

**PM and Vapor Phase Hg: Are they  
appropriate surrogates for HAP  
metals and total mercury?**

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**McIlvaine Company Hot Topic Hour**  
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*Cooper Environmental Services*

# Outline

- **Surrogacy: Webster and the Courts**
- **PM: Surrogate for HAP metals?**
- **Vapor phase mercury: Surrogate for total mercury?**
- **Direct measurement alternative**

# Surrogate

- Definition: Takes the place of, a substitute, representative
- Courts: Three criteria, **all** of which must be met
  - “...HAP metals are invariably present in PM...”
  - “...PM control technology indiscriminately captures HAP metals along with other metals.”
  - “...PM control is the only means by which facilities achieve reductions in HAP metal emissions...”
- Plus:
  - “In considering the role of inputs, the EPA must also insure itself that the fuels and other inputs affect HAP metal emissions in the same fashion as they affect the other components of PM. For example, PM might **not** be an appropriate surrogate for HAP metals if switching fuels would decrease HAP metal emissions without causing a corresponding reduction in total PM emissions.”

# PM is not an appropriate surrogate for HAP Metals

- Chemistry and physics of formation and control are different for trace HAP metals than for bulk properties like PM
- PM does not meet any of three court defined criteria
  - HAP metals are not invariably present in PM
  - PM controls do not indiscriminately capture HAP metals along with other PM
  - PM control is not the only means to achieve reductions in HAP metal emissions
- Not expected to be met during SSM conditions
- Direct measurement required to evaluate health and residual risk impacts – PM not surrogate for health effects of As, etc.
- Availability of proven HAP metal CEMS
- HAP metal CEMS are the simpler, lower cost option

# Mercury emission limits should include all phases of mercury (PM and vapor)

- CAA specifies mercury, not vapor phase mercury
- Vapor phase Hg does not meet criteria for surrogacy
  - Mercury vapor is not invariably present in cement kiln total mercury emissions; i.e. mercury vapor is not a constant fraction of total mercury at various stages of the process and emission controls. For example, downstream of PAC injection
  - Mercury vapor control does not indiscriminately capture total mercury emissions
  - Mercury vapor control is not the only means by which facilities can achieve reductions in total mercury emissions; e.g. wasting CKD, low mercury limestone, etc.
- Total mercury can now be measured with proven methods
- Total mercury monitoring represents enhanced monitoring

