


# Gasmeter™

Multicomponent FTIR Gas Analyzers

- :: Continuous Emission Monitoring
- :: Stack Testing
- :: Process Monitoring
- :: Quality Control
- :: Engine Exhaust Gas Monitoring
- :: Workplace Air Quality Monitoring
- :: Combustion Research
- :: Emergency Rescue Services



			HCN		HCl
CO		CO <sub>2</sub>		SO <sub>2</sub>	
		Hydrocarbons		VOC'S	Aromatics
	N <sub>2</sub> O	Inorganic gases			NO <sub>x</sub>
				CH <sub>4</sub>	
	HF				H <sub>2</sub> O

# **Gasmeter CMM Continuous Mercury Monitoring system**

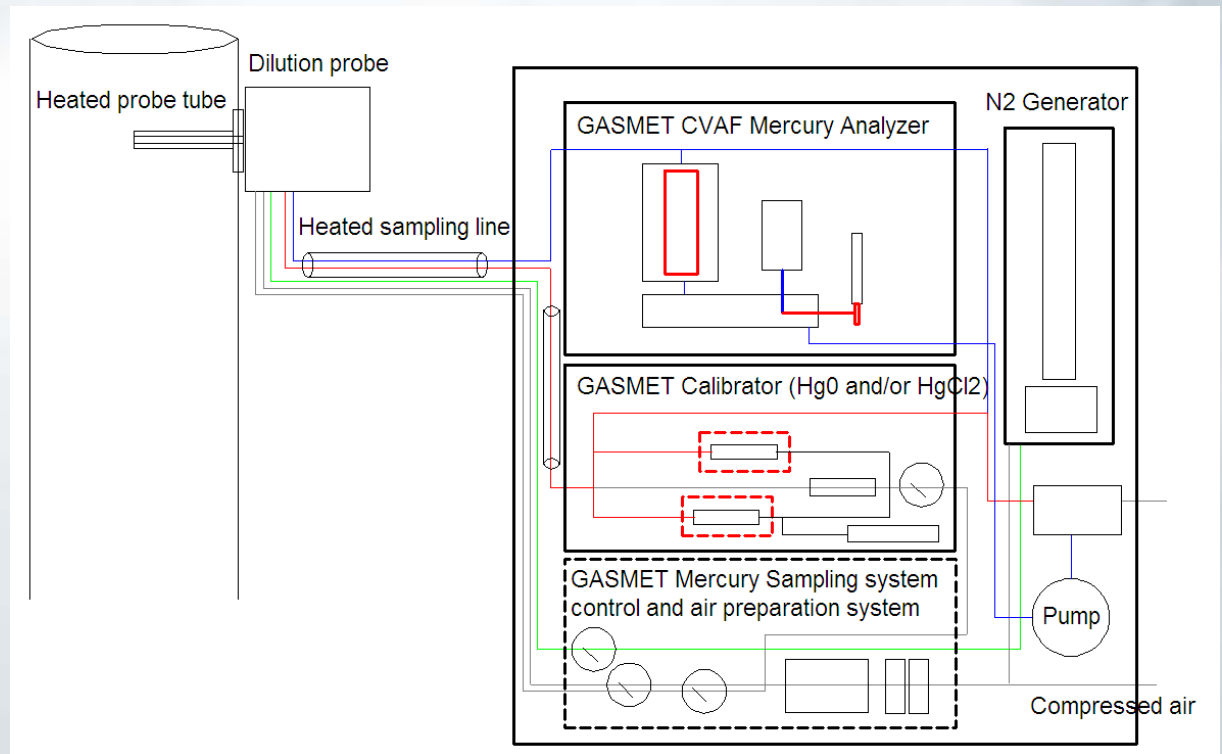
# Challenges for a Hg CEM

- Different mercury compounds exist in stack gases
  - Atomic mercury  $\text{Hg}^0$  and oxidized  $\text{Hg}^{2+}$  ( $\text{HgCl}_2$ )
  - Systems response for all compounds must be the same
- $\text{Hg}^0$  and especially  $\text{HgCl}_2$  sticks to surfaces
  - Special care in sample preparation and transportation
  - Elevated temperature, proper materials
- Accurate calibration gas generation required both for  $\text{Hg}^0$  and  $\text{HgCl}_2$
- Low concentrations in sub-ppb level to be measured
  - Potential problems with other interfering compounds

