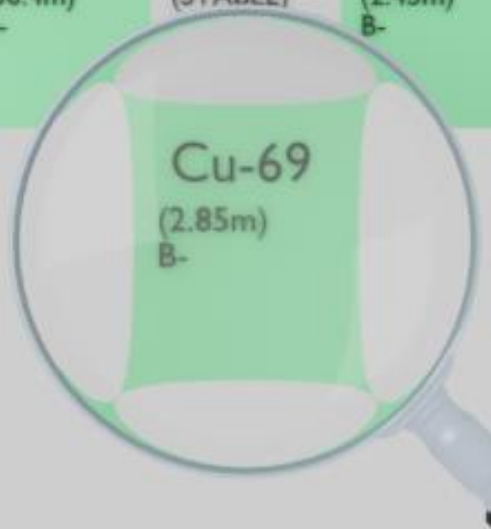




|                   |                           |                         |                        |                   |                        |                        |
|-------------------|---------------------------|-------------------------|------------------------|-------------------|------------------------|------------------------|
| Zn-66<br>(STABLE) | Zn-67<br>(STABLE)         | Zn-68<br>(STABLE)       | Zn-69<br>(56.4m)<br>B- | Zn-70<br>(STABLE) | Zn-71<br>(2.45m)<br>B- | Zn-72<br>(46.5h)<br>B- |
| Cu-65<br>(STABLE) | Cu-66<br>(5.120m)<br>B-   | Cu-67<br>(61.83h)<br>B- | Cu-69<br>(2.85m)<br>B- |                   |                        |                        |
| Ni-64<br>(STABLE) | Ni-65<br>(2.51719h)<br>B- | Ni-66<br>(54.6h)<br>B-  |                        |                   |                        |                        |

# COPPER-69

## SUMMARY DATA

### GENERAL

### CLASSIFICATION

Isotope: Cu-69  
Atomic number (Z): 29  
Mass number (A): 69  
Neutron number (N): 40

### RADIOACTIVE DECAY

Decay modes:  $\beta^-$   
Half-life: 2.85 [m]  
Decay constant: 4.0535e-03 [1/s]  
Daughters: Zn-69 (100.0%)  
Radioactive daughters: Zn-69

### DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]  
Mean electron energy: 0.88627 [MeV]  
Mean photon energy: 0.52838 [MeV]  
Air kerma rate constant,  $\Gamma_{10}$ : 1.885e-17 [Gy·m<sup>2</sup>/Bq·s]  
Air kerma coefficient,  $K_{\text{air}}$ : 1.885e-17 [Gy·m<sup>2</sup>/Bq·s]  
Equilibrium dose constant for weakly-penetrating radiations ( $\alpha$  and/or electrons),  $\Delta_{\text{wp}}$ : 1.420e-13 [Gy·kg/Bq·s]  
Equilibrium dose constant for alphas,  $\Delta_{\alpha}$ : 0.000e+00 [Gy·kg/Bq·s]

