

# Applications of MIMS for long term monitoring in the field

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# Why membrane inlet mass spectrometry ?

- \* Most gas, liquid and solid samples can be analysed directly and without any pretreatment.
- \* Chemical and biological processes can be monitored continuously in an on-line fashion.

## Limitations:

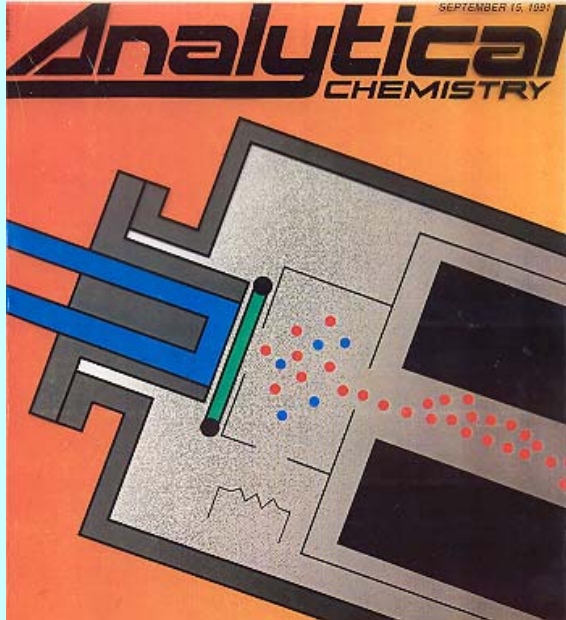
- \* Sensitivity depends strongly on the hydrophobicity and volatility of the analytes.
- \* Selectivity not as good as GC/MS, but better than many on-line sensors.

# Contents of the presentation

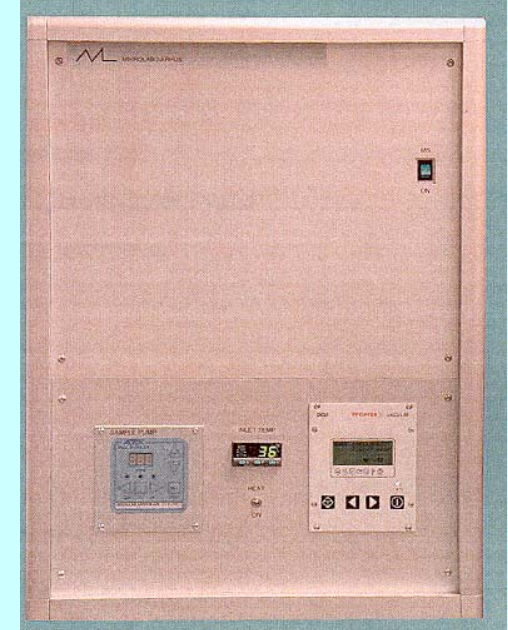
- Design of a rugged field instrument for industrial use
- On-line monitoring of drinking water supplies
- On-line monitoring of off-odours near farms
- On-line monitoring of PAHs in gases from power stations
- On-line monitoring of water quality in a public swimming pool

# Design of a rugged MIMS system for industrial applications

MIMS:  
The principle



Industrial  
version:  
Mikrolab  
Aarhus  
A/S

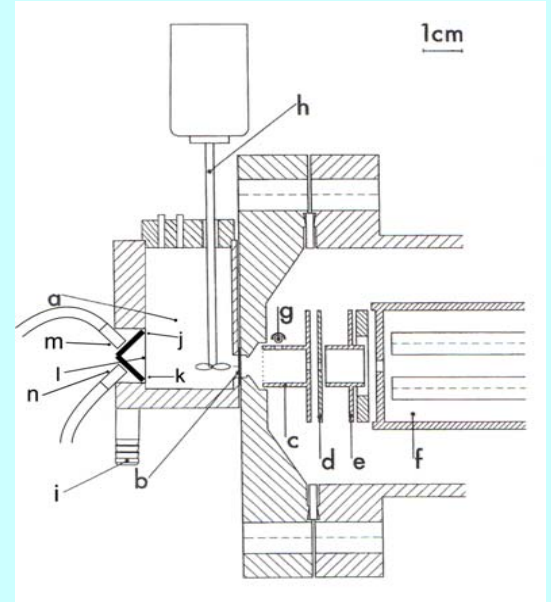
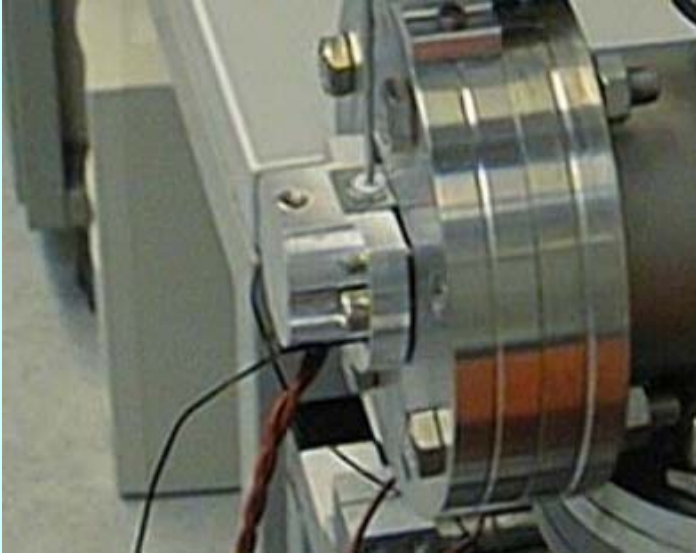


