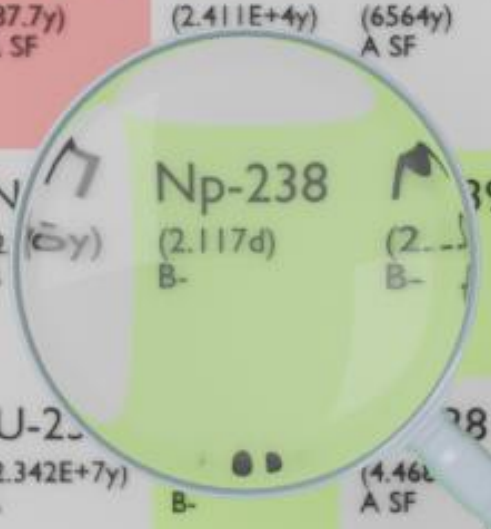




U-233 (1.592E+5y) A	U-234 (2.455E+5y) A	U-235 (7.04E+8y) A	U-236 (2.342E+7y) A	Np-238 (2.117d) B-	Np-239 (2.1E+4y) B-	Np-240 (61.9m) B-	Np-241 (13.9m) B-	Np-242 (2.2m) B-
U-233 (1.592E+5y) A	U-234 (2.455E+5y) A	U-235 (7.04E+8y) A	U-236 (2.342E+7y) A	U-238 (4.468E+9y) A	U-239 (23.45m) B-	U-240 (14.1h) B-	U-241 (4.54E+5y) A	U-242 (6.89E+5y) A
Np-234 (4.4d) CB+	Np-235 (396.1d) ECA	Np-236 (1.54E+5y) ECB-A	Np-237 (6.7E+6y) A	Np-238 (2.117d) B-	Np-239 (2.1E+4y) B-	Np-240 (61.9m) B-	Np-241 (13.9m) B-	Np-242 (2.2m) B-
Pu-233 (4.37E+3y) CA	Pu-234 (2.85E+5y) A SF	Pu-237 (45.2d) ECA	Pu-238 (87.7y) A SF	Pu-239 (2.411E+4y) A	Pu-240 (6564y) A SF	Pu-241 (14.35y) B-A	Pu-242 (3.75E+5y) A SF	Pu-243 (4.956h) B-

NEPTUNIUM-238

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Np-238
Atomic number (Z): 93
Mass number (A): 238
Neutron number (N): 145

RADIOACTIVE DECAY

Decay modes: β^-
Half-life: 2.117 [d]
Decay constant: 3.7896e-06 [1/s]
Daughters: Pu-238 (100.0%)
Radioactive daughters: Pu-238

DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]
Mean electron energy: 0.25191 [MeV]
Mean photon energy: 0.58789 [MeV]
Air kerma rate constant, Γ_{10} : 2.790e-17 [Gy·m²/Bq·s]
Air kerma coefficient, K_{air} : 2.790e-17 [Gy·m²/Bq·s]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : 4.036e-14 [Gy·kg/Bq·s]
Equilibrium dose constant for alphas, Δ_{α} : 0.000e+00 [Gy·kg/Bq·s]

