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BISMUTH-204

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Bi-204
Atomic number (Z): 83
Mass number (A): 204
Neutron number (N): 121

RADIOACTIVE DECAY

Decay modes: β^+ , Electron capture
Half-life: 11.22 [h]
Decay constant: 1.7161×10^{-5} [1/s]
Daughters: Pb-204m (9.85%), Pb-204 (90.1%)
Radioactive daughters: Pb-204m

DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]
Mean electron energy: 0.08066 [MeV]
Mean photon energy: 2.91615 [MeV]
Air kerma rate constant, Γ_{10} : 1.206×10^{-16} [Gy $\cdot$ m²/Bq $\cdot$ s]
Air kerma coefficient, K_{air} : 1.207×10^{-16} [Gy $\cdot$ m²/Bq $\cdot$ s]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : 1.292×10^{-14} [Gy $\cdot$ kg/Bq $\cdot$ s]
Equilibrium dose constant for alphas, Δ_{α} : 0.000×10^0 [Gy $\cdot$ kg/Bq $\cdot$ s]

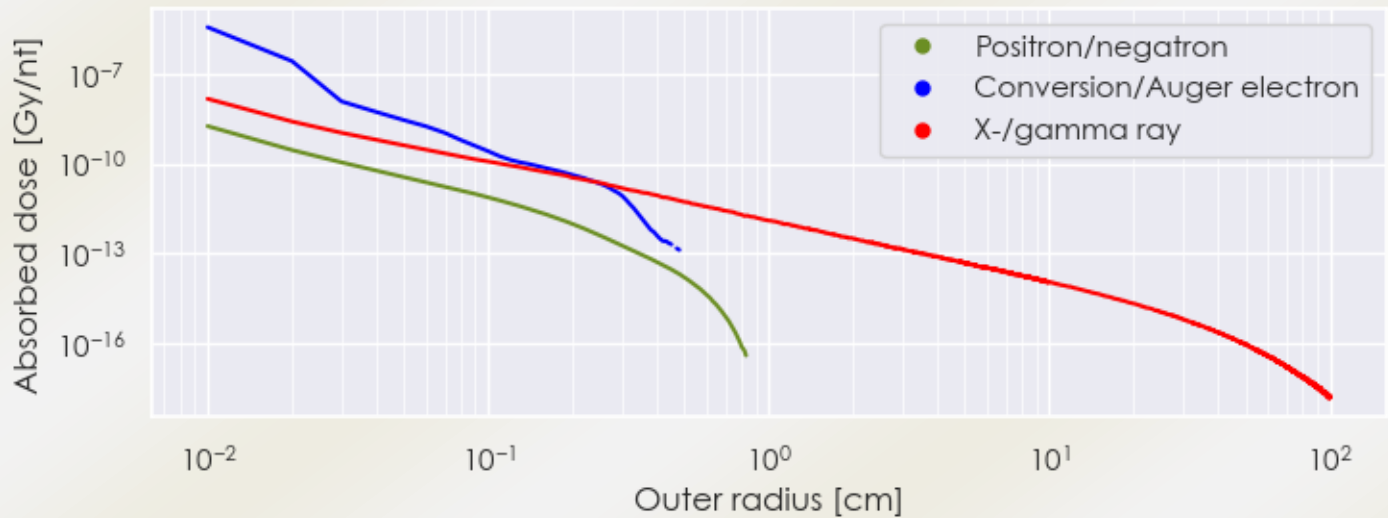
Equilibrium dose constant for betas/electrons, $\Delta_{\beta,\beta^+,e^-}$: 1.292×10^{-14} [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : 4.672×10^{-13} [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

