Portland Cement MACT Regulations
Frequently-**A**sked **Q**uestions (FAQs)

An Overview of Key Questions and Compliance Challenges

Presented at Cement MACT Review

McIlvaine Webex

February 9, 2011

Karl R. Wilber, PE

TEKRAN Instruments Corporation

Situation Overview

- EPA PC MACT Regulations promulgated September 9, 2010

- Compliance deadline – October, 2013

- Abatement and continuous measurements will be required for new pollutants such as Hg, THC, PM, HCl

- Significant investments will be required in Pollution Control Equipment and CEMS, among other areas

- Some plants may be retired vs. comply with MACT. Those that stay in operation, face a challenging timeline to comply.

TEKRAN Instruments Corporation

Interesting Items from PC MACT Preamble – Mercury[(1)]

- EPA is also eliminating restrictions on the CKD waste rate
- ACI appears to be the primary control technology EPA has evaluated. (wet scrubbers may also be in the mix)
- EPA, in developing the standard, assumed no kilns currently control mercury emissions

[1] Gossman, GCI Powerpoint Slides, McIlvaine Webinar, September 16, 2010

TEKRAN Instruments Corporation

Interesting Items (continued)

- Eleven (11) kilns were used to set MACT floor limits
- EPA acknowledges that the main source of variability is raw materials and fuel
- EPA is eliminating the restriction on the use of fly ash containing mercury

TEKRAN Instruments Corporation

Tekran Products, Services and Markets Focus Primarily on Mercury [1]

- **Point-Source Emissions Monitoring & Pollution Control Equipment Performance**
- **Ambient Air Monitoring**
- **Laboratory/Analytical**

• *Recent EPA MACT Rules require abatement and monitoring of a number of HAPS including Hg, THC, HCl, PM*

• *Tekran is developing a turnkey approach to include the above parameters, stack gas flow and CEMS DAHS and reporting*.

1. Tekran is currently selecting, integrating, testing and evaluating a range of sensors designed to comply with EPA MACT rules.

TEKRAN® Instruments Corporation

Some Frequently Asked Questions (FAQs)

1. What are the PC MACT Rules and Limits on Emissions?
2. What are the General Steps for Compliance?
3. What are the ranges of regulated pollutants?
4. What are the abatement strategies?
5. Why use Electronic CEMS?
6. Can parameters be measured via a single transport system?
7. Why are accuracies at low levels important?
8. What is NIST Traceability for Mercury all about?
9. Why are Commissioning, Training, and Service important?
10. Now What?

TEKRAN Instruments Corporation

FAQ 1– What are the Limits for Emissions from PC Sources?

If your source is:	And the operating mode is:	And if source is located:	Your emissions limits are:	And the units of the emissions limit are:	The oxygen correction factor is:
An existing kiln	Normal operation	At a major or area source	PM – 0.04 D/F – 0.2 Mercury – 55 THC – 24	Lb/ton clinker Ng/dscm Lb/MM tons clinker ppmvd	NA 7 percent NA 7 percent
An existing kiln	Normal Operation	At a major source	HCl – 3	Ppmvd	7 percent
An existing kiln	Start Up and Shut Down	At a major or area source	PM – 0.004 D/F – 0.2 Mercury – 10 THC – 24	Gr/dscf ng/dscm Ug/dscm ppmvd	NA NA NA NA

Reference: Communications with Environmental Quality Management, 800-229-5299 askeq@eqm-rtp.com

TEKRAN Instruments Corporation

2010 NESHAP Portland Cement Final Mercury Limits

40 CFR 63.1343(b)(1)

Source	Operating Mode	Hg Limit	Units
Existing	Normal	55	Lb/MM tons clinker
Existing	Startup and Shutdown	10	µg/dscm
New	Normal	21	Lb/MM tons clinker
New	Startup and Shutdown	4	µg/dscm

TEKRAN Instruments Corporation

FAQ 2 – What are some of the Steps for Compliance

A2 – Some Key Actions are Listed Below

Action	Elapsed Time (months) (*Customer Defined*)
1. Finalize/Understand Regulatory Requirements	5
2. Profiling of Facilities/Planning/Permitting	3
3. CEMS Specification, Purchase and Commissioning (could be started earlier?)	4
4. Base-lining of Process and Pollutants Emissions (Mill On/Down – and SSM?)	6
5. Assessment and Planning of HAPS Abatement Strategies	2
6. Specification and Purchase of Required Abatement Systems	3
7. Facility Permitting (e.g. NSPS?)	3
8. Abatement Systems Engineering, Fabrication, Installation and Commissioning	18
9. Training, Fine tuning of Abatement, Operations, CEMS DAHS, etc.	4
TOTAL ELAPSED MONTHS →	**48**

TEKRAN Instruments Corporation

FAQ 3 - What Are the Likely Ranges of Pollutants?

