



# CERIUM-133M

## SUMMARY DATA

### GENERAL

#### CLASSIFICATION

Isotope: Ce-133m  
Atomic number (Z): 58  
Mass number (A): 133  
Neutron number (N): 75

#### RADIOACTIVE DECAY

Decay modes:  $\beta^+$ , Electron capture  
Half-life: 4.9 [h]  
Decay constant:  $3.9294 \times 10^{-5}$  [1/s]  
Daughters: La-133 (100.0%)  
Radioactive daughters: La-133

#### DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]  
Mean electron energy: 0.07393 [MeV]  
Mean photon energy: 1.73728 [MeV]  
Air kerma rate constant,  $\Gamma_{10}$ :  $6.232 \times 10^{-17}$  [Gy  $\cdot$  m<sup>2</sup>/Bq  $\cdot$  s]  
Air kerma coefficient,  $K_{\text{air}}$ :  $6.418 \times 10^{-17}$  [Gy  $\cdot$  m<sup>2</sup>/Bq  $\cdot$  s]  
Equilibrium dose constant for weakly-penetrating radiations ( $\alpha$  and/or electrons),  $\Delta_{\text{wp}}$ :  $1.184 \times 10^{-14}$  [Gy  $\cdot$  kg/Bq  $\cdot$  s]  
Equilibrium dose constant for alphas,  $\Delta_{\alpha}$ : 0.000e+00 [Gy  $\cdot$  kg/Bq  $\cdot$  s]

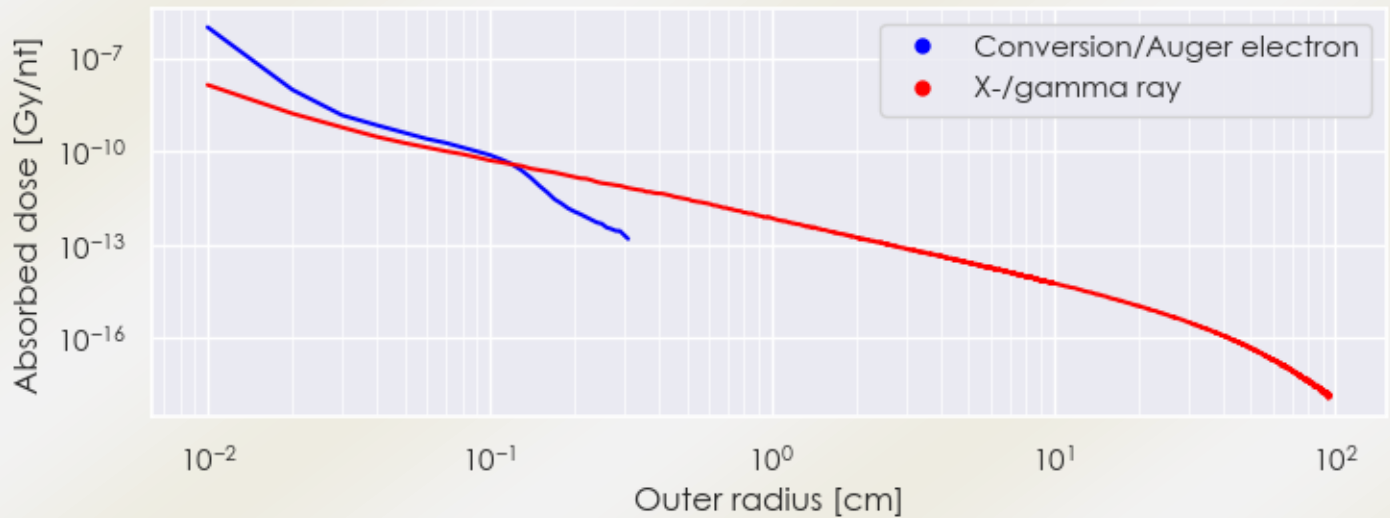
Equilibrium dose constant for betas/electrons,  $\Delta_{\beta,\beta^+,e^-}$ :  $1.184 \times 10^{-14}$  [Gy·kg/Bq·s]

Equilibrium dose constant for photons,  $\Delta_p$ :  $2.783 \times 10^{-13}$  [Gy·kg/Bq·s]

