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# Dry Sampling Method used by E.ON for Mercury Speciation in Flue Gas

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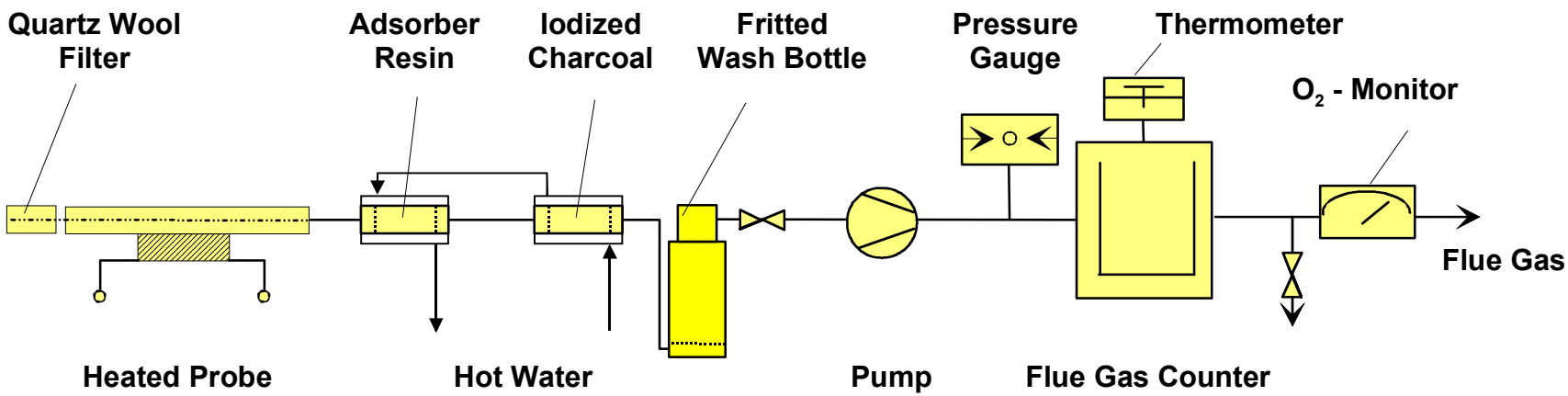
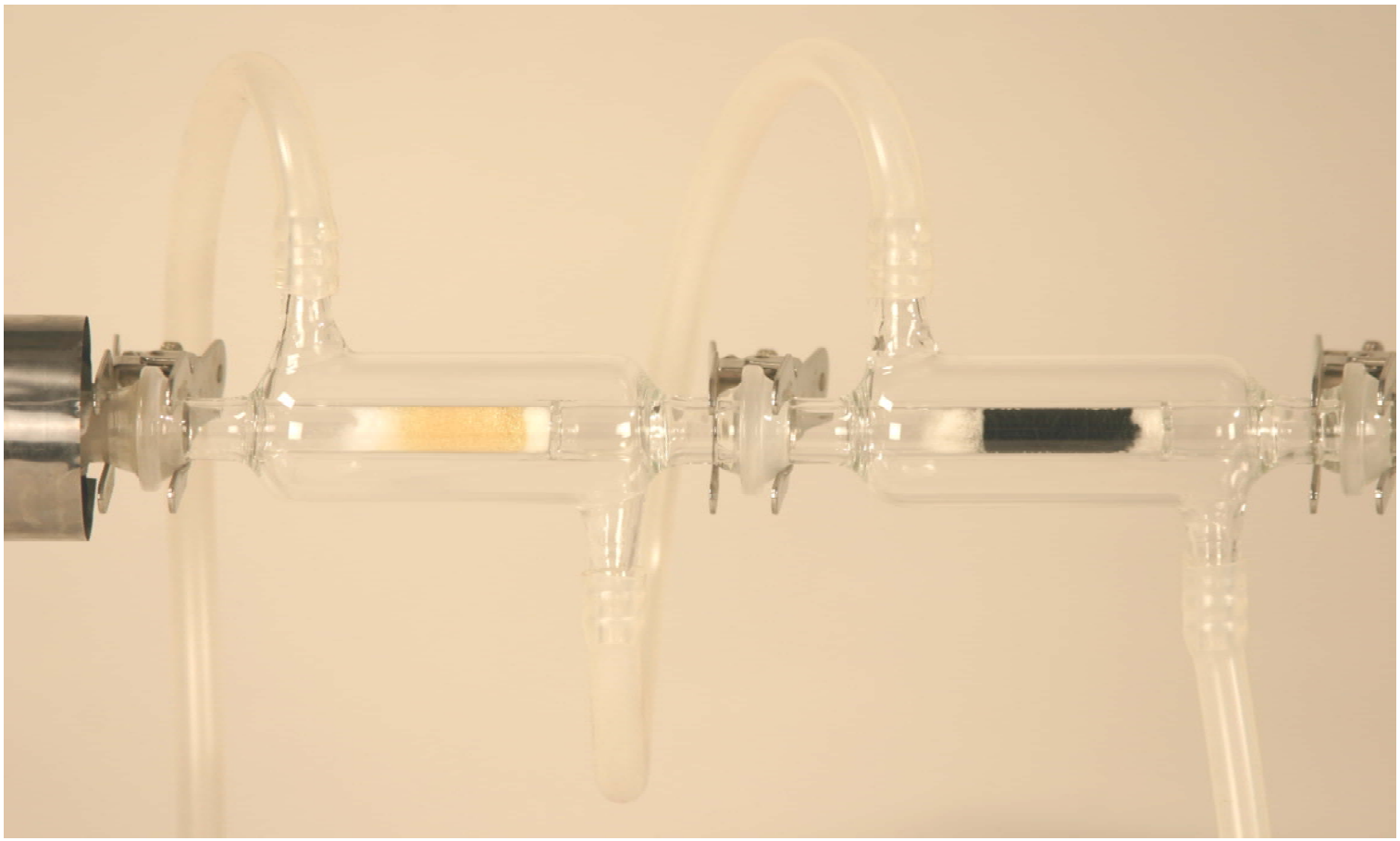
# Sampling Train