A3 – Pollutants emissions will vary substantially from source to source – and are a function of raw mix chemistry, fuel characteristics, existing pollution control equipment, plant operations (e.g. mill on/mill down), etc.

By example, Mercury (Hg) concentrations will vary from <1.0 µg/m3 to greater than 250 µg/m3

"Baselining" of your plant emissions is needed to specify appropriate pollution control strategies

TEKRAN Instruments Corporation

FAQ 4 – What are the Abatement Strategies for the Target Pollutants?

A4 - Abatement strategies and technologies will depend upon, among other factors:

1. baseline emissions of targeted pollutants
2. existing air pollution control equipment
3. proven performance of current abatement technologies
4. economics

In the case of Mercury reductions, it would appear that Activated Carbon Injection (ACI) will be squarely in the evaluation mix, given the targets and the prospective performance of this approach. EPA included Plants with scrubbers in their MACT analyses.

TEKRAN Instruments Corporation

FAQ 5 -Why Use an Electronic (i.e. Real-time) Hg CEMS vs. Sorbent Traps?

A5 – While both methods may be acceptable from a regulatory perspective, Electronic (AKA – "Real-time") CEMS provide:

- ✓ Real-time perspective on Hg emissions, including ability to see how process and fuel changes impact emissions
- ✓ Assessment of whether the HgCEMS is functioning (Sorbent Traps only tell you "After the Fact" – then it's too late)
- ✓ Performance Monitoring and Optimization of Pollution Control Equipment
- ✓ Electronic record, which facilitates data analyses and reporting

TEKRAN Instruments Corporation

FAQ 6 – Can Multiple CEMS Parameters share the same umbilical/flue-gas transport system?

A6 - ***Yes***, parameters such as Hg, THC, HCl, might share the same heated umbilical. {Note: SO2, NOx, etc. CEMS umbilical's cannot support Hg or acid gas transport as temperatures are insufficient to maintain integrity of the sample}.

Tekran has successfully demonstrated shared transport for Hg and THC on the Cement Process. Tekran is also evaluating a variety of PM CEMS.

TEKRAN Instruments Corporation

Incremental CEMS Parameters - PM?

PM CEMS (Surrogate for Non-mercury metals?)

- ✓ A number of different candidate technologies are available for PM CEMS including:
  - ✓ Light Scattering
  - ✓ Beta Gauge (Beta Attenuation)
  - ✓ Light Extinction
  - ✓ Probe Oscillation Frequency (e.g. TEOM)
  - ✓ Probe Electrification (Tribo-electric Effect)
- ✓ Without pre-conditioning of the flue gas, many of the above technologies are challenged in wet-stack environments
- ✓ PM CEMS must meet EPA Performance Specification 11 Tests
- ✓ EPRI PM CEMS “Olympics” are underway at DTE Monroe Plant
- ✓ Calibration of PM CEMS has been evaluated using technologies such as the Cooper Environmental (QAG 820) as part of EPA and EPRI-funded initiatives

TEKRAN Instruments Corporation

What About the Other CEMS Parameters?

Total HydroCarbons (THC)

- ✓ THC Monitors have been used in a number of processes (e.g. Cement Process) to assess combustion conditions. There is little experience with these systems on coal-fired power plants, however the environment for operation is much less severe than that of the Cement Process.
- ✓ THC Monitoring Systems are available from a variety of suppliers, who supply both ambient and point-source THC monitoring. Many use Flame Ionization Detectors (FID).
- ✓ THC Monitors must meet EPA Performance Specification 8A.
- ✓ Without pre-conditioning of the flue gas, many of the above technologies are challenged in wet-stack environments.
- ✓ Tekran has successfully incorporated a THC Monitor (CAI) into the 3300 HgCEMS flue-gas sampling system.

TEKRAN Instruments Corporation

FAQ 7 – What is the importance of low-level measurement accuracy?

A7 – Compliance with EPA MACT Regulations will result in emissions levels which *may be (10) percent or less of current levels*. Resultant concentrations of specified pollutants could be at, or near, the Lower Limit of Detection (LLD) of commercially-available instrumentation!

Plants which invest in abatement and monitoring technology should demand and realize both accurate and traceable measurements – *and* the attendant "credit" (i.e. regulatory and economic) for same.