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

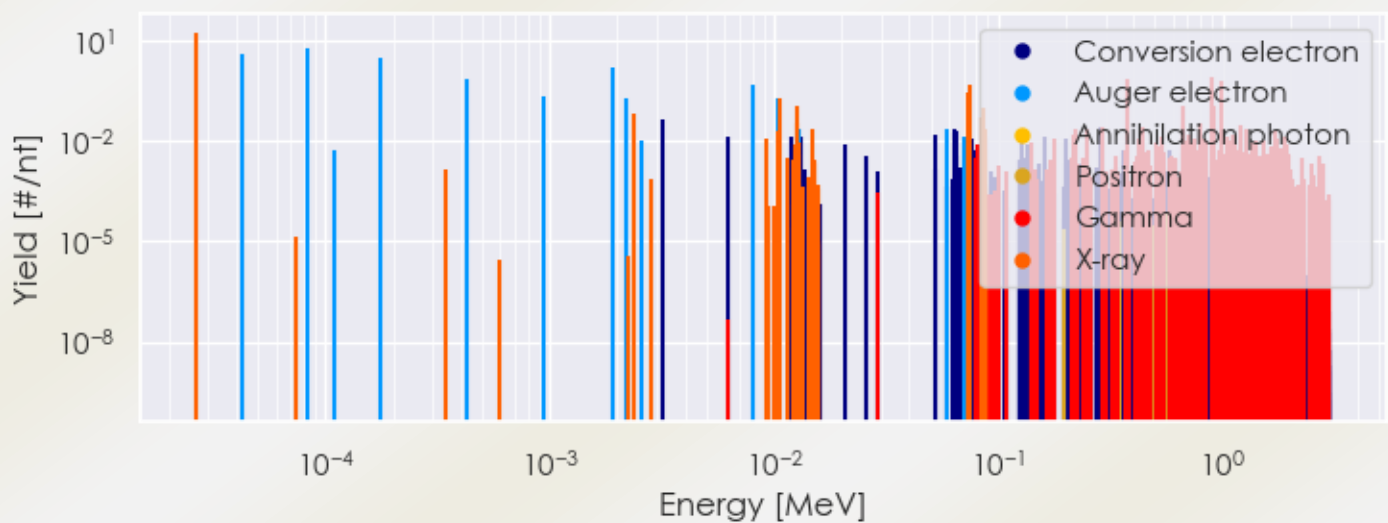
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/Bi-204 DPK.csv

SUMMARY SPECTRA (PLOT)

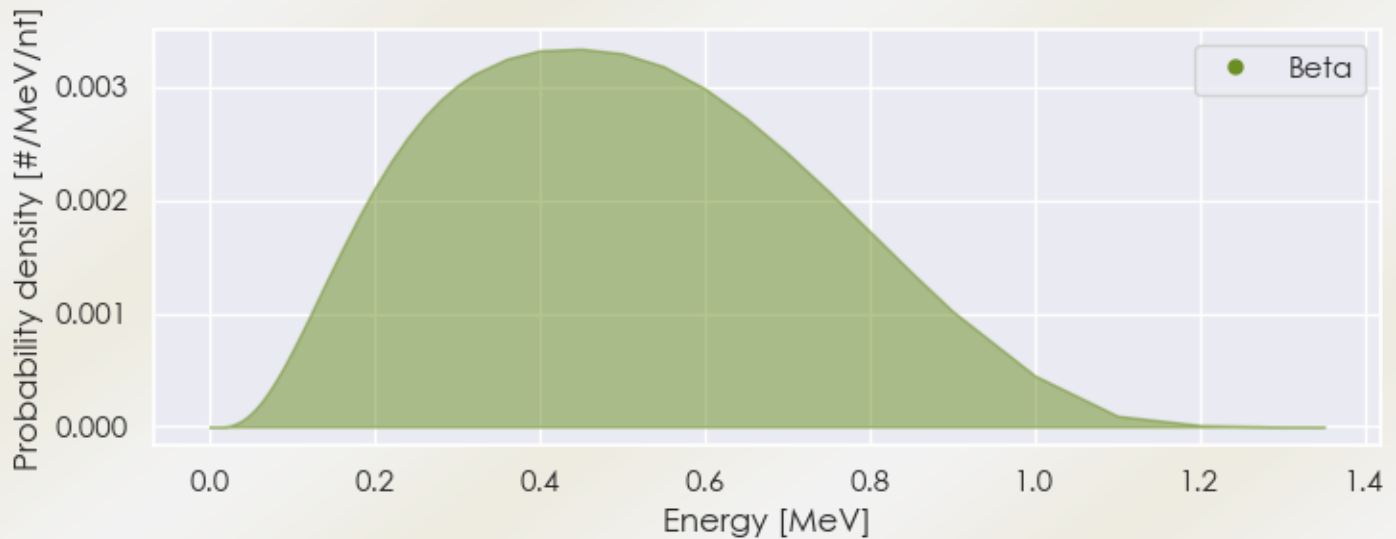
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/Bi-204 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/Bi-204 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/Bi-204 Summary Spectrum.csv

