SULLIVAN, MOUNTJOY, STAINBACK & MILLER PSC
ATTORNEYS AT LAW

Ronald M. Sullivan
Jesse T. Mountjoy
Frank Stainback
James M. Miller
Michael A. Fiorella
Allen W. Holbrook
R. Michael Sullivan
Bryan R. Reynolds*
Tyson A. Kamuf
Mark W. Starnes
C. Ellsworth Mountjoy

*Also Licensed in Indiana

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JUL 15 2013
PUBLIC SERVICE COMMISSION

July 12, 2013

Via Federal Express

Jeff Derouen
Executive Director
Public Service Commission
211 Sower Boulevard, P.O. Box 615
Frankfort, Kentucky 40602-0615

Re: ***In the Matter of: Application of Big Rivers Electric Corporation for Approval of its 2012 Environmental Compliance Plan, for Approval of its Amended Environmental Cost Recovery Surcharge Tariff, for Certificates of Public Convenience and Necessity, and for Authority to Establish a Regulatory Account,*** PSC Case No. 2012-00063

Dear Mr. Derouen:

Enclosed for filing on behalf of Big Rivers Electric Corporation are an original and ten copies of a report of MATS testing as required by Section 1.03 of the Stipulation and Recommendation that was approved by the Public Service Commission by order dated October 1, 2012, in the above-referenced matter. I certify that copies of this letter and the attachment were served on each of the persons shown on the attached service list by first class mail, postage prepaid.

Sincerely,

Tyson Kamuf

TAK/ej
Enclosure

cc: Robert W. Berry
Eric M. Robeson
Service List

Telephone (270) 926-4000
Telecopier (270) 683-6694

100 St. Ann Building
PO Box 727
Owensboro, Kentucky
42302-0727

www.westkylaw.com

Service List
PSC Case No. 2012-00063

Jennifer B. Hans, Esq.
Dennis G. Howard, II, Esq.
Lawrence W. Cook, Esq.
Matt James, Esq.
Assistant Attorneys General
1024 Capital Center Drive
Suite 200
Frankfort, KY 40601-8204

Michael L. Kurtz, Esq.
Kurt J. Boehm, Esq.
Boehm, Kurtz and Lowry
36 East Seventh Street, Suite 1510
Cincinnati, OH 45202

David C. Brown, Esq.
Stites & Harbison PLLC
1800 Providian Center
400 West Market Street
Louisville, KY 40202

Joe Childers, Esq.
Joe F. Childers & Associates
300 Lexington Building
201 West Short Street
Lexington, Kentucky 40507

Kristin Henry
Staff Attorney
Sierra Club
85 Second Street
San Francisco, CA 94105

Shannon Fisk
745 N. 24th St.
Philadelphia, PA 19130

Christopher Leung
Earthjustice
156 William Street
Suite 800
New York, New York 10038

Walt Drabinski
Vantage Energy Consulting LLC
24160 Overseas Highway
Cudjoe Key, Florida 33042

Chuck Buechel
10 Eagleview Lane
Fort Thomas, KY 41075

Mike Boismenu
3 Lotus Bay Estate Drive
Irving, NY 14081

Greg Starheim
President and CEO
Kenergy Corp.
P.O. Box 18
Henderson, Kentucky 42419-0024

J. Christopher Hopgood, Esq.
318 Second Street
Henderson, Kentucky 42420

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Dry Sorbent Injection and Activated Carbon Injection Testing

Big Rivers Electric Corporation

Green, Wilson and Coleman Stations

Contract Number: 4346-010

Report Date

July 12th, 2013

Author: Mitch Lund

425 Apollo Drive • Lino Lakes, MN 55014 • P(651) 780-8600 F(651) 780-4400

Table of Contents

Executive Summary

As part of PSC Order 2012-00063, Big Rivers Electric Corporation was required to conduct particulate tests on its 6 affected generating units while injecting activated carbon and hydrated lime for mercury removal.

This testing occurred during the months of March through June 2013. The successful results of these tests are summarized below:

TABLE E-1: AVERAGE RESULTS FROM GREEN, WILSON AND COLEMAN STATIONS				
Unit	**Number of Passing Paired Tests**	**Average FPM Result of Tests (lbs/MMBtu)**	**Average Hg Result of Tests (lb/TBtu)**	**Passed MATS Emission Limits for PM & Hg**
Acceptable Limits		0.030	1.20	
Green 1	6	0.0029	0.92	Yes
Green 2	5	0.0029	1.09	Yes
Wilson	6	0.0153	0.50	Yes
Coleman 1	3	0.0247	0.93	Yes
Coleman 2	3	0.0217	0.83	Yes
Coleman 3	3	0.0143	0.98	Yes

Emission testing was performed by Clean Air Engineering and Airtech. Test methods used to determine compliance were USEPA Test Method 5 for Filterable Particulate Matter (FPM) and USEPA Test Method 30B for Mercury (Hg) Emissions.