TEKRAN Instruments Corporation

FAQ 8a – What is NIST Traceability for Mercury About?

- EPA has released interim traceability protocols for Hg calibrators (July 2, 2009)
  (http://www.epa.gov/airmarket/emissions/mercury/hgmonitoring.html)
- NIST may not currently be prepared for the PC MACT regulations;
  1. *Not yet capable of certifying low (sub µg/m^3) concentrations for MACT Utility rule; lowest point to date is 0.5 µg/m^3 with 5-6% uncertainty (2σ)*
  2. *Have not yet certified high-level (~250 µg/m^3) concentrations for PC MACT*
  3. *Cannot certify $HgCl_2$ generators*

TEKRAN Instruments Corporation

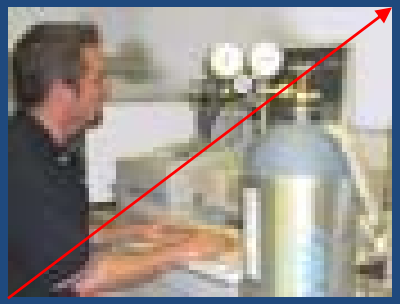
Mercury Traceability (continued)

- Tekran has and continues to assist NIST and EPA with the “science” of Hg Generator Traceability.
- Tekran 3300 HgCEMS have three (3) Hg generators on board.
  - Elemental Generator (Hg^0), Permeation Source and Ionic (Hg^{2+})
  - Only Tekran HgCEM Systems Hg generators can be extended to 8 rolling quarters before certification.
- Tekran can support traceability programs for any electronic HgCEMS.

Tekran Hg Calibrators – HOT – Standby System for NIST Traceability

TEKRAN Instruments Corporation

FAQ 8b - Are there traceable calibration gas cylinders for Hg?

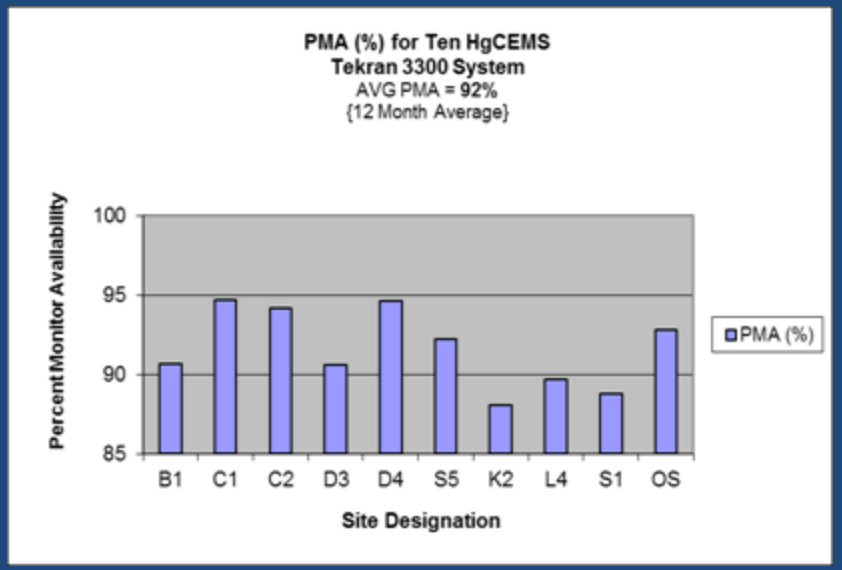


A8b - ***No***. There are currently no acceptable Hg calibration gases available in cylinders – as exist for SOx, NOx, etc.