# Mercury Adsorber Tubes



Adsorption of Hg(O)

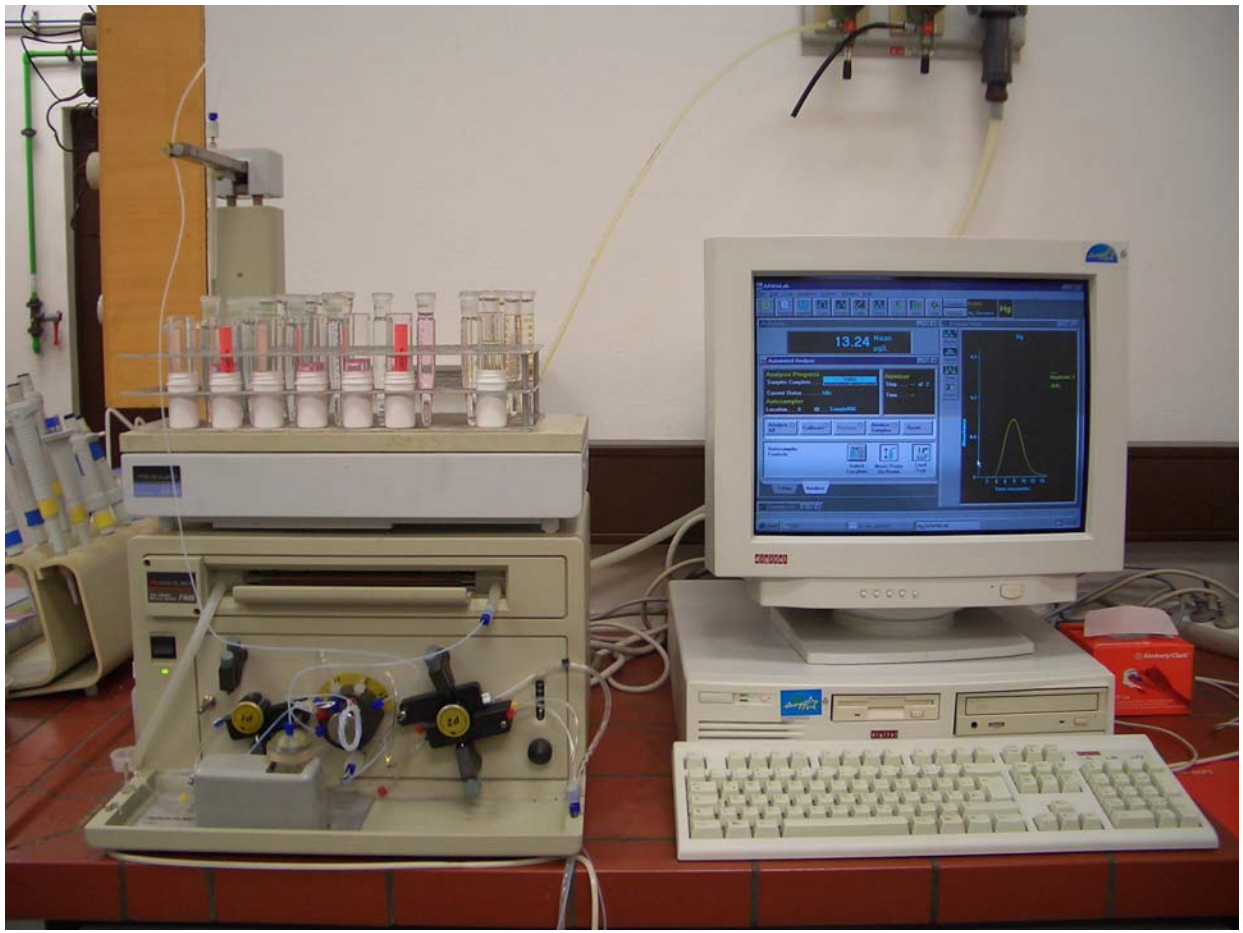
Chemisorption of Hg(ion)