The mass spectrometer:





# High performance design of the ion source/membrane inlet



Flexibility



Mini-MIMS  
Poster #XX

# On-line monitoring of water for drinking water supplies

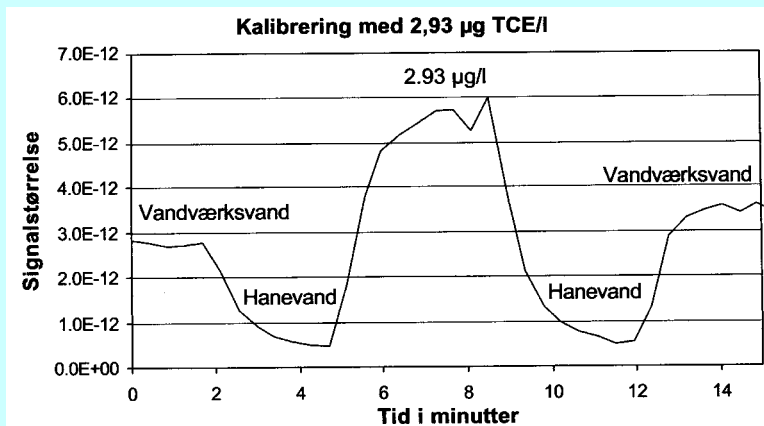
The first on-site test (2000)