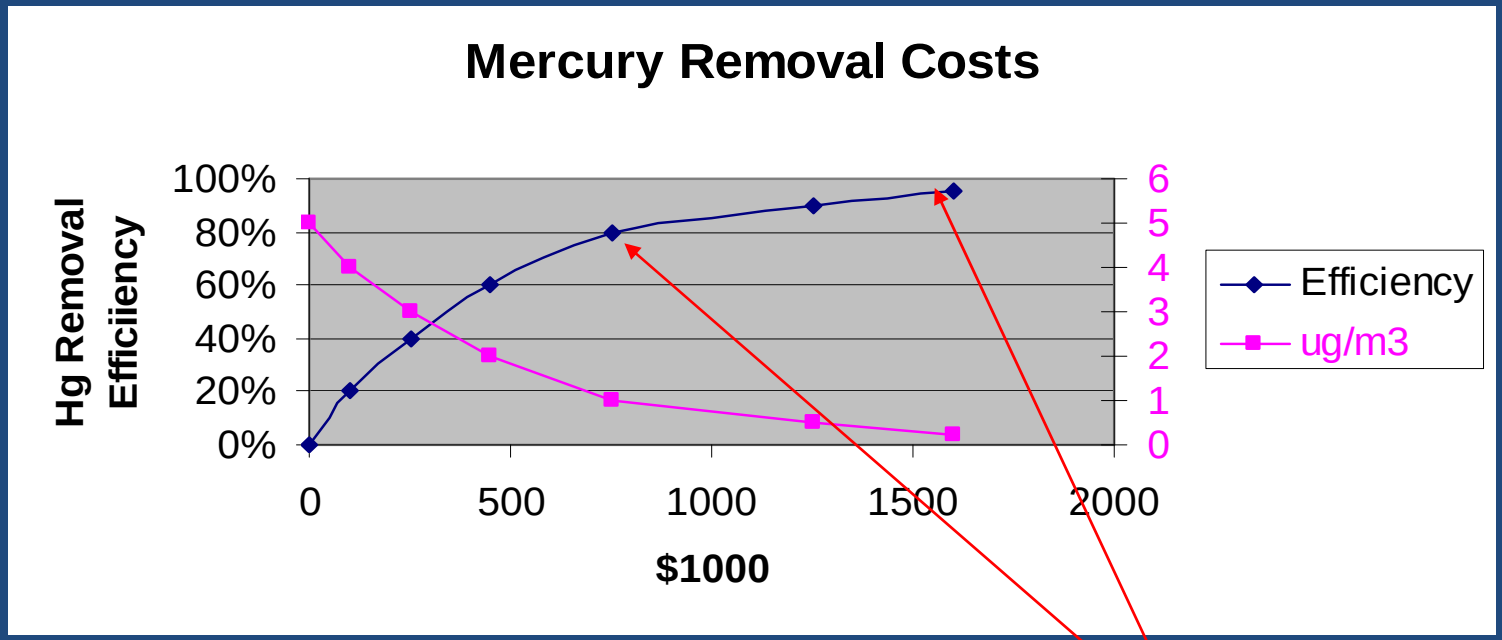
TEKRAN Instruments Corporation

FAQ 9 – Why are CEM Commissioning, Training, and Service/Aftermarket Support Important?

A9 - **Commissioning** process: validates CEM performance, initiates site awareness and ownership of systems, establishes relationship between supplier and owner. **Training** is critical for on-site ownership of CEM Operations, Maintenance, etc. Particularly beneficial for Percent Monitor Availability (PMA% - see graph) and Abatement Systems Performance Monitoring and Optimization (Slide 20). **Service/Aftermarket Support** is ***Critical*** for on-going compliance and "ownership" of CEMS Operations and Maintenance.