# Direct Measurement of HAP Metals

EPA Method 301  
Validated

EPA Site  
Certified



**CES Xact 640  
Multi-Metals CEMS**

AMP EPA  
Approved

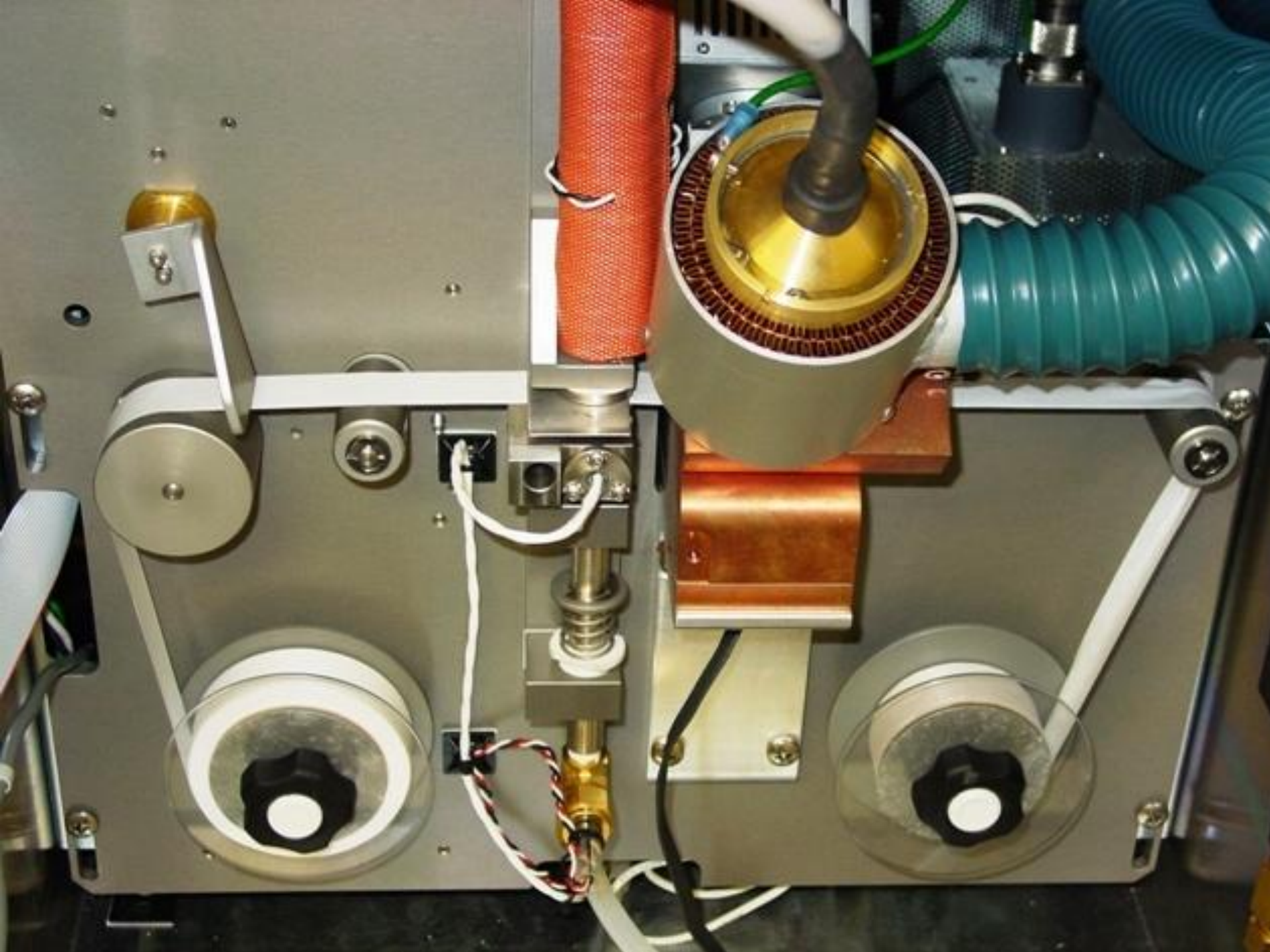
~6 Years On-  
Stack Operations

One man-day per  