Monitoring raw ground water in a well



Calibration

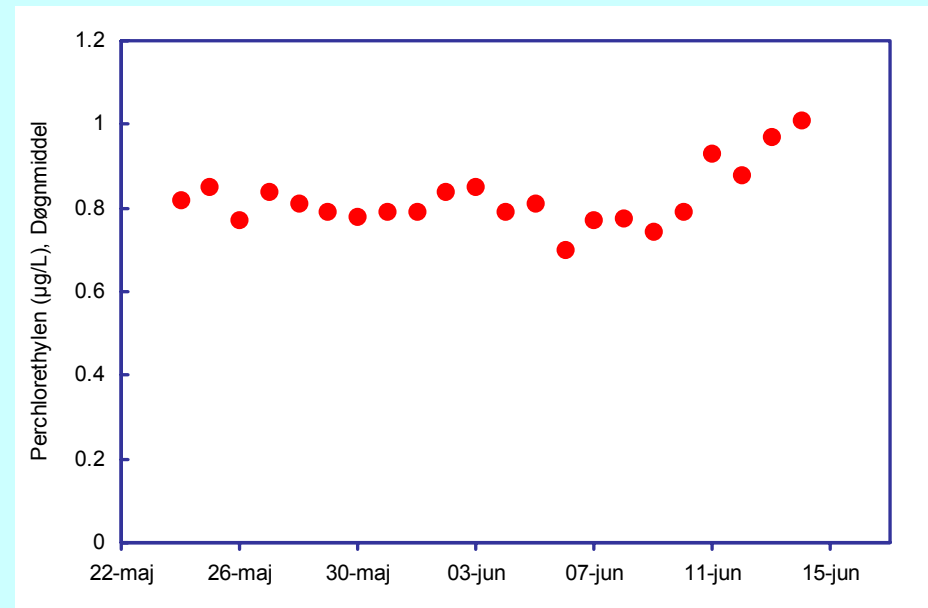


Problems

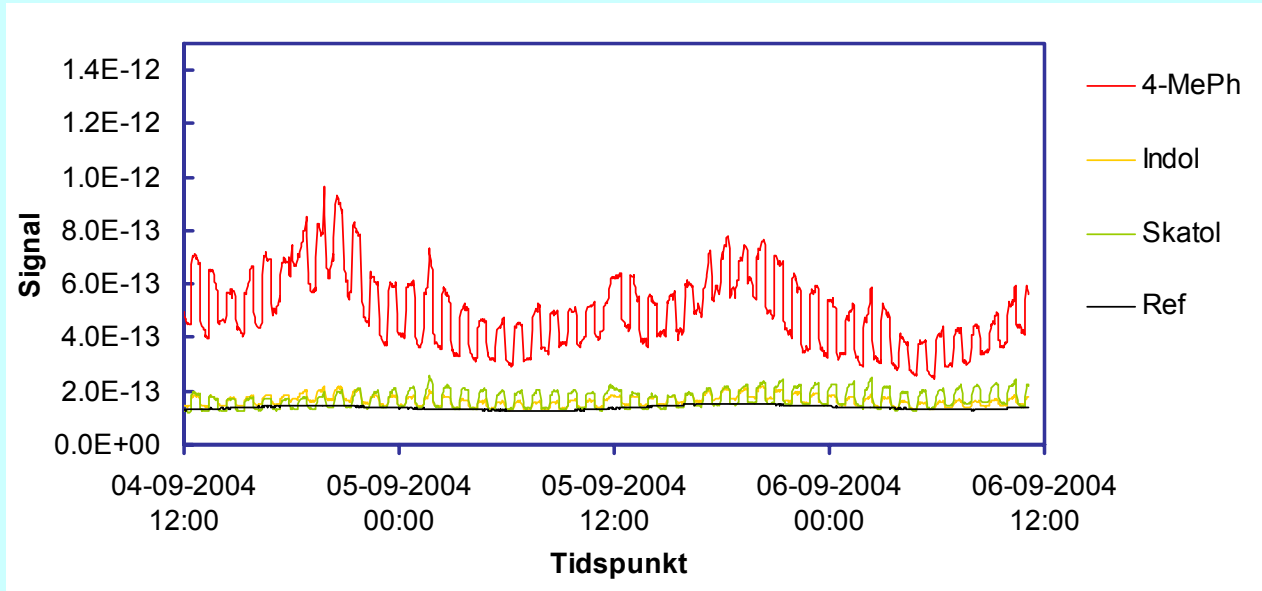


# On-line monitoring of groundwater to Copenhagen 2004

- Trichloroethylene, Perchloroethylene and MTBE
- Automatic calibration
- Optional datatransmission for remote site alarm



# The effect of reduced ventilation inside a pig farm





# Detection of off-odours near farms



Typical off odours :

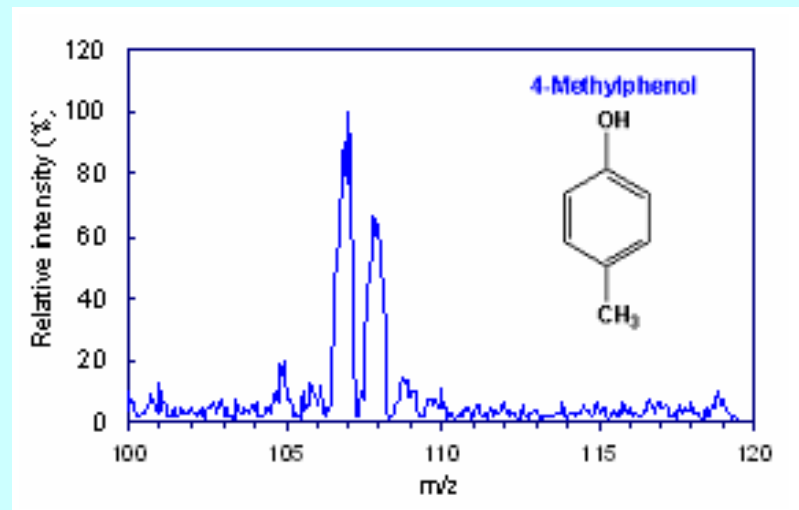
Phenols (4-Methyl-phenol)

Reducing sulphur compounds  
(Dimethyl sulfide)

