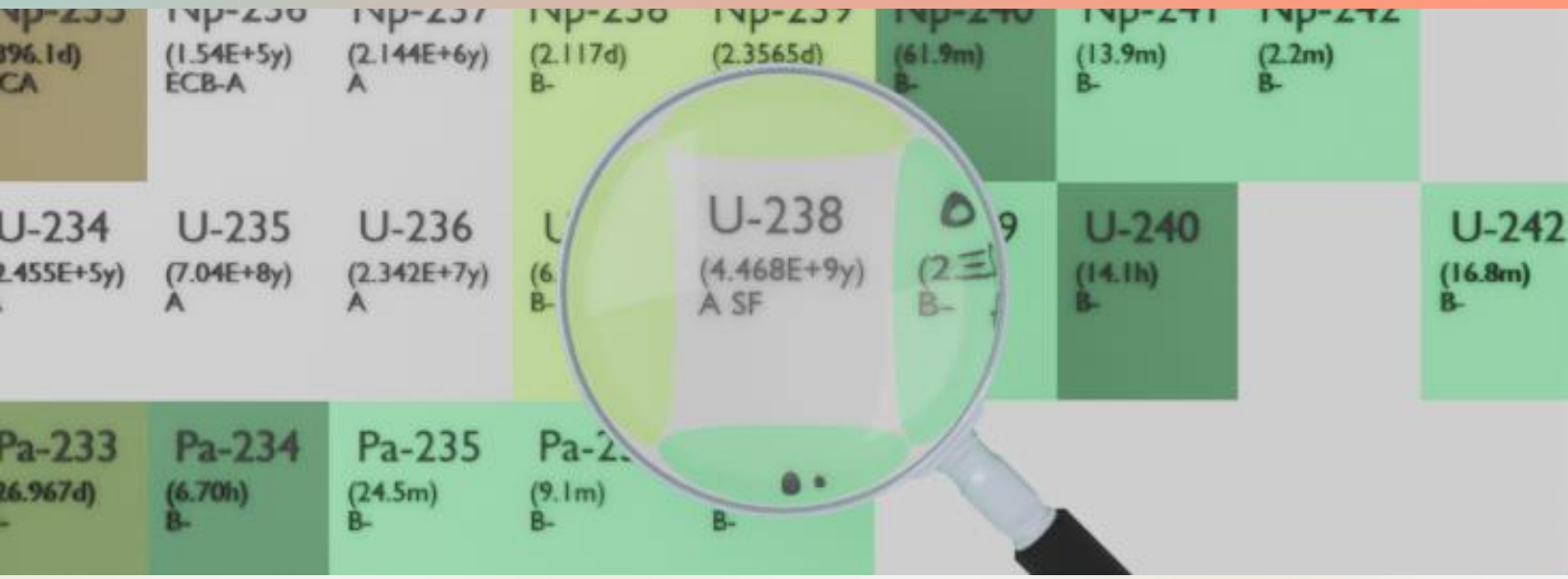



# URANIUM-238

## SUMMARY DATA

### GENERAL

#### CLASSIFICATION

*Isotope:* U-238
*Atomic number (Z):* 92
*Mass number (A):* 238
*Neutron number (N):* 146

#### RADIOACTIVE DECAY

*Decay modes:* a, Spontaneus fission
*Half-life:* 4468000000.0 [y]
*Decay constant:* 4.9161e-18 [1/s]
*Daughters:* Th-234 (100.0%), SF (5.45e-05%)
*Radioactive daughters:* Th-234

