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Assessment of Mercury Removal in a PAC System on a Pulverized Coal Boiler

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Answers That Matter.

Objectives of this Presentation

- Describe test method for mercury injection.
- Discuss the reasons why mercury injection may be desired.
- Discuss the mercury removal observed in a baghouse using brominated PAC.

Boiler with Baghouse & PAC Injection

- Pulverized coal with two pulverizers
- 210 kpph steam max (~70 kpph min)
- 243 MMBTU/hr
- Four burners
- Air to air heat exchanger
- Five module baghouse installed for 2007 BPH MACT compliance, PM and Hg
- PAC injection system installed for 2007 BPH MACT compliance, Hg

Problem Statement #1

- The mercury analyses of 18 weekly composite samples of coal showed that most, but not all, of the coal would meet the 2007 BPH MACT mercury limit of 9 lbs per trillion BTU with no treatment. Analysis required 2 – 4 weeks.
- Three weeks had high mercury levels of 9.6, 18.5, and 28.1 lbs per trillion BTU.
- The average was 7.5 lbs/trillion BTU.
- The low four weeks had mercury concentrations of 3.7, 3.7, 4.3, and 4.4 lbs per trillion BTU (4.0 average)

Problem Statement #2

- Could pass 2007 BPH MACT for Hg ~88% of the time with no controls.
- How could a PAC system be tested for acceptance from the vendor?
- How could the proper PAC injection rate be set, other than by using a rate recommended by the vendor?