$$R\text{-}(N(\overset{+}{C}H_3)_3Cl^- + HgCl_2 \longrightarrow \overset{+}{R}\text{-}N(CH_3)_3HgCl_3^-$$

Iodized Charcoal Pellets

Dowex 1x8 Resin
Particle Size (Mesh): 20 - 50
Counter Ion: $Cl^-$

# Mercury Analyzing System FIMS (Perkin Elmer)

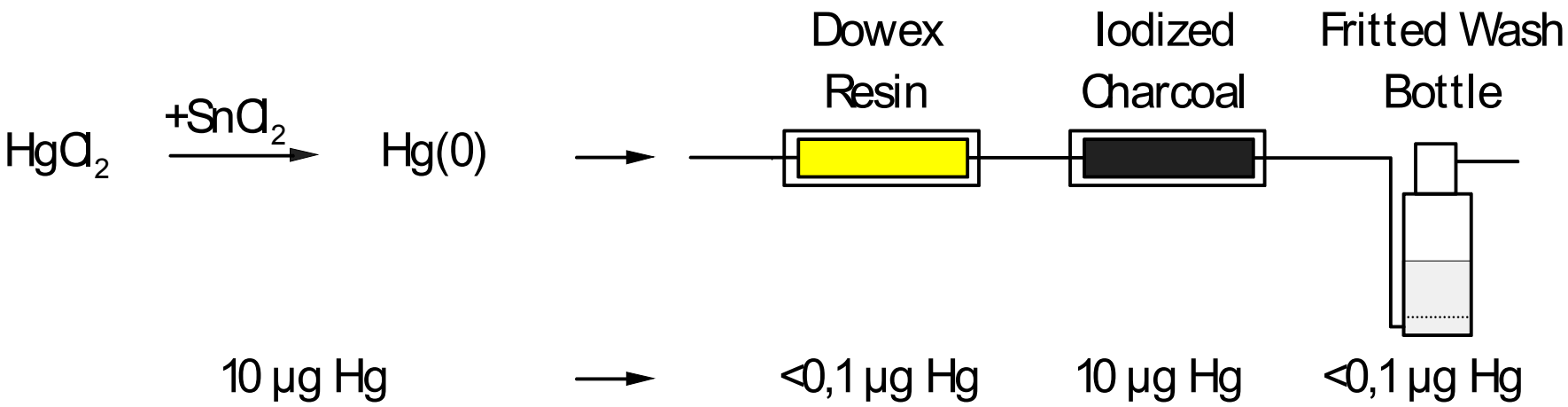


# Mercury Concentrations in blank materials

| | Digestion Blank µg Hg | Charcoal Blank µg Hg | Dowex Blank µg Hg |
|---|---|---|---|
| | | | |
| | 0,004 | 0,020 | 0,006 |
| | 0,002 | 0,018 | 0,004 |
| | 0,002 | 0,016 | 0,004 |
| | 0,006 | 0,016 | 0,006 |
| | 0,004 | 0,018 | 0,012 |
| | 0,004 | 0,018 | 0,010 |
| | 0,006 | 0,006 | 0,008 |
| | 0,004 | 0,006 | 0,008 |
| | 0,002 | 0,004 | 0,010 |
| | 0,002 | 0,004 | 0,008 |
| | | | |
| Average Value | 0,004 | 0,012 | 0,007 |
| Standard Deviation | 0,002 | 0,006 | 0,003 |
| | | | |
| Detection Limit (5*SD) | 0,010 | 0,030 | 0,015 |

