

Diffusive Sampler for Total Nitrogen NO_x

Effects and Limit values

NO₂ and NO_x have implications for acidification of ecosystems and formation of ozone. It is pointed out that synergistic effects are very important and the guideline is given for NO_x rather than NO₂ alone.

WHO recommended a guideline to protect vegetation as an annual average of 30 µg/m³; for NO_x, calculated as the sum of NO and NO₂ in ppb and expressed as NO₂ in mg/m³

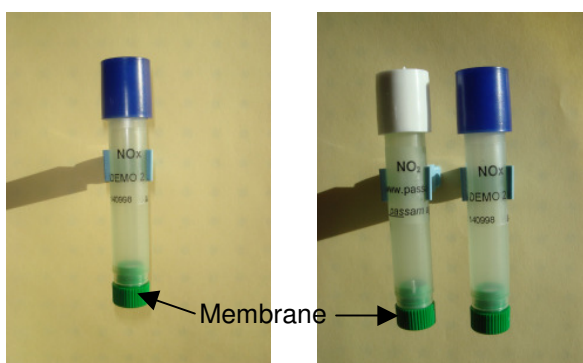
Annual limit value for the protection of vegetation 30 µg/m³ [1]

Sampler design

The sampler is based on that of Palmes. The absorbing medium contains an oxidant, which transform NO to NO₂. The amount of NO_x is trapped as total nitrite

The measurement of NO_x is carried out with two different samplers: firstly NO₂ is assessed with Triethanolamine and secondly NO + NO₂ is trapped after transforming NO into NO₂ with an oxidizing agent in the TEA

The samplers are placed in a special shelter to protect them from rain and minimize the wind influence. To avoid the influence of vertical air turbulences at high trafficked roads, Membranes shall be used.



Direct measurement as NO₂ equivalents

Indirect measurement via NO measurement

Direct Measurement

NO_x is determined as the total amount of nitrite

$$C_{NO_x} = \frac{Q_{NO_x} [\mu g] \cdot 10^6}{SR_{NO_x} [ml/min] \cdot t [min]} \quad [1]$$

C_{NO_x} is expressed in NO₂ equivalents in µg/m³

Indirect measurement

The measurement is done by NO₂ and NO_x tube simultaneously.

First, the NO₂ concentration is calculated according to [1]

Second:

Based on the difference NO_x and NO₂ as nitrite, the concentration of NO is calculated

$$C_{NO} = \frac{(Q_{NO_x} - Q_{NO_2}) [\mu g] \cdot 10^6}{SR_{NO} [ml/min] \cdot t [min]} \quad [1]$$

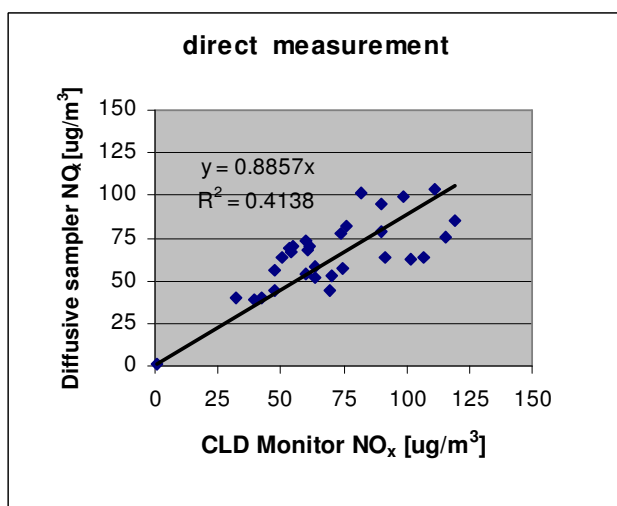
The concentrations of NO₂ and NO are added:

$$C_{NO_x} = C_{NO_2} + C_{NO} \quad [\mu g/m^3]$$

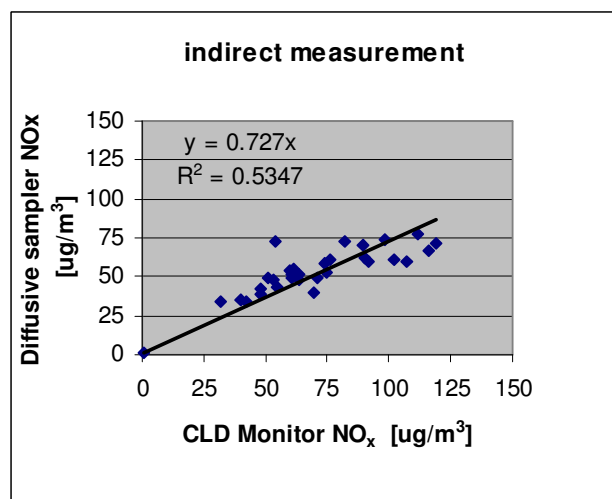
C_{NO_x}: ambient concentration [µg/m³]
 Q: mass absorbed [µg]
 SR: sampling rate [ml/min]
 CF: Conversion Factor µg/m³ → ppb



Specifications



The diagram shows the comparison of NO_x diffusive samplers and NO_x (sum of NO + NO₂ in µg/m³) measurements of different continuous monitoring sites in Switzerland 2006.



There is a underestimation of the diffusion tube measurement. This might be due to the fact, that CLD monitors collect also higher Nitrogen oxides

Sampling rate Nitrogen dioxide	0.7432 ml/min at 20°C equipped with membrane
Sampling rate Nitrogen monoxide	0.9566 ml/min at 20°C equipped with membrane
Working range	2 – 200 µg/m ³
Sampling time	2 to 4 weeks
Detection limit	1 µg/m ³ for sampling periods of one month
External influences: wind speed	influence of wind speed < 10% up to 4.5 m/sec use of membranes at highly trafficked sites recommended
temperature	no influence between 10 to 30°C
humidity	no influence between 20 to 80%
Storage	before use: 6 months after exposure: 6 months
Cross sensitivity	Specific method
Expanded uncertainty*	30.1 %

*according to GUM; subject to change without notice

revised 5.1.2012

References

Council Directive 1999/30/EC
relating of limit values for SO₂, NO₂ and oxides of
Nitrogen, 22 April 1999

[2] Validation report passam ag [VP1206_01 \(2006\)](#)

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