REINHOLD ENVIRONMENTAL Ltd.

2015 NOx-Combustion Round Table & Expo Presentations

February 23 & 24, 2015, in Richmond, VA / Hosted by Dominion

2015 NOx-Combustion Round Table

Mercury Field Testing; A Critical Component to A Comprehensive SCR Management Approach in a MATS Environment.

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February 23, 2015

Introduction

- **Why Field Testing?**

- **Keys to Success**
  - Experienced program manager
  - Experienced testing firm
  - Sound test plan
  - Analyze data as its generated so plan may be adjusted

Why Field Testing?

- **Expensive**
  - Field testing - $50,000 -$100,000
  - Lab testing - $8,000-$15,000 per sample
- **Complicated**
- **Requires significant outside and inside resources**

BUT……

- **Return can be significant**
  - Reduced risk of non compliance.
  - Avoid costly mistakes based on limited data
  - Reduced Compliance Cost (1 year pay back for 10% reduction)

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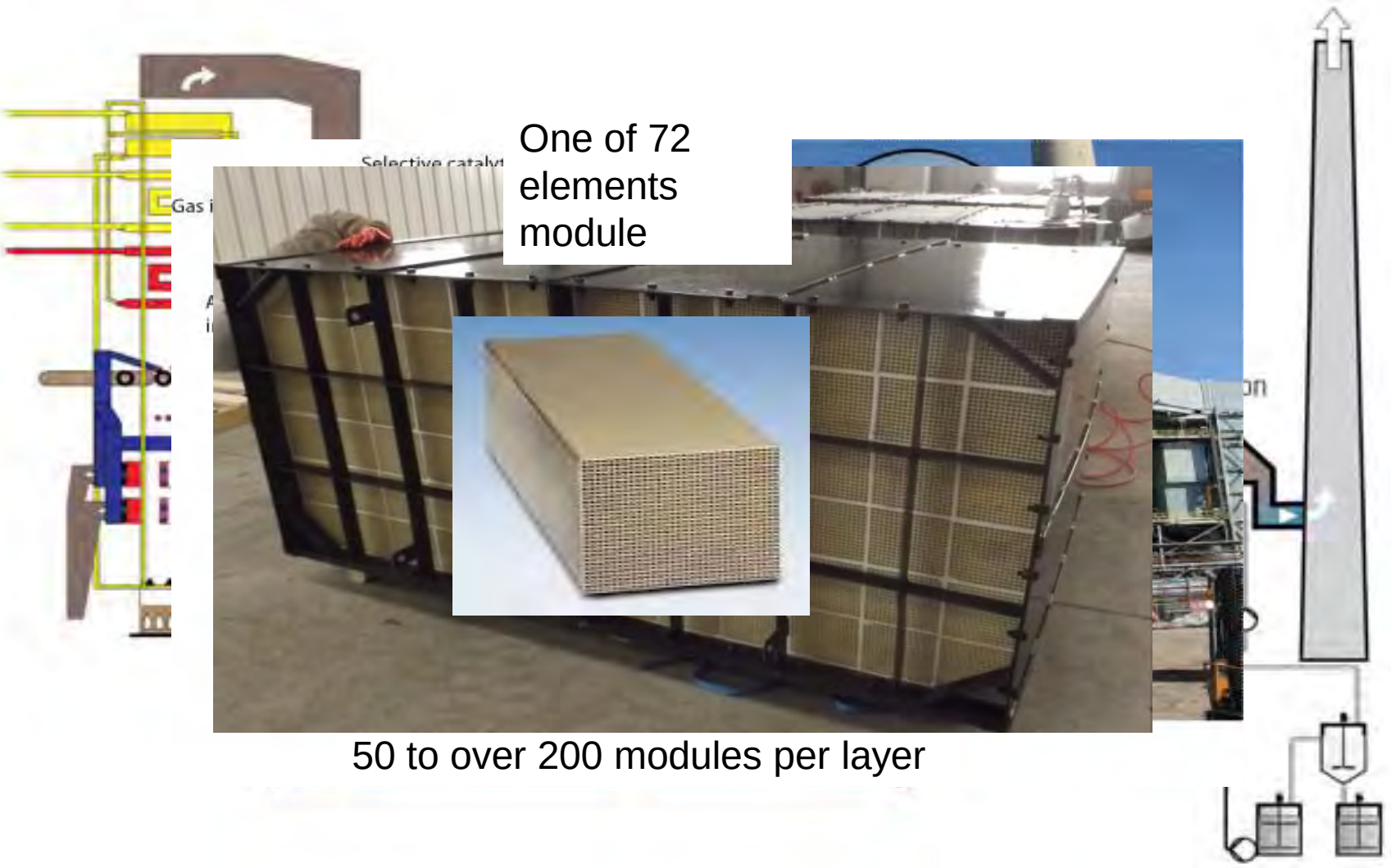
Lab Testing