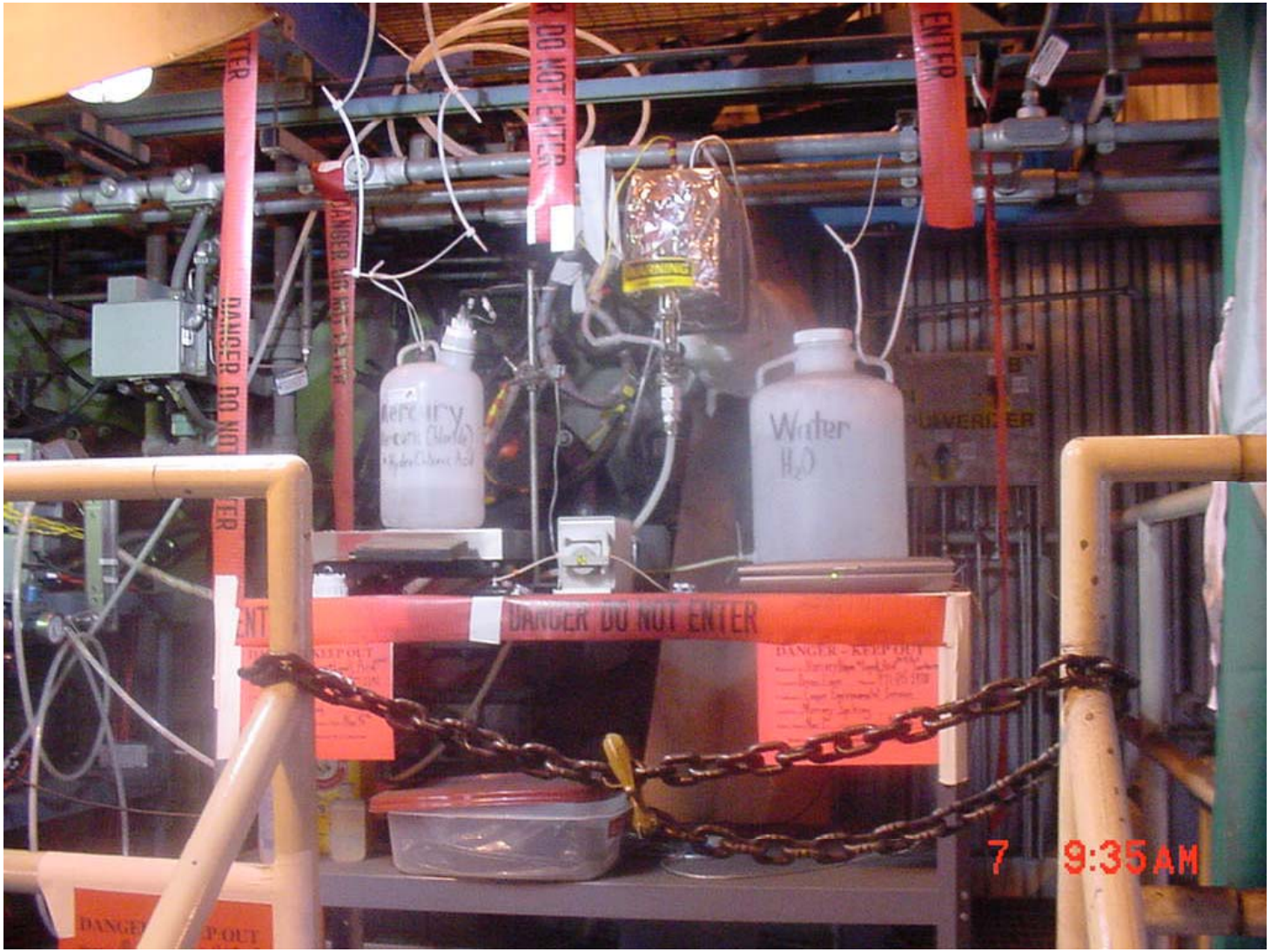
Our Answer

- Inject mercury into the coal tube carrying pulverized coal and combustion air to one of the burners.
- Control mercury injection rate by continuously monitoring the mercury leaving the boiler in the flue gas before the baghouse.
- Run tests at the maximum expected mercury concentration in coal received to demonstrate that the PAC system could comply with the BPH MACT Hg standard and to set PAC injection rate.