# Requirements for a Hg CEM

- US EPA Clean Air Mercury Rule in 2006: Continuous measurement in coal fired power plants 2009
  - Performance Specification PS 12A
    - Relative error < 1  $\mu\text{g}/\text{m}^3$  (span 10  $\mu\text{g}/\text{m}^3$ )
    - Seven day calibration drift < 5% of span or < 1  $\mu\text{g}/\text{m}^3$
    - 24h calibration drift < 2.5% of span
    - Converter efficiency < 5% of span
    - Linearity error < 10% of span or 1  $\mu\text{g}/\text{m}^3$
    - Response time < 15 min
- EU will follow (Standard EN 14884)
  - Emission limits for waste incineration already exist
- Other industries (e.g. steel and iron manufacturing, solid waste combustion, chlor-alkali plants), ambient air measurement

# Main parts of Gasmet CMM



# Gasmeter CVAF Mercury Analyzer (Cold Vapor Atomic Fluorescence)

- With integrated high temperature dry thermal converter
  - Eliminates problems with recombination during transportation of converted sample
- Detection limit
  - 5 ng/m<sup>3</sup> with air
  - 0,5 ng/m<sup>3</sup> with N<sub>2</sub>
- Build-in control panel for system control
- Gasmeter CVAF application software



# Gasmeter Calibrator for $\text{Hg}^0$ and/or $\text{HgCl}_2$

- $\text{Hg}^0$  calibration gas from a saturated Hg source
- $\text{HgCl}_2$  calibration gas with  $\text{HgCl}_2$  solution evaporation
- Automatic span and linearity calibrations with wide ranges for Hg concentration and gas delivery rate



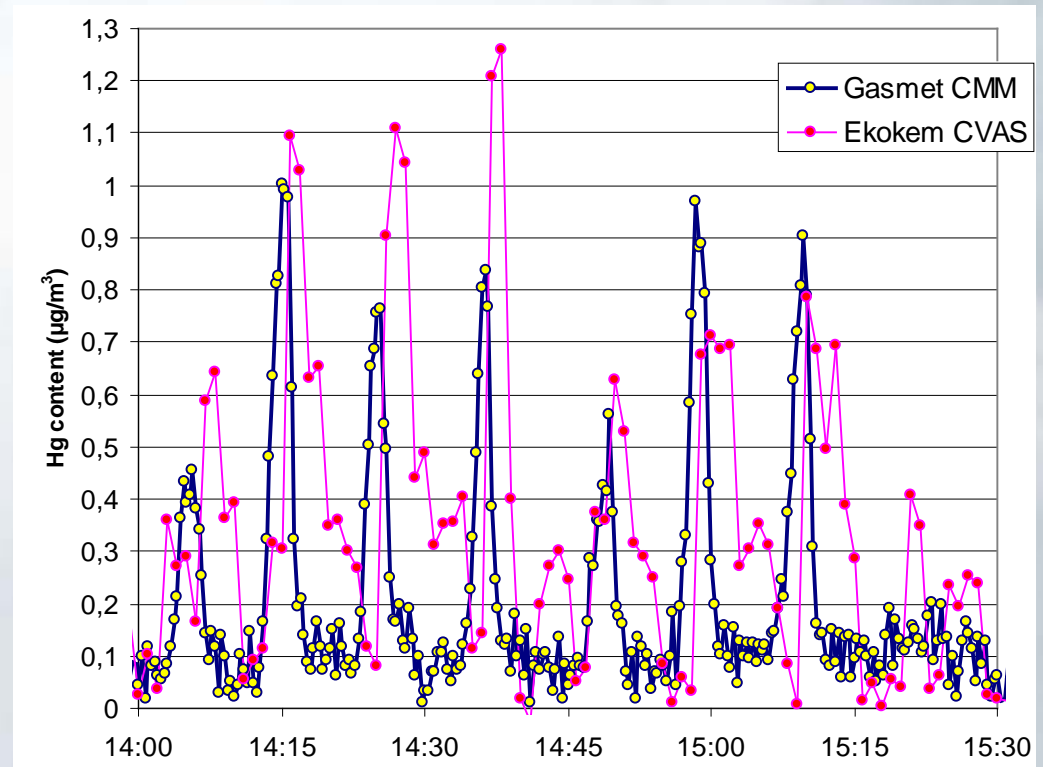
# Gasmeter Hg sampling system

- Heated dilution probe and probe tube
  - Lightweight design
  - Effective double blowback system for heated filter
  - All sample wetted parts by PFA Teflon or glass coated SS
  - Normal dilution ratio 1:50
  - Calibration of the whole probe
- Sample dilution with generated N<sub>2</sub> or instrument air
  - CMM system detection limit 0,03 µg/m<sup>3</sup> (0,2 µg/m<sup>3</sup> with instrument air)
- Option: M&C SP2006 (or SP2000) dilution probe