50 to over 200 modules per layer

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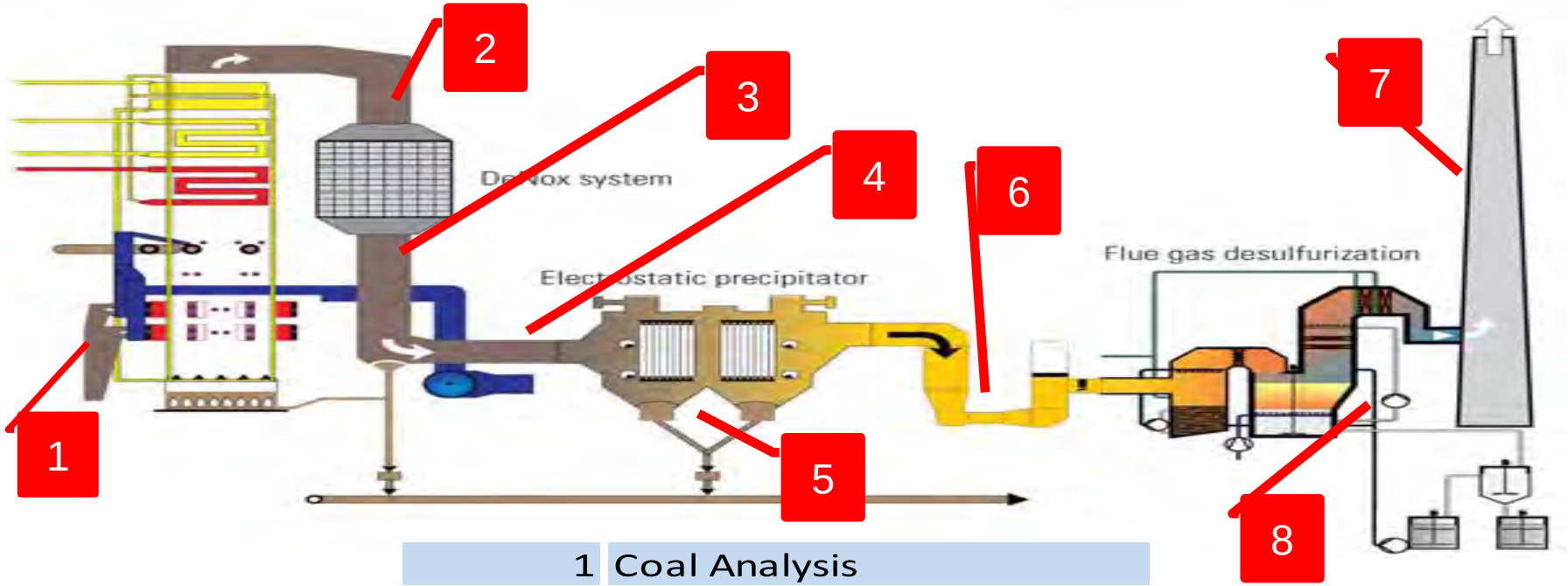
Field Testing



1	Coal Analysis
2	SCR Inlet
3	SCR Outlet
4	Particulate Catpure Inlet
5	Ash Analysis
6	Particulate Capture Outlet
7	Stack
8	Scrubber Water

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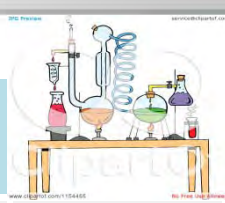
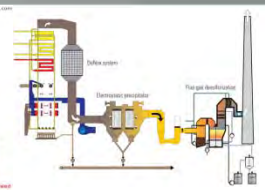
Comparison Between Lab and Field Testing

Objective		
Evaluate catalyst condition to predict life	√	
Assess New/Regenerated Catalysts on Reactor Performance	√	
Impact of variables on SCR Performance	√	
Evaluate Reactor performance		√
Impact of SCR performance on overall removal		√
Impact of variables on Hg Removal Performance		√
Overall plant Hg removal efficiency		√
Predict Hg removal efficiency		√
Trouble shoot Hg removal problems		√
Evaluate potential solutions to meet compliance Limits		√

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Plan Ahead – Define Test Objectives