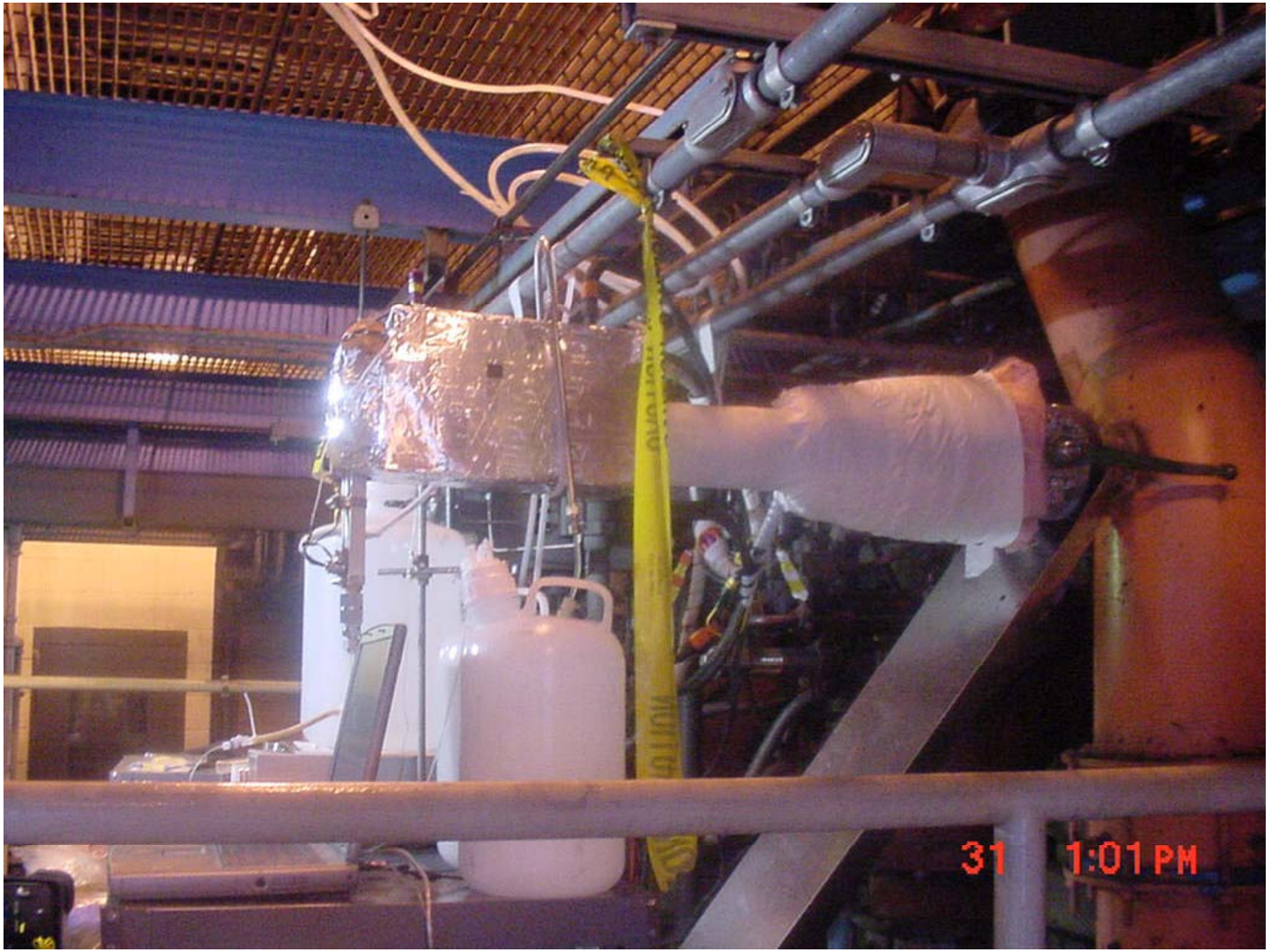
Injection Point

Lower Burner Platform

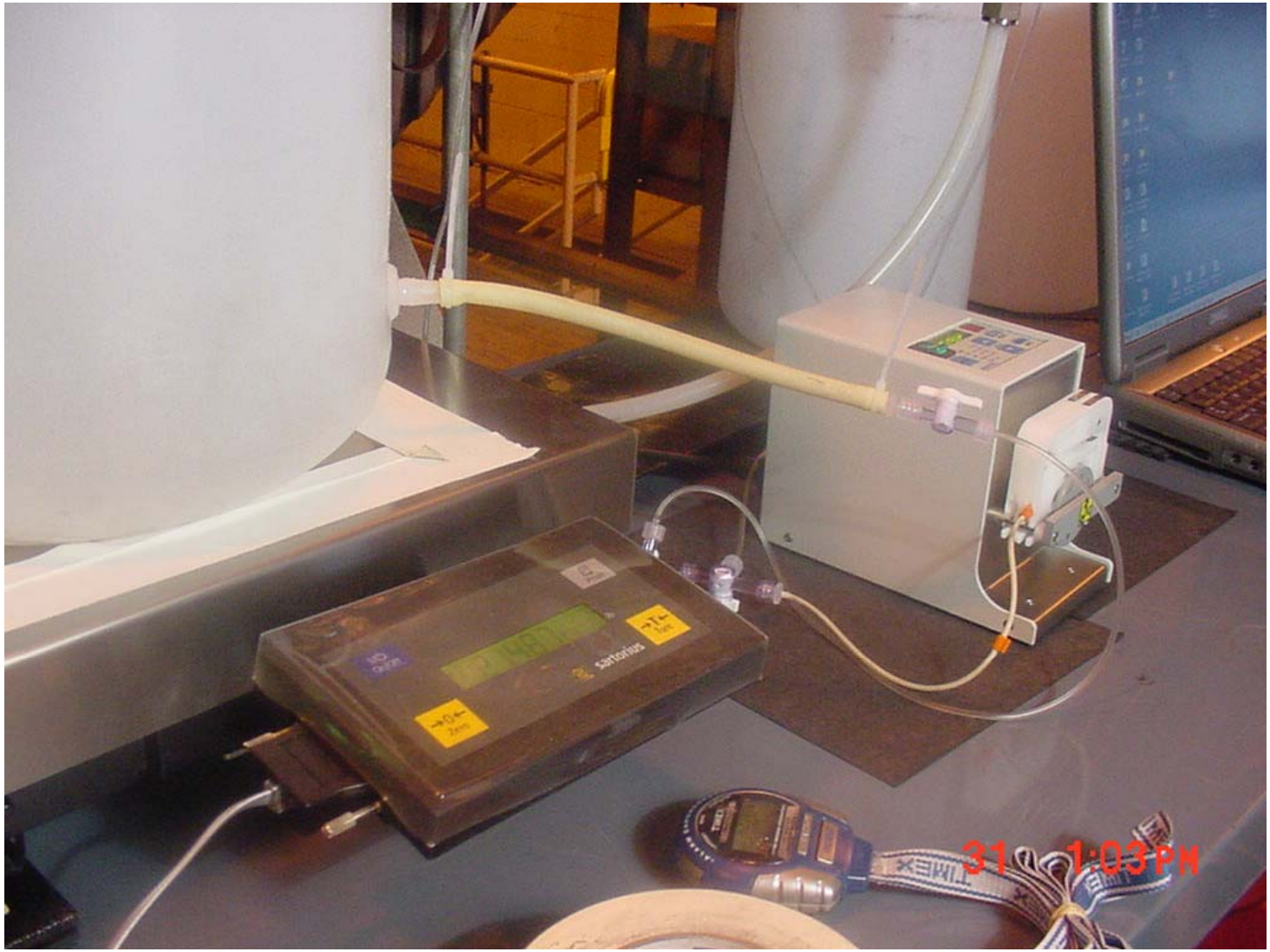
Mercury Injection



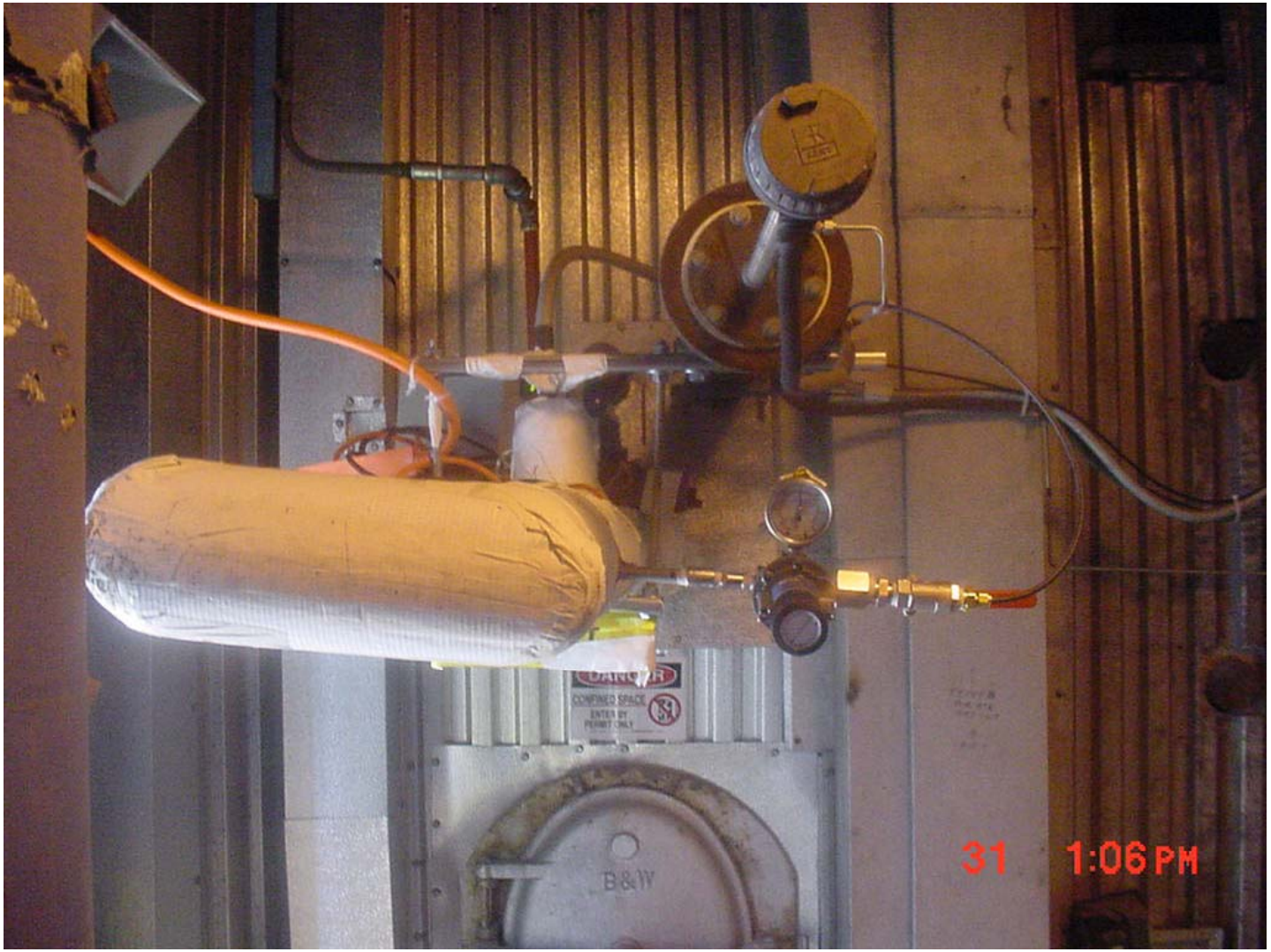
Mercury Injection



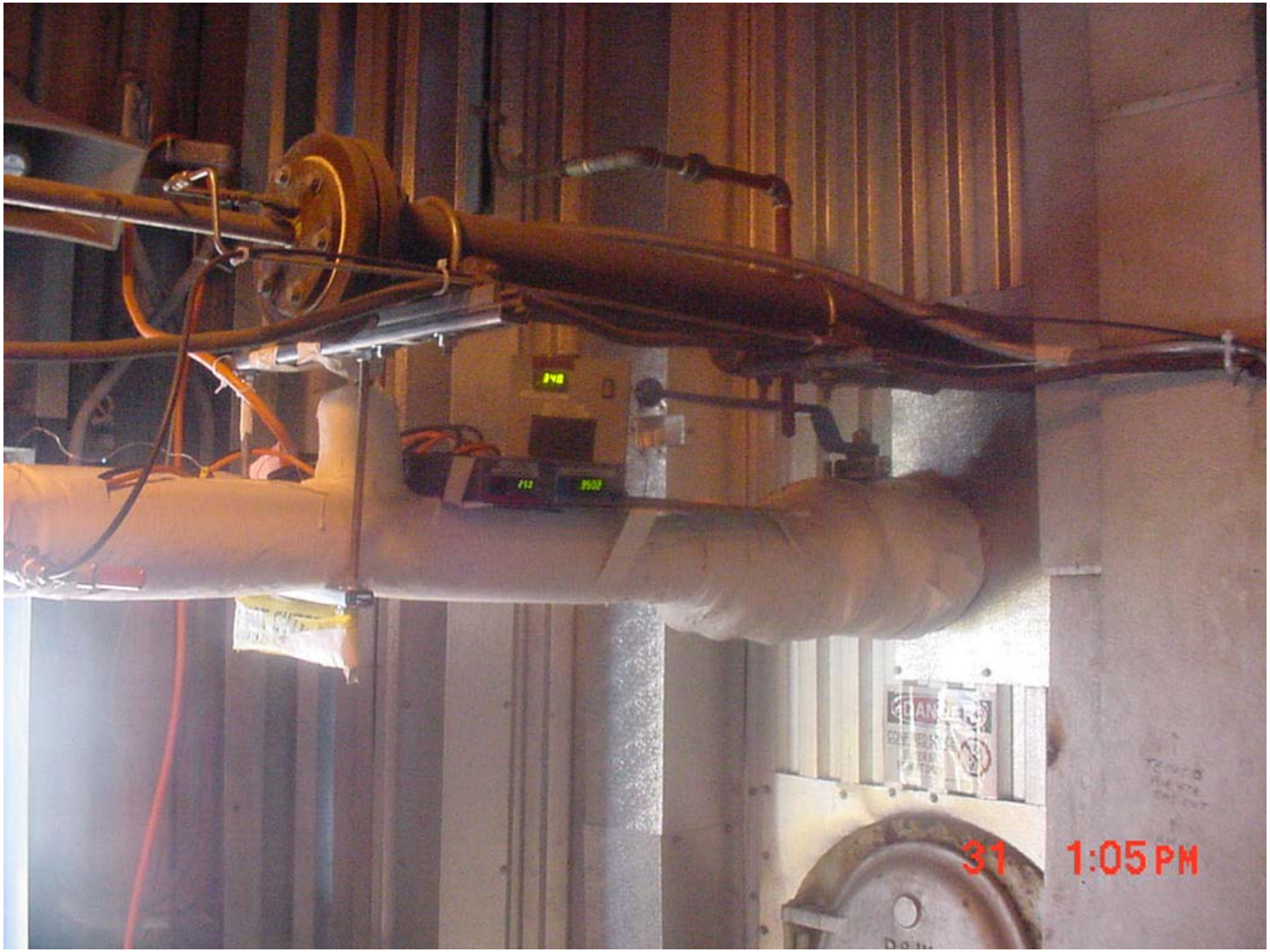
Injection Control



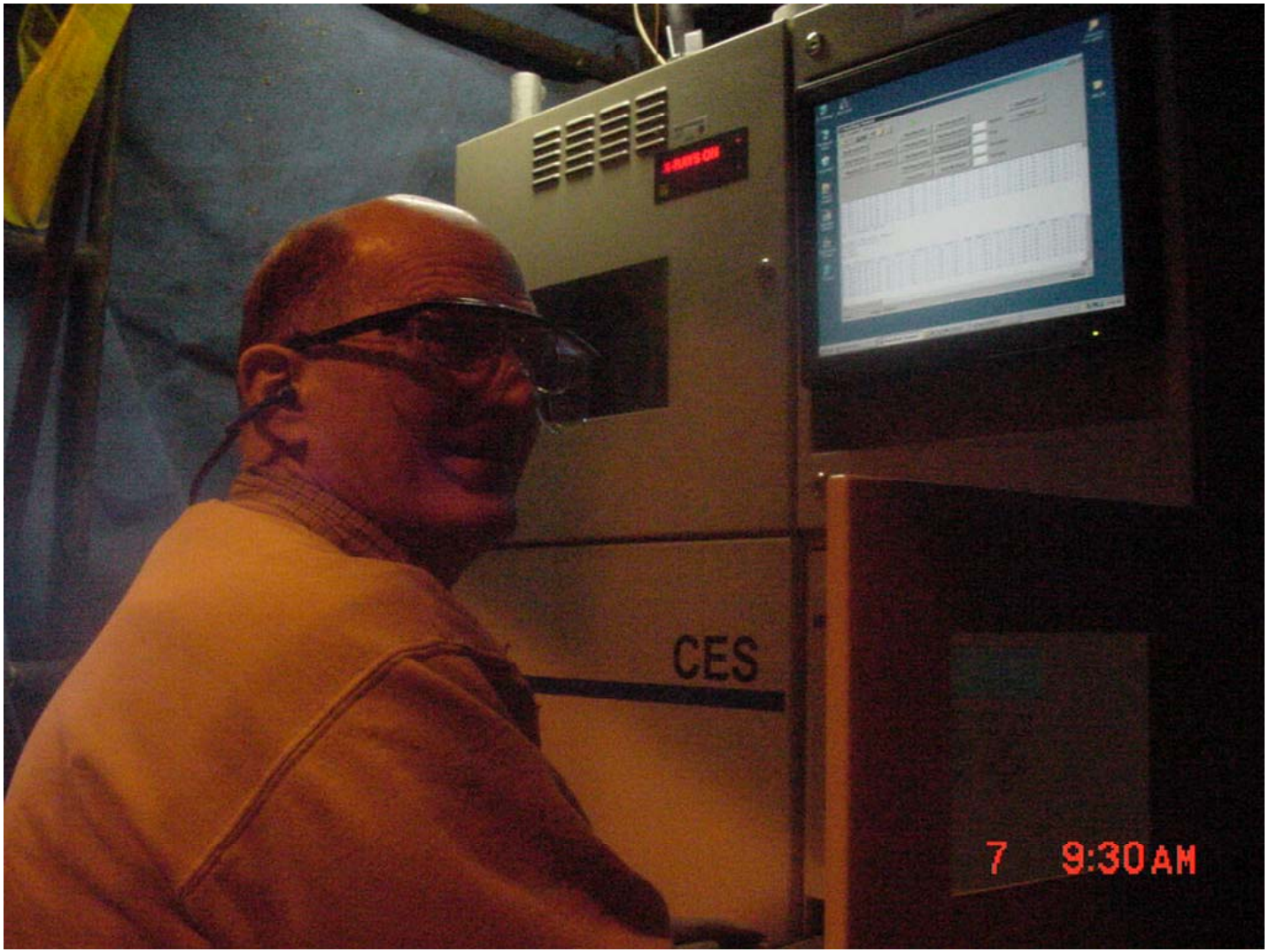
Mercury Sampling-Inertial Filter



Inertial Filter



XACT Multi-Metals Analyzer



Test Conditions

Test	PAC Injection Rate[a] ($lbs/10^6$ acf)	Inlet Mercury[a] ($lbs/10^{12}$ BTU)	Est. Boiler Firing Rate (10^6 BTU/hr)[b]
No PAC	0	19.11	231