### DOSE POINT KERNELS (PLOT)

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

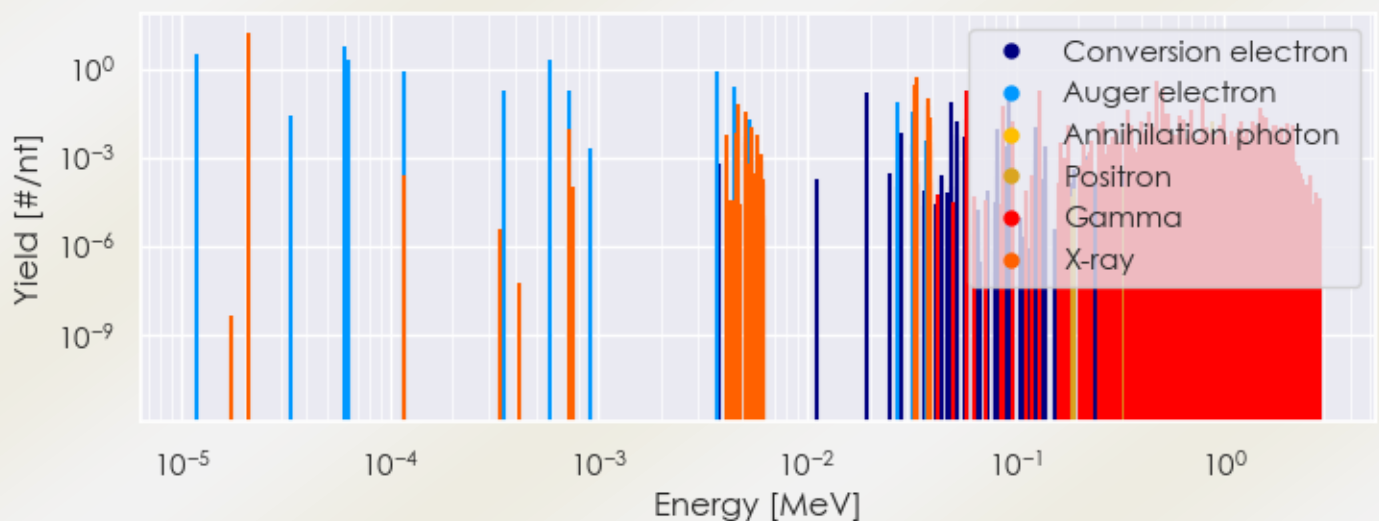
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: [www.mirdsoft.org/products/MIRDspecs/Ce-133m DPK.csv](http://www.mirdsoft.org/products/MIRDspecs/Ce-133m DPK.csv)

### SUMMARY SPECTRA (PLOT)

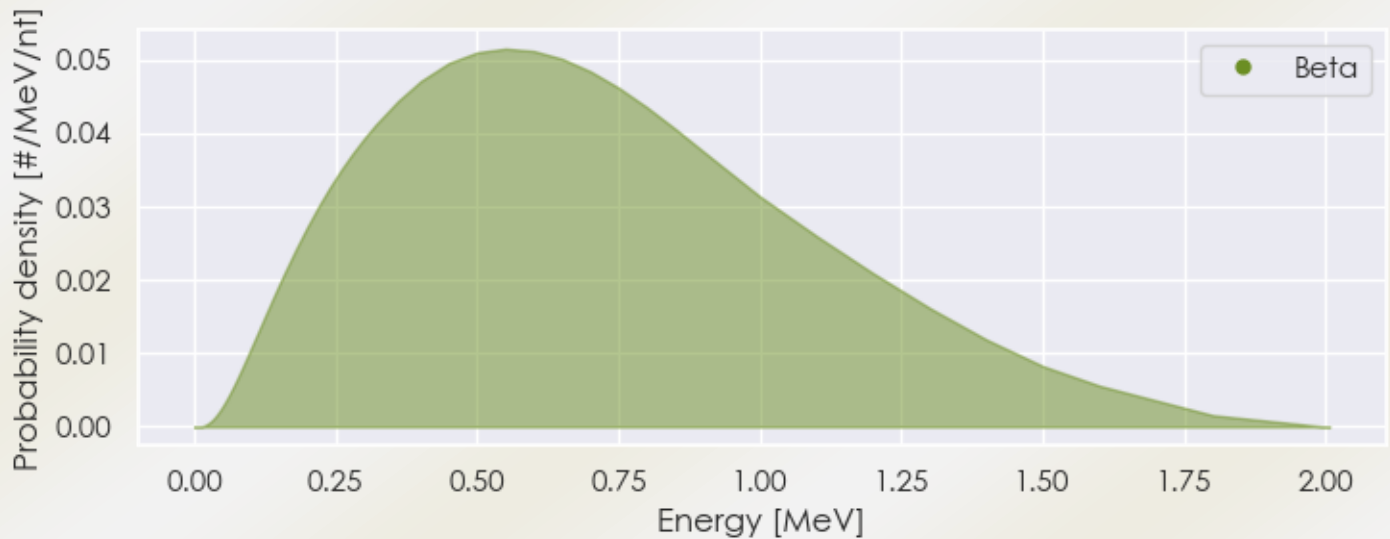
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: [www.mirdsoft.org/products/MIRDspecs/Ce-133m Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Ce-133m 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/Ce-133m Beta Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Ce-133m 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/Ce-133m Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Ce-133m Summary Spectrum.csv)