➢ Sample Locations

Objective	SCR Inlet	SCR Outlet	Particulate Capture Inlet	Scrubber Inlet	Stack
Evaluate Reactor performance	√	√			
Impact of SCR performance on overall removal	√	√		√	*
Impact of variables on Hg Removal Performance					
Overall plant Hg removal efficiency	√				*
Predict Hg removal efficiency	√	√	√	√	*
Trouble shoot Hg removal problems					
Evaluate Scrubber Performance				√	*

* Use Plant CEMS

- **Identify location of each sample**
- **Port exist, accessible, traverse available?**
- **SCR outlet sample as far downstream as possible**

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Plan Ahead – Define Test Objectives

- **Duration of test for each objective**
  - Baseline testing 3-5 days.
  - Impact of variables on SCR – 1to 2 days for each variable
  - Sorbent evaluations - 2 days for set of 3-4 sorbents
  - Scrubber performance and chemical additives – 3 to 7 days

- **Choose period when plant can maintain load**
  - Reduce testing time
  - Reduce costs
  - Improves data

- **Don't shortchange testing time**
  - Daily testing cost is typically 1/10th of Mob and Demob Costs!
  - Consider combining AIG tuning with Hg Testing to reduce costs.

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Plan Ahead – Define Test Objectives

➢ CEMS vs Traps

- Continuous measurements - Movie versus a picture
- CEMS Eliminates transient changes from influencing results
- Traps have temperature and solids limitations
- Traps are only certified for Stack
- Speciated traps are not proven at SCR Temperatures
- CEMS cost is generally higher

➢ Conclusion

- Use CEMS to evaluate performance
- Use Traps as a QA/QC tool to verify CEMS total Hg Results.

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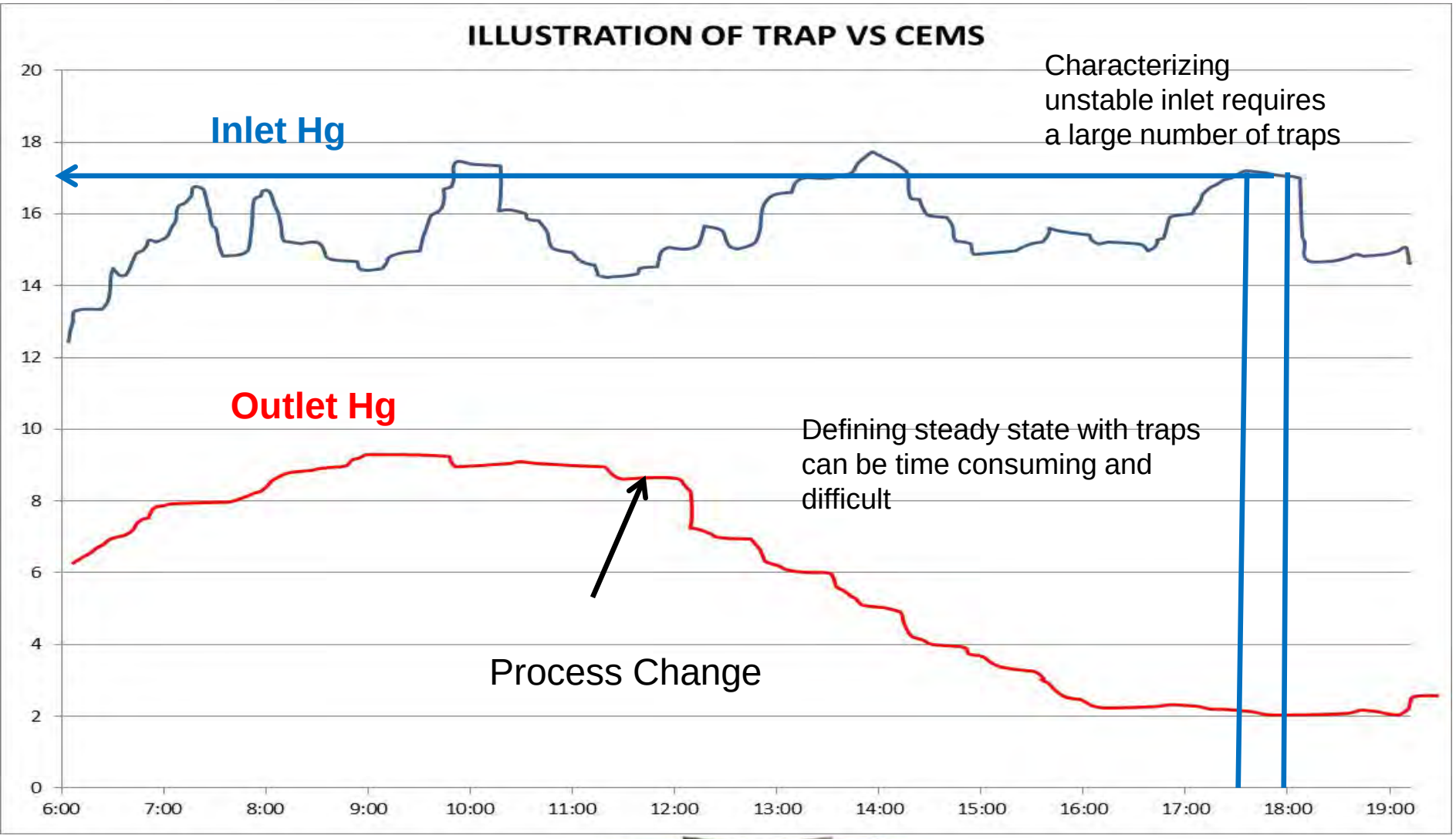
CEMs vs Traps



