

Cost Effective Measurement of Halogens and Metals Using a Sorbent Trap Approach

***Multi-pollutant Control Technology
McIlvaine Hot Topic***

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MATS: HCl Numerical Limits

Existing Sources

MATS Rules	Published Units	dppmv at 3% O ₂	µg/dNm ³ at 3% O ₂
Utilities			
Unit Not Designed for Low Rank (≥8,300 Btu/lb) ^a	2.0E-3 lb/MMBtu (2.0E-2 lb/MWh)	~1.9	2900
Designed for Low Rank (<8,300 Btu/lb) ^b	2.0E-3 lb/MMBtu (2.0E-2 lb/MWh)	~1.8	2700

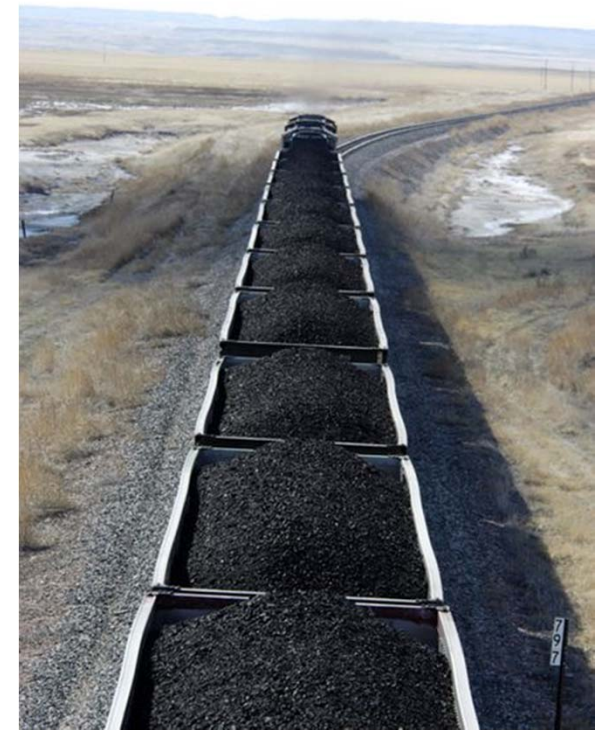
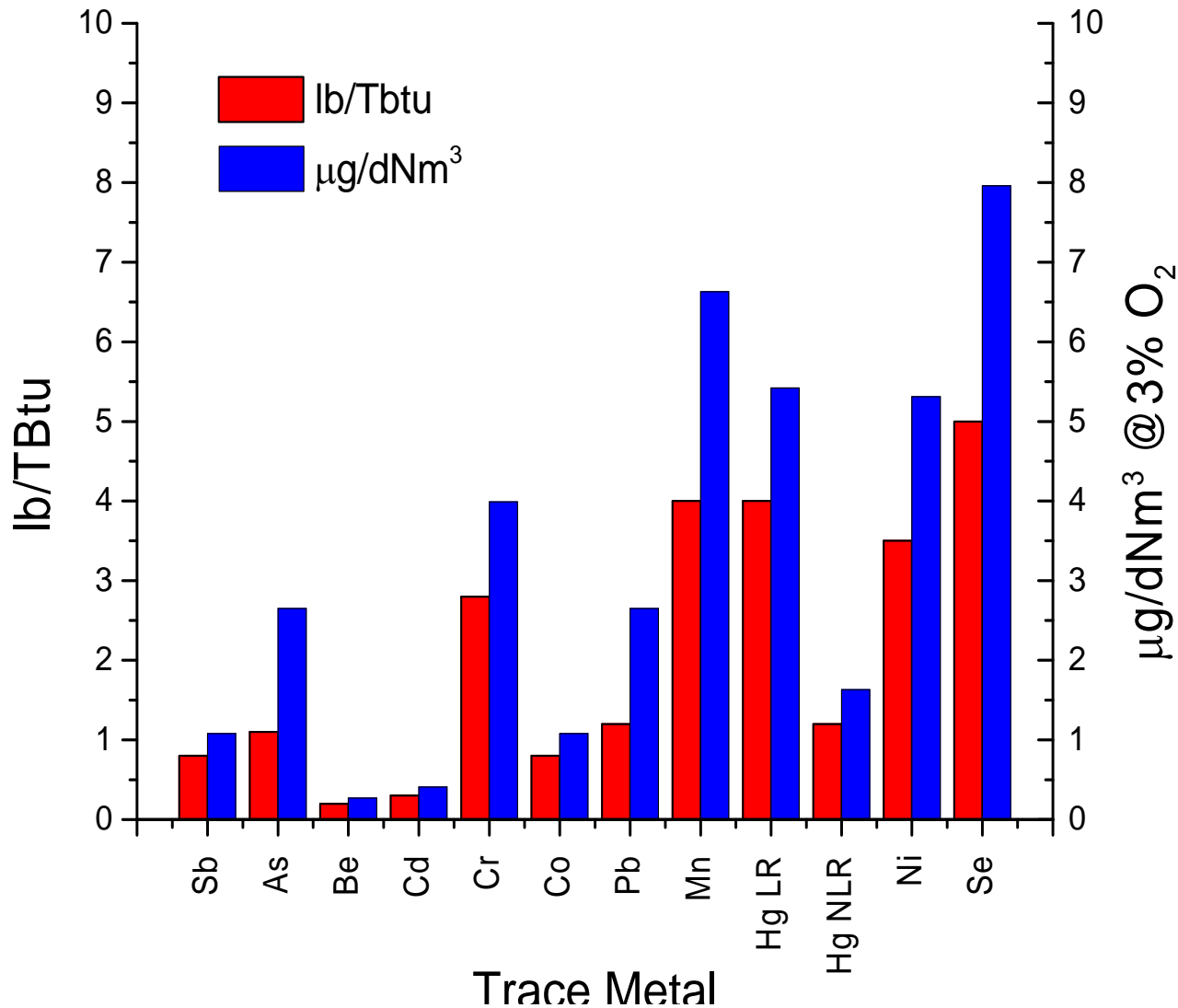
New Sources (*Proposed Limit*)