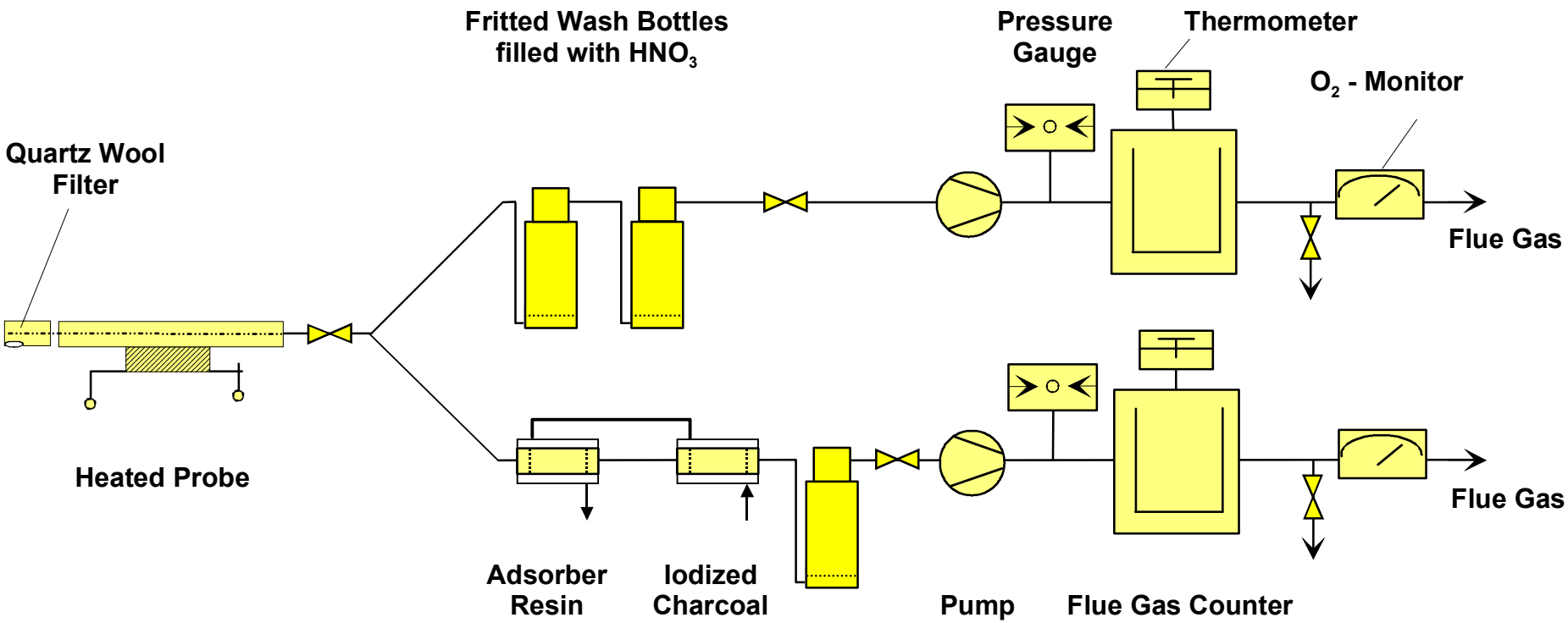
**Detection Limit for each species 0,05 µg/m³ (1 m³ Sampling Volume)**

# Selectivity Test of the Sampling Train

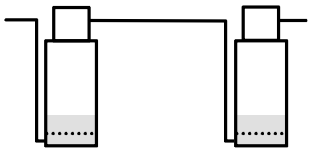
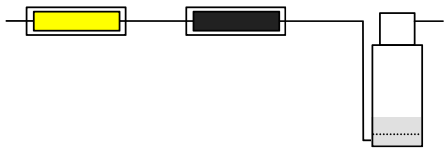



- resin does not adsorb Hg(0)
- all Hg(0) is adsorbed on iodized charcoal
- no Hg slip