Injection equipment was provided by Nol-Tec. Reagent suppliers were ADA-CS for activated carbon and Mississippi Lime for hydrated lime.

GREEN STATION: UNIT #1

Test Overview

Project Description

Objective: Big Rivers Electric Corporation (BREC) utilized dry sorbent injection (DSI) and activated carbon injection (ACI) technology to demonstrate simultaneous compliance for both mercury and particulate matter at Green 1. The stack level compliance limits for MATS are 1.2 lbs/TBtu for total Hg and 0.030 lbs/MMBtu for FPM.

Contracted Companies: Nol-Tec supplied injection related equipment and test system design. Mississippi Lime supplied calcium hydroxide (hydrated lime). ADA-Carbon Solutions supplied powdered activated carbon.

Monday, February 18th and Tuesday, February 19th

Baseline testing of mercury (Hg) and filterable particulate matter (FPM) were performed utilizing USEPA Method 30B and USEPA Method 5, respectively. A mercury CEMS installed in the stack was used to give a real time indication of mercury emission levels. A detailed account of these methods can be found in the section of the report labeled "Test Methods" beginning on page 49.

Results from these baseline tests are shown on the following page.

Table G1-1: Green Station Unit 1
FPM Results - Baseline

Date (2013)		Feb 19
Start Time (approx.)		06:53
Stop Time (approx.)		08:07
Process Conditions		
R_P	Unit Load (MW)	252
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780
Gas Conditions		
O_2	Oxygen (dry volume %)	8.4
CO_2	Carbon dioxide (dry volume %)	10.9
T_s	Sample temperature (°F)	120
B_w	Actual water vapor in gas (% by volume)	7.5
Gas Flow Rate		
Q_a	Volumetric flow rate, actual (acfm)	851,000
Q_{std}	Volumetric flow rate, dry standard (dscfm)	702,000
FPM Results		
C_{sd}	Particulate Concentration (lb/dscf)	2.92E-07
C_{sd}	Particulate Concentration (gr/dscf)	0.00204
C_{sd}	Particulate Concentration (mg/dscm)	4.67
$E_{lb/hr}$	Particulate Rate (lb/hr)	12.3
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.00477

Table G1-2: Green Station Unit 1
Mercury Results - Baseline

				Average
Date (2013)		Feb 18	Feb 19	
Start Time (approx.)		10:02	07:16	
Stop Time (approx.)		11:02	08:16	
Process Conditions				
R_P	Unit Load (MW)	252	252	**252**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	8.5	8.4	**8.5**
T_s	Sample temperature (°F)	123	120	**121.5**
B_w	Actual water vapor in gas (% by volume)	12.8	11.8	**12.3**
Q_{std}	Volumetric flow rate, dry standard (dscfm)		702,000	**702,000**
Mercury Results - Modified EPA Method 30B				
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)		2.37	**2.37**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)		0.29	**0.29**
C_{sw}	**% Hg - Oxidized**		10.9%	**10.9%**
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	2.37	2.66	**2.52**
E_{Fd}	Rate - Fd-based (lb/TBtu)	2.44	2.71	**2.58**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)		0.0279	**0.0279**

Tuesday, March 26th- Thursday, March 28th

Simultaneous injection of lime and carbon was performed from March 26th through March 28th in order to demonstrate compliance of mercury and filterable particulate matter. Hydrated lime and powdered activated carbon were injected. Mississippi Lime supplied their FGT Hydrated Lime product and ADA-Carbon Solutions supplied ACS DEV 2012 BBB.

Hydrated Lime was injected using Nol-Tec's self erecting vertical silo and PAC was injected using Nol-Tec's stand alone bulk bag unloader. A more detailed description of the equipment and injection layout can be found in the "Equipment Description" section beginning on page 43.

Two (2) mercury samples and two (2) FPM samples were used for compliance confirmation on March 26th, March 27th, and March 28th. The results of these samples are shown on the following pages.