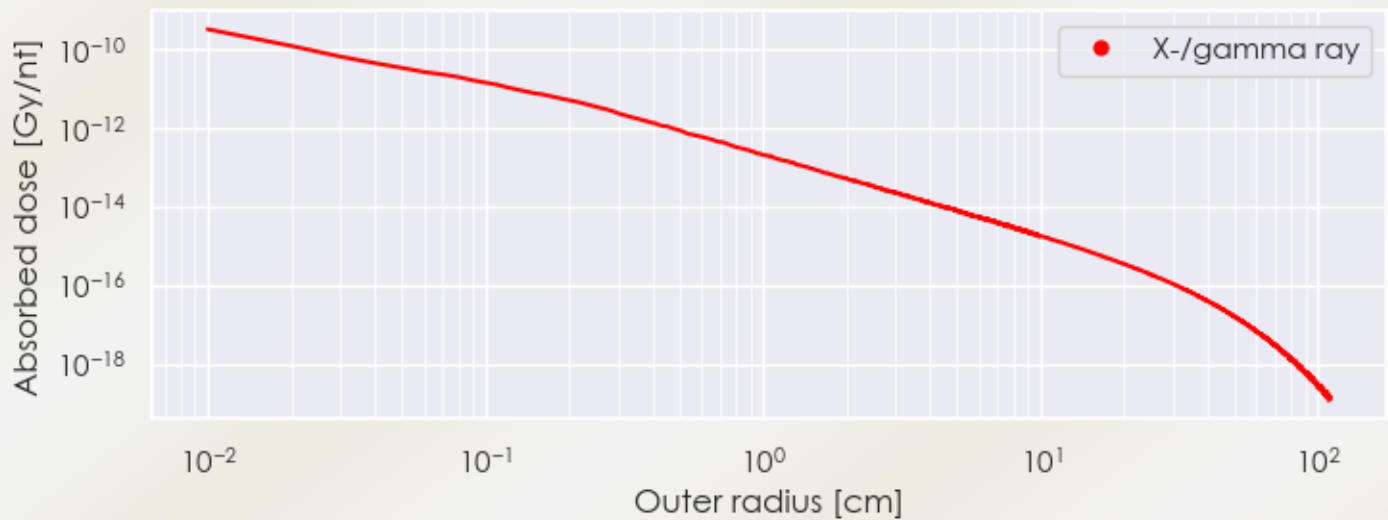
Equilibrium dose constant for betas/electrons,  $\Delta_{\beta, \beta+, e-}$ :  $1.420 \times 10^{-13}$  [Gy·kg/Bq·s]

Equilibrium dose constant for photons,  $\Delta_p$ :  $8.466 \times 10^{-14}$  [Gy·kg/Bq·s]

### DOSE POINT KERNELS (PLOT)

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

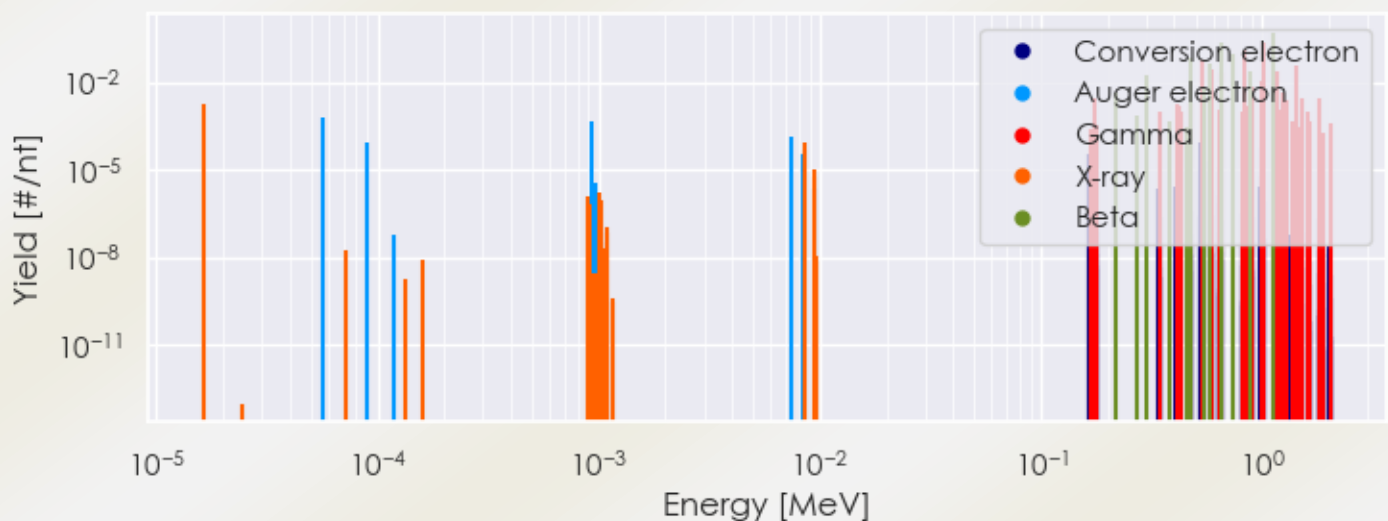
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: [www.mirdsoft.org/products/MIRDspecs/Cu-69 DPK.csv](http://www.mirdsoft.org/products/MIRDspecs/Cu-69 DPK.csv)

