Gamma Dose Rate from a Point Source, Stay Time and Safe Distance

Dose rate near an unshielded gamma source from its activity and dose-rate constant, with the dose over a time, stay time and distance for a target rate.

Method: Inverse-square law with a specific gamma-ray dose-rate constant

Input parameters

Unit system: SI

Parameter	Value	Unit
Source activity	37.000	GBq
Dose-rate constant (mSv per hour at 1 m per GBq; Co-60 about 0.35)	0.35000	
Distance	3.0000	m
Exposure time	30.000	min
Dose allowed for the task	0.10000	mSv
Target dose rate (for safe distance)	2.5000	µSv/h

Calculated results

Parameter	Value	Unit
Dose rate at the distance	1.4389	mSv/h
Dose over the exposure time	0.71944	mSv
Stay time to reach the allowed dose	4.1699	min
Distance for the target dose rate	71.972	m

Notes for this case

• Inverse-square law Ḋ = ΓA/r² for a point source in air, no shielding or scatter. Γ depends on the nuclide (photons per decay and their energies); use the value published for the nuclide and dose quantity. Time, distance and shielding are the three means of protection.

Formula and method

$$\dot{D} = \frac{\Gamma A}{r^2}, \quad t_s = \frac{D_{lim}}{\dot{D}}, \quad r_t = r\sqrt{\frac{\dot{D}}{\dot{D}_t}}$$

Variables

A	Source activity	Bq
Γ	Dose-rate constant (mSv per hour at 1 m per GBq; Co-60 about 0.35)	-
r	Distance	m
t	Exposure time	s
D_{lim}	Dose allowed for the task	Gy
$\dot{D}_t$	Target dose rate (for safe distance)	Gy/s
$\dot{D}$	Dose rate at the distance	Gy/s
D	Dose over the exposure time	Gy
t_s	Stay time to reach the allowed dose	s
r_t	Distance for the target dose rate	m

Method and standards

Inverse-square dose rate.

Assumptions and limits

- Point source; no attenuation or scatter.

References

Inverse-square law with a specific gamma-ray dose-rate constant

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/nuclear-power/gamma-dose-rate-point-source

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.