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
2.66208e-05	1.731e+01	X-ray
2.38092e-03	6.473e-02	X-ray
9.21570e-03	1.129e-02	X-ray
1.04453e-02	1.975e-02	X-ray
1.05510e-02	1.739e-01	X-ray
1.26275e-02	3.347e-02	X-ray
1.26563e-02	1.130e-01	X-ray
1.48158e-02	2.307e-02	X-ray
7.30390e-02	2.707e-01	X-ray
7.52501e-02	4.547e-01	X-ray

8.47407e-02	5.065e-02	X-ray
8.52354e-02	9.811e-02	X-ray
8.75343e-02	1.208e-02	X-ray
8.76558e-02	2.374e-02	X-ray
1.76090e-01	1.120e-02	Gamma
2.16110e-01	1.429e-02	Gamma
2.19410e-01	2.303e-02	Gamma
2.48950e-01	2.144e-02	Gamma
2.89300e-01	2.700e-02	Gamma
3.74760e-01	6.749e-01	Gamma
4.21610e-01	1.127e-02	Gamma
4.40460e-01	2.461e-02	Gamma
5.32720e-01	1.350e-02	Gamma
6.61580e-01	2.541e-02	Gamma
6.70720e-01	1.135e-01	Gamma
7.09130e-01	1.429e-02	Gamma
7.10480e-01	1.429e-02	Gamma
7.53790e-01	1.080e-02	Gamma
7.91200e-01	3.255e-02	Gamma
8.34160e-01	1.112e-02	Gamma
8.99150e-01	8.337e-01	Gamma
9.11960e-01	1.112e-01	Gamma
9.18260e-01	1.080e-01	Gamma
9.83980e-01	5.876e-01	Gamma
9.90400e-01	1.191e-02	Gamma
1.04363e+00	1.270e-02	Gamma
1.11135e+00	1.469e-02	Gamma
1.20372e+00	1.985e-02	Gamma
1.21172e+00	3.017e-02	Gamma
1.27476e+00	2.144e-02	Gamma
1.70327e+00	1.985e-02	Gamma
1.75528e+00	1.223e-02	Gamma
1.89627e+00	1.286e-02	Gamma
4.21799e-05	3.896e+00	Auger electron
8.24210e-05	5.599e+00	Auger electron
1.73964e-04	2.959e+00	Auger electron
4.24597e-04	6.761e-01	Auger electron
9.42145e-04	2.201e-01	Auger electron

1.91252e-03	1.565e+00	Auger electron
2.17456e-03	1.954e-01	Auger electron
3.21540e-03	4.510e-02	Conversion electron
6.27000e-03	1.365e-02	Conversion electron
8.05742e-03	4.454e-01	Auger electron
1.04343e-02	1.971e-01	Auger electron
1.20300e-02	1.276e-02	Conversion electron
1.28394e-02	2.089e-02	Auger electron
1.31530e-02	1.400e-02	Conversion electron
5.25100e-02	1.598e-02	Conversion electron
5.87487e-02	2.293e-02	Auger electron
6.32890e-02	2.375e-02	Conversion electron
6.43030e-02	1.762e-02	Conversion electron
6.55000e-02	2.052e-02	Conversion electron
7.07077e-02	1.254e-02	Auger electron
7.54854e-02	1.191e-02	Conversion electron
8.78000e-02	1.397e-02	Conversion electron
1.27820e-01	1.301e-02	Conversion electron
1.60660e-01	1.319e-02	Conversion electron
2.01010e-01	1.092e-02	Conversion electron
2.86470e-01	2.643e-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