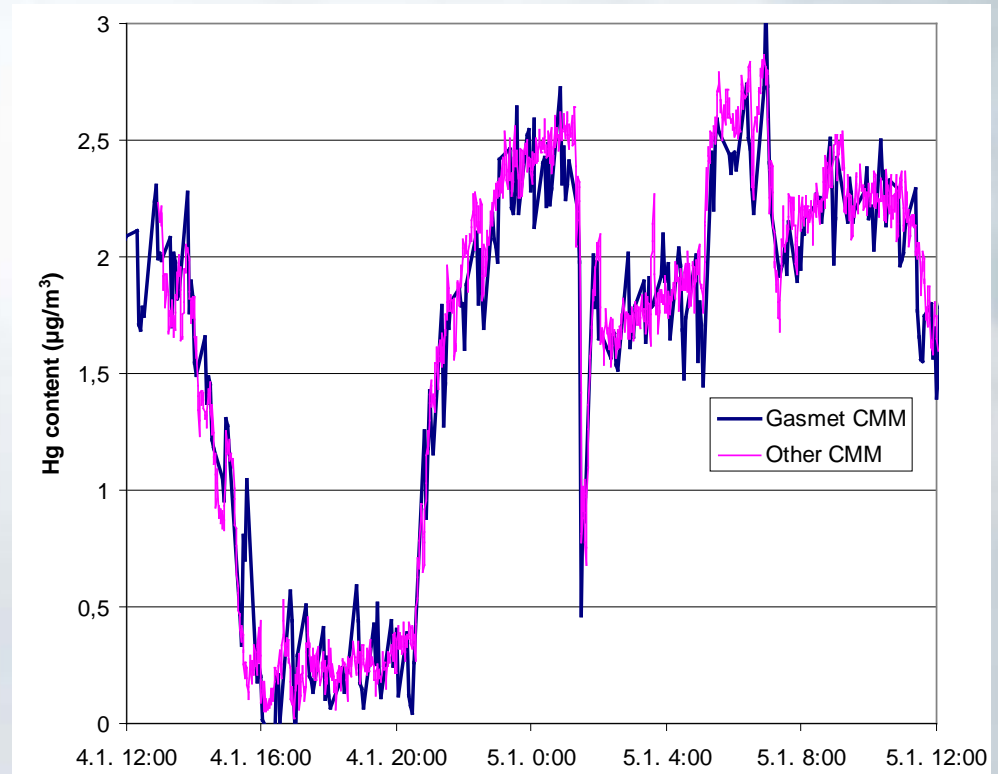
# Case study in Ekokem Hazardous Waste Incinerator, Riihimäki Finland

- Downstream of all abatement systems (HCl and SO<sub>2</sub> removal, ESP, baghouse, activated carbon bed)
- Very low Hg-content
- Periodic variation of Hg-content due to fuel feeding system



# Testing in Mercury Research Center at Gulf Power Company, Pensacola FL

- Coal from Columbia and Russia
- CMM downstream of SCR and ESP
- Hg content varies between 1-10  $\mu\text{g}/\text{m}^3$  due to arbitrary mixing of coals with different origin



# Testing in Mercury Research Center at Gulf Power Company, Pensacola FL

## 3-point linearity check (< 10% or 1µg/m<sup>3</sup>)

	Hg µg/m <sup>3</sup>	CMM µg/m <sup>3</sup>	Abs Diff	% Span	Status
low	0,3	0,0	0,3		Pass
mid	6,8	7,0	-0,2	-2,8	Pass
high	7,9	8,0	-0,1	-1,3	Pass
low	3,9	4,0	-0,1	-3,3	Pass
mid	4,6	4,7	-0,1	-2,1	Pass
high	9,3	9,3	0,0	-0,5	Pass
low	3,5	3,5	0,0	-0,4	Pass
mid	5,4	5,6	-0,2	-3,3	Pass
high	11,5	11,2	0,3	2,8	Pass

