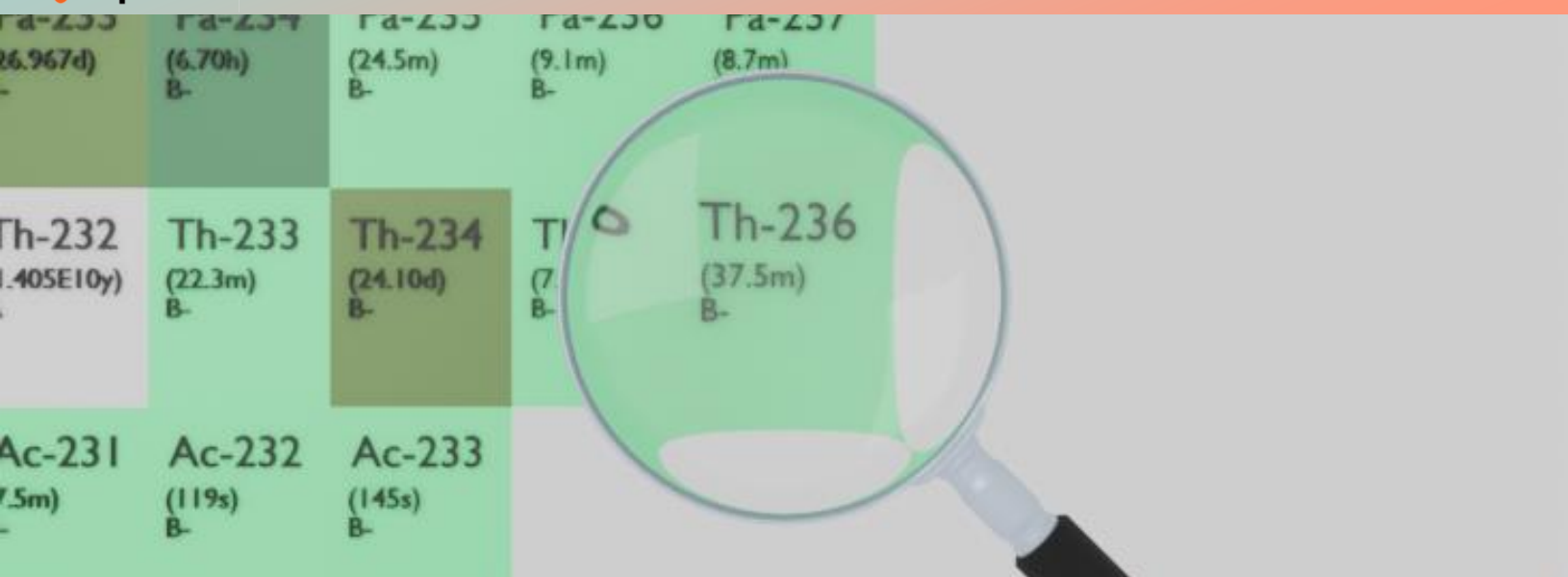




# THORIUM-236

## SUMMARY DATA

### GENERAL

#### CLASSIFICATION

Isotope: Th-236  
Atomic number (Z): 90  
Mass number (A): 236  
Neutron number (N): 146

#### RADIOACTIVE DECAY

Decay modes:  $\beta^-$   
Half-life: 37.5 [m]  
Decay constant:  $3.0807\text{e-}04$  [1/s]  
Daughters: Pa-236 (100.0%)  
Radioactive daughters: Pa-236

#### DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]  
Mean electron energy: 0.36705 [MeV]  
Mean photon energy: 0.03463 [MeV]  
Air kerma rate constant,  $\Gamma_{10}$ :  $2.959\text{e-}18$  [Gy  $\cdot$  m<sup>2</sup>/Bq  $\cdot$  s]  
Air kerma coefficient,  $K_{\text{air}}$ :  $2.959\text{e-}18$  [Gy  $\cdot$  m<sup>2</sup>/Bq  $\cdot$  s]  
Equilibrium dose constant for weakly-penetrating radiations ( $\alpha$  and/or electrons),  $\Delta_{\text{wp}}$ :  $5.881\text{e-}14$  [Gy  $\cdot$  kg/Bq  $\cdot$  s]  
Equilibrium dose constant for alphas,  $\Delta_{\alpha}$ :  $0.000\text{e+}00$  [Gy  $\cdot$  kg/Bq  $\cdot$  s]

Equilibrium dose constant for betas/electrons,  $\Delta_{\beta-, \beta+, e-}$ :  $5.881 \times 10^{-14}$  [Gy·kg/Bq·s]

Equilibrium dose constant for photons,  $\Delta_p$ :  $5.548 \times 10^{-15}$  [Gy·kg/Bq·s]

## DOSE POINT KERNELS (PLOT)

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

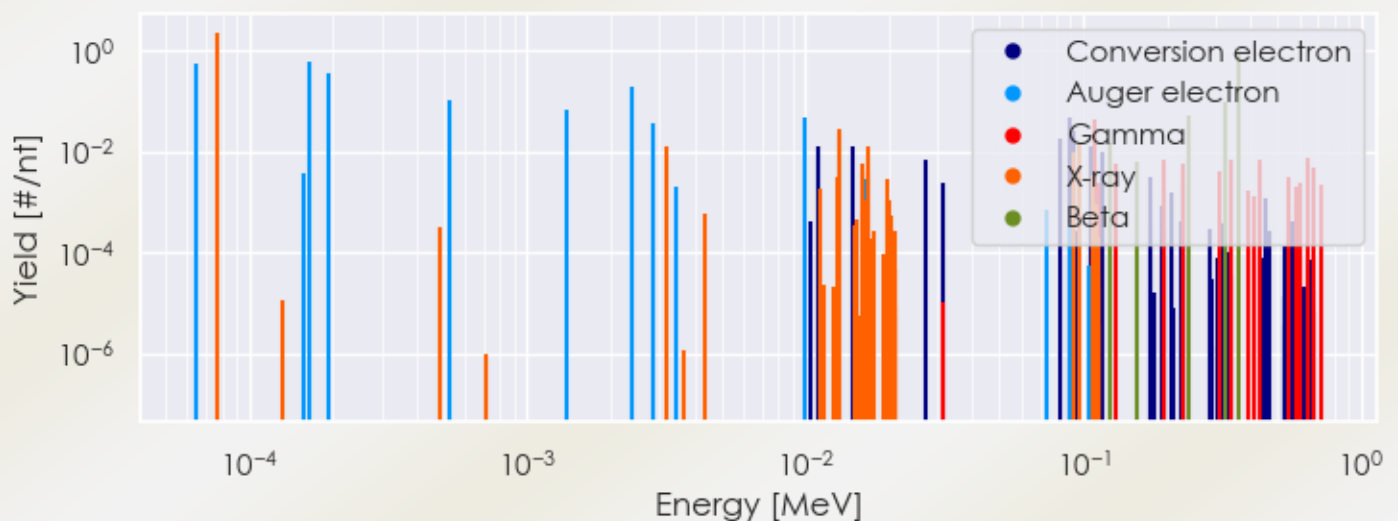
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: [www.mirdsoft.org/products/MIRDspecs/Th-236 DPK.csv](http://www.mirdsoft.org/products/MIRDspecs/Th-236 DPK.csv)

## SUMMARY SPECTRA (PLOT)

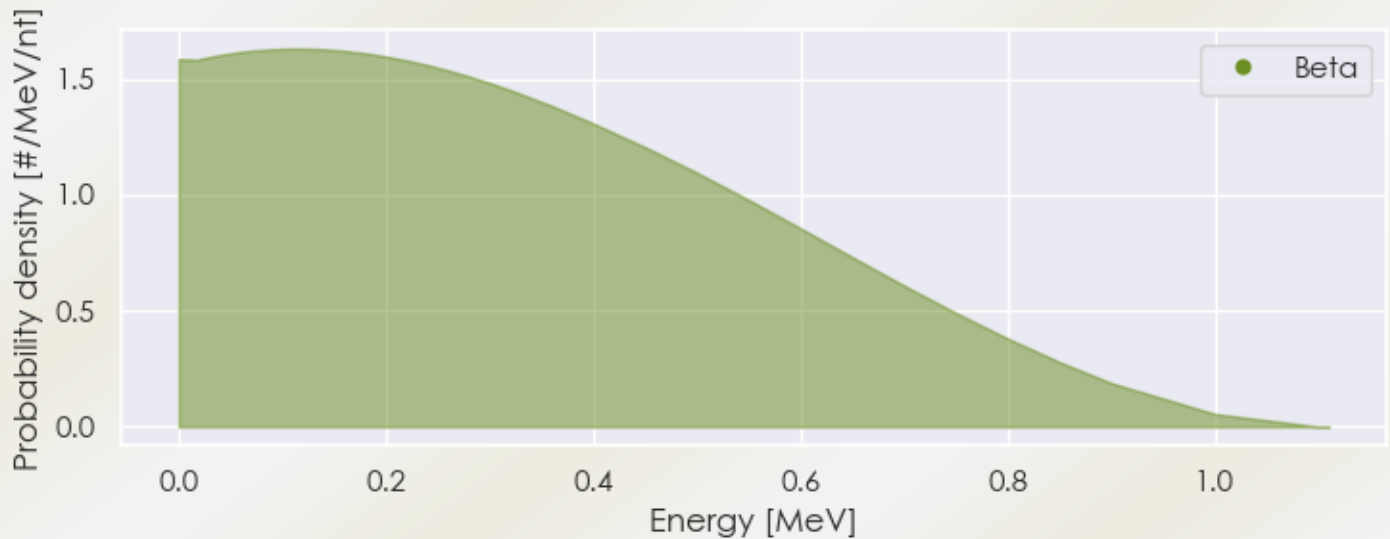
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: [www.mirdsoft.org/products/MIRDspecs/Th-236 Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Th-236 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-236 Beta Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Th-236 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-236 Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Th-236 Summary Spectrum.csv)

| Energy [MeV] | Yield [# / nt] if > 0.01 | Radiation type |
|--------------|--------------------------|----------------|
| 7.65028e-05  | 2.281e+00                | X-ray          |
| 3.15673e-03  | 1.312e-02                | X-ray          |
| 1.32994e-02  | 2.720e-02                | X-ray          |
| 1.67859e-02  | 1.248e-02                | X-ray          |
| 9.63371e-02  | 1.540e-02                | X-ray          |
| 1.10800e-01  | 4.200e-02                | Gamma          |
| 1.24464e-01  | 1.529e-02                | Beta           |
| 2.38698e-01  | 5.097e-02                | Beta           |
| 3.21811e-01  | 9.174e-02                | Beta           |
| 3.63162e-01  | 8.359e-01                | Beta           |

|                    |           |                                     |
|--------------------|-----------|-------------------------------------|
| <b>6.46231e-05</b> | 5.564e-01 | <a href="#">Auger electron</a>      |
| <b>1.65263e-04</b> | 6.034e-01 | <a href="#">Auger electron</a>      |
| <b>1.93697e-04</b> | 3.379e-01 | <a href="#">Auger electron</a>      |
| <b>5.27541e-04</b> | 9.908e-02 | <a href="#">Auger electron</a>      |
| <b>1.39056e-03</b> | 6.463e-02 | <a href="#">Auger electron</a>      |
| <b>2.37537e-03</b> | 1.964e-01 | <a href="#">Auger electron</a>      |
| <b>2.81837e-03</b> | 3.528e-02 | <a href="#">Auger electron</a>      |
| <b>1.00071e-02</b> | 4.599e-02 | <a href="#">Auger electron</a>      |
| <b>1.10980e-02</b> | 1.280e-02 | <a href="#">Conversion electron</a> |
| <b>1.32435e-02</b> | 2.312e-02 | <a href="#">Auger electron</a>      |
| <b>1.47570e-02</b> | 1.236e-02 | <a href="#">Conversion electron</a> |
| <b>8.29200e-02</b> | 1.790e-02 | <a href="#">Conversion electron</a> |
| <b>8.96870e-02</b> | 4.831e-02 | <a href="#">Conversion electron</a> |
| <b>9.16870e-02</b> | 2.436e-02 | <a href="#">Conversion electron</a> |
| <b>1.06641e-01</b> | 1.300e-02 | <a href="#">Conversion electron</a> |

## 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](https://sites.snmmi.org/SNMMI-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6)