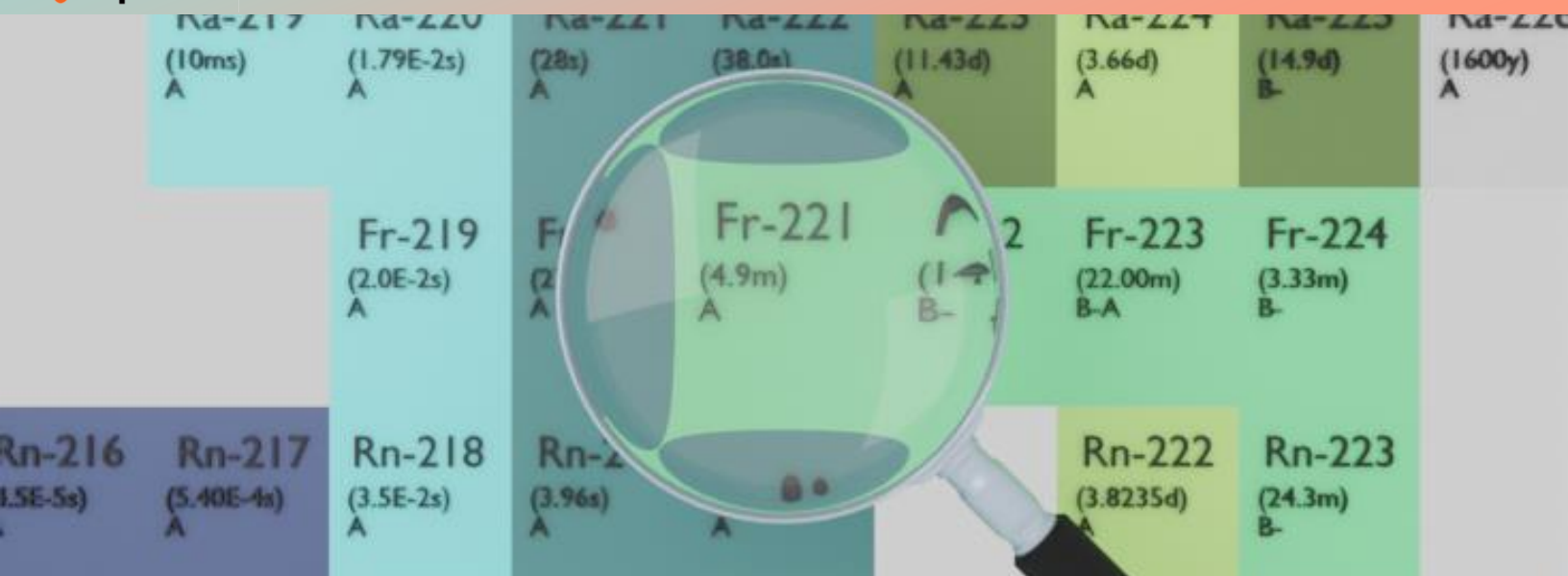




FRANCIUM-221

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Fr-221
Atomic number (Z): 87
Mass number (A): 221
Neutron number (N): 134

RADIOACTIVE DECAY

Decay modes: α
Half-life: 4.9 [m]
Decay constant: 2.3576×10^{-3} [1/s]
Daughters: At-217 (100.0%)
Radioactive daughters: At-217

DOSIMETRIC CONSTANTS

Mean alpha energy: 6.4198 [MeV]
Mean electron energy: 0.0089 [MeV]
Mean photon energy: 0.02941 [MeV]
Air kerma rate constant, Γ_{10} : 1.743×10^{-18} [Gy $\cdot$ m²/Bq $\cdot$ s]
Air kerma coefficient, K_{air} : 1.743×10^{-18} [Gy $\cdot$ m²/Bq $\cdot$ s]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : 1.030×10^{-12} [Gy $\cdot$ kg/Bq $\cdot$ s]
Equilibrium dose constant for alphas, Δ_{α} : 1.029×10^{-12} [Gy $\cdot$ kg/Bq $\cdot$ s]

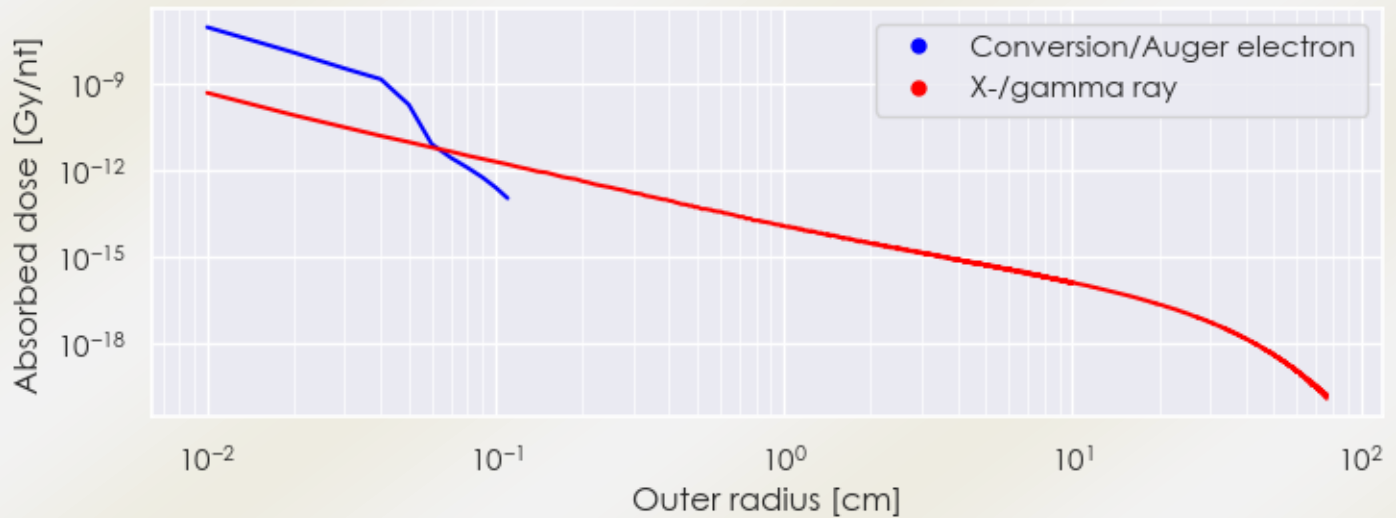
Equilibrium dose constant for betas/electrons, $\Delta_{\beta, \beta^+, e^-}$: 1.426×10^{-15} [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : 4.712×10^{-15} [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

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

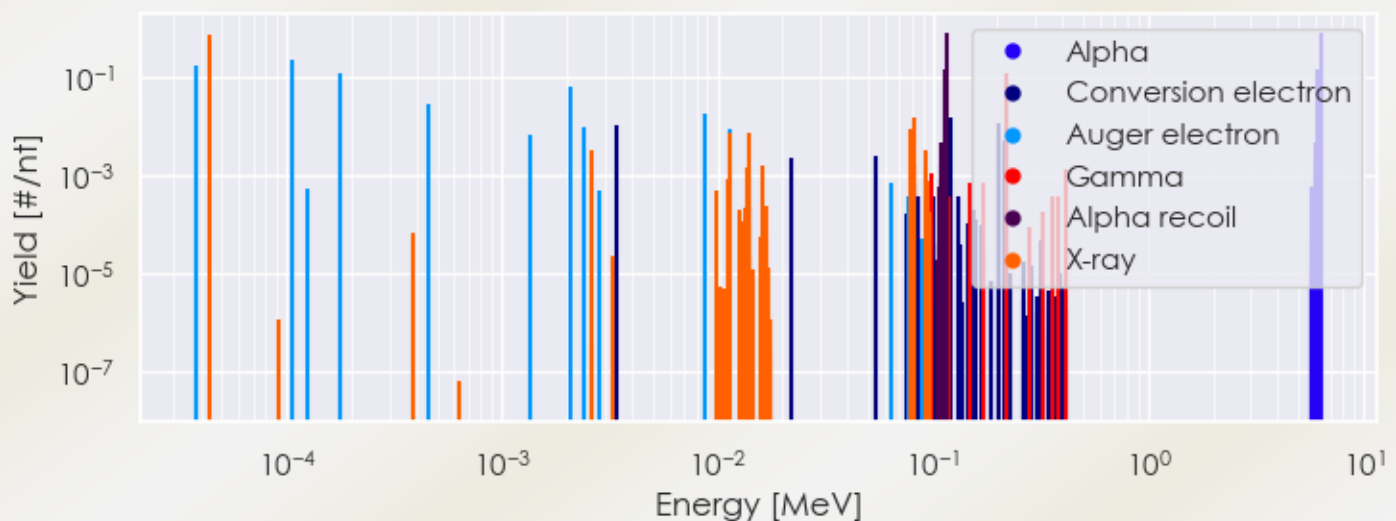
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/Fr-221 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/Fr-221 Summary 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/Fr-221 Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Fr-221%20Summary%20Spectrum.csv)

Energy [MeV]	Yield [# /n _t] if > 0.01	Radiation type
4.42881e-05	7.188e-01	X-ray
8.18531e-02	1.472e-02	X-ray
2.18190e-01	1.158e-01	Gamma
3.81201e-05	1.782e-01	Auger electron
1.05088e-04	2.182e-01	Auger electron
1.76894e-04	1.193e-01	Auger electron
4.54470e-04	2.801e-02	Auger electron
2.07289e-03	6.449e-02	Auger electron
3.43201e-03	1.026e-02	Conversion electron
8.81746e-03	1.850e-02	Auger electron
1.22122e-01	1.591e-02	Conversion electron
2.01350e-01	1.135e-02	Conversion electron
6.12641e+00	1.497e-01	Alpha
6.24295e+00	1.329e-02	Alpha
6.34065e+00	8.271e-01	Alpha
1.13003e-01	1.497e-01	Alpha recoil
1.15152e-01	1.329e-02	Alpha recoil
1.16954e-01	8.271e-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/SNMML-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6