| Energy [MeV] | Yield [# / nt] if > 0.01 | Radiation type |
|--------------|--------------------------|----------------|
| 2.10725e-05  | 1.712e+01                | X-ray          |
| 4.63652e-03  | 6.174e-02                | X-ray          |
| 5.03753e-03  | 3.675e-02                | X-ray          |
| 5.37004e-03  | 1.010e-02                | X-ray          |
| 3.30405e-02  | 3.025e-01                | X-ray          |
| 3.34591e-02  | 5.555e-01                | X-ray          |
| 3.77381e-02  | 5.354e-02                | X-ray          |
| 3.78203e-02  | 1.037e-01                | X-ray          |
| 3.87183e-02  | 1.136e-02                | X-ray          |

|             |           |                     |
|-------------|-----------|---------------------|
| 3.87359e-02 | 2.212e-02 | X-ray               |
| 5.83900e-02 | 1.925e-01 | Gamma               |
| 8.79390e-02 | 5.135e-02 | Gamma               |
| 9.72610e-02 | 1.756e-02 | Gamma               |
| 1.30803e-01 | 1.791e-01 | Gamma               |
| 1.78650e-01 | 1.215e-02 | Gamma               |
| 2.48950e-01 | 1.333e-02 | Gamma               |
| 2.61396e-01 | 1.740e-02 | Gamma               |
| 3.46390e-01 | 4.155e-02 | Gamma               |
| 3.64190e-01 | 1.254e-02 | Gamma               |
| 4.04780e-01 | 1.697e-02 | Gamma               |
| 4.32550e-01 | 3.528e-02 | Gamma               |
| 4.44200e-01 | 1.372e-02 | Gamma               |
| 4.75490e-01 | 3.175e-02 | Gamma               |
| 4.77220e-01 | 3.920e-01 | Gamma               |
| 5.10360e-01 | 2.070e-01 | Gamma               |
| 5.11000e-01 | 9.637e-02 | Annihilation photon |
| 5.23760e-01 | 3.136e-02 | Gamma               |
| 5.41090e-01 | 2.940e-02 | Gamma               |
| 6.11830e-01 | 2.595e-02 | Gamma               |
| 6.17700e-01 | 1.646e-02 | Gamma               |
| 6.44740e-01 | 1.968e-02 | Gamma               |
| 6.89480e-01 | 4.116e-02 | Gamma               |
| 7.84550e-01 | 9.643e-02 | Gamma               |
| 8.29420e-01 | 1.007e-02 | Gamma               |
| 9.50990e-01 | 1.274e-02 | Gamma               |
| 9.90130e-01 | 2.940e-02 | Gamma               |
| 1.18333e+00 | 1.098e-02 | Gamma               |
| 1.19990e+00 | 1.568e-02 | Gamma               |
| 1.37722e+00 | 1.725e-02 | Gamma               |
| 1.43222e+00 | 1.200e-02 | Gamma               |
| 1.49485e+00 | 3.214e-02 | Gamma               |
| 1.50041e+00 | 4.743e-02 | Gamma               |
| 1.52656e+00 | 2.470e-02 | Gamma               |
| 1.58462e+00 | 2.391e-02 | Gamma               |
| 1.72020e+00 | 1.282e-02 | Gamma               |
| 1.76936e+00 | 1.219e-02 | Gamma               |
| 1.88730e+00 | 1.015e-02 | Gamma               |

|                    |           |                     |
|--------------------|-----------|---------------------|
| <b>2.01823e+00</b> | 1.364e-02 | Gamma               |
| <b>2.11920e+00</b> | 1.254e-02 | Gamma               |
| <b>8.83695e-01</b> | 1.539e-02 | Positron            |
| <b>1.18532e-05</b> | 2.990e+00 | Auger electron      |
| <b>3.33700e-05</b> | 2.464e-02 | Auger electron      |
| <b>6.07189e-05</b> | 5.959e+00 | Auger electron      |
| <b>6.29238e-05</b> | 1.888e+00 | Auger electron      |
| <b>1.17773e-04</b> | 8.428e-01 | Auger electron      |
| <b>3.55064e-04</b> | 1.805e-01 | Auger electron      |
| <b>5.79555e-04</b> | 2.001e+00 | Auger electron      |
| <b>7.30056e-04</b> | 1.726e-01 | Auger electron      |
| <b>3.69615e-03</b> | 7.862e-01 | Auger electron      |
| <b>4.50972e-03</b> | 2.600e-01 | Auger electron      |
| <b>5.35437e-03</b> | 2.042e-02 | Auger electron      |
| <b>1.94470e-02</b> | 1.659e-01 | Conversion electron |
| <b>2.73123e-02</b> | 6.949e-02 | Auger electron      |
| <b>3.21336e-02</b> | 3.251e-02 | Auger electron      |
| <b>4.89960e-02</b> | 7.018e-02 | Conversion electron |
| <b>5.21482e-02</b> | 1.571e-02 | Conversion electron |
| <b>5.83180e-02</b> | 1.809e-02 | Conversion electron |
| <b>9.18600e-02</b> | 7.996e-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](https://sites.snmmi.org/SNMMI-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6)