Table G1-3: Green Station Unit 1
FPM Results - 3/26/13

				Average
Date (2013)		Mar 26	Mar 26	
Start Time (approx.)		12:40	14:32	
Stop Time (approx.)		14:16	15:40	
Process Conditions				
R_P	Unit Load (MW)	231	231	**231**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	7.6	7.7	**7.7**
CO_2	Carbon dioxide (dry volume %)	12.3	12.5	**12.4**
T_s	Sample temperature (°F)	119	118	**119**
B_w	Actual water vapor in gas (% by volume)	11.3	11.2	**11.3**
Gas Flow Rate				
Q_a	Volumetric flow rate, actual (acfm)	848,100	845,300	**846,700**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	669,400	668,400	**668,900**
FPM Results				
C_{sd}	Particulate Concentration (gr/dscf)	0.00112	0.00078	**0.00095**
$E_{lb/hr}$	Particulate Rate (lb/hr)	6.42	4.46	**5.44**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.00245	0.00172	**0.00209**

Table G1-4: Green Station Unit 1
FPM Results - 3/27/13

				Average
Date (2013)		Mar 27	Mar 27	
Start Time (approx.)		08:48	14:32	
Stop Time (approx.)		09:55	15:40	
Process Conditions				
R_P	Unit Load (MW)	231	230	**231**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	7.6	7.6	**7.6**
CO_2	Carbon dioxide (dry volume %)	12.5	12.3	**12.4**
T_s	Sample temperature (°F)	118	118	**118**
B_w	Actual water vapor in gas (% by volume)	11.1	11.1	**11.1**
Gas Flow Rate				
Q_a	Volumetric flow rate, actual (acfm)	848,900	855,400	**852,200**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	672,100	676,900	**674,500**
FPM Results				
C_{sd}	Particulate Concentration (gr/dscf)	0.00119	0.00117	**0.00118**
$E_{lb/hr}$	Particulate Rate (lb/hr)	6.85	6.81	**6.83**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.00261	0.00258	**0.00260**

Table G1-5: Green Station Unit 1
FPM Results - 3/28/13

				Average
Date (2013)		Mar 28	Mar 28	
Start Time (approx.)		07:14	08:39	
Stop Time (approx.)		08:21	09:47	
Process Conditions				
R_P	Unit Load (MW)	230	230	**230**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	7.8	7.8	**7.8**
CO_2	Carbon dioxide (dry volume %)	12.2	12.2	**12.2**
T_s	Sample temperature (°F)	119	119	**119**
B_w	Actual water vapor in gas (% by volume)	11.3	11.6	**11.5**
Gas Flow Rate				
Q_a	Volumetric flow rate, actual (acfm)	856,200	855,100	**855,700**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	675,800	672,300	**674,100**
FPM Results				
C_{sd}	Particulate Concentration (gr/dscf)	0.00196	0.00172	**0.00184**
$E_{lb/hr}$	Particulate Rate (lb/hr)	11.4	9.91	**10.7**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.00435	0.00383	**0.00409**

Table G1-6: Green Station Unit 1
Mercury Results - 3/26/13

				Average
Date (2013)		Mar 26	Mar 26	
Start Time (approx.)		12:40	14:32	
Stop Time (approx.)		13:46	15:32	
	PAC Type	BBB	BBB	
Process Conditions				
R_P	Unit Load (MW)	231	231	**231**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	7.5	7.7	**7.6**
T_s	Sample temperature (°F)	119	118	**119**
B_w	Actual water vapor in gas (% by volume)	10.4	10.9	**10.7**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	669,400	668,400	**669,000**
Mercury Results - EPA Method 30B				
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	1.03	0.717	**0.874**
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.988	0.693	**0.841**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.0112	0.0078	**0.0095**

Table G1-7: Green Station Unit 1
Mercury Results - 3/27/13

				Average
Date (2013)		Mar 27	Mar 27	
Start Time (approx.)		08:48	10:34	
Stop Time (approx.)		09:55	11:41	
	PAC Type	BBB	BBB	
Process Conditions				
R_P	Unit Load (MW)	231	230	**231**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	7.6	7.6	**7.6**
T_s	Sample temperature (°F)	118	118	**118**
B_w	Actual water vapor in gas (% by volume)	9.5	10.2	9.9
Q_{std}	Volumetric flow rate, dry standard (dscfm)	672,100	676,900	**675,000**
Mercury Results - EPA Method 30B				
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	0.975	0.977	**0.976**
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.935	0.938	**0.937**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.0106	0.0108	**0.0107**