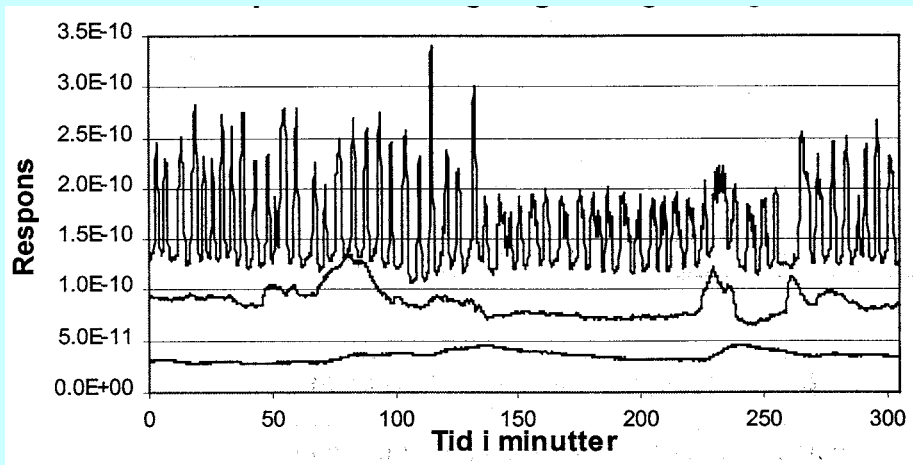
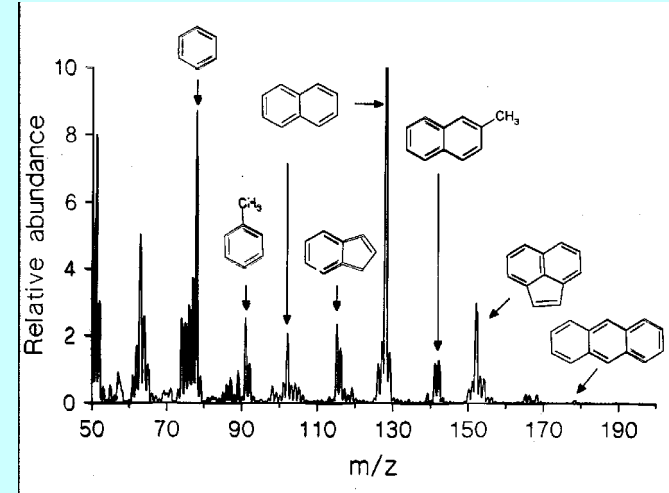
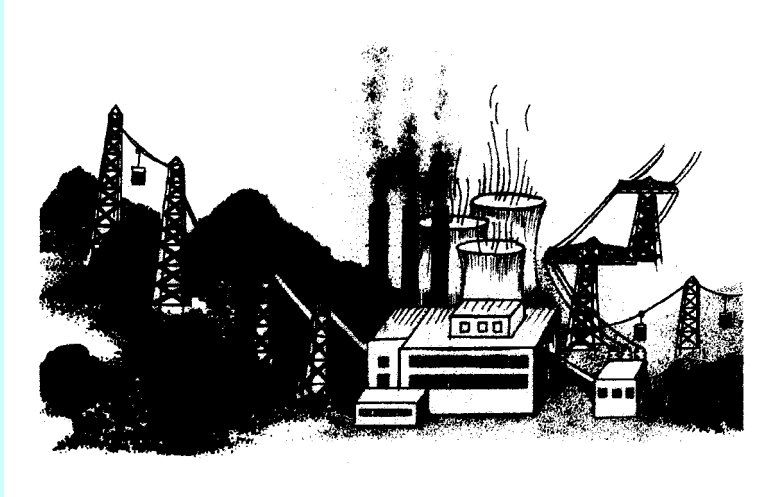
Indoles

Short chain fatty acids

Aldehydes (3-methylbutanal)



