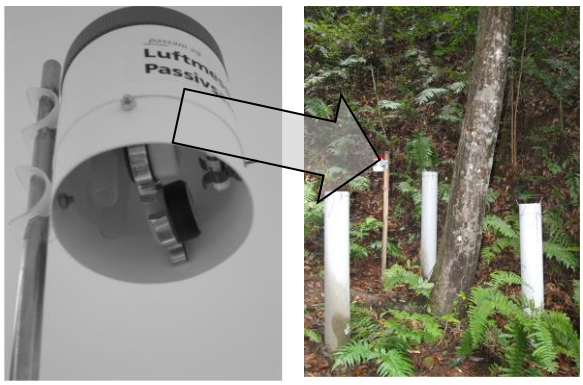
Diffusive sampler for Ammonia

The main source of ammonia is the decay of organic matter containing nitrogen, especially animals' excrements. In Germany, the most important source of NH_3 is livestock farming. Actually, a large quantity of NH_3 is released by producing, storing, transporting/handling, and using animals' excrements (black liquid, manure). Other sources of emissions do include the use of agricultural fertilizer containing Nitrogen and, in a smaller proportion, the production industry. There is currently no precise measure of NH_3 emissions in Germany. Estimated and extrapolated values are $0.6 - 1.1 \cdot 10^3$ kt NH_3



Protective shelter for ammonia and forest measuring site

Ammonia is the sole atmospheric constituent that can be found in large concentration. Other acid pollutant including sulphuric acid, nitric acid, and nitrates are quickly transformed by the formation of ammonium salts. Such ammonium emissions can be found in the atmosphere as small aerosol particles (diameter (< 2.5 μm). They can be transported and stored (in wet as well as in dry storage), far away from the emission source. In contrary, ammonia deposition occurs in the immediate environment of its emission source. Depending on the distance from its emission source, ammonia causes different emissions containing nitrogen.

The ammonia diffusive sampler is based on the principle of ammonia molecules diffusion of on an absorbent medium, in this case phosphoric acid. The diffusive sampler consists in a polypropylene housing which has a 20mm diameter opening. A Teflon membrane supported by a wire net is used in order to reduce wind effects. A special suspension device is also recommended to protect the sampler from wind and stress of weather.

Schematic view of NH_3 sampler

The amount of ammonia absorbed by the sampler is in proportion with the concentration found in the environment. After a predetermined period of time (ranging from 2 weeks and up to 1 month), ammonia is extracted in its entirety from the sampler and its quantity is determined spectrophotometrically by Indophenol-method at 630 nm

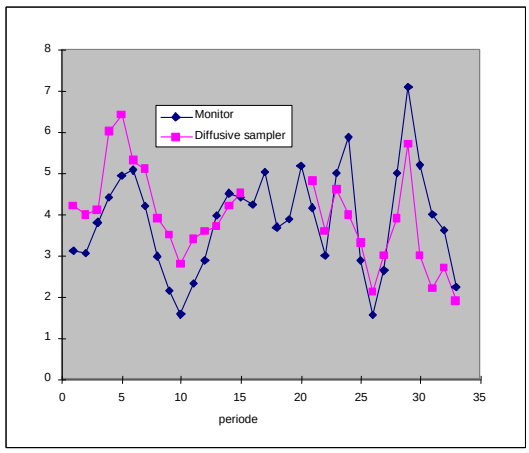
Annual values for ammonia is not the object of any regulation or recommendation from EU, Switzerland and WHO.
Proposed limit values for odour:
Regulation in Colombia 100 μg/m^3/24hours

Critical levels were adopted [1]:
protection of vegetation and ecosystem 1 μg/m^3
protection of mosses and vegetation 3 μg/m^3

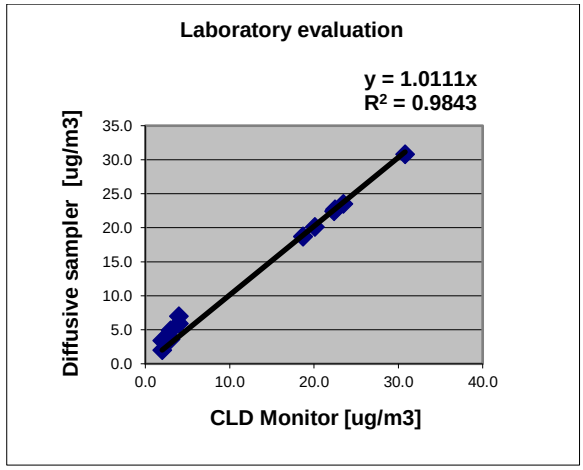
NH_3 ambient concentration range from μg/m^3 in area characterized by intensive agriculture and can reach much higher values in immediate neighbourhood from industrial or agricultural emission sources.

Location	Mean values	Maximal values
Rural area. No specific sources	0.5 μg/m^3	20 μg/m^3
Forests	2 μg/m^3	2 μg/m^3
Extensive agriculture without specific sources	5 μg/m^3	10 μg/m^3
High traffic	5 μg/m^3	10 μg/m^3
Industrial sources	20 μg/m^3	400 μg/m^3

Specifications



Comparison with measures from continuous monitoring in the field [2]



Laboratory comparison with Chemiluminescence Monitor at different concentrations

Sampling rate		31.5 ml/min at 20^{0}C	
Working range		0.25 – 100 µg/m^3	
Sampling period		1 – 4 weeks	
Detection limit		0.25 µg/m^3 for a 4 week exposure period	
External influences:	wind speed	no influence between	< 2.5 m/s
	temperature	no influence between	5 to 25 ^{o}C
	humidity	unknown	
Storage		Before use:	4 months
		After exposure:	3 months
Interferences		Ammonium particles are not collected	
Expanded uncertainty*		19.4 % at a 10 µg/m^3 level	

∗ According to GUM; subject to change without notice; revised

revised 03.10.2024

Bibliography

[1] UNECE 2007 Edinburgh workshop on atmospheric ammonia: Detecting emission changes and environmental impacts (4-6 December 2006).

[2] Kirchner, M. et al.: Field intercomparison of diffusive samplers for measuring ammonia. J. Environ. Monit., 1999, 1, 259-265

passam ag

Männedorf/Switzerland

passam@passam.ch