Table G1-8: Green Station Unit 1
Mercury Results - 3/28/13

				Average
Date (2013)		Mar 28	Mar 28	
Start Time (approx.)		07:14	08:39	
Stop Time (approx.)		08:14	09:39	
	PAC Type	BBB	BBB	
Process Conditions				
R_P	Unit Load (MW)	230	230	**230**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	7.8	7.8	**7.8**
T_s	Sample temperature (°F)	119	119	**119**
B_w	Actual water vapor in gas (% by volume)	11.3	11.6	**11.5**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	675,800	672,300	**674,000**
Mercury Results - EPA Method 30B				
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	1.11	0.890	**1.00**
E_{Fd}	Rate - Fd-based (lb/TBtu)	1.08	0.865	**0.973**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.0122	0.0097	**0.0110**

GREEN STATION: UNIT #2

Test Overview

Project Description

Objective: Big Rivers Electric Corporation (BREC) utilized dry sorbent injection (DSI) and activated carbon injection (ACI) technology to demonstrate simultaneous compliance for both mercury and particulate matter at Green 2. The stack level compliance limits for MATS are 1.2 lbs/TBtu for total Hg and 0.030 lbs/MMBtu for FPM.

Contracted Companies: Nol-Tec supplied injection related equipment and test system design. Mississippi Lime supplied calcium hydroxide (hydrated lime). ADA-Carbon Solutions supplied powdered activated carbon.

Tuesday, March 5th and Monday, March 18th

Baseline testing of mercury (Hg) and filterable particulate matter (FPM) were performed utilizing USEPA Method 30B and USEPA Method 5, respectively. A mercury CEMS installed in the stack was used to give a real time indication of mercury levels. A detailed account of these methods can be found in the section of the report labeled "Test Methods" beginning on page 49.

Results from these baseline tests are shown on the following page.

Table G2-1: Green Station Unit 2
FPM Results - Baseline

Date (2013)		Mar 18
Start Time (approx.)		14:53
Stop Time (approx.)		16:02
Process Conditions		
R_P	Unit Load (MW)	241
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780
Gas Conditions		
O_2	Oxygen (dry volume %)	8.0
CO_2	Carbon dioxide (dry volume %)	11.2
T_s	Sample temperature (°F)	124
B_w	Actual water vapor in gas (% by volume)	10.7
Gas Flow Rate		
Q_a	Volumetric flow rate, actual (acfm)	851,000
Q_{std}	Volumetric flow rate, dry standard (dscfm)	667,000
FPM Results		
C_{sd}	Particulate Concentration (lb/dscf)	2.28E-07
C_{sd}	Particulate Concentration (gr/dscf)	0.00160
C_{sd}	Particulate Concentration (mg/dscm)	3.66
$E_{lb/hr}$	Particulate Rate (lb/hr)	9.14
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.00362

Table G2-2: Green Station Unit 2
Mercury Results - Baseline

					Average
Date (2013)		Mar 5	Mar 18	Mar 18	
Start Time (approx.)		07:48	10:46	13:43	
Stop Time (approx.)		08:18	11:16	14:43	
Process Conditions					
R_P	Unit Load (MW)	238	241	241	**240**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.4	8.0	8.0	**8.1**
T_s	Sample temperature (°F)	120	125	124	**123**
B_w	Actual water vapor in gas (% by volume)	10.7	10.7	10.7	**10.7**
Q_{std}	Volumetric flow rate, dry standard (dscfm)		667,000	667,000	**667,000**
Mercury Results - Modified EPA Method 30B					
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)	2.60	2.68	3.25	**2.84**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)	<0.043	<0.035	0.104	**0.061**
C_{sw}	**% Hg - Oxidized**	0.0%	0.0%	3.1%	**1.0%**
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	2.60	2.68	3.36	**2.88**
E_{Fd}	Rate - Fd-based (lb/TBtu)	2.66	2.65	3.32	**2.87**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)		0.0277	0.0348	**0.0313**

Wednesday, March 20th and Thursday, March 21st

Simultaneous injection of lime and carbon was performed on March 20th and March 21st in order to demonstrate compliance of mercury and filterable particulate matter. Hydrated lime and powdered activated carbon were injected. Mississippi Lime supplied their FGT Hydrated Lime product and ADA-Carbon Solutions supplied ACS DEV 2012 BBB.

Hydrated Lime was injected using Nol-Tec's self erecting vertical silo and PAC was injected using Nol-Tec's stand alone bulk bag unloader. A more detailed description of the equipment and injection layout can be found in the "Equipment Description" section beginning on page 43.