Low PAC (50%)	2.57	17.99	225
Vendor Advised	5.21	19.68	239
High PAC (150%)	8.22	16.79	220

a. The rate is the average of three runs (four runs for High PAC test)
b. Based on Method 19.

Inlet Sampling and Monitoring

❖Method 1	Sample and Velocity Traverses of Stationary Sources
❖Method 2	Determination of Stack Gas Velocity and Volumetric Flow Rate
❖Method 3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)
❖Method 4	Determination of Moisture Content in Stack Gases
❖Method 17	Determination of Particulate Matter Emissions from Stationary Sources (High PAC test condition only)
❖Method 8	Determination of sulfuric acid mist and sulfur dioxide emissions from stationary sources
❖Method 29	Determination of metals emissions from stationary sources. (High PAC test condition only, used to verify accuracy of XACT for mercury)
❖Mercury	XACT Multi Metals Monitor

Stack Sampling

- Method 1 — Sample and Velocity Traverses of Stationary Sources
- Method 2 — Determination of Stack Gas Velocity and Volumetric Flow Rate
- Method 3 — Gas Analysis for Determination of Dry Molecular Weight
- Method 4 — Determination of Moisture Content in Stack Gases
- Method 5 — Determination of Particulate Matter Emissions from Stationary Sources (High PAC test condition only)
- Method 29 — Determination of metals emissions from stationary sources.

Mercury Removal Results

Test	PAC Rate[a] (lbs/10^6 acf)	Stack Hg (lbs/10^{12} BTU)	Removal (%)	SO_3/H_2SO_4 (ppmdv)[b]	Stack Temp. (^OF)
No PAC	0	15.74	18	4.63	283
Low PAC (50%)	2.57	6.05	66	3.67	281
Vendor Advice	5.21	1.10	94	2.47	277
High PAC (150%)	8.22	2.43	85	9.06	283

a. The rate is the average of three runs (four runs for High PAC test)
b. Method 8 was performed during each test run for Test #1 and at the start of each test day during subsequent tests.

Conclusions

- The 2007 BPH MACT mercury Standard could be met using the 50% PAC injection rate, based on the vendor recommendation of 5 lb/10^6 acf.
- The proposed BPH MACT mercury Standard will require a PAC injection rate of 5 lb/10^6 acf.
- Both conclusions are based on the maximum mercury present in the coal.
- Sulfur trioxide levels may affect the mercury removal by PAC
- No additional equipment should be required.