MATS Rules	Published Units	dppmv at 3% O ₂	µg/dNm ³ at 3% O ₂
Utilities			
Unit Not Designed for Low Rank (≥8,300 Btu/lb) ^a	1.0E-2 lb/MWh	~0.9	1450
Unit Designed for Low Rank (<8,300 Btu/lb) ^b	1.0E-2 lb/MWh	~0.9	1350

^a Calculated values based on a Subbituminous/Bituminous coal and a heat rate of 10,000 Btu/kWh.

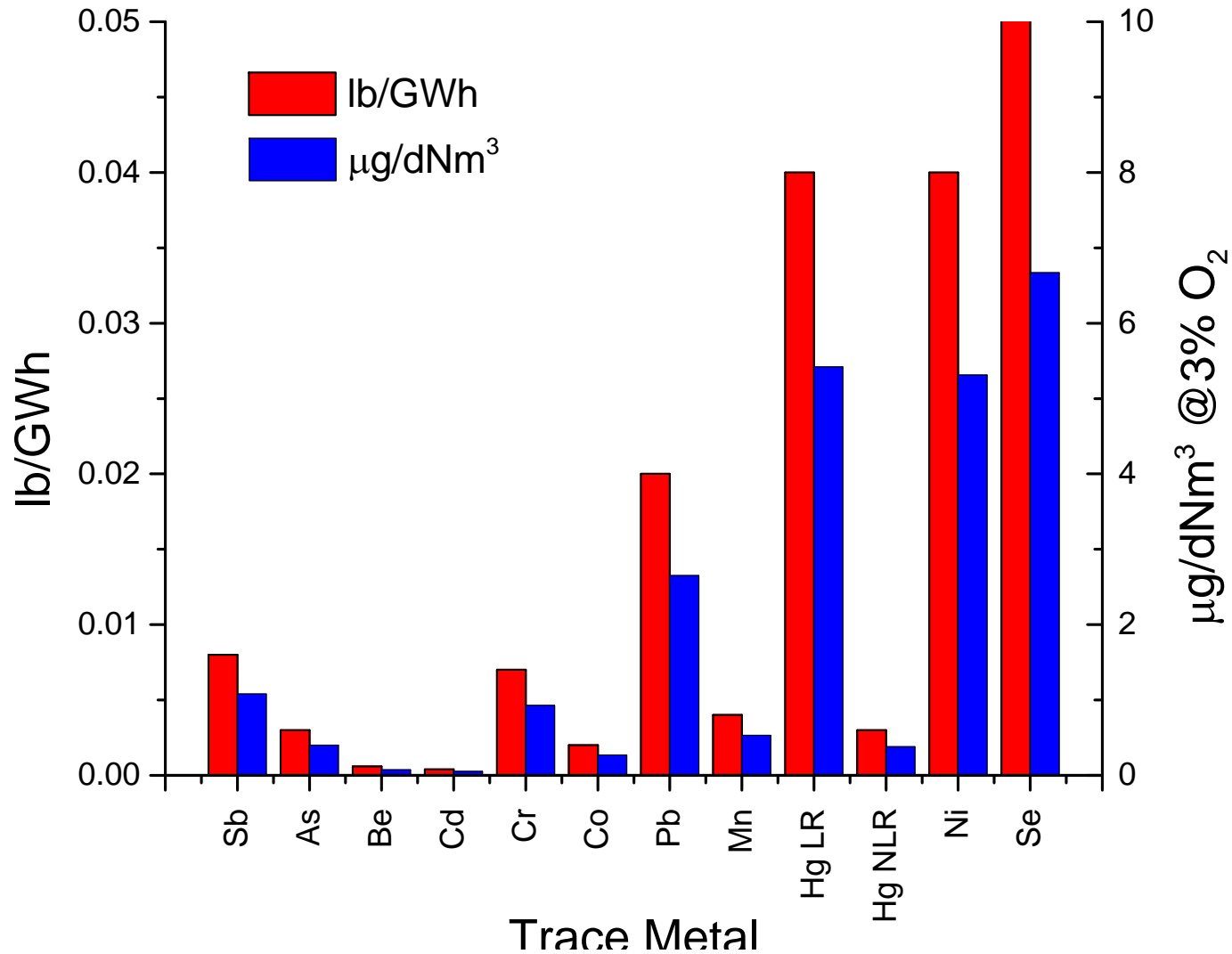
^b Calculated values based on a Lignite coal and a heat rate of 10,600 Btu/kWh.

