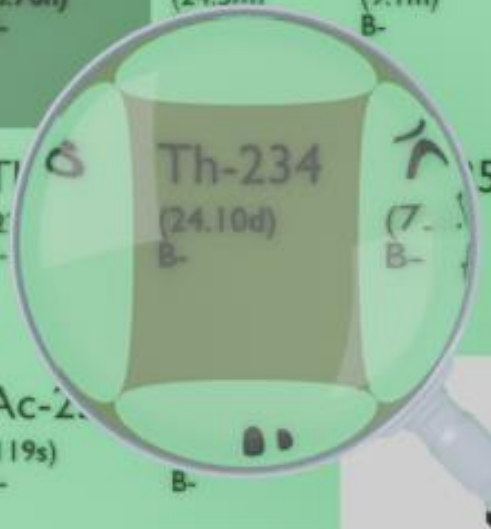




Pa-231 (3.276E+4y) B-	Pa-232 (1.31d) B-EC	Pa-233 (26.967d) B-	Pa-234 (6.70h) B-	Pa-235 (24.5m) B-	Pa-236 (9.1m) B-	Pa-237 (8.7m) B-
Th-230 (7.538E+4y) B-	Th-231 (25.52h) B-	Th-232 (1.405E10y) A	Th-233 (22.3m) B-	Th-234 (24.10d) B-	Th-235 (7.04E+8y) B-	Th-236 (37.5m) B-
Ac-230 (122s) B-	Ac-231 (7.5m) B-	Ac-232 (119s) B-	Ac-233 (11.9s) B-	Ac-234 (13.5d) B-	Ac-235 (9.7E+8y) B-	Ac-236 (1.2E+5y) B-

THORIUM-234

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Th-234
Atomic number (Z): 90
Mass number (A): 234
Neutron number (N): 144

RADIOACTIVE DECAY

Decay modes: β^-
Half-life: 24.1 [d]
Decay constant: $3.3289\text{e-}07$ [1/s]
Daughters: Pa-234m (100.0%)
Radioactive daughters: Pa-234m

DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]
Mean electron energy: 0.06223 [MeV]
Mean photon energy: 0.01051 [MeV]
Air kerma rate constant, Γ_{10} : $2.868\text{e-}18$ [$\text{Gy} \cdot \text{m}^2/\text{Bq} \cdot \text{s}$]
Air kerma coefficient, K_{air} : $2.868\text{e-}18$ [$\text{Gy} \cdot \text{m}^2/\text{Bq} \cdot \text{s}$]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : $9.970\text{e-}15$ [$\text{Gy} \cdot \text{kg}/\text{Bq} \cdot \text{s}$]
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, $\Delta_{\beta, \beta^+, e^-}$: 9.970×10^{-15} [Gy · kg/Bq · s]

Equilibrium dose constant for photons, Δ_p : 1.684×10^{-15} [Gy · kg/Bq · s]

DOSE POINT KERNELS (PLOT)

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

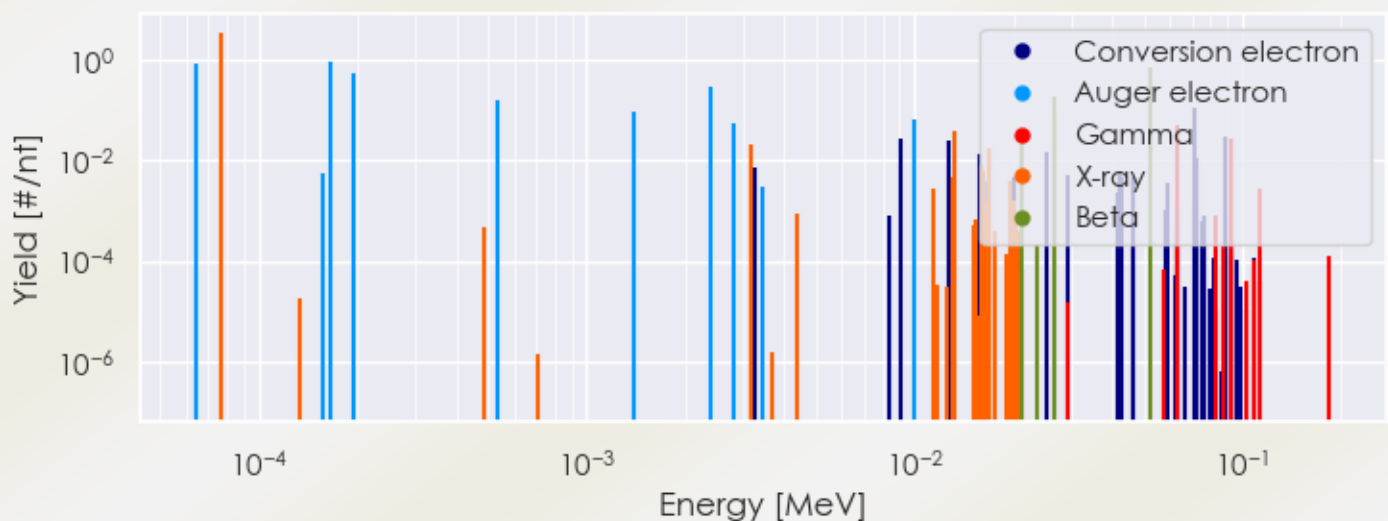
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/Th-234 DPK.csv