### SUMMARY SPECTRA (PLOT)

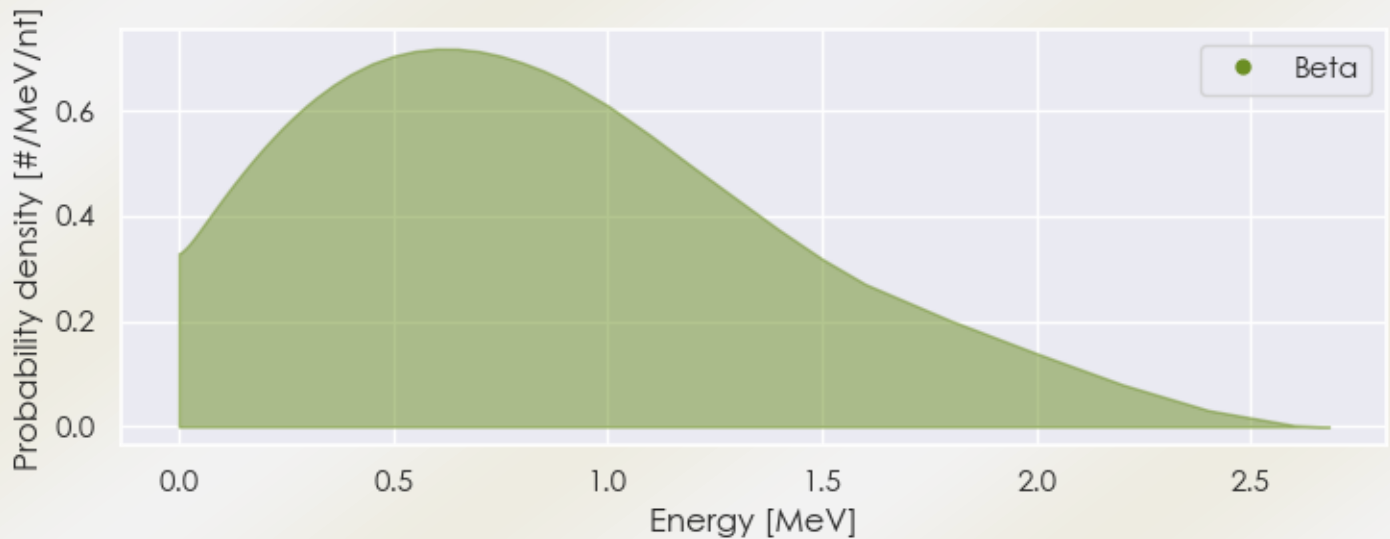
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: [www.mirdsoft.org/products/MIRDspecs/Cu-69 Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Cu-69 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/Cu-69 Beta Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Cu-69 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/Cu-69 Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Cu-69 Summary Spectrum.csv)

| Energy [MeV] | Yield [# / nt] if > 0.01 | Radiation type |
|--------------|--------------------------|----------------|
| 5.31200e-01  | 5.967e-02                | Gamma          |
| 5.94900e-01  | 2.621e-02                | Gamma          |
| 6.49400e-01  | 2.083e-02                | Gamma          |
| 8.34400e-01  | 1.310e-01                | Gamma          |
| 9.93400e-01  | 1.147e-02                | Gamma          |
| 1.00750e+00  | 2.340e-01                | Gamma          |
| 1.18070e+00  | 2.293e-02                | Gamma          |
| 1.42980e+00  | 3.416e-02                | Gamma          |
| 3.00617e-01  | 1.794e-02                | Beta           |
| 4.71212e-01  | 6.876e-02                | Beta           |

|                    |           |      |
|--------------------|-----------|------|
| <b>5.82038e-01</b> | 4.186e-02 | Beta |
| <b>6.60493e-01</b> | 2.392e-01 | Beta |
| <b>7.39710e-01</b> | 8.770e-02 | Beta |
| <b>8.80379e-01</b> | 2.491e-02 | Beta |
| <b>1.13066e+00</b> | 5.082e-01 | Beta |

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