-ray

1.96582e-02	4.100e-02	X-ray
2.56400e-02	1.412e-01	Gamma
8.42140e-02	6.600e-02	Gamma
3.74941e-02	2.720e-02	Beta
5.55493e-02	1.243e-01	Beta
5.82484e-02	1.263e-02	Beta
7.95026e-02	1.166e-01	Beta
7.97617e-02	3.885e-01	Beta
8.49467e-02	3.205e-01	Beta
6.45480e-05	5.999e+00	Auger electron
1.56407e-04	4.024e-02	Auger electron
1.67740e-04	6.429e+00	Auger electron
1.95073e-04	3.653e+00	Auger electron
5.50761e-04	1.283e+00	Auger electron
1.27148e-03	2.877e-01	Auger electron
1.32700e-03	9.038e-02	Conversion electron
2.39392e-03	2.015e+00	Auger electron
2.84966e-03	3.664e-01	Auger electron
3.45897e-03	2.146e-02	Auger electron
4.52700e-03	8.752e-02	Conversion electron
5.23800e-03	1.625e-01	Conversion electron
8.89700e-03	2.149e-01	Conversion electron
9.89787e-03	4.337e-01	Auger electron
1.30406e-02	3.184e-01	Conversion electron
1.31169e-02	2.179e-01	Auger electron
1.39106e-02	7.949e-02	Conversion electron
1.63676e-02	2.580e-02	Auger electron
1.72000e-02	1.137e-01	Conversion electron
1.80700e-02	2.788e-02	Conversion electron
2.14806e-02	1.219e-01	Conversion electron
2.56400e-02	4.051e-02	Conversion electron
3.81680e-02	2.868e-01	Conversion electron
4.18270e-02	2.391e-01	Conversion electron
5.44106e-02	1.481e-01	Conversion electron
5.85700e-02	5.158e-02	Conversion electron
6.01150e-02	4.914e-02	Conversion electron
6.09740e-02	2.208e-02	Conversion electron
6.31010e-02	5.506e-02	Conversion electron

6.38120e-02	3.569e-02	Conversion electron
6.74710e-02	3.328e-02	Conversion electron
7.70686e-02	1.436e-02	Conversion electron
8.00546e-02	3.049e-02	Conversion electron
8.42140e-02	1.048e-02	Conversion electron

USEFUL LINKS

Isotope decay characteristics are periodically updated as better measurements can be made - changes that may not be reflected on this page. Please see useful links:

National Nuclear Data Center (NNDC): <https://www.nndc.bnl.gov/nudat3/mird/>

International Atomic Energy Agency (IAEA) Livechart: <https://www-nds.iaea.org/relnsd/vcharthtml/VChartHTML.html>

REFERENCE LINKS

ICRP Report 107: <https://www.icrp.org/publication.asp?id=ICRP%20Publication%20107>

Graves et al. Dose Point Kernels: <https://doi.org/10.1002/mp.13789>

MIRD Decay Schemes 2nd Edition: https://sites.snmmi.org/SNMML-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6