Gaussian Plume: Ground-Level Centreline Concentration

Ground-level centreline concentration downwind of a stack from emission rate, wind speed, effective height and the dispersion coefficients there.

Method: Gaussian plume with total ground reflection C = Q/(πuσ_yσ_z) exp(−H²/2σ_z²) (Turner, Workbook of Atmospheric Dispersion Estimates)

Input parameters

Unit system: SI

Parameter	Value	Unit
Emission rate	100,000	kg/h
Wind speed at stack height	5.0000	m/s
Effective stack height (stack plus plume rise)	150.00	m
Horizontal dispersion coefficient at the distance From Pasquill–Gifford curves for the stability class and distance.	160.00	m
Vertical dispersion coefficient at the distance	90.000	m

Calculated results

Parameter	Value	Unit
Ground-level centreline concentration	30,622	µg/m³

Notes for this case

- Includes full ground reflection; a screening estimate, not a regulatory model.

Formula and method

$$C = \frac{Q}{\pi u \sigma_y \sigma_z} \exp\left(-\frac{H^2}{2\sigma_z^2}\right)$$

Variables

Q	Emission rate	kg/s
u	Wind speed at stack height	m/s
H	Effective stack height (stack plus plume rise)	m
σ_y	Horizontal dispersion coefficient at the distance	m
σ_z	Vertical dispersion coefficient at the distance	m
C	Ground-level centreline concentration	kg/m³

Method and standards

Gaussian plume, ground-level centreline.

Assumptions and limits

- Steady, flat terrain, full ground reflection.
- No reflection from the top of the mixing layer and no averaging-time correction (the σ curves are for about 10-minute averages): a screening estimate.

References

• Gaussian plume with total ground reflection C = Q/(πuσ_yσ_z) exp(−H²/2σ_z²) (Turner, Workbook of Atmospheric Dispersion Estimates)

Report details

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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/air-pollution/gaussian-plume-ground-level

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.