UV Disinfection: Dose, Log Inactivation and Exposure Time

UV dose from average intensity and exposure time, the log inactivation for an organism's dose per log, and the exposure needed for a target log reduction.

Method: UV dose D = I·t; log-linear inactivation with dose per log (US EPA, Ultraviolet Disinfection Guidance Manual, EPA 815-R-06-007)

Input parameters

Unit system: SI

Parameter	Value	Unit
Average UV intensity	100.00	W/m²
Exposure time	4.0000	s
Dose per log inactivation (mJ/cm²)	10.000	
Target log inactivation	4.0000	
UV transmittance (1 cm), for the low-UVT check only Does not change the dose: the average intensity entered must already allow for the water's transmittance.	65.000	%

Calculated results

Parameter	Value	Unit
UV dose (mJ/cm²)	40.000	
Log inactivation achieved	4.0000	
Exposure time for the target	4.0000	s
Dose for the target (mJ/cm²)	40.000	

Notes for this case

- Log-linear inactivation assumed; validated reactors are rated by a biodosimetric (RED) dose, not by average intensity × time.

Formula and method

$$D = I t, \quad \log_{10}\frac{N_0}{N} = \frac{D}{D_{10}}, \quad t_{req} = \frac{\log \cdot D_{10}}{I}$$

Variables

I	Average UV intensity	W/m²
t	Exposure time	s
D_{10}	Dose per log inactivation (mJ/cm²)	-
$\log_{10}$	Target log inactivation	-
UVT	UV transmittance (1 cm), for the low-UVT check only	-
D	UV dose (mJ/cm²)	-
t_{req}	Exposure time for the target	s
D_{req}	Dose for the target (mJ/cm²)	-

Method and standards

Dose definitions.

Assumptions and limits

- UVT does not enter the dose: it only triggers a warning below 55 %. The average intensity I must be the value in the water at its transmittance (from the reactor maker or a fluence-rate calculation).
- Log-linear kinetics; uniform intensity.

References

- UV dose D = I·t; log-linear inactivation with dose per log (US EPA, Ultraviolet Disinfection Guidance Manual, EPA 815-R-06-007)

Report details

Report reference	FCC-VH5B-H6RP (the same inputs always give the same reference)
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Release checks	2 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/environmental/wastewater/uv-disinfection-dose

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.