month for  
maintenance

May 2007 – EPA Clean Air  
Excellence Award

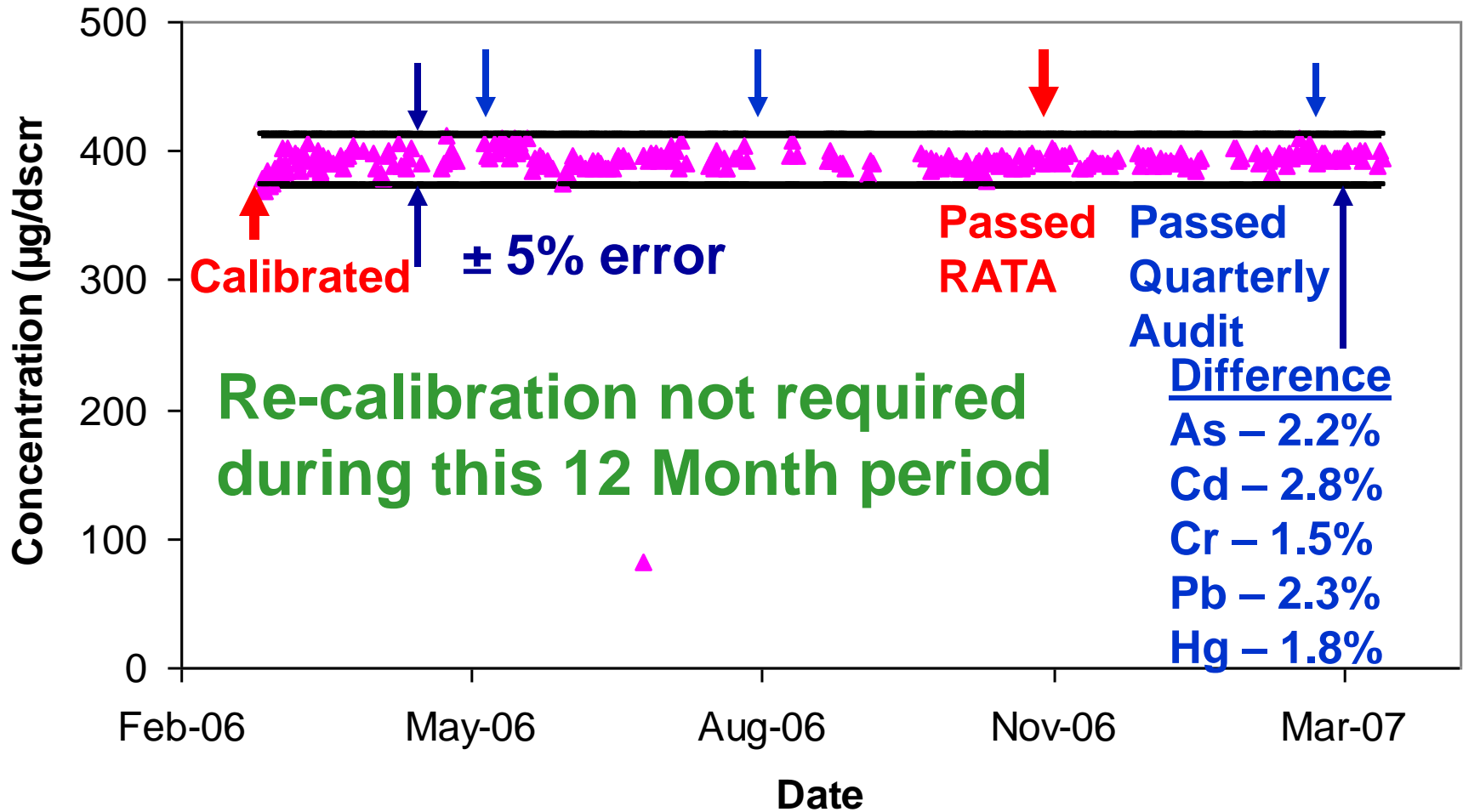
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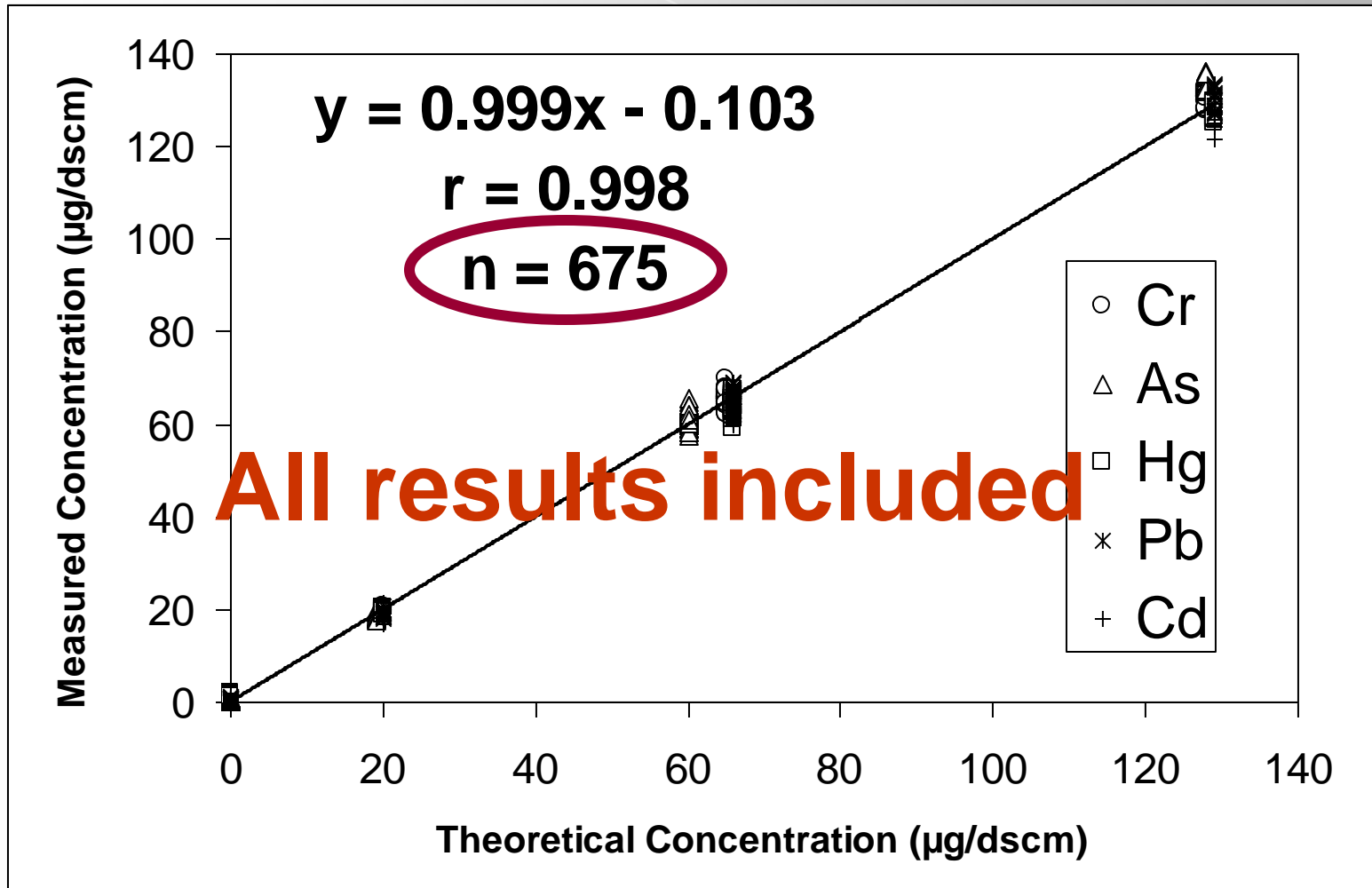
# 12 Month Daily Calibration Error Check