# Dual Line Set-Up to compare Test Methods

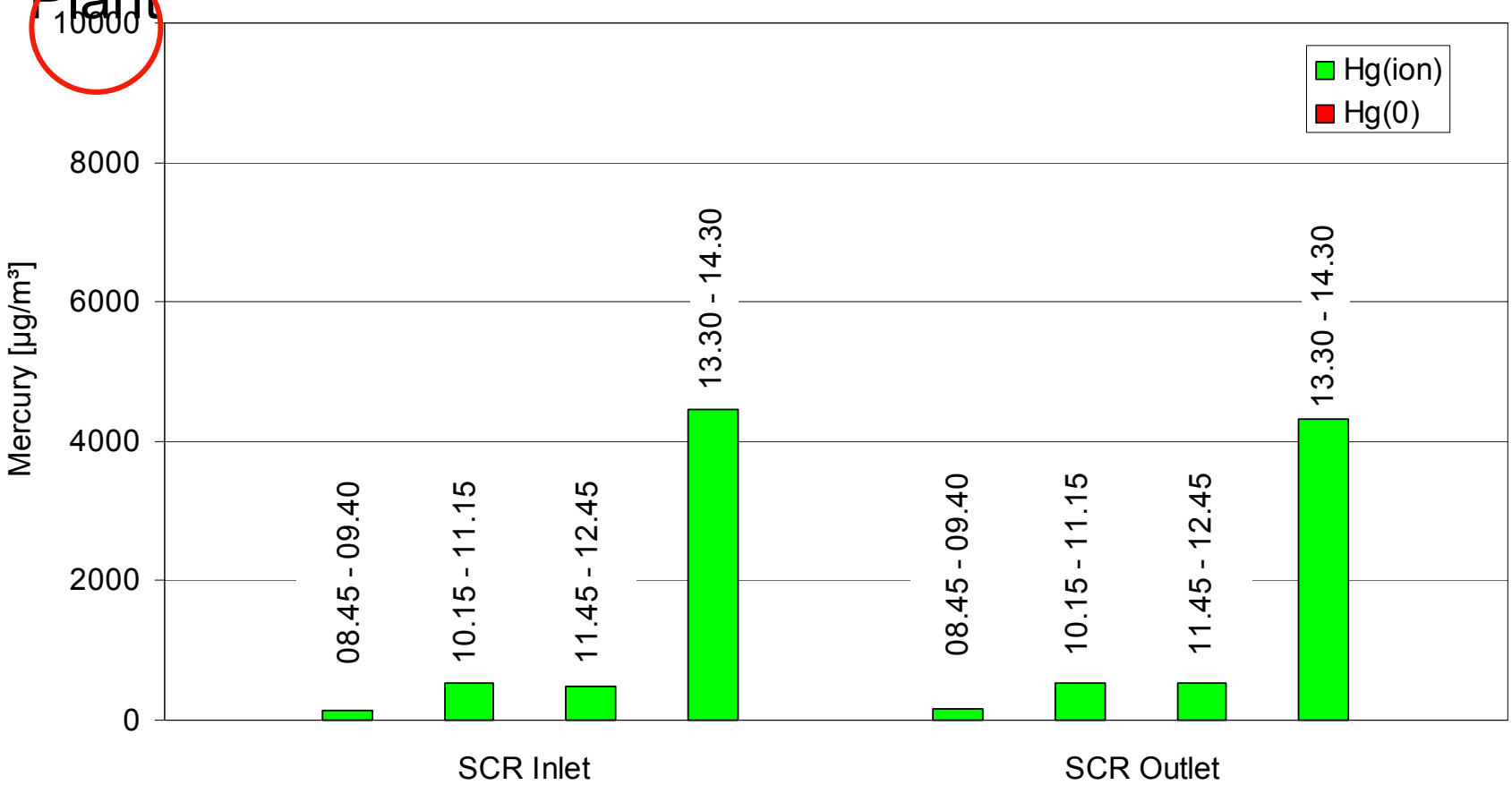


# Dual Line Test Results at an Industrial Waste Incinerator

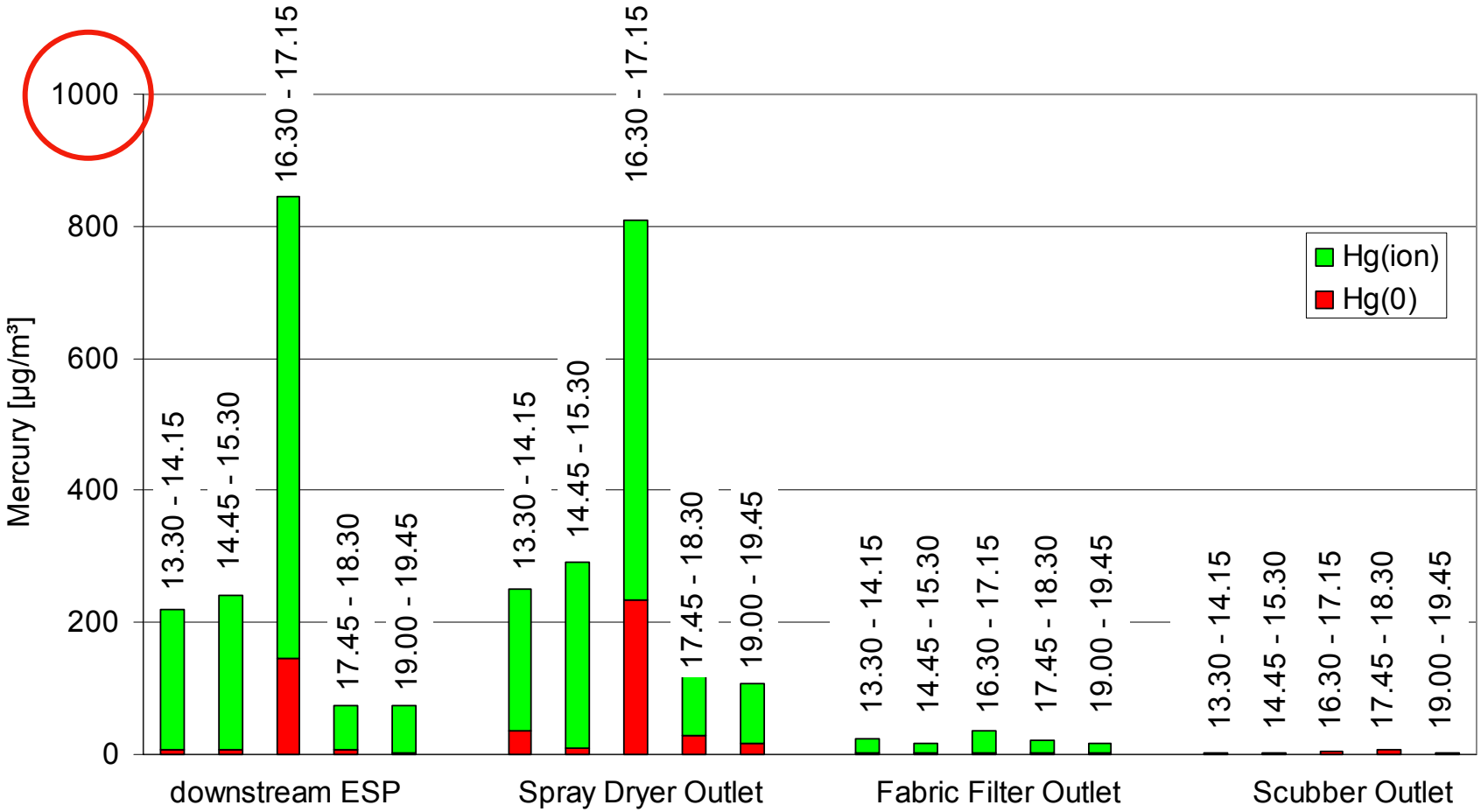
| | | Wet Sampling Train | | | Dry Sampling Train | | | |
|---|---|---|---|---|---|---|---|---|
| | |  | | |  | | | |
| | | 1st Wash Bottle | 2nd Wash Bottle | Total | Resin | Charcoal | Wash Bottle | Total |
| Location | Period | Hg µg/m³ | Hg µg/m³ | Hg µg/m³ | Hg(ion) µg/m³ | Hg(O) µg/m³ | Hg µg/m³ | Hg µg/m³ |
| SCR Inlet | 08:45 - 09:40 | 141 | 0,4 | 141 | 146 | 0,9 | 0,5 | 148 |
| | 10:15 - 11:15 | 524 | 0,7 | 525 | 538 | 0,9 | 0,5 | 539 |
| | 11:45 - 12:45 | 536 | 1,7 | 538 | 493 | 1,5 | 0,3 | 495 |
| | 13:30 - 14:30 | 4915 | 4,9 | 4920 | 4447 | 1,0 | 1,1 | 4449 |
| SCR Outlet | 08:45 - 09:40 | 150 | 0,4 | 150 | 150 | 0,8 | 0,6 | 151 |
| | 10:15 - 11:15 | 552 | 0,7 | 553 | 528 | 0,9 | 0,5 | 530 |
| | 11:45 - 12:45 | 567 | 0,6 | 568 | 535 | 0,8 | 0,5 | 537 |
| | 13:30 - 14:30 | 4728 | 3,1 | 4731 | 4310 | 0,8 | 0,4 | 4310 |

