Flue Gas Concentration: Wet ↔ Dry Basis

Convert a flue gas concentration or composition between wet and dry basis from the moisture content, and the dry flow from the wet flow.

Method: Dilution by water vapour: C_dry = C_wet/(1 − x_H₂O)

Input parameters

Unit system: SI

Parameter	Value	Unit
Concentration given on	Wet basis (convert to dry)	
Concentration	180.00	mg/Nm³
Water vapour volume fraction (of the wet gas) Volume (mole) fraction in the wet gas. From a dry-basis ratio x_d use x_d/(1 + x_d); from a mass fraction convert with the molar masses (18 for water, about 30 for flue gas).	12.000	%
Wet flue gas flow (normal)	150,000	Nm³/h

Calculated results

Parameter	Value	Unit
Dry-basis concentration	204.55	mg/Nm³
Wet-basis concentration	180.00	mg/Nm³
Dry flue gas flow	132,000	Nm³/h

Notes for this case

- Mass emission is the same on either basis: C_d × dry flow = C_w × wet flow.

Formula and method

$$C_d = \frac{C_w}{1 - x_{H_2O}}, \quad \dot{V}_d = \dot{V}_w(1 - x_{H_2O})$$

Variables

given	Concentration given on	-
C	Concentration	kg/m³
x_{H_2O}	Water vapour volume fraction	-
$\dot{V}_w$	Wet flue gas flow (normal)	Nm³/s
C_d	Dry-basis concentration	kg/m³
C_w	Wet-basis concentration	kg/m³
$\dot{V}_d$	Dry flue gas flow	Nm³/s

Method and standards

Mole balance.

Assumptions and limits

- The moisture is the volume (mole) fraction of water vapour in the wet gas. Moisture given as a mass fraction or on a dry basis must be converted first (dry-basis ratio x_d → x_d/(1 + x_d)).
- Ideal gas.

References

- Dilution by water vapour: C_dry = C_wet/(1 − x_H₂O)

Report details

Report reference	FCC-ACP0-EQHP (the same inputs always give the same reference)
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Calculator	Flue Gas Concentration: Wet ↔ Dry Basis
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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/wet-dry-concentration

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.