# On-line monitoring of "clean" gas from a power station

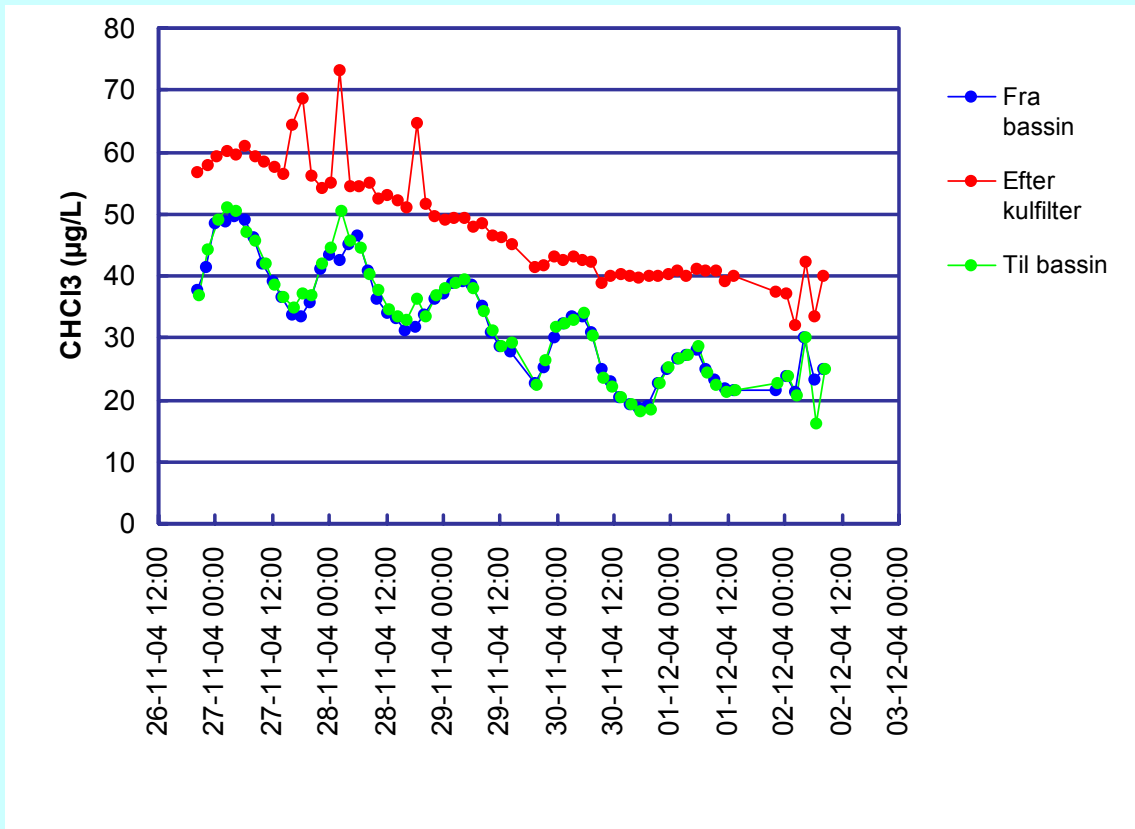


Oxygene

Toluene

Naphthalene

# Monitoring water quality at a public swimming pool



# Conclusion

A rugged MIMS system for monitoring of industrial processes in the field was constructed and its potential for long term monitoring in various environments demonstrated

## **Acknowledgements**

Developemnt of the transportable MIMS system was funded by:

Danish Natural Research Council

Danish Ministry of trade

Danish Energy Research Programme



# Some observations in connection with gas analysis at high pressures

Relative signal from atmospheric gases at elevated pressures using a membrane inlet for gas analysis.

Nitrogen signal at 1.5 bar with silicone membrane set to 1. Inlet temperature 25 °C.

Pressure (bars)	Nitrogen		Oxygen		Argon		Carbondioxide	
	Silicone	Teflon	Silicone	Teflon	Silicone	Teflon	Silicone	Teflon
1.5	1	0.5	0.4	0.23	0.025	0.008	0.008	0.023
3	3	0.9	1.2	0.5	0.1	0.02	0.025	0.025
5	13	1.7	5	0.9	0.3	0.03	0.043	0.025
9	50	4	20	1.8	1.4	0.07	0.12	0.037
14	90	6	35	3.2	2.2	0.11	0.11	0.043
18	98	6.7	42	3.3	2.7	0.14	0.11	0.050

Direct gas-inlet with automatically adjustable conductance

Nitrogen at 1.5 bars set to 1.

Pressure (bars)	Gas		
	Nitrogen	Oxygen	Argon
1.5	1.0	0.19	0.010
3	1.0	0.19	0.010
5	1.0	0.19	0.010
10	1.2	0.24	0.012
15	1.2	0.24	0.012
18	1.2	0.24	0.013



# Fordele ved MIMS

- Stor følsomhed
  - Detektionsgrænser luft:  $\mu\text{g}/\text{m}^3$
  - Detektionsgrænser vand:  $\text{ng}/\text{L}$
- Linearitet:

