

REINHOLD ENVIRONMENTAL Ltd.



2011 APC Round Table & Expo Presentation

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On-site Optimization of Hg Sorbent Injections with PS 12A Method compliant Portable Hg CEM

Joseph Siperstein, Mark Seibel, Dr. Qiao He,
(Ohio Lumex Comp.)

Maggie Cangro, (Catalyst Air Management)

Will Roberson, (RMB Consulting)



2011APC/PCUG

Introduction

- Objective: Conduct 30 days of real time mercury monitoring to obtain reference and baseline data.
- PS-12A test requirements along with daily calibrations and integrity tests used to verify the data accuracy.

Question ??

Can a portable mercury CEMS pass all the requirements of PS-12A in the field?



Background

- Ohio Lumex IRM-915 Portable CEMS used for monitoring.
- Hovacal Hg²⁺ calibrator and Thermo 81i Hg⁰ calibrator used as reference gas sources for all monitor testing.

Background

- Catalyst Air Management oversaw the project, compiled and calculated the results and conducted the RATA using 30B sampling with Ohio Lumex sorbent traps and analysis.
- RMB conducted and compiled the results for the PS-12A testing.

Setup

- Probe installed in a duct 110' from the ground.
- Sample umbilical containing sample and calibration gas lines heated to 180C, run from duct port to trailer.
- Analyzer System and calibrators mounted on a table in the test trailer.
- Setup time, approx. 4 hours.

Sample Probe and Heated line Mounting



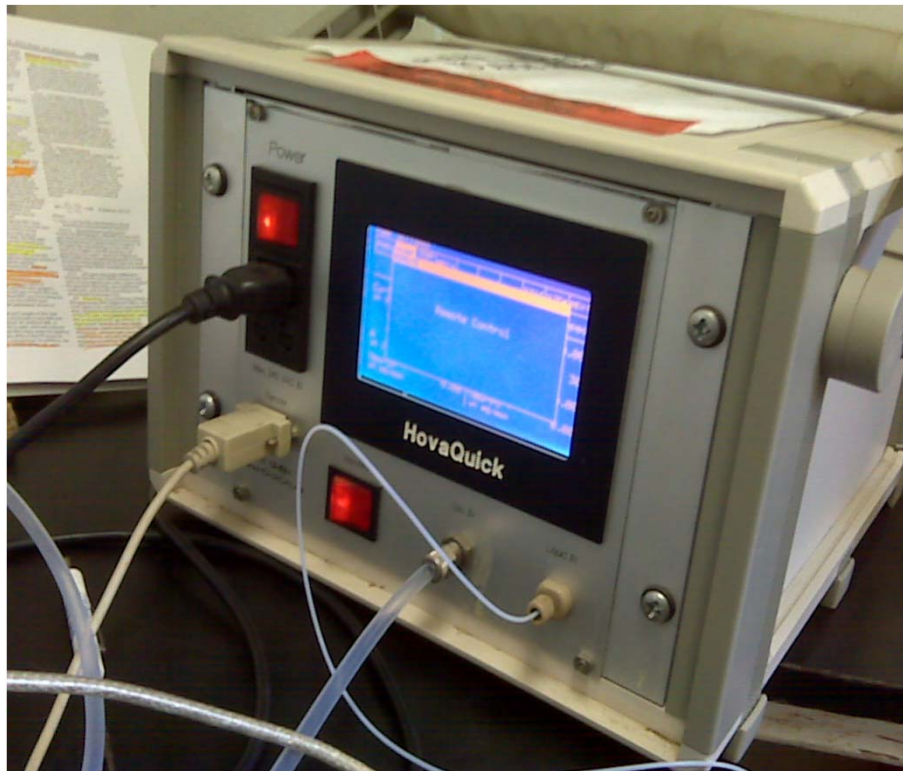
IRM-915 Analyzer



Test Per PS-12A

- **Measurement Error Test:** 3 reference gas concentration levels run 3 times each for Hg^0 (max error 5%) and Hg^{2+} (max error 10%)
- **Calibration Drift Test:** 7 day test run at two levels (max error 5%)
- **RATA:** Method 30B, 9 runs (max error 20%)
- **Ongoing QA/QC:** Daily Calibrations & Weekly System Integrity Checks.