Example Mercury Abatement Using Sorbent Injection – 500 Mwe Coal-fired Plant

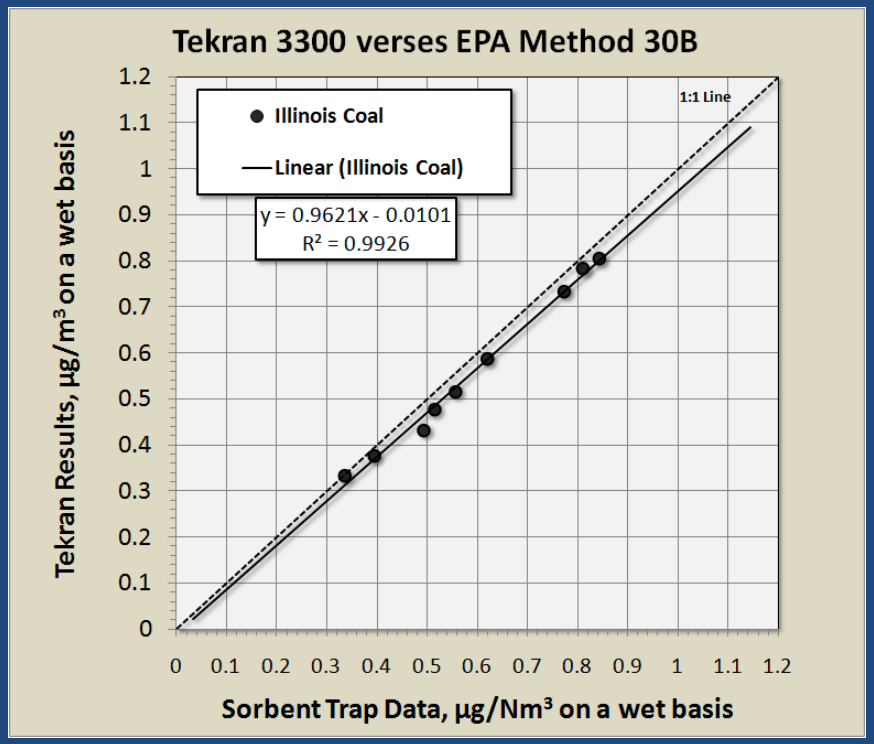


Stack Concentrations will be lower than current levels,
The last 10% removal may cost an additional 50%
Low-level measurement accuracy more important than ever !

TEKRAN Instruments Corporation

EERC Low-Level Accuracy Study, 2010

Tekran Series 3300 and Thermo Freedom were chosen for this study



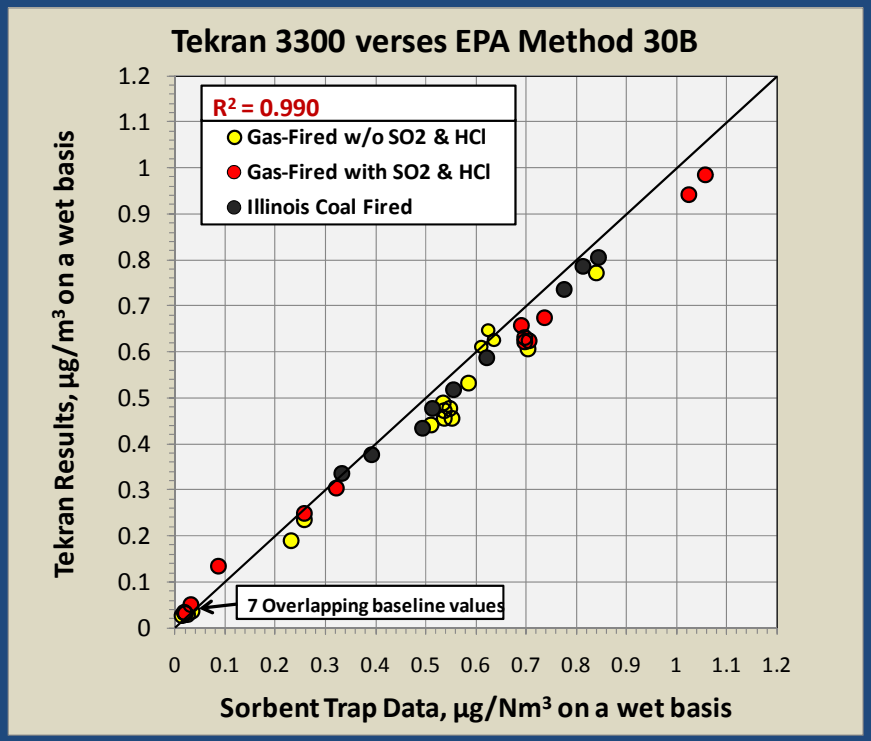
THIS GRAPH REMOVED AT THE REQUEST OF EPRI

- Coal results only (gas-fired data was removed)
- Tekran is highly accurate at very low mercury concentration in actual coal-fired flue gas
- "Evaluation of the Variability of CMMs at Low Mercury Levels", Laudal, et al (*EUEC January 31, 2011*)