#### DOSIMETRIC CONSTANTS

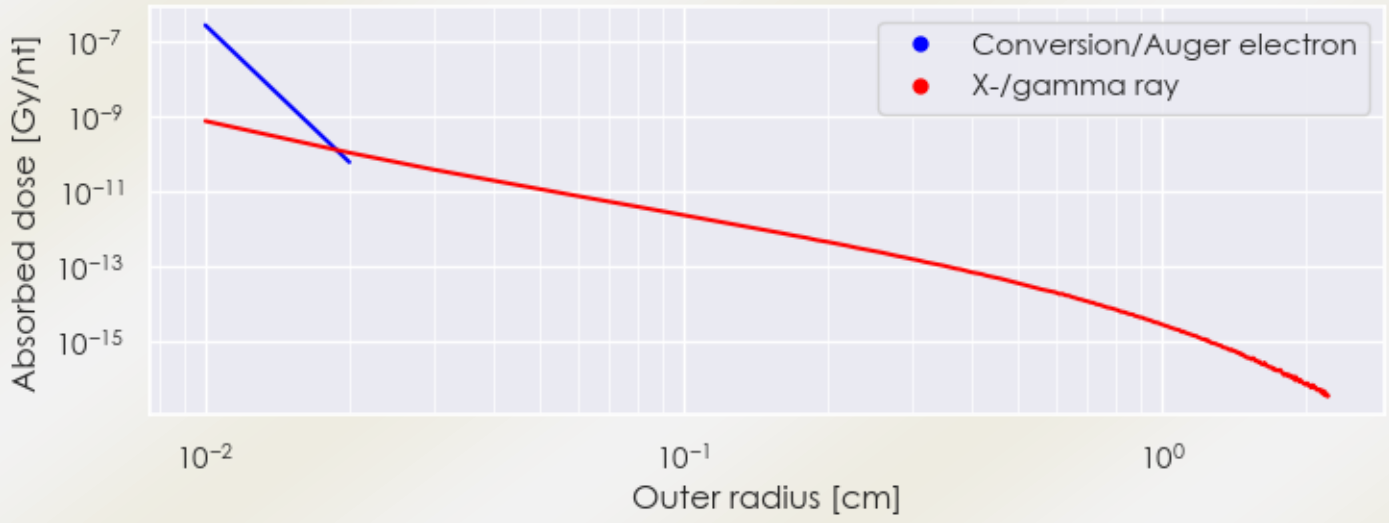
*Mean alpha energy:* 4.2584 [MeV]
*Mean electron energy:* 0.00917 [MeV]
*Mean photon energy:* 0.00143 [MeV]
*Air kerma rate constant, $\Gamma_{10}$:* 2.037e-18 [Gy·m$^2$/Bq·s]
*Air kerma coefficient, $K_{air}$:* 2.038e-18 [Gy·m$^2$/Bq·s]
*Equilibrium dose constant for weakly-penetrating radiations (a and/or electrons), $\Delta_{wp}$:* 6.837e-13 [Gy·kg/Bq·s]
*Equilibrium dose constant for alphas, $\Delta_a$:* 6.823e-13 [Gy·kg/Bq·s]

*Equilibrium dose constant for betas/electrons, $\Delta_{\beta-,\beta+,e-}$:* 1.469e-15 [Gy·kg/Bq·s]
*Equilibrium dose constant for photons, $\Delta_{p}$:* 2.291e-16 [Gy·kg/Bq·s]

## DOSE POINT KERNELS (PLOT)

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

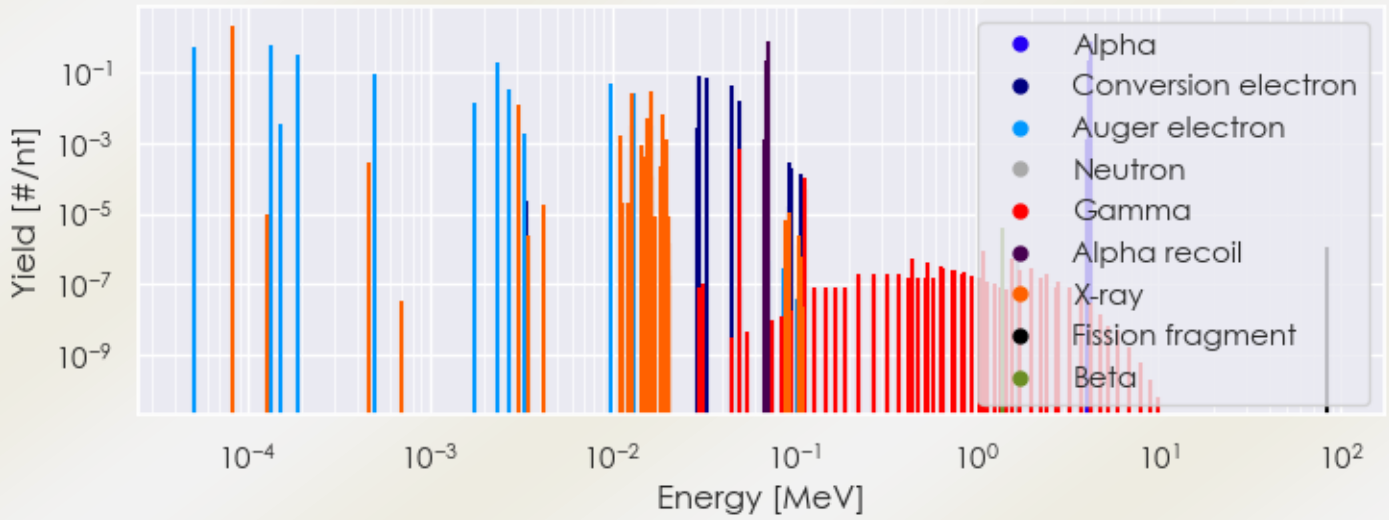
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.




*Download tabulated dose point kernel file here:* www.mirdsoft.org/products/MIRDspecs/U-238 DPK.csv

## SUMMARY SPECTRA (PLOT)

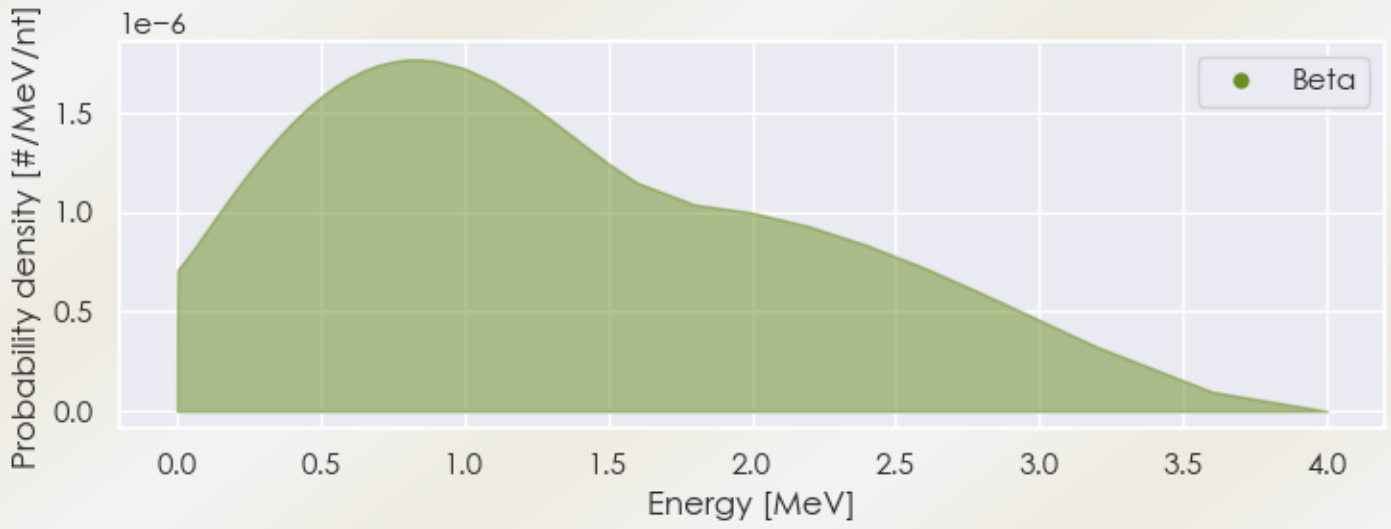
*Spectra source:* **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**




*Download tabulated summary spectra file here:* www.mirdsoft.org/products/MIRDspecs/U-238 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/U-238 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/U-238 Summary Spectrum.csv

| Energy [MeV] | Yield [#/nt] if > 0.01 | Radiation type |
|---|---|---|
| **8.23171e-05** | 2.156e+00 | X-ray |
| **3.07062e-03** | 1.194e-02 | X-ray |
| **1.29764e-02** | 2.506e-02 | X-ray |
| **1.62776e-02** | 3.036e-02 | X-ray |
| **5.13398e-05** | 5.190e-01 | Auger electron |
| **1.33126e-04** | 5.743e-01 | Auger electron |
| **1.88109e-04** | 3.294e-01 | Auger electron |
| **4.97239e-04** | 8.433e-02 | Auger electron |
| **1.77870e-03** | 1.338e-02 | Auger electron |
| **2.32658e-03** | 1.870e-01 | Auger electron |

| | | |
|---|---|---|
| **2.74420e-03** | 3.224e-02 | Auger electron |
| **9.94648e-03** | 4.978e-02 | Auger electron |
| **1.30815e-02** | 2.482e-02 | Auger electron |
| **2.97700e-02** | 8.042e-02 | Conversion electron |
| **3.32350e-02** | 7.103e-02 | Conversion electron |
| **4.55138e-02** | 4.227e-02 | Conversion electron |
| **4.95500e-02** | 1.460e-02 | Conversion electron |
| **4.14918e+00** | 2.233e-01 | Alpha |
| **4.19790e+00** | 7.754e-01 | Alpha |
| **7.09722e-02** | 2.233e-01 | Alpha recoil |
| **7.18055e-02** | 7.754e-01 | Alpha recoil |

## 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