Calibration Equipment



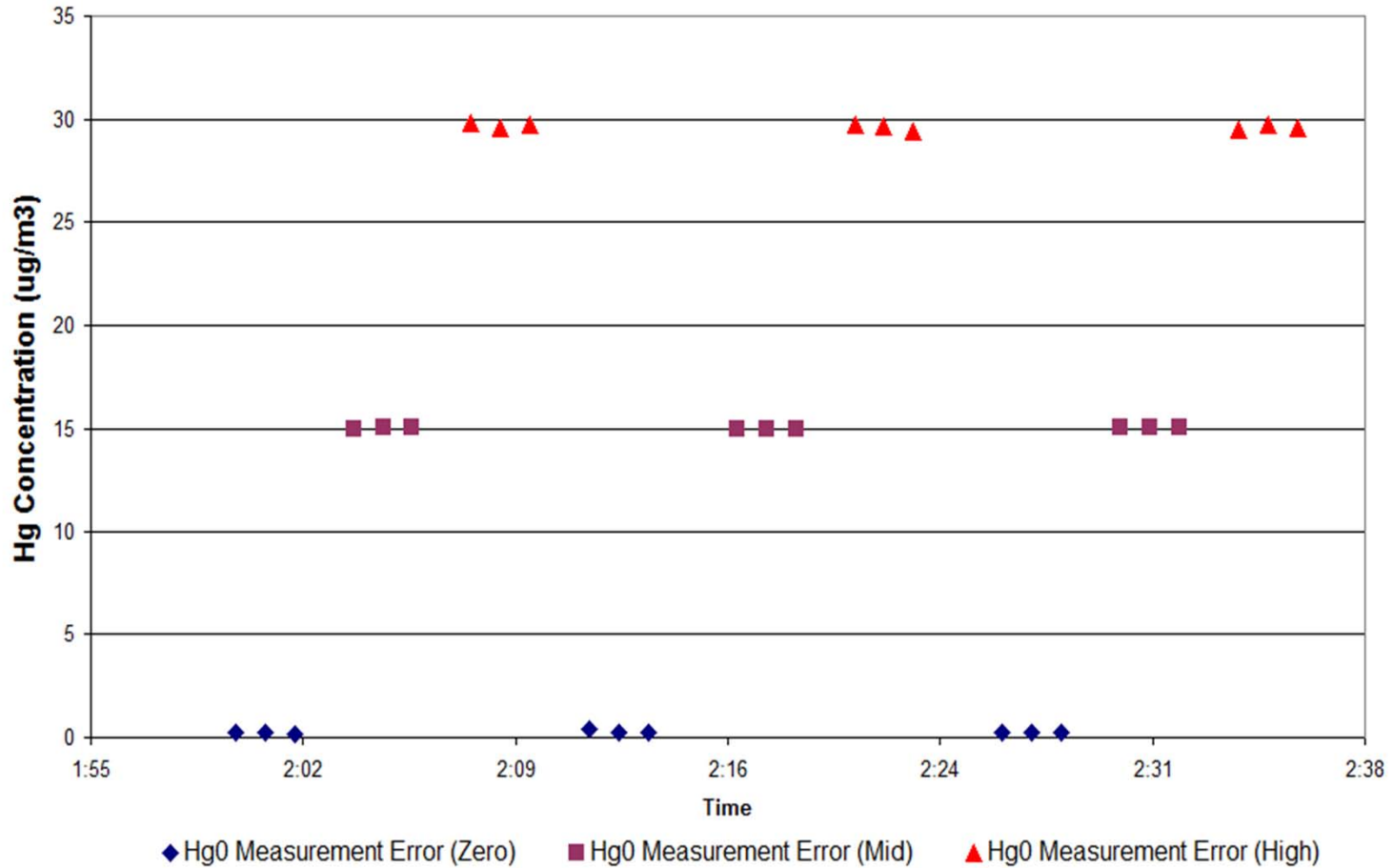
Hg⁰ Measurement Error Test

10/27/2010

		Reference Value ($\mu\text{g}/\text{m}^3$)	Analyzer Response ($\mu\text{g}/\text{m}^3$)	Measurement Error (R-A)/S	PASS / FAIL	
Gas Level	Zero	Run 1	0.0	0.2	0.7%	PASS
		Run 2	0.0	0.2		
		Run 3	0.0	0.2		
		Avg	0.0	0.2		
	Mid	Run 1	15.0	15.1	0.2%	PASS
		Run 2	15.0	15.0		
		Run 3	15.0	15.1		
		Avg	15.0	15.1		
	High	Run 1	30.0	29.7	1.3%	PASS
		Run 2	30.0	29.6		
		Run 3	30.0	29.6		
		Avg	30.0	29.6		

Hg⁰ Measurement Error Test

10/27/2010



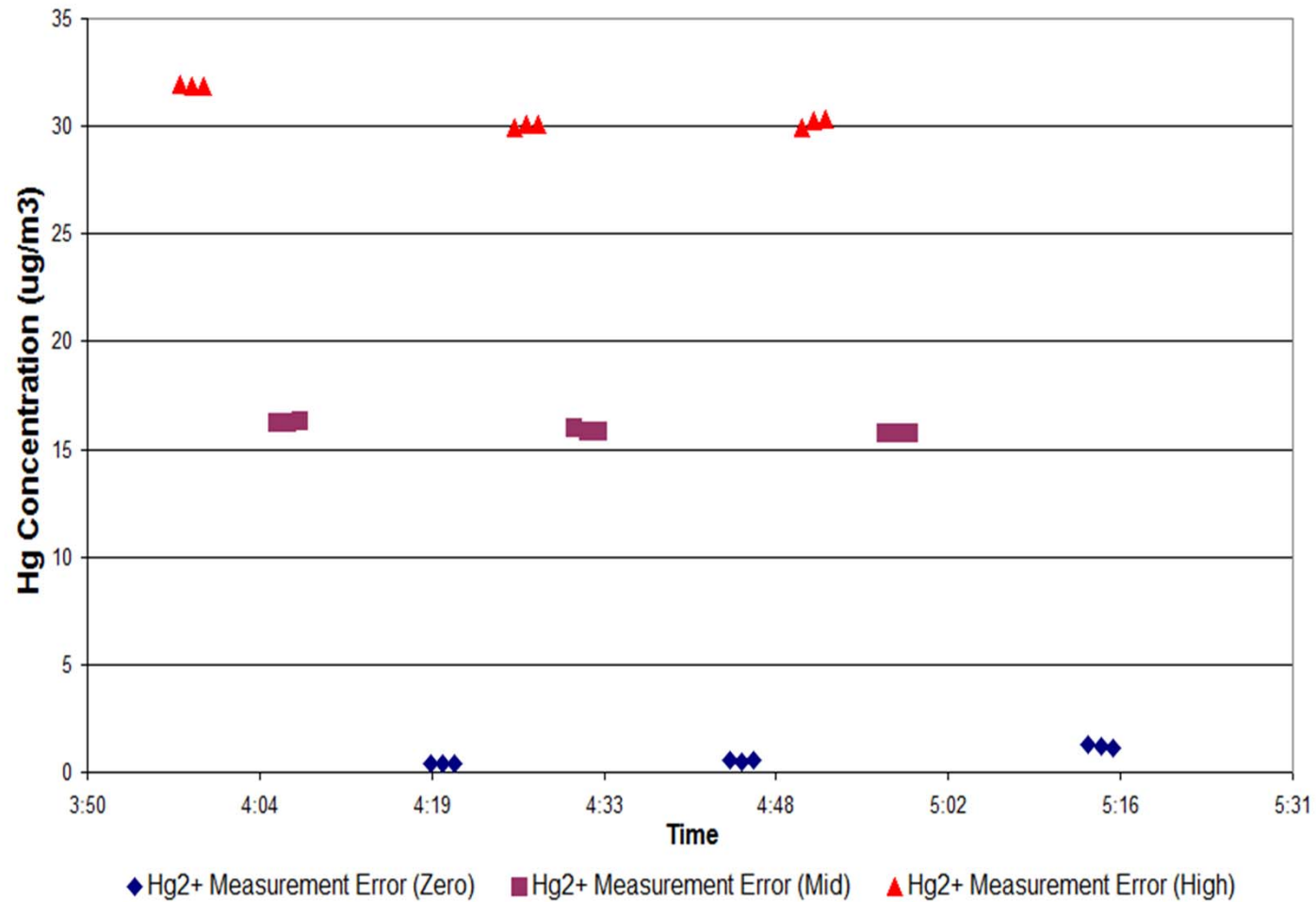
Hg²⁺ Measurement Error Test

10/27/2010

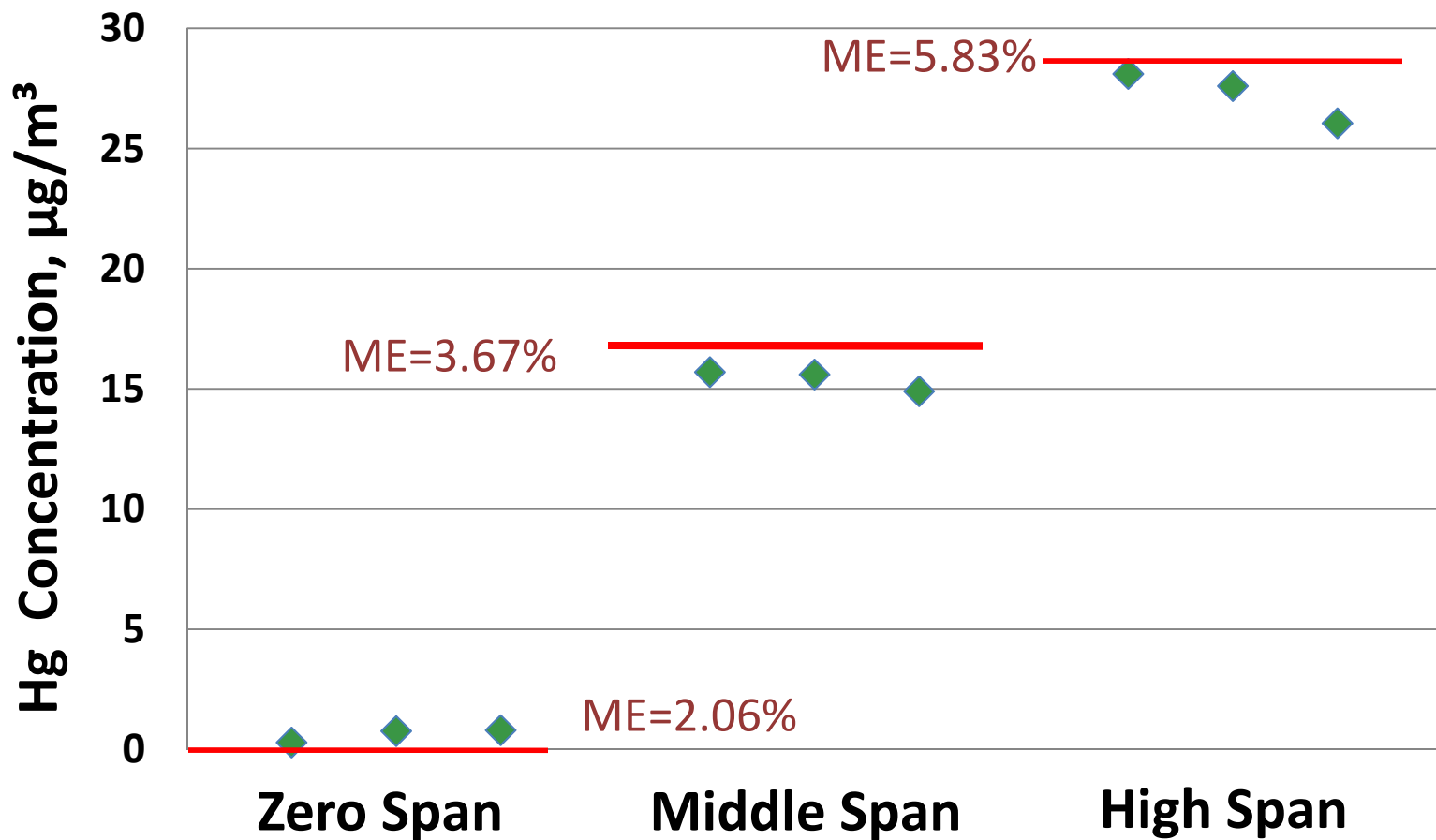
		Reference Value ($\mu\text{g}/\text{m}^3$)	Analyzer Response ($\mu\text{g}/\text{m}^3$)	Measurement Error (R-A)/S	PASS / FAIL	
Gas Level	Zero	Run 1	0.0	0.4	2.2%	PASS
		Run 2	0.0	0.4		
		Run 3	0.0	1.2		
		Avg	0.0	0.7		
	Mid	Run 1	15.5	16.2	1.3%	PASS
		Run 2	15.5	15.8		
		Run 3	15.6	15.8		
		Avg	15.5	15.9		
	High	Run 1	30.0	31.9	2.2%	PASS
		Run 2	30.0	29.9		
		Run 3	30.0	30.2		
		Avg	30.0	30.7		

Hg²⁺ Measurement Error Test

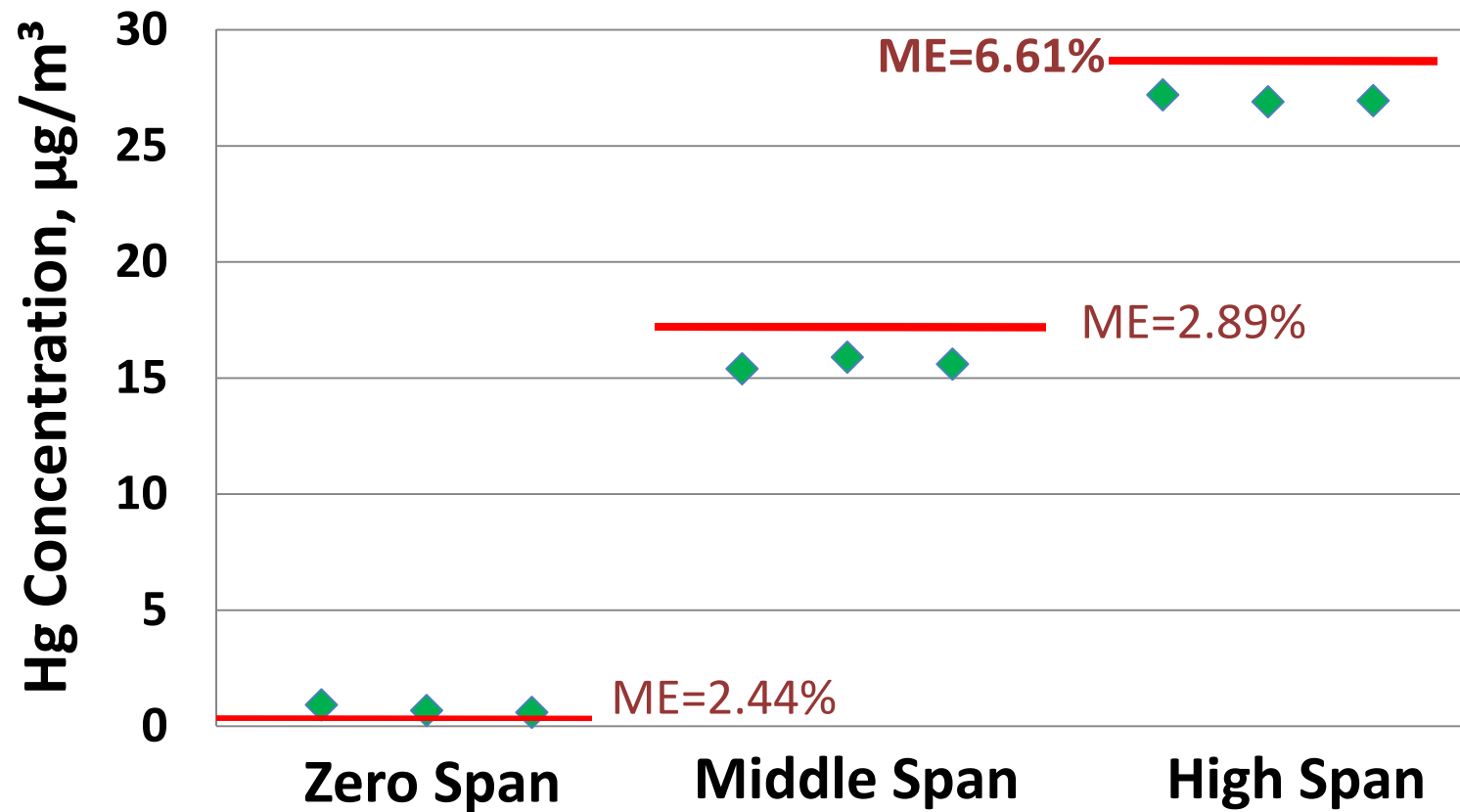
10/27/2010



Converter Integrity of 11/18/2010



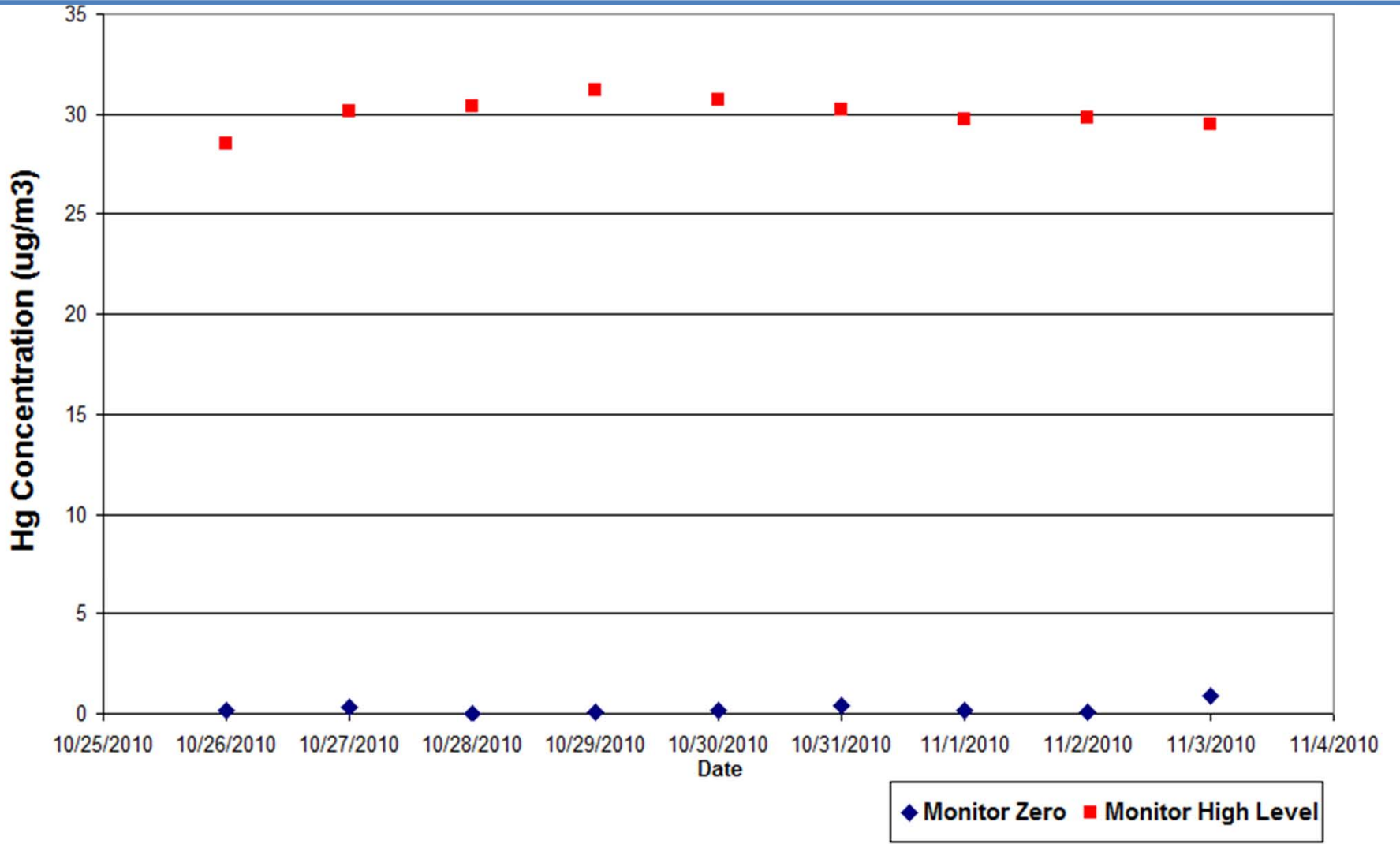
Converter Integrity of 11/30/2010



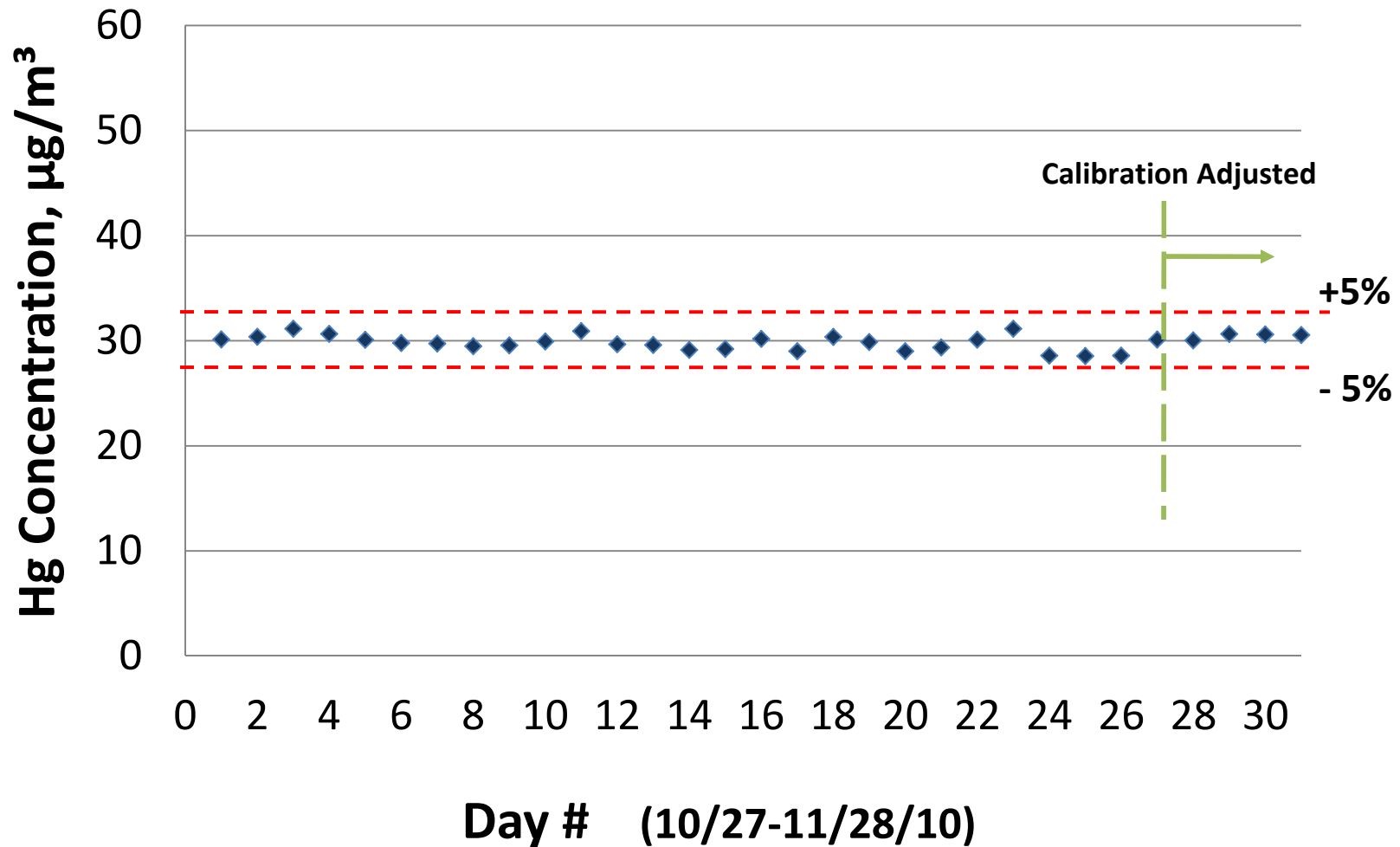
7-Day Calibration Drift Test

			Reference Value ($\mu\text{g}/\text{m}^3$)	Analyzer Response ($\mu\text{g}/\text{m}^3$)	Calibration Drift (R-A)/S	PASS / FAIL
10/26/2010	Gas Level	Zero	0.0	0.2	0.7%	PASS
		High	30.0	28.5	5.0%	PASS
10/27/2010	Gas Level	Zero	0.0	0.3	1.0%	PASS
		High	30.0	30.1	0.3%	PASS
10/28/2010	Gas Level	Zero	0.0	0.0	0.0%	PASS
		High	30.0	30.4	1.3%	PASS
10/29/2010	Gas Level	Zero	0.0	0.1	0.3%	PASS
		High	30.0	31.2	4.0%	PASS
10/30/2010	Gas Level	Zero	0.0	0.2	0.7%	PASS
		High	30.0	30.7	2.3%	PASS
10/31/2010	Gas Level	Zero	0.0	0.4	1.3%	PASS
		High	30.0	30.2	0.7%	PASS
11/1/2010	Gas Level	Zero	0.0	0.2	0.7%	PASS
		High	30.0	29.7	1.0%	PASS
11/2/2010	Gas Level	Zero	0.0	0.1	0.3%	PASS
		High	30.0	29.8	0.7%	PASS
11/3/2010	Gas Level	Zero	0.0	0.9	3.0%	PASS
		High	30.0	29.5	1.7%	PASS

Seven-Day Calibration Drift Test

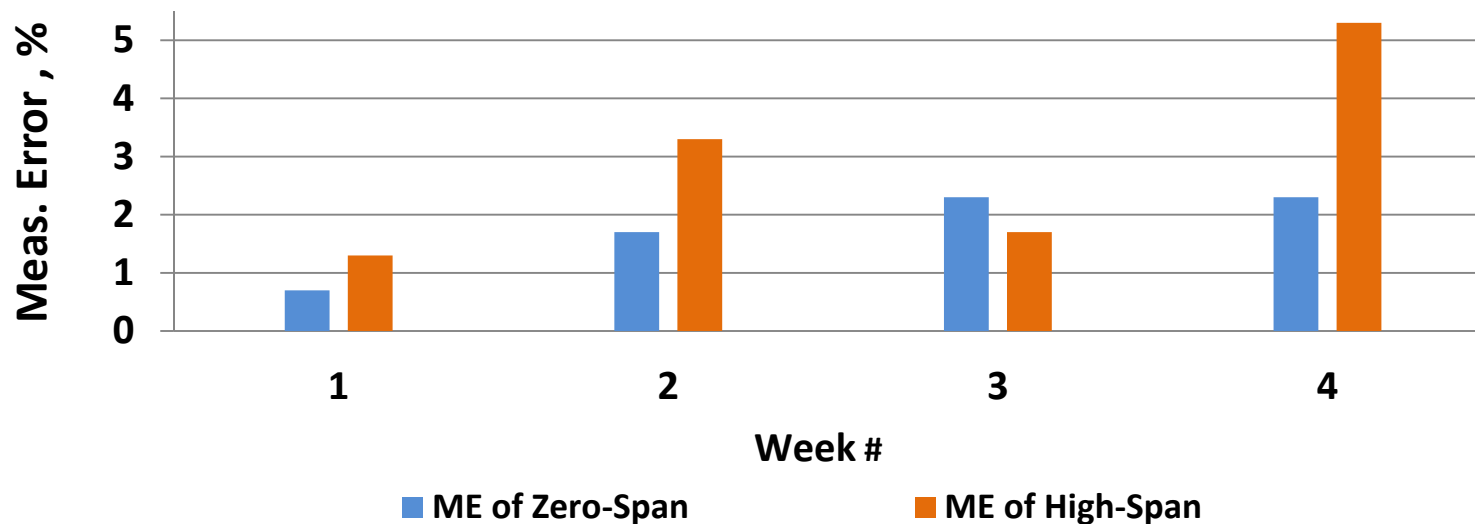


Daily Calibrations (10/27/10-11/28/10)



Weekly System Integrity Check with Hg²⁺

		Reference Value ($\mu\text{g}/\text{m}^3$)	CEMs Response ($\mu\text{g}/\text{m}^3$)	Measurement Error (R-A)/S	Pass / Fail
Week 1 10/26/10	12:40-12:50	0.0	0.2	0.7%	Pass
	12:50-13:05	30.0	29.6	1.3%	Pass
Week 2 11/6/10	12:40-12:50	0.0	0.5	1.7%	Pass
	12:50-13:05	29.5	30.5	3.3%	Pass
Week 3 11/14/10	12:00-12:26	0.0	0.7	2.3%	Pass
	12:26-12:36	30.0	29.5	1.7%	Pass
Week 4 11/21/10	12:00-12:15	0.0	0.7	2.3%	Pass
	12:13-12:33	29.6	28	5.3%	Pass



Spike Recovery Test

Train ID	Hg in Sec.1 ng	Hg in Sec.2 ng	Total Hg ng	Breakthrough %	Spike Mass ng	Spike Recovery R, %
1A	347.0	0.1	347.1	0.0	300.0	95.4
1B	55.0	0.5	55.5	0.9	0.0	
2A	436.0	0.9	436.9	0.2	300.0	97.6
2B	132.0	0.0	132.0	0.0	0.0	
3A	537.0	0.1	537.1	0.0	300.0	103.6
3B	208.0	0.0	208.0	0.0	0.0	

Ave. Field Recovery of Spike (R) : 99.00%

* Tested on 11/18/2010

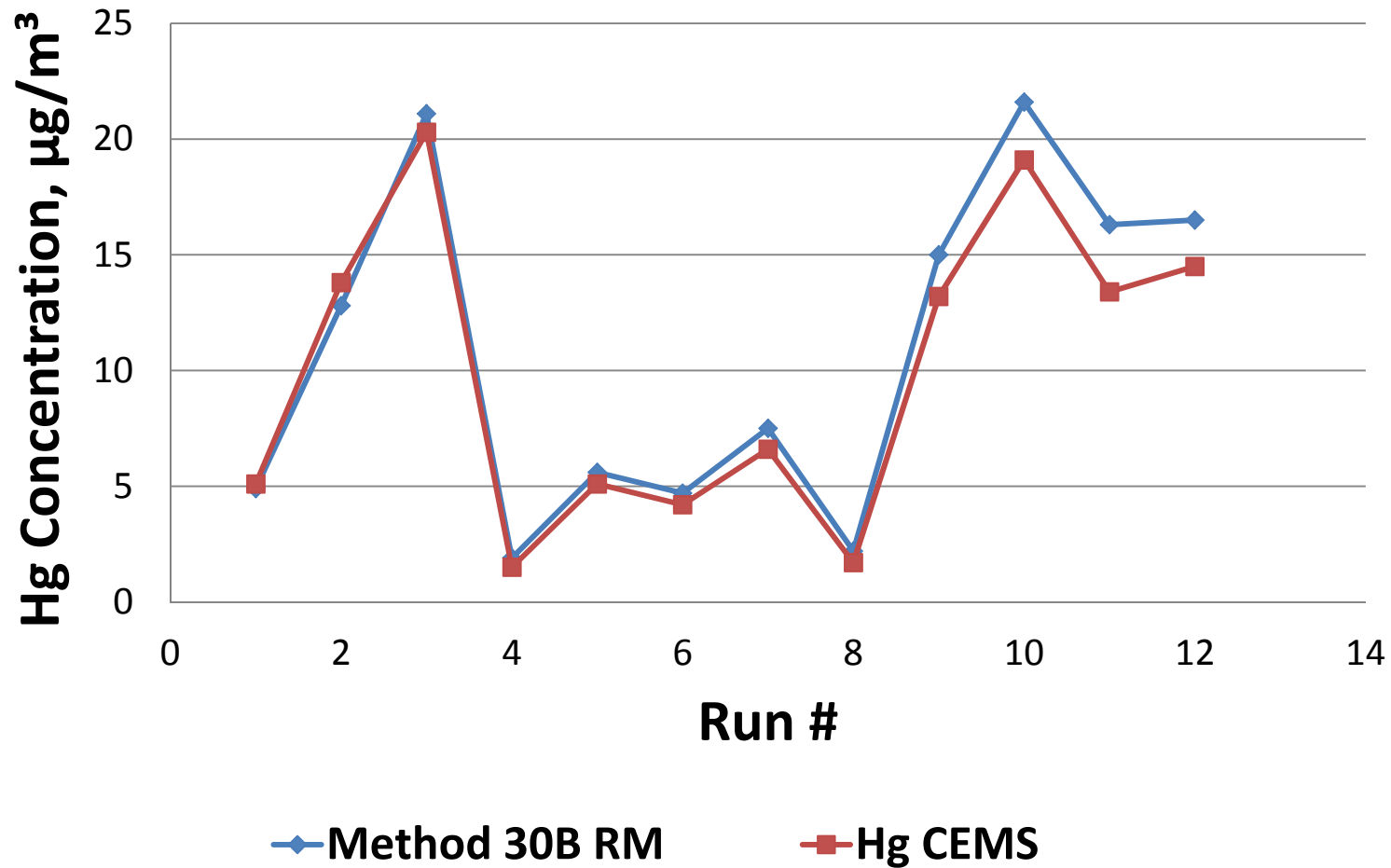
* Method 30B requires average spike recovery to be between 85-115%