TEKRAN Instruments Corporation

EERC Low-Level Accuracy Study, 2010

Tekran Series 3300 and Thermo Freedom were chosen for this study

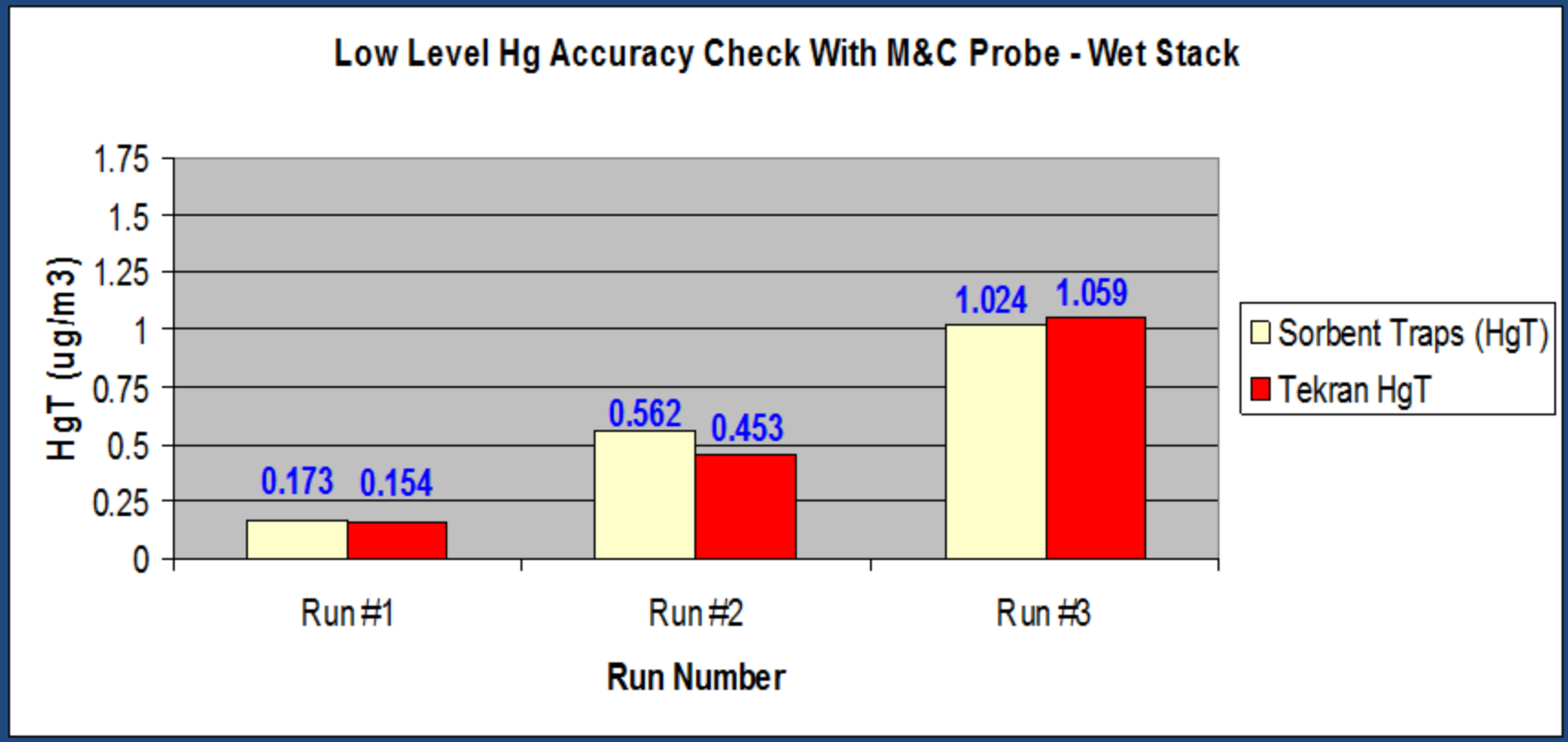


THIS GRAPH REMOVED AT THE REQUEST OF EPRI

- Tekran Series 3300 performance was superior at low mercury concentrations
- Notice the Tekran results were consistent in all three matrices, even in Illinois coal at concentrations below 0.5 ug/m^3
- "Evaluation of the Variability of CMMs at Low Mercury Levels", Laudal, et al (*EUEC January 31, 2011*)

TEKRAN Instruments Corporation

Example Low-Level Hg RATA Results
Reliant Energy HgCEMS Evaluation Program



Sorbent Traps (avg) = 0.59 ug/m3
Tekran with M&C (avg) = 0.56 ug/m3

Note: Some Utilities Looking at sub 0.1 ug/m3 levels at some sites !!!

TEKRAN® Instruments Corporation

Perspectives and Conclusions

1. *The EPA PC MACT Regulations present a number of challenges:*
   - ✓ *New parameters are regulated including PM, THC, Hg, HCl.*
   - ✓ *New CEMS and Pollution Control Equipment will be needed*
   - ✓ *Development of necessary baseline data (i.e. defining the objectives)*
   - ✓ *Specification of appropriate pollution control strategies*
   - ✓ *Understanding CEM system options and their implementation*
   - ✓ *Assessment of economic compliance of the "fleet" (possible retirement/mothballing of plants which don't make the grade)*
   - ✓ *Straining of necessary supply-chain resources (i.e. engineering, construction, materials, utility labor force, etc.)*
   - ✓ *Development and underwriting of defensible budgets*

NOW WHAT?...i.e. what is "our" Plan of Attack?

TEKRAN Instruments Corporation