## System integrity check (< 5%)

	HgCl <sub>2</sub> µg/m <sup>3</sup>	CMM µg/m <sup>3</sup>	Abs Diff	% Span	Status
low	2,5	2,6	0,1	0,9	Pass
mid	5,0	4,8	-0,2	-2,5	Pass
high	10,0	10,2	0,2	2,0	Pass
low	0,0	0,0	0,0	0,0	Pass
mid	5,0	5,2	0,2	1,9	Pass
high	10,0	9,9	-0,1	-1,5	Pass
low	2,5	2,5	0,0	0,0	Pass
mid	5,0	5,3	0,3	3,0	Pass
high	10,0	10,1	0,1	1,0	Pass

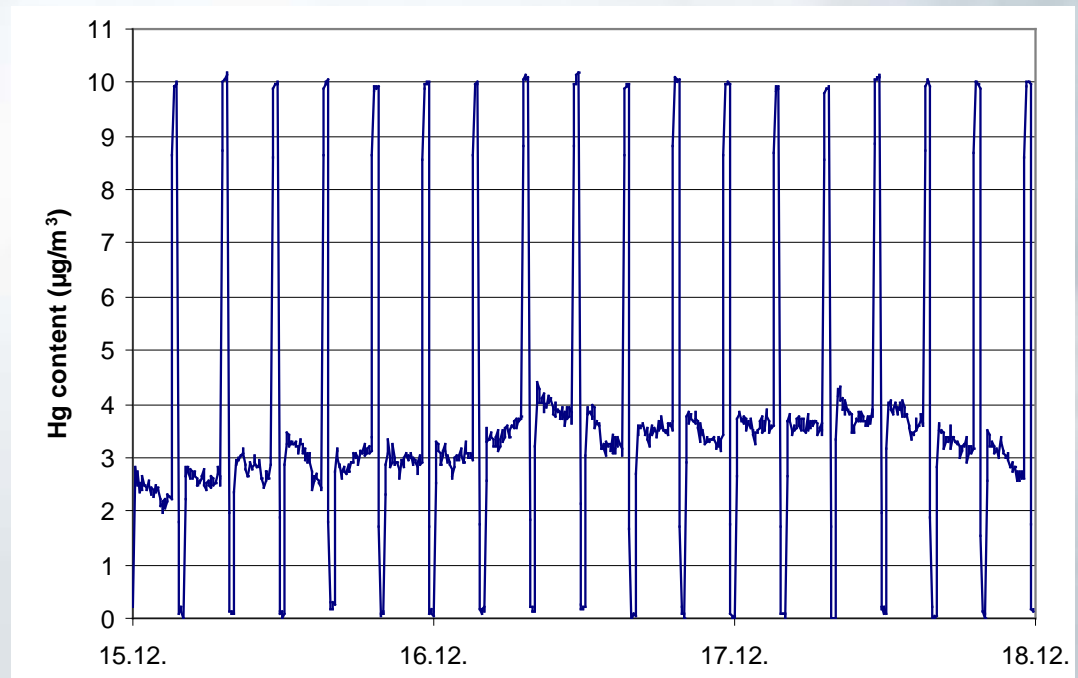
# Testing in Mercury Research Center at Gulf Power Company, Pensacola FL

7-day calibration error (< 1µg/m<sup>3</sup>)

	Day	Hg µg/m <sup>3</sup>	CEM µg/m <sup>3</sup>	Abs Diff	Status
Hg low	1	0	0,6	0,6	Pass
	2	0	0,5	0,5	Pass
	3	0	-0,1	-0,1	Pass
	4	0	0,1	0,1	Pass
	5	0	0,0	0	Pass
	6	0	-0,2	-0,2	Pass
	7	0	-0,1	-0,1	Pass
Hg high	1	5	4,9	-0,1	Pass
	2	5	5,5	0,5	Pass
	3	5	5,0	0	Pass
	4	5	5,0	0	Pass
	5	5	5,2	0,2	Pass
	6	5	5,5	0,5	Pass
	7	5	4,7	-0,3	Pass

# Testing in Hanasaari coal power plant Helsinki, Finland

- Coal from Russia (low Sulphur content) and Poland
- CMM downstream of ESP, before desulphurization plant
- Low, stable Hg content
- Integrated thermal converter and Gasmet Hg sampling system working without any problems



# GASMET CMM

Simplified, cost effective design utilizing proven technologies and novel solutions

- ✓ Direct sampling with sample dilution and effective filter blowback system – simple probe design
- ✓ Hg measurement using direct CVAF with integrated thermal converter – eliminates recombination during sample transportation
- ✓ No need for acid scrubbers, additional gases, or gold amalgamation traps

**For more information  
[www.gasmet.fi](http://www.gasmet.fi)**