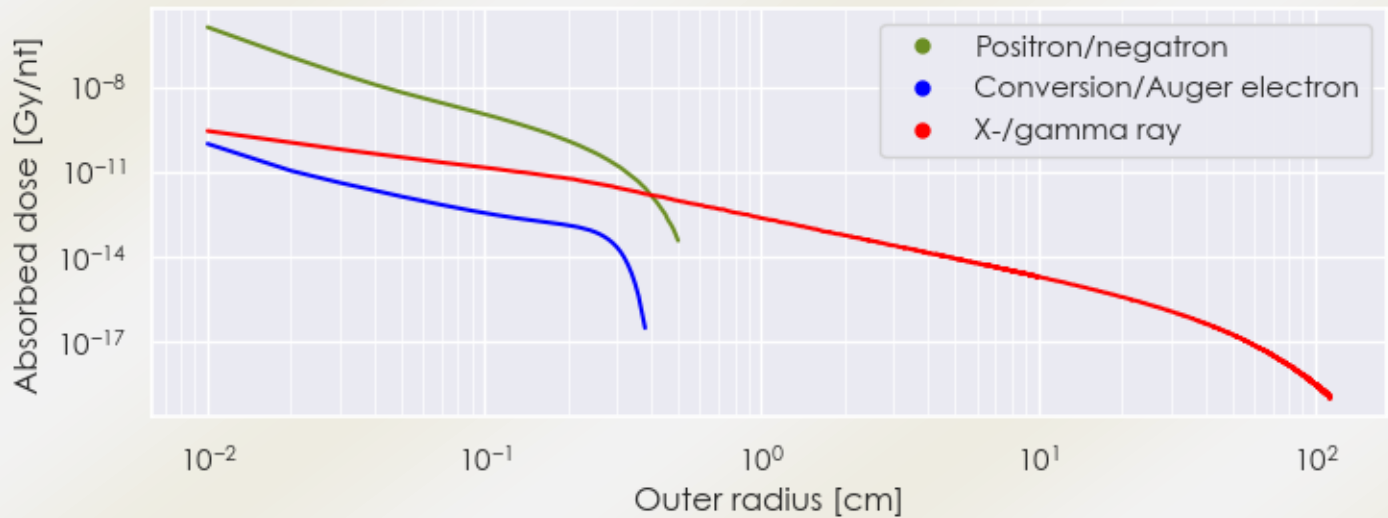
Equilibrium dose constant for betas/electrons, $\Delta_{\beta-, \beta+, e-}$: 4.036×10^{-14} [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : 9.419×10^{-14} [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

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

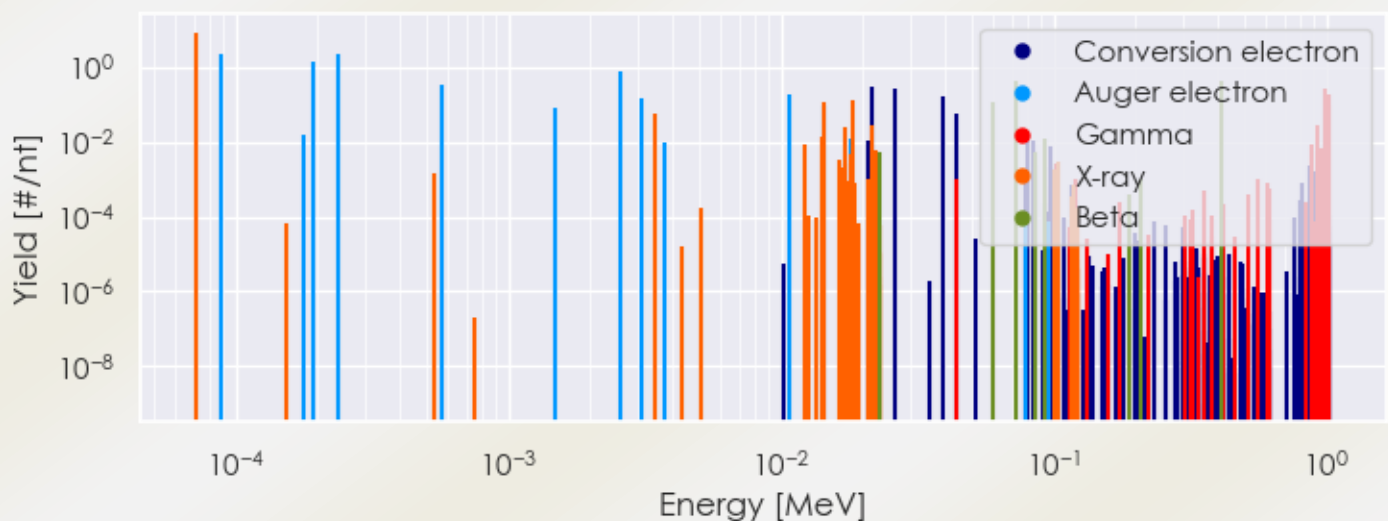
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



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

SUMMARY SPECTRA (PLOT)

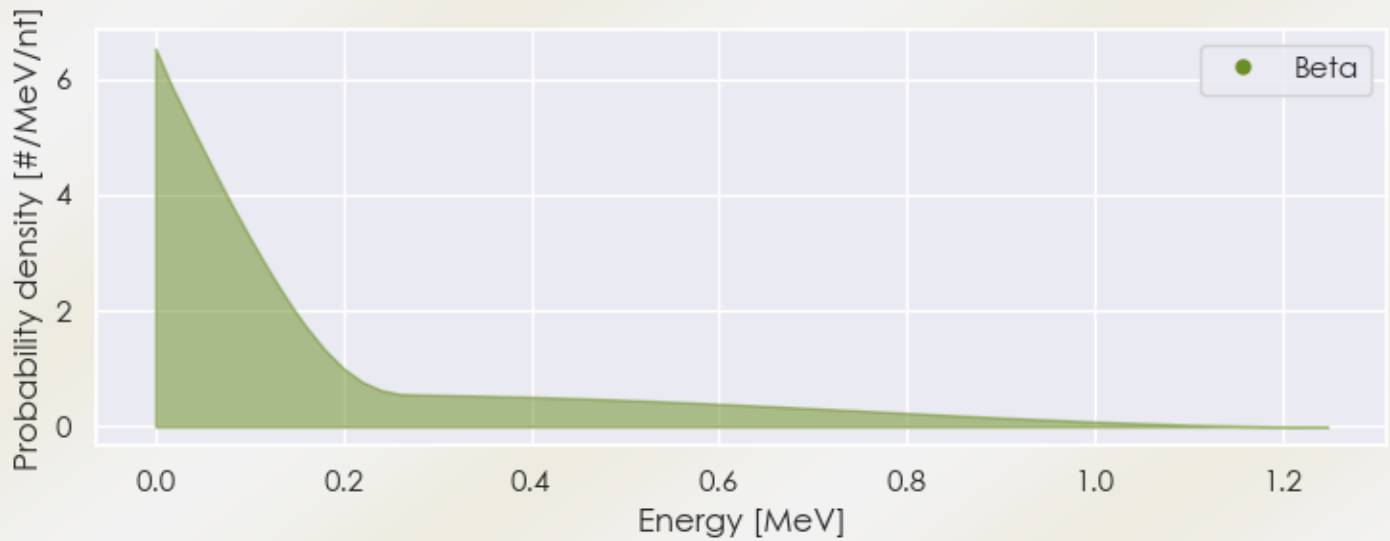
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



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

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
7.20452e-05	8.520e+00	X-ray
3.45656e-03	5.611e-02	X-ray
1.40932e-02	1.304e-02	X-ray
1.42941e-02	1.145e-01	X-ray
1.72768e-02	2.437e-02	X-ray
1.83932e-02	1.228e-01	X-ray
2.15284e-02	2.835e-02	X-ray
9.23980e-01	2.620e-02	Gamma
9.84450e-01	2.519e-01	Gamma
1.02587e+00	8.716e-02	Gamma

1.02854e+00	1.829e-01	Gamma
6.00768e-02	1.148e-01	Beta
7.22093e-02	4.482e-01	Beta
9.19825e-02	1.256e-02	Beta
4.12298e-01	4.102e-01	Beta
8.91193e-05	2.332e+00	Auger electron
1.76443e-04	1.469e-02	Auger electron
1.91667e-04	1.330e+00	Auger electron
2.37001e-04	2.236e+00	Auger electron
5.74239e-04	3.454e-01	Auger electron
1.48754e-03	8.133e-02	Auger electron
2.56517e-03	7.313e-01	Auger electron
3.09860e-03	1.501e-01	Auger electron
1.07803e-02	1.808e-01	Auger electron
1.43276e-02	9.384e-02	Auger electron
1.79146e-02	1.146e-02	Auger electron
2.09580e-02	1.115e-02	Conversion electron
2.17090e-02	3.087e-01	Conversion electron
2.60090e-02	2.650e-01	Conversion electron
3.95301e-02	1.634e-01	Conversion electron
4.40800e-02	5.831e-02	Conversion electron
7.95290e-02	1.571e-02	Conversion electron
8.38290e-02	1.029e-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