Individual Non-Hg MATS Metal Emission Limits¹ for Existing Coal-Fired Sources



¹ Calculated values based on a North Dakota lignite coal and a heat rate of 10,800 Btu/kWh.

Individual Non-Hg MATS Metal Emission Limits¹ for New Coal-fired Sources



¹ Calculated values based on a North Dakota lignite coal and a heat rate of 10,800 Btu/kWh.

Description of ME-ST Method

- Isokinetic sampling
- Sorbent tubes
 - Paired A and B tubes.
 - Separate sorbent tubes, one for metals and one for halogens (combined trap being considered if analysis can be worked out).
 - Proprietary “trap” sorbents (EERC, with Ohio Lumex).
- Analysis
 - Return samples to laboratory for analysis (ship via overnight delivery for next-day result).
 - On-site analysis may be possible.
 - Analytical method fairly well established with minor refinement underway.





Full-Scale Test Results

Project Sponsors

- North Dakota Industrial Commission (NDIC)
Lignite Energy Council (LEC)

- U.S. Department of Energy (DOE)



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North Dakota Industrial
Commission

- Electric Power Research Institute (EPRI)

- Minnesota Power



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DOE Support

Acknowledgment

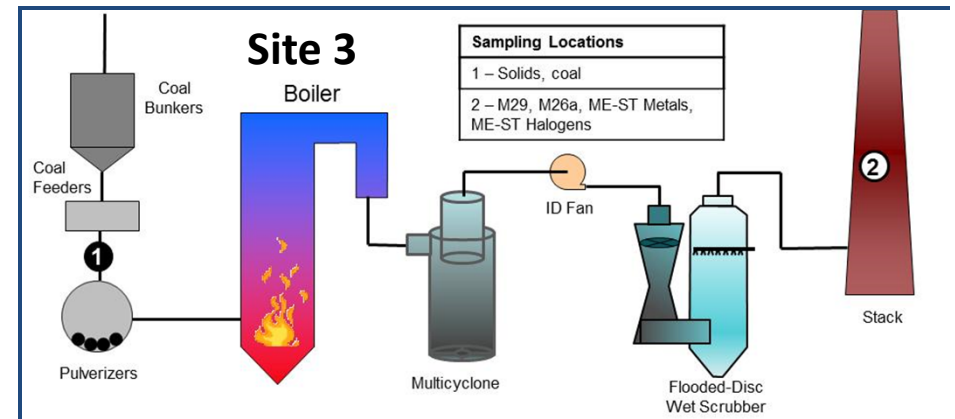
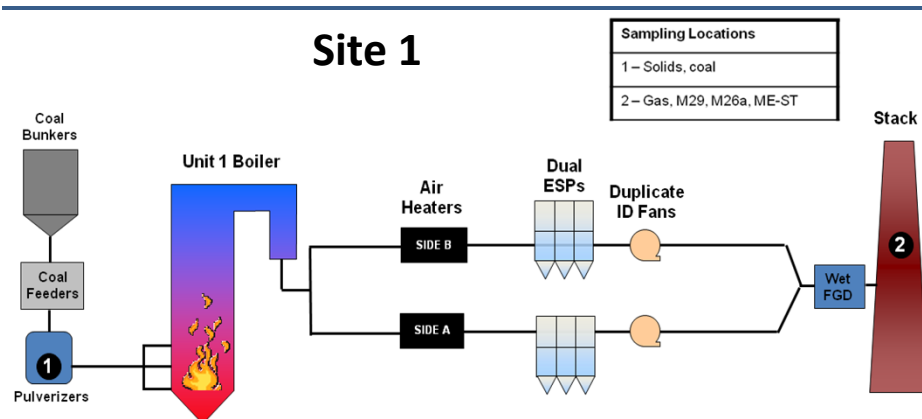
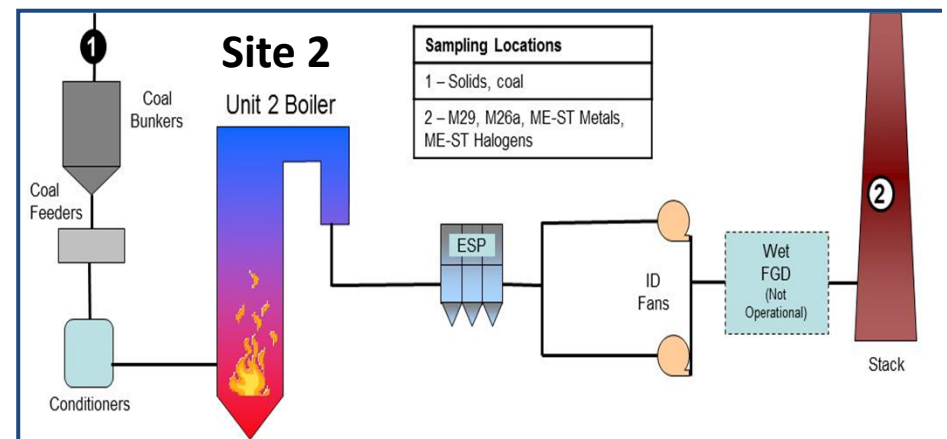
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Disclaimer

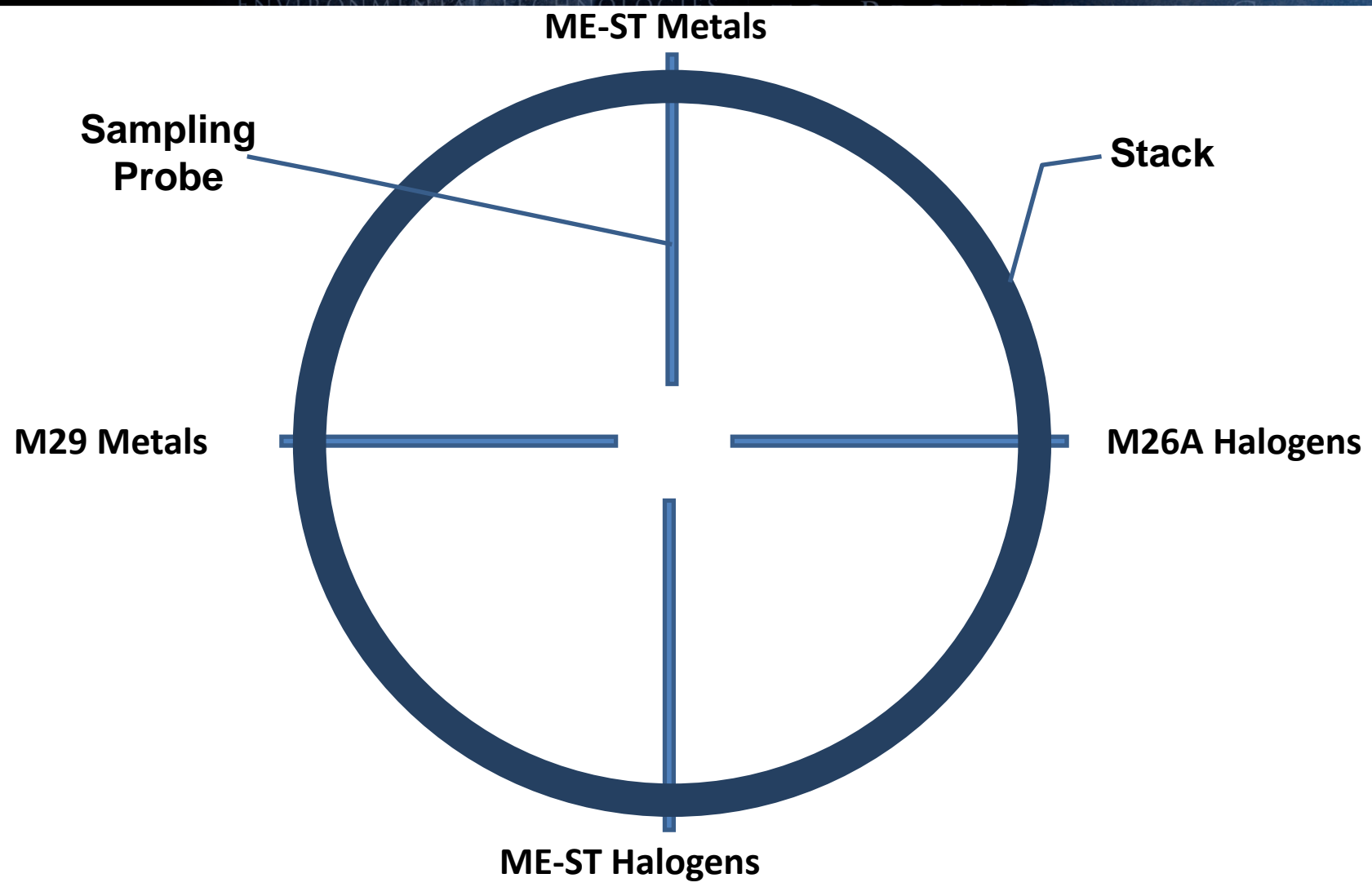
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Full-Scale Sampling North Dakota Lignite-Fired Plants

- Trace metal and halogen ME-ST data were collected along with M26A (halogens) and M29 (metals) data.
 - 9 paired (or more) samples were collected concurrently, 2-hour sampling.
- Samples were collected at three North Dakota lignite-fired plants.
 - Electrostatic precipitator (ESP)–wet flue gas desulfurization (WFGD) configuration.
 - ESP-only configuration.
 - Multicyclone and flooded-disk wet scrubber.



Stack Sampling at North Dakota Lignite-Fired Plants



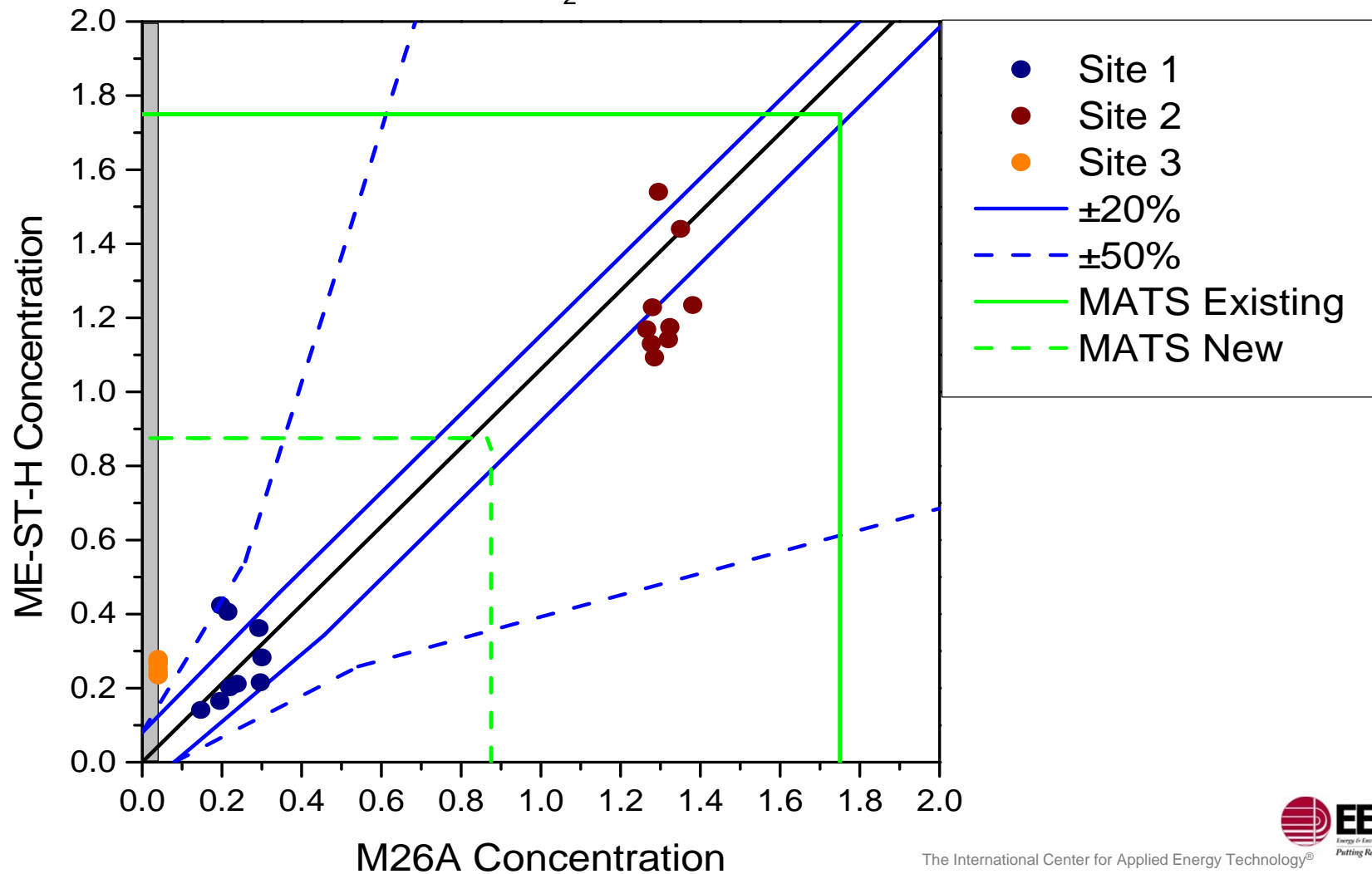
Halogen Data

- Nine M26A and ME-ST (paired set) samples were collected.
- Stack-sampling location.



Stack Emissions HCl Measurements

HCl Flue Gas Concentrations
dppmv @3% O₂



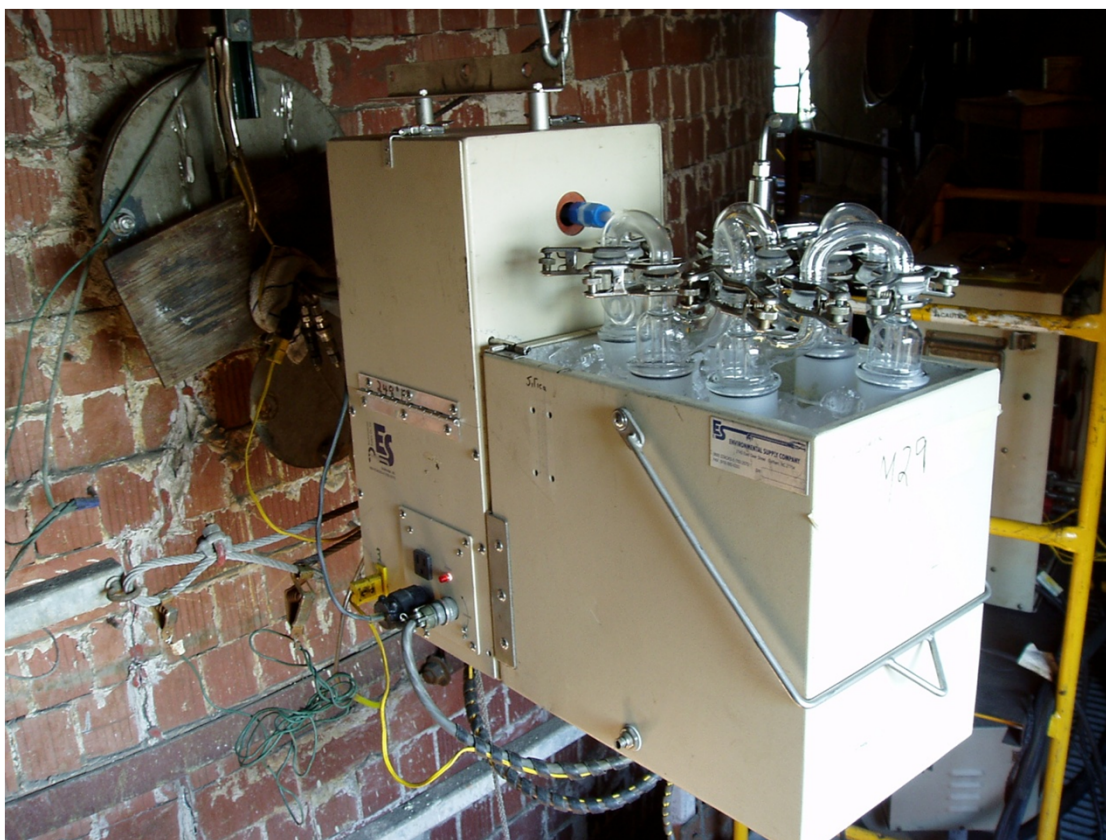
Results Summary

Halogen Sampling

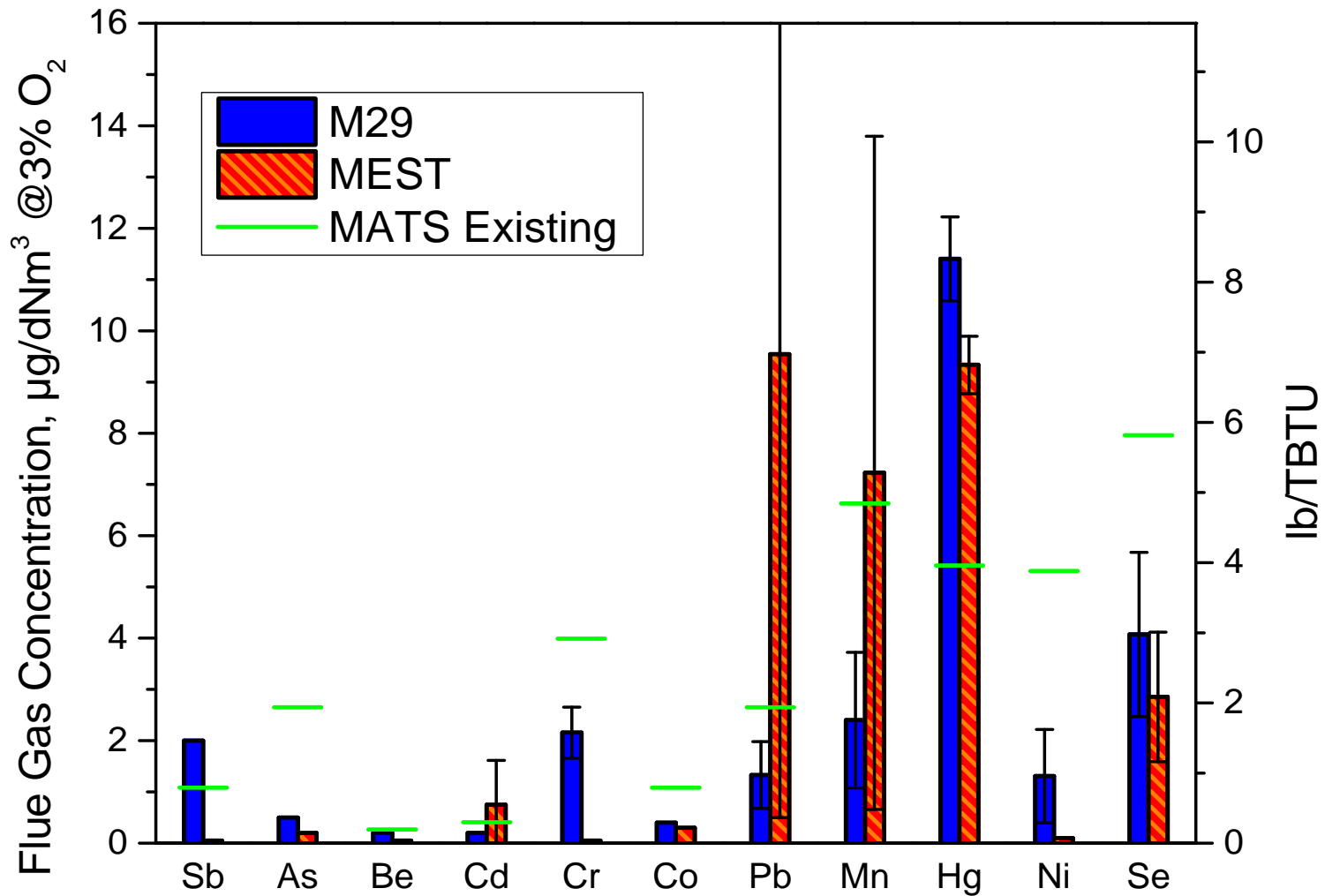
- HCL Stack Emissions
 - All sites < MATS limit for existing plants
 - Two sites <0.5 dppmv @3%O₂
- M26a and ME-ST agreement
 - Sites 1,2 – results generally within 10%
 - Site 3 (wet stack) - low bias for Method 26a versus ME-ST
- Paired ME-ST traps generally <20% RD, most <10% RD
- Reduced trap background by factor of ten
- Improvements to analytical procedures and trap design
 - Can measure ~100 times <MATS limit for new sources
 - Still need to determine in-stack quantitation limit
- ME-ST method shows potential for measurement of HBr, although focus of this project has been on HCl