**- wet and dry sampling train show the same results for total mercury**
**- more than 99 % Adsorption of Hg(ion) on Dowex resin**

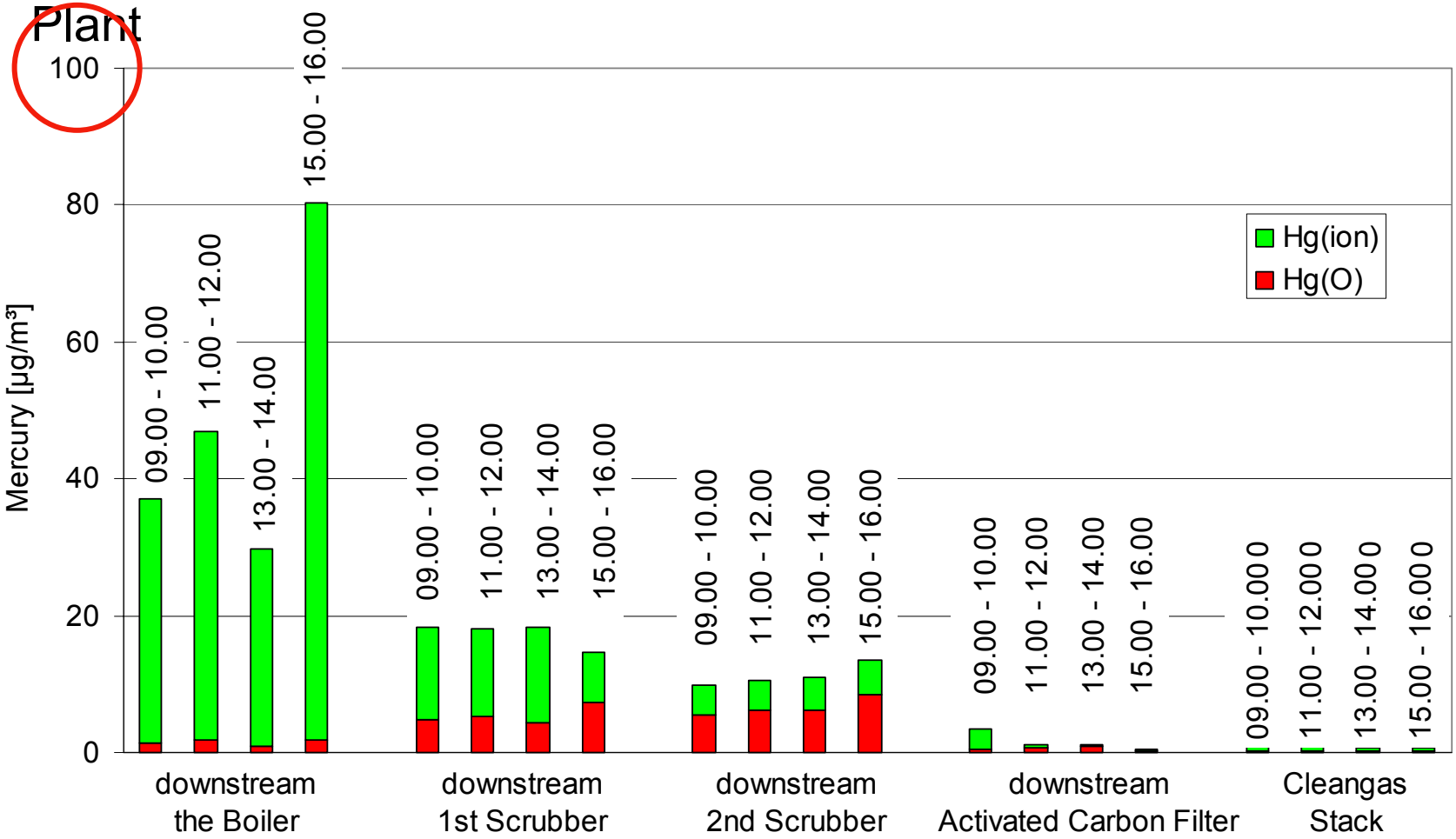
# Measuring campaign in an Industrial Waste Incineration Plant