## Xact Mercury Upscale Results March 2006 - March 2007

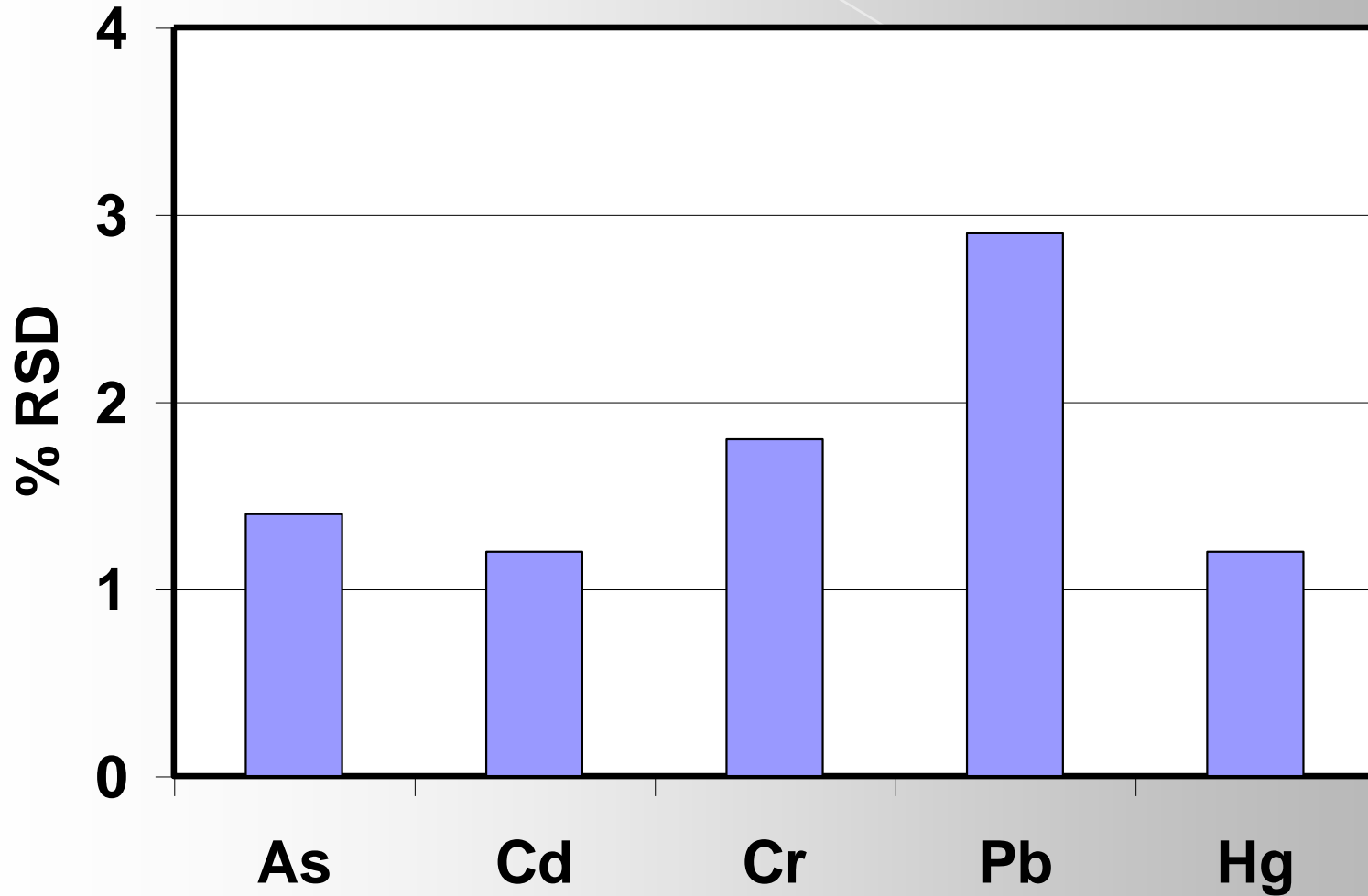




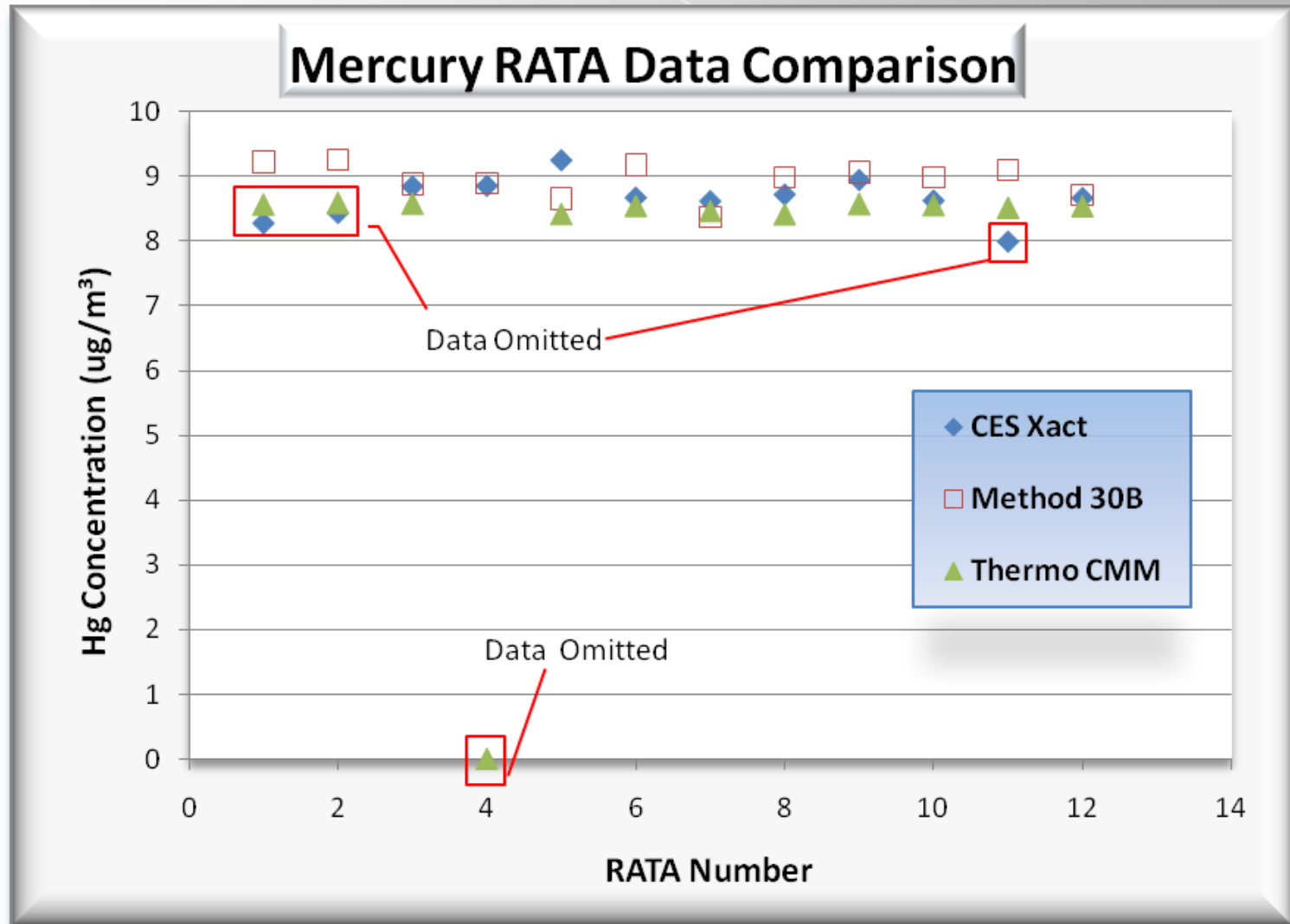
# Xact Linearity Demonstration



# **XACT** PHASE II PRECISION - Spiked Stack Gas -



# Comparison of Hg Conc. Measurements RATA Tests (March 31, 2009)



# Xact Compared to Thermo CEMS

	RATA <u>(%)</u>	Av. Conc. <u>µg/dscm</u>	Av. Diff 30B <u>µg/dscm</u>
● Thermo	6.5	8.5	0.37
● Xact	3.5	8.8	0.06

## Demonstrated Plug and Play Capabilities

## Multi-Metal Detection Limits in the low ng/m<sup>3</sup> range

# QUESTIONS



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