Stack Emissions Trace Metal Data

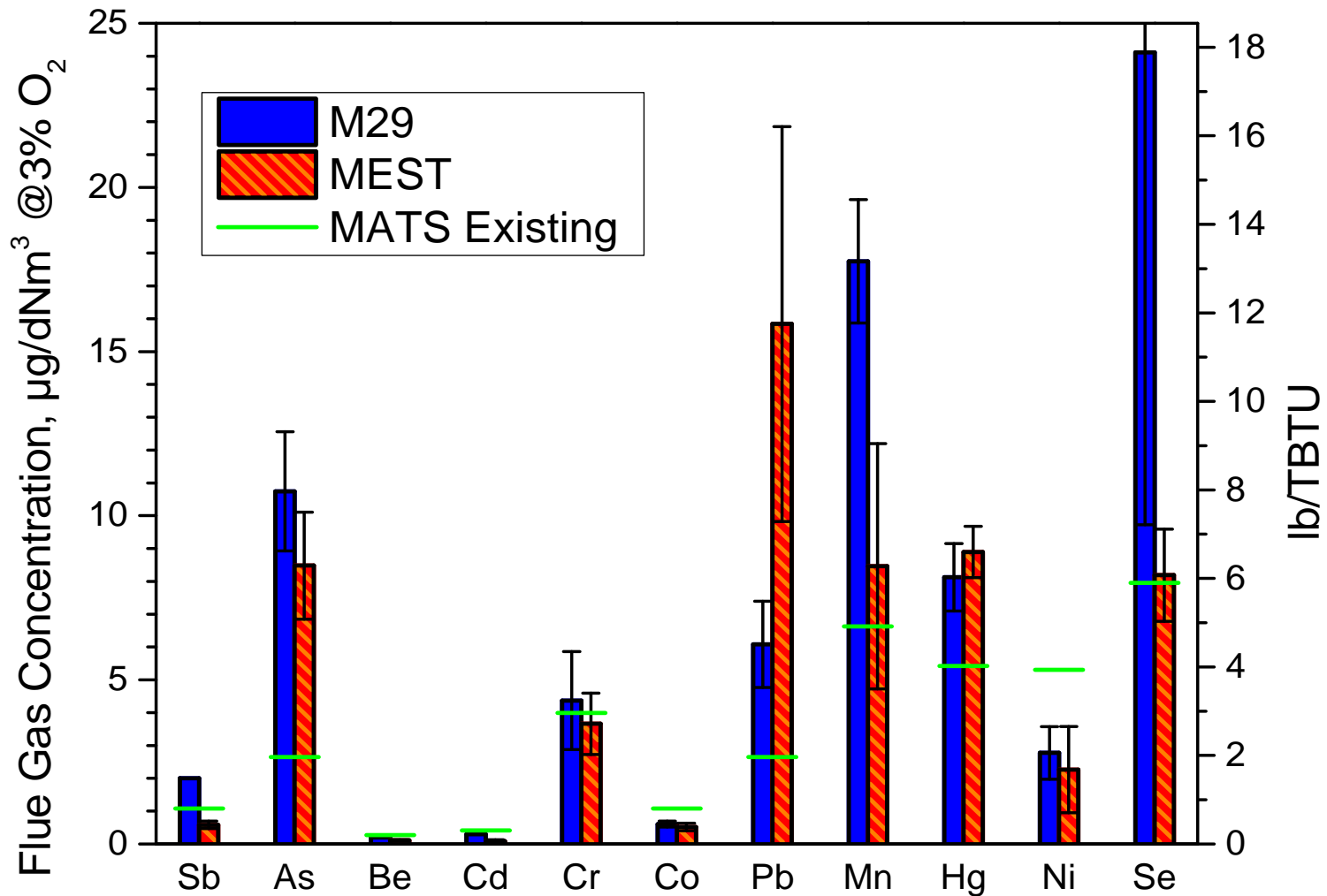
- Nine M29 and ME-ST (paired set) samples were collected at the stack.