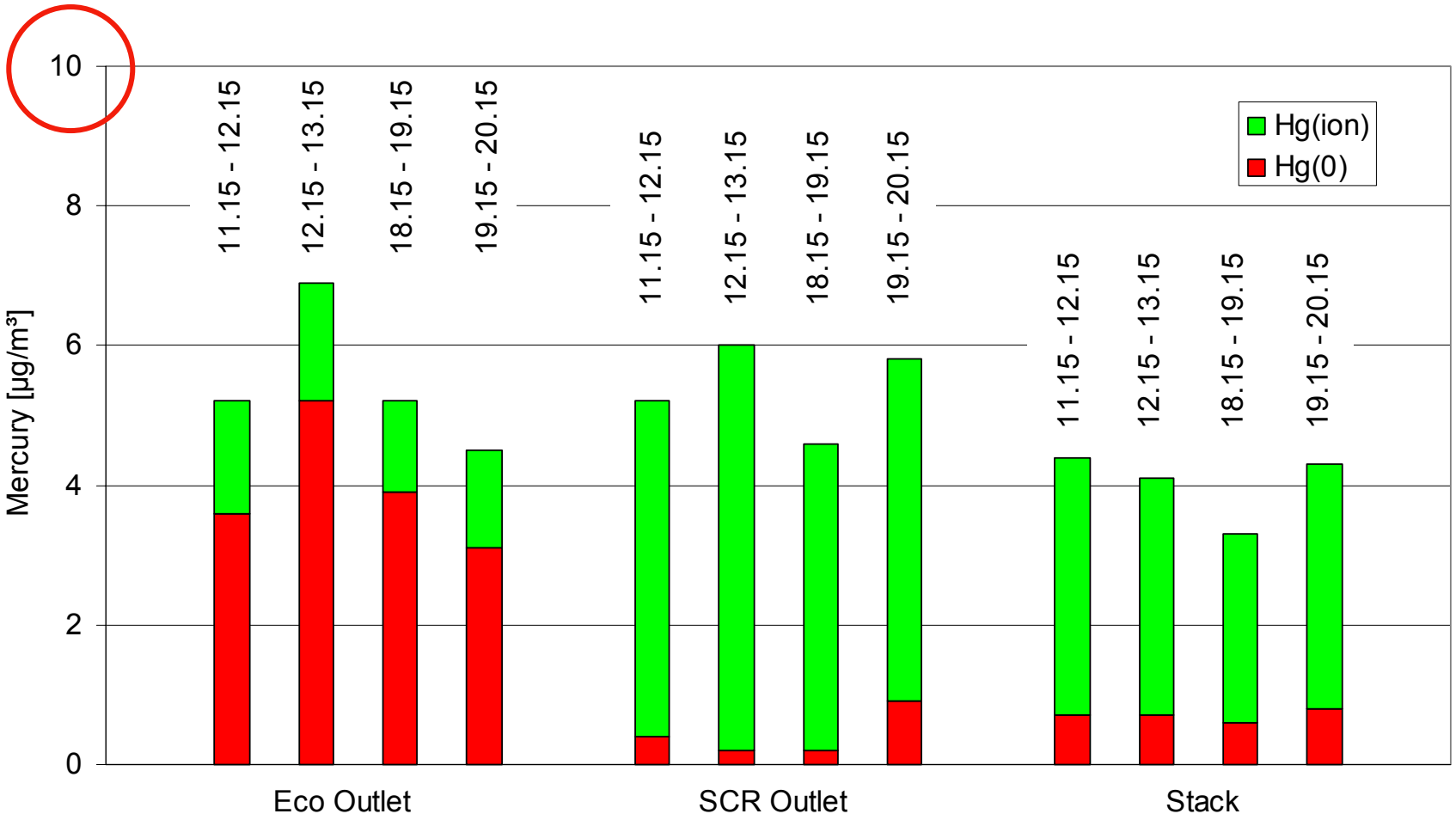
# Flue Gas Measuring Campaign in a Soil Decontamination Plant



# Flue Gas Measuring Campaign in a Municipal Waste Incineration Plant



# Flue Gas Measuring Campaign in an US Power Plant



# Sources:

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  presented at EPRI SCR Workshop, Memphis, TE, April 18 - 21, 2000

- Gutberlet, H.; Spiesberger, A.; Kastner, F.; Tembrink, J.
  Behaviour of the Trace Element Mercury in Bituminous Coal Furnaces with Flue Gas Cleaning Plants
  VGB Kraftwerkstechnik 1992, 72, 586-591

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