SUMMARY SPECTRA (PLOT)

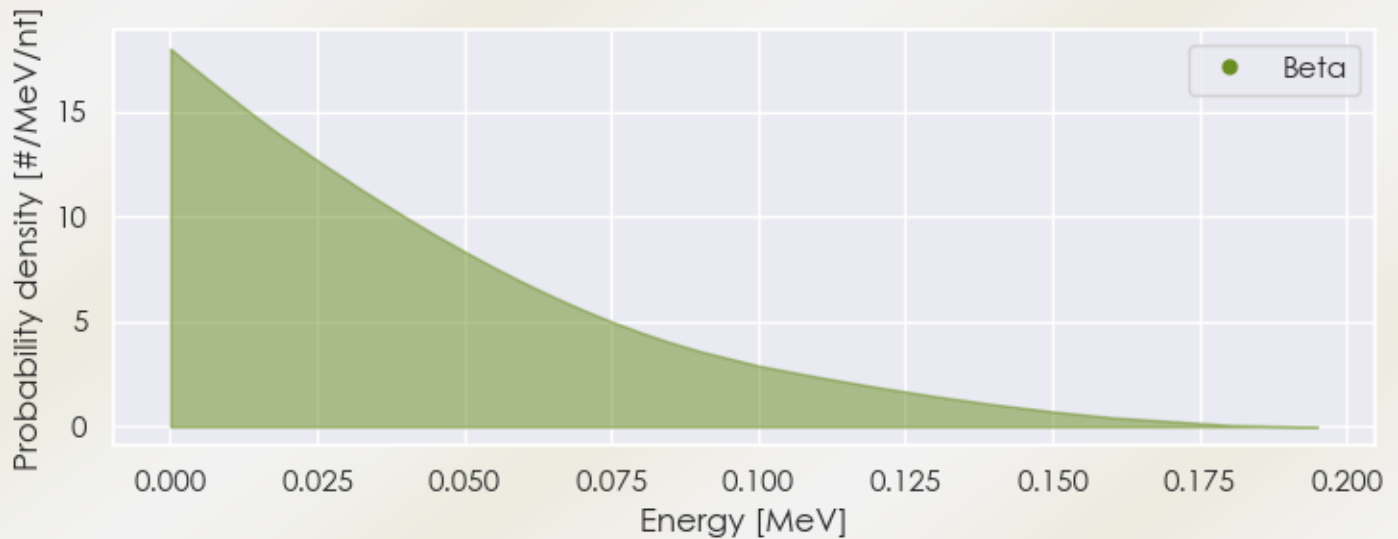
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/Th-234 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-234 Beta Spectrum.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-234 Summary Spectrum.csv

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
7.65007e-05	3.490e+00	X-ray
3.15978e-03	1.982e-02	X-ray
1.32994e-02	3.949e-02	X-ray
1.67859e-02	1.785e-02	X-ray
6.32900e-02	4.838e-02	Gamma
9.23800e-02	2.812e-02	Gamma
9.28000e-02	2.772e-02	Gamma
2.11758e-02	2.899e-02	Beta
2.65438e-02	7.598e-02	Beta
2.66601e-02	1.920e-01	Beta

5.23776e-02	7.029e-01	Beta
6.45967e-05	8.533e-01	Auger electron
1.66015e-04	9.221e-01	Auger electron
1.94130e-04	5.176e-01	Auger electron
5.37796e-04	1.604e-01	Auger electron
1.39233e-03	9.564e-02	Auger electron
2.37943e-03	2.966e-01	Auger electron
2.82573e-03	5.343e-02	Auger electron
9.08800e-03	2.616e-02	Conversion electron
1.00115e-02	6.687e-02	Auger electron
1.27470e-02	2.558e-02	Conversion electron
1.32485e-02	3.363e-02	Auger electron
1.58606e-02	1.304e-02	Conversion electron
2.53306e-02	1.433e-02	Conversion electron
7.12670e-02	1.076e-01	Conversion electron
7.19780e-02	1.148e-02	Conversion electron
8.82206e-02	2.900e-02	Conversion electron
9.23800e-02	1.037e-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/SNMMI-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6