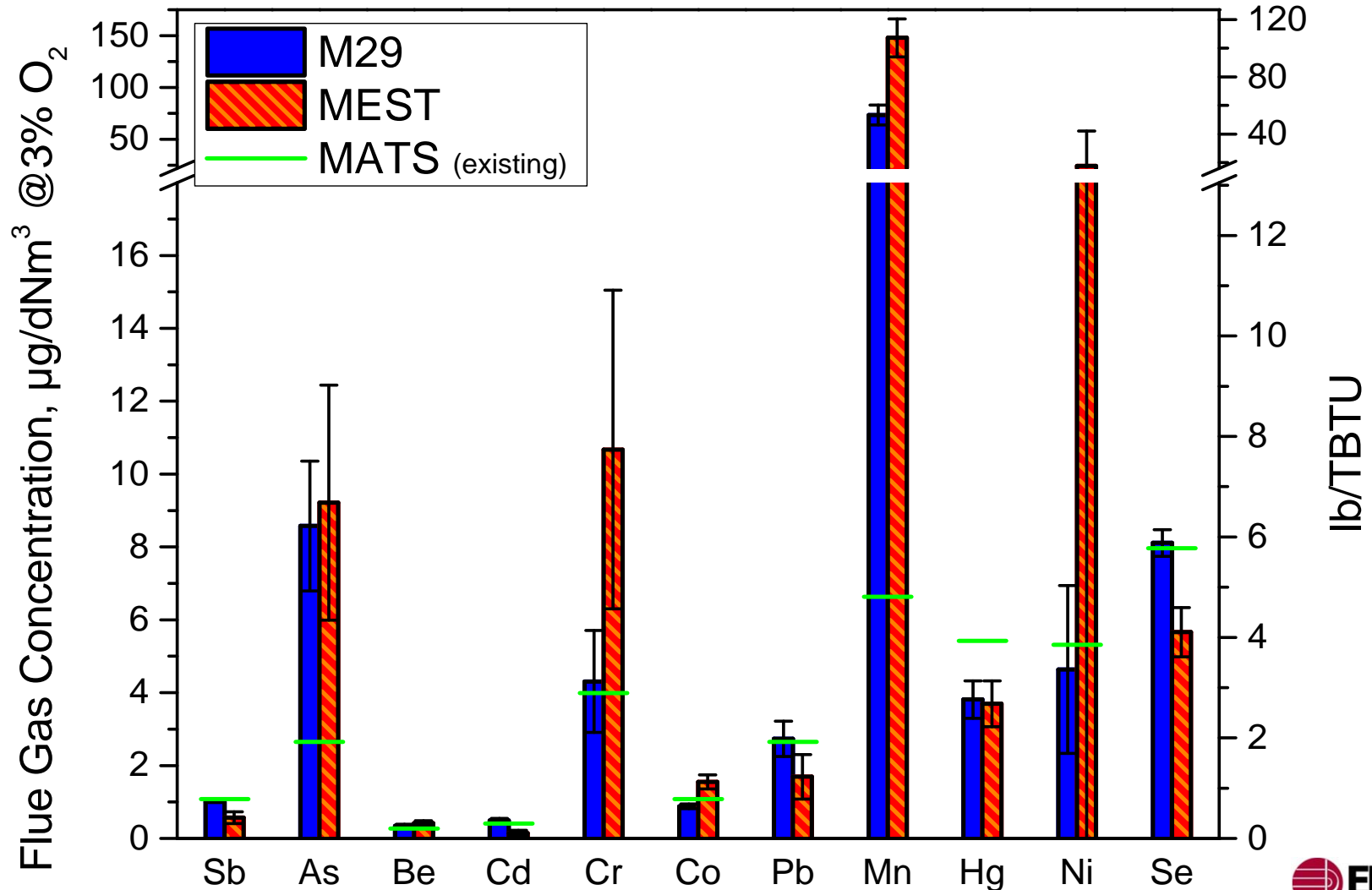
Site 1: Stack Emissions Metal Data



Site 2: Stack Emissions Metal Data



Site 3: Stack Emissions Metal Data



Results Summary

Metals Data

- Metals concentrations: some >MATS limit for existing sites
- ME-ST showed improved (lower) detection limits for many of the metals
- ME-ST comparison with EPA Method 29
 - Sb, As, Cd, and Co >MATS limit, mostly <20% RD
 - Hg and Se mostly <less 10% RD
 - Ni, Pb, Cr, and Mn poorer agreement, higher background values in both M29 and ME-ST.
- Background/blank correction values still need more investigation – different sorbent materials should be considered.
- A longer sampling duration (larger sample volume) may be required for improved accuracy

Observed ME-ST Time Savings

	M26A/M29	ME-ST
Pretest Preparation	180 min	30 min
Sample Preparation	75 min	30 min
Sample Recovery	75 min	30 min
Total	330 min	90 min



Future Direction of ME-ST Method

- Seek support for additional full-scale testing to include additional bituminous and subbituminous coals and different plant configurations. Bituminous site planned.
- Continue to refine sampling and analysis process to improve (lower) detection limits.
- Evaluate longer sampling duration (4+ hours) for ME-ST metal traps and M29.
- Evaluate potential of shorter sampling duration (1 hour or less) with ME-ST halogen (HCl) traps.
- Explore the possibility of extending the ME-ST halogen traps to be used as a continuous monitor approach for HCl.
- Seek formal EPA approval and acceptance as alternative – reference method.

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