**Title**: Shielding-Distance

**Purpose**: To calculate the radiation dose rate from a gamma source at various distances and with a simple shield (e.g. only lead or only concrete).

**Theory**: The dose rate from a gamma-emitting source at a distance of one meter is calculated by multiplying the source activity (in Ci) by the gamma constant for that radionuclide: Dr=ΓA. This spreadsheet provides gamma constants for 3 radionuclides (Co-60, Cs-137, Ir-192); to calculate dose rate from other radionuclides you will have to look up the appropriate gamma constant and enter that into the cell in Column C.

* 1. Radiation dose rate drops with the square of the distance, so the dose rate at a distance of 2 meters is ¼ the dose rate at 1 meter: 
  2. Radiation dose rate drops with the addition of shielding between the radiation source and the person (or instrument) making measurements. The can be calculated by using the attenuation coefficient or by using the concept of Tenth Value Layer (TVL) or Half Value Layer (HVL).
     1. Radiation passing through 1 TVL of shielding will have its intensity reduced by a factor of 10; radiation passing through 1 HVL of shielding will have its intensity reduced by a factor of 2:  and  where n is the number of HVLs or TVLs respectively.
     2. The attenuation coefficient is the amount that radiation dose rate is reduced by a given material – multiplying the attenuation coefficient (µ) by the shield’s thickness and density gives you the total amount of dose rate reduction:  where µ is the attenuation coefficient, ρ is the density, and x is the shield thickness
     3. **NOTE**: TVL, HVL, and µ are all specific for the radionuclide and for the shield material. This spreadsheet provides these values for three radionuclides and four common shielding materials; if you are interested in a radionuclide (e.g. Am-241) or a shielding material (e.g. gypsum drywall) not included here you will have to look up the relevant values online or in an appropriate reference and enter those values into this spreadsheet.

**You enter**: Nuclide, gamma constant, distance, the appropriate shielding term (HVL, TVL, or attenuation coefficient + shielding density), and shielding thickness

**The spreadsheet**: Calculates radiation dose rate from a given gamma-emitting radionuclide, including attenuation due to distance and shielding.

**In addition**: You can calculate dose rate only by setting the distance to 1 meter and leaving the shielding parameters blank.

You can calculate the attenuation due to distance only by leaving the shielding parameters blank.

You can calculate the attenuation due to shielding only by entering the shielding parameters and leaving the distance at one meter.