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Program Manager and Testing Firm

➢ Program Manager

- Designs test plan with client to meet objectives
- Defines equipment used by testing firm
- Has expertise in all test areas
- Facilitates data analysis
- Provides daily summary of results
- Manages testing firm

➢ Testing Firm

- Field Testing is **NOT** the same as Stack Testing
  - ✓ Sample Collection/Conditioning is far more difficult and complicated
- Needs experience personal
  - ✓ Understand sampling artifacts and chemistry interactions
- Needs correct and maintain equipment

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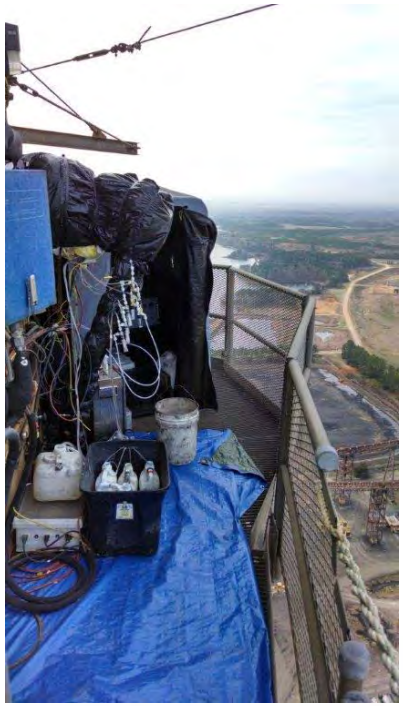
Program Manger and Testing Firm

- **Experience testing at locations upstream of the stack**
- **Conduct a site walk prior to testing**
- **Identify logistical and safety concerns**



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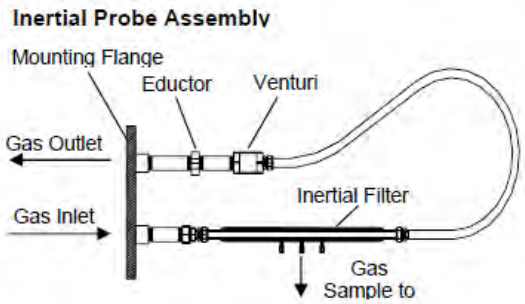
Keys to Successful Test

- **Use inertial probes**
- **Conditioning train at point of extraction**
- **Locate CEMS near sample points**
- **Monitor O2 to identify system leaks**
- **Access to data AS ITS COLLECTED**
- **QA/QC CEMS AND sample train 2X Day**



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EXECUTION PHASE – Daily Updates

- **Review prior days results including DCS data**
- **Revise plan based on results**
- **Notify key plant personnel of any special requirements**

Eliminate surprises in Final Report

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Additives Product Evaluation

- **Field Testing is the ONLY WAY to evaluate**
  - Select based on Price/Performance
  - Relative economics will vary from plant to plant

- **Sorbents**
  - Use bulk bag feeder to reduce testing time.
  - ALWAYS compare in the same day
  - Use a reference sorbent each day to get a determine repeatability
  - Defines use rate to achieve desired Hg reduction target
  - Reverse order of testing.
  - Allow system to reach baseline between tests if possible (50% is minimum)

- **Oxidants – response time is generally fast**

- **Scrubber additives – response time 3 to 7 days**

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SUMMARY

- **Proper Field Testing**
  - Typical costs of $50,000 to $100,000
  - Easily recouped by reducing treatment costs
  - Identifies source(s) and solution(s) to emission problems
  - Reduces risk of non compliance
  - Valuable tool in any Hg management program

- **Poorly Executed Field Testing**
  - Leads to poor and costly decisions
  - Avoided with experienced program manager and testing firm
  - Waste internal resources

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Acknowledgment to E1E

Questions?

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