Hg RATA Results Summary

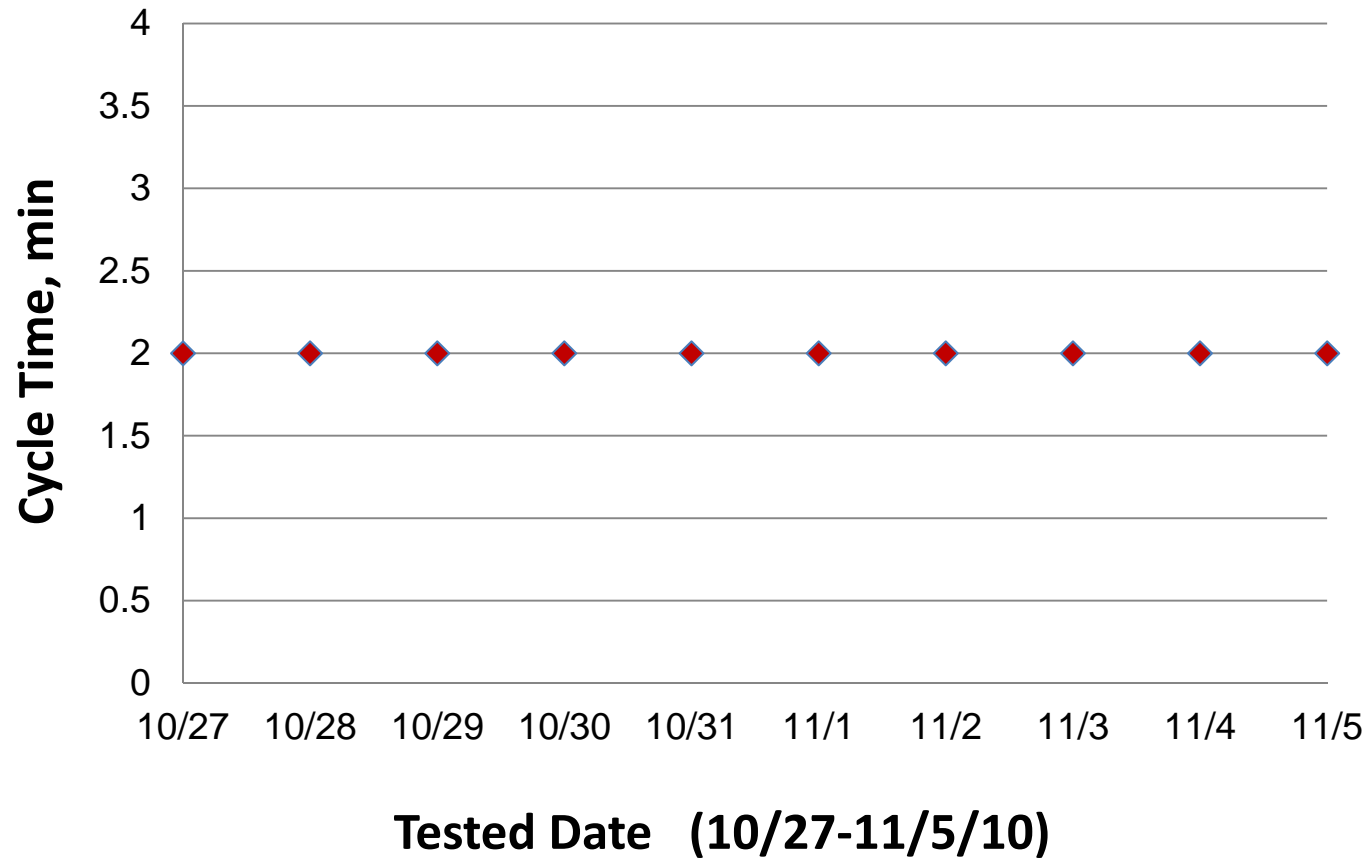
Run ID	RM Avg Concentration ($\mu\text{g}/\text{m}^3$)	Hg CEMS IRM 915 HgT Concentration ($\mu\text{g}/\text{m}^3$)	Difference ($\mu\text{g}/\text{m}^3$)
1 ^a	4.9	5.1	-0.20
2 ^a	12.8	13.8	-1.00
3 ^a	21.1	20.3	0.80
4	1.9	1.5	0.45
5	5.6	5.1	0.48
6	4.7	4.2	0.53
7	7.5	6.6	0.91
8	2.2	1.7	0.48
9	15.0	13.2	1.80
10	21.6	19.1	2.55
11	16.3	13.4	2.90
12	16.5	14.5	2.03
Mean	8.4	7.9	0.47

Relative Accuracy **12.6%**

RATA Results Summary



System Rise/Fall (Cycle Time) Test



* Average system cycle time is **2 minutes** based on 10-days system rise time test.

Tests Summary



Daily Calibration



Weekly Integrity Test



CD Test
(7-Day Calibration Drift Test)



Hg⁰ ME Test
(Measurement Error Test)



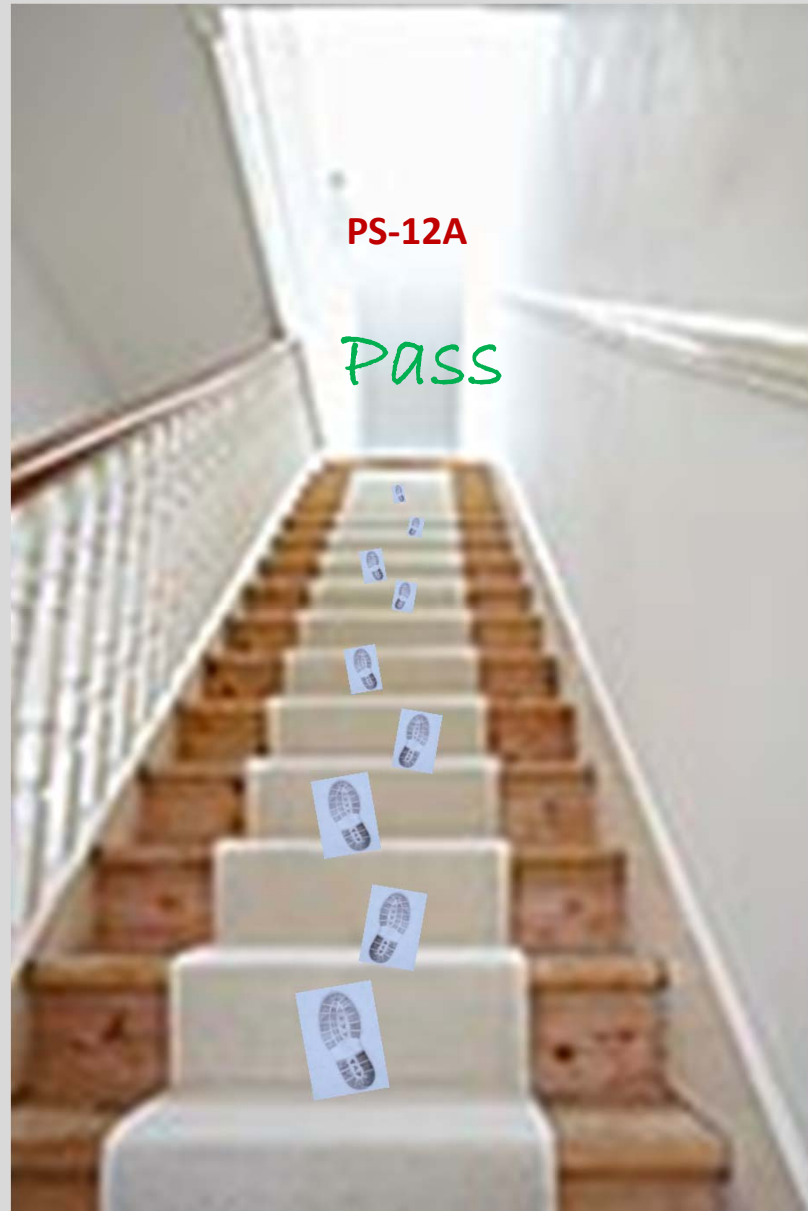
Hg²⁺ ME Test
(Measurement Error Test)



RA Test
(Relative Accuracy Test)



