Effluent Design Mean for a Permit Limit at a Reliability Level

Mean (median) effluent value a process must achieve so a permit limit is met at a chosen reliability, from a log-normal spread with geometric standard deviation.

Input parameters

Unit system: SI

Parameter	Value	Unit
Permit limit	15.000	mg/L
Required reliability	99.000	%
Geometric standard deviation (P84.1/P50)	1.2500	

Calculated results

Parameter	Value	Unit
Standard normal deviate	2.3263	
Required geometric mean (median)	8.9258	mg/L
Required arithmetic mean	9.1508	mg/L
Coefficient of reliability (mean/limit)	0.61005	

Notes for this case

- The effluent is assumed log-normal with the stated geometric standard deviation, kept the same at the lower design level. A typical rule: to meet a limit 95 % of the time, design for about half the limit.

Formula and method

$$M_g = \frac{C_{lim}}{s_g^{\,z}}, \quad \bar{C} = M_g\, e^{(\ln s_g)^2/2}, \quad z = \Phi^{-1}(R)$$

Variables

C_{lim}	Permit limit	kg/m³
R	Required reliability	-
s_g	Geometric standard deviation (P84.1/P50)	-
z	Standard normal deviate	-
M_g	Required geometric mean (median)	kg/m³
$\bar{C}$	Required arithmetic mean	kg/m³
COR	Coefficient of reliability (mean/limit)	-

Method and standards

Log-normal statistics of effluent quality.

Assumptions and limits

- Log-normal effluent; stationary variability.

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/environmental/wastewater/effluent-design-mean-lognormal

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.