System Rise/Fall Test

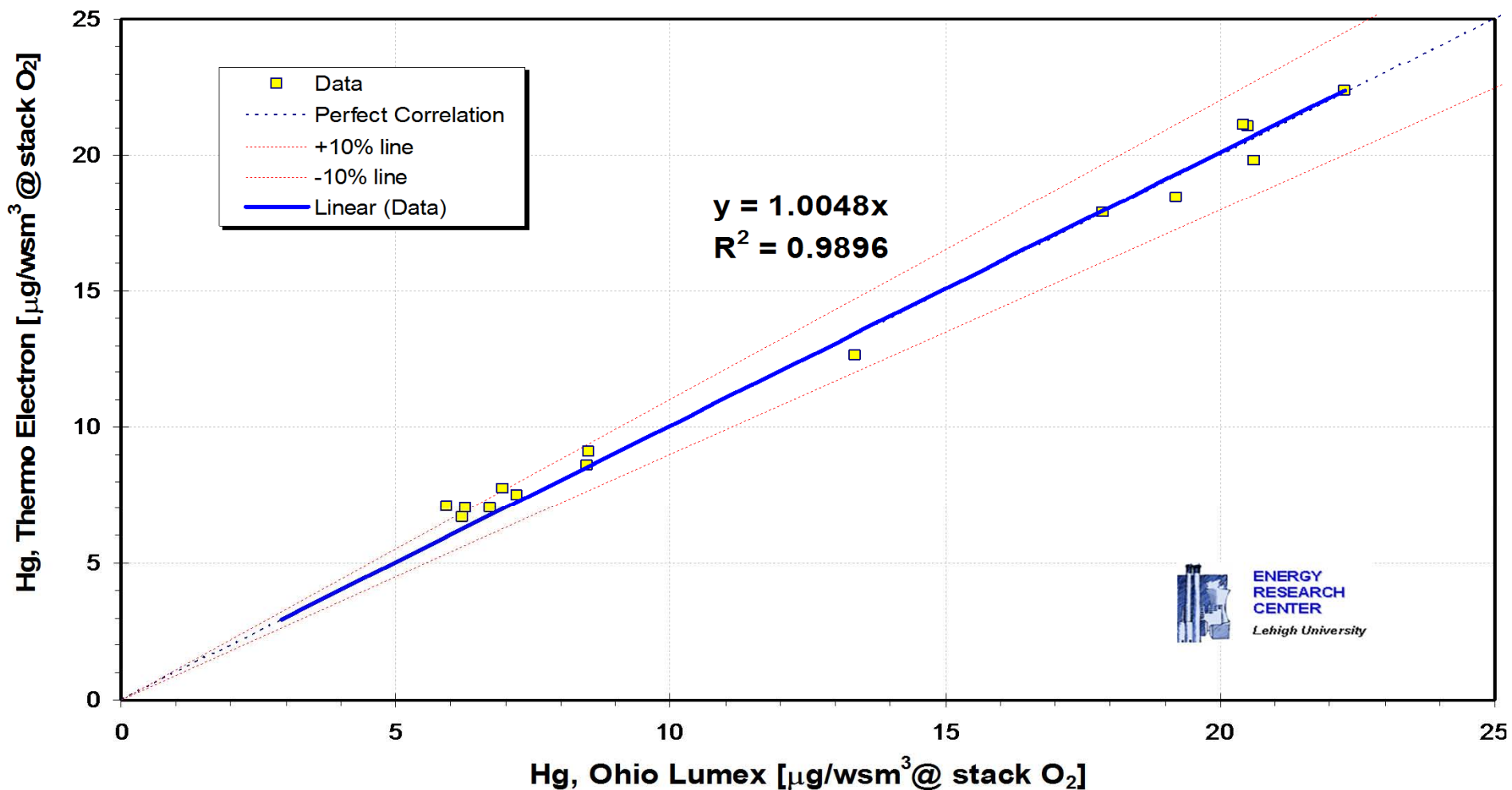


Analyzer at the stack platform



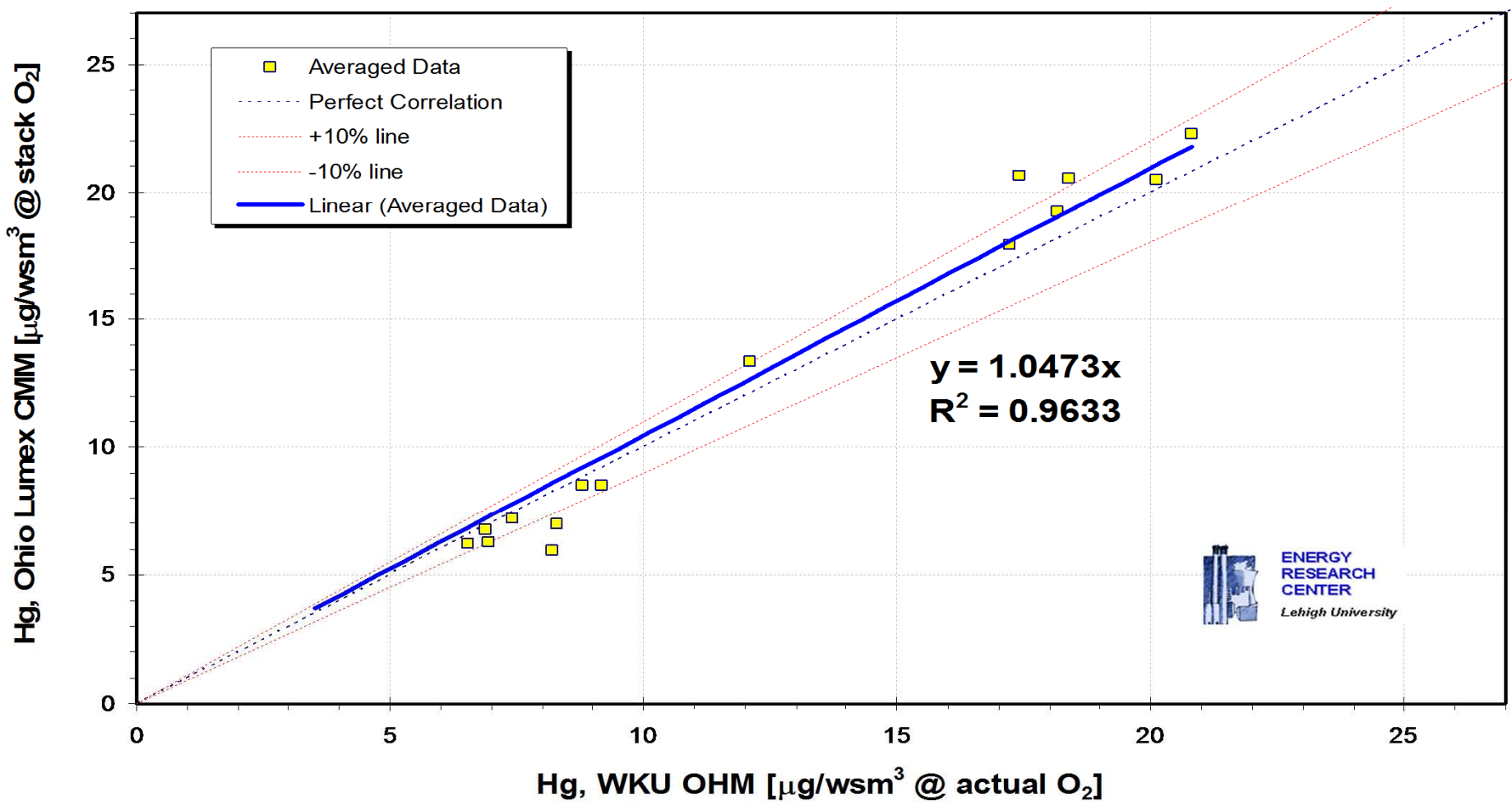
Armstrong Unit 2: Thermo CMM vs. OhioLumex IRM 915

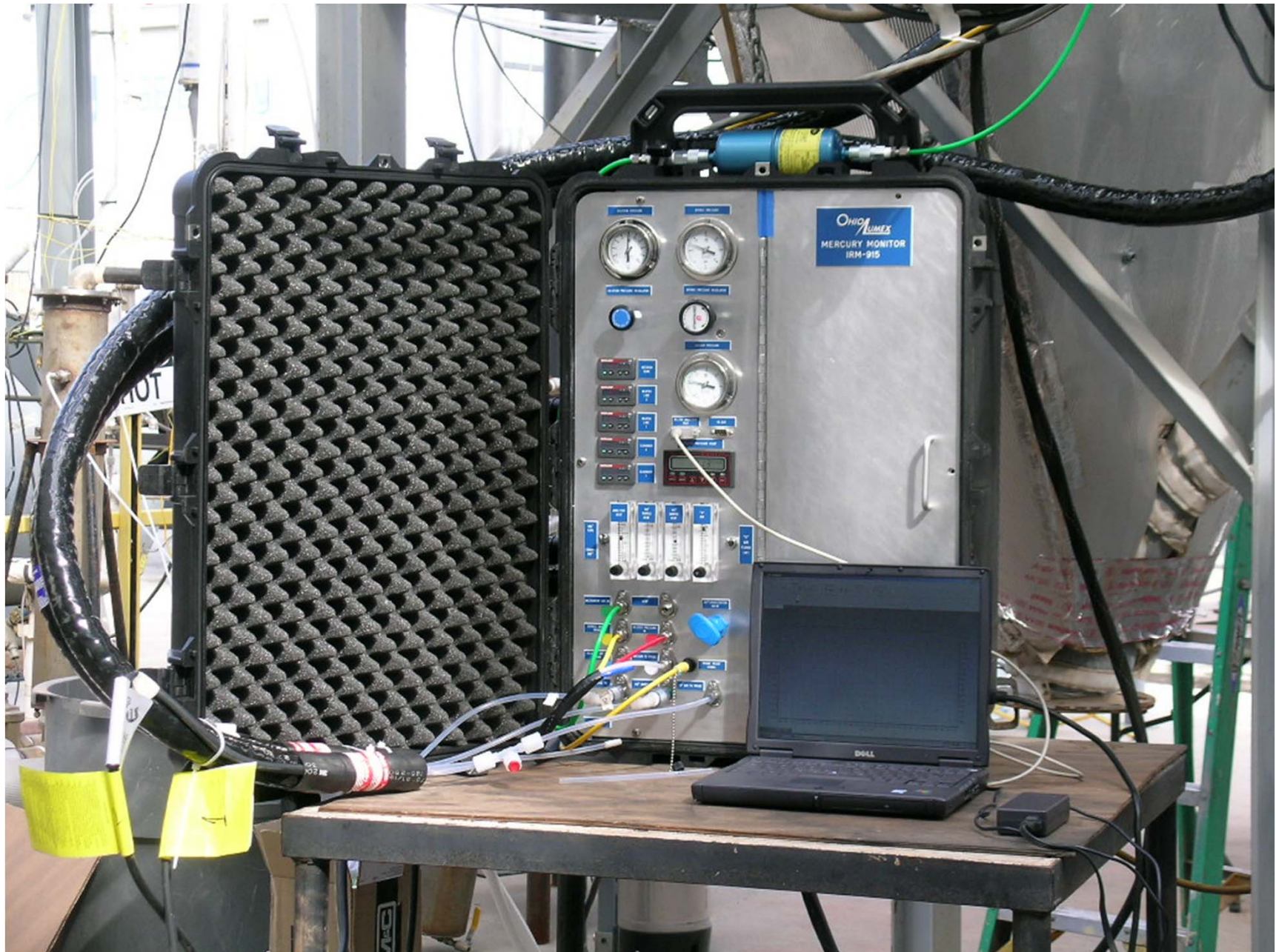
Armstrong Unit 2: Thermo Electron CMM vs. Ohio Lumex IRM915



Armstrong Unit 2: OhioLumex IRM 915 vs. WKU Ontario Hydro

Armstrong Unit 2: Ohio Lumex CMM vs. WKU OHM







Probe/Converter



Probe



Results & Conclusions

- All PS-12A Testing Requirements and QA were completed and passed using the Ohio Lumex IRM-915 Portable Monitor.
- A highly mobile, real time monitoring system, can be used to obtain accurate mercury data in difficult sampling areas and sources with high fluctuation of Hg concentration.

Proven Applications for IRM 915

- **Inlet / Outlet Hg speciating measurements.**
- **Hg Control Performance Verifications.**
- **Optimization of Sorbent Injection Rate.**
- **Demonstration of mercury removal.**
- **Scrubber/ Bag house optimization for mercury removal.**

OHIO LUMEX

www.OhioLumex.com

IRM-915 REAL TIME HG CEMS

***FOR MORE INFORMATION PLEASE
CALL OR EMAIL OHIO LUMEX AT:***

888-876-2611 OR 330-405-0837

mail@ohiolumex.com