A total of ten (10) samples (i.e. 5 mercury and 5 FPM) were used to demonstrate compliance at Green 2. The results of these samples are shown on the following pages.

Table G2-3: Green Station Unit 2
FPM Results - 3/20/13

					Average
Date (2013)		Mar 20	Mar 20	Mar 20	
Start Time (approx.)		11:37	13:10	14:31	
Stop Time (approx.)		12:50	14:15	15:41	
Process Conditions					
R_P	Production Rate (MW)	241	241	241	**241**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	7.8	8.9	8.0	**8.2**
CO_2	Carbon dioxide (dry volume %)	11.5	10.4	11.5	**11.1**
T_s	Sample temperature (°F)	123	123	124	**123**
B_w	Actual water vapor in gas (% by volume)	11.3	11.7	11.2	**11.4**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	846,000	848,000	846,000	**847,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	668,000	667,000	667,000	**667,000**
FPM Results					
C_{sd}	Particulate Concentration (lb/dscf)	1.58E-07	2.37E-07	1.91E-07	**1.96E-07**
C_{sd}	Particulate Concentration (gr/dscf)	0.0011	0.0017	0.0013	**0.0014**
C_{sd}	Particulate Concentration (mg/dscm)	2.54	3.79	3.07	**3.13**
$E_{lb/hr}$	Particulate Rate (lb/hr)	6.35	9.47	7.67	**7.83**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.0025	0.0040	0.0030	**0.0032**

Table G2-4: Green Station Unit 2
FPM Results - 3/21/13

				Average
Date (2013)		Mar 21	Mar 21	
Start Time (approx.)		13:13	16:23	
Stop Time (approx.)		14:23	17:29	
Process Conditions				
R_P	Production Rate (MW)	241	241	**241**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	7.6	7.6	**7.6**
CO_2	Carbon dioxide (dry volume %)	11.3	11.5	**11.4**
T_s	Sample temperature (°F)	124	122	**123**
B_w	Actual water vapor in gas (% by volume)	11.3	11.5	**11.4**
Gas Flow Rate				
Q_a	Volumetric flow rate, actual (acfm)	848,000	844,000	**846,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	666,000	668,000	**667,000**
FPM Results				
C_{sd}	Particulate Concentration (lb/dscf)	1.33E-07	1.88E-07	**1.61E-07**
C_{sd}	Particulate Concentration (gr/dscf)	0.00093	0.0013	**0.0011**
C_{sd}	Particulate Concentration (mg/dscm)	2.14	3.02	**2.58**
$E_{lb/hr}$	Particulate Rate (lb/hr)	5.34	7.55	**6.44**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.0021	0.0029	**0.0025**

Table G2-5: Green Station Unit 2
Mercury Results - 3/20/13

					Average
Date (2013)		Mar 20	Mar 20	Mar 20	
Start Time (approx.)		11:29	12:54	14:21	
Stop Time (approx.)		12:29	13:54	15:21	
	PAC Type	BBB	BBB	BBB	
Process Conditions					
R_P	Unit Load (MW)	241	241	241	**241**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	7.8	8.9	8.0	**8.2**
T_s	Sample temperature (°F)	121	122	122	**122**
B_w	Actual water vapor in gas (% by volume)	11.30	11.70	11.20	**11.4**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	668,000	667,000	667,000	**667,000**
Mercury Results - Modified EPA Method 30B					
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)	1.13	1.11	1.10	**1.11**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)	<0.043	<0.042	<0.042	**<0.042**
C_{sw}	**% Hg - Oxidized**	0.0%	0.0%	0.0%	**0.0%**
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	1.13	1.11	1.10	**1.11**
E_{Fd}	Rate - Fd-based (lb/TBtu)	1.10	1.18	1.09	**1.12**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.0117	0.0115	0.0114	**0.0115**

Table G2-6: Green Station Unit 2
Mercury Results - 3/21/13

				Average
Date (2013)		Mar 21	Mar 21	
Start Time (approx.)		13:04	16:02	
Stop Time (approx.)		14:04	17:02	
	PAC Type	BBB	BBB	
Process Conditions				
R_P	Unit Load (MW)	241	241	**241**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions[3]				
O_2	Oxygen (dry volume %)	7.6	7.6	**7.6**
T_s	Sample temperature (°F)	124	121	**122**
B_w	Actual water vapor in gas (% by volume)	11.3	11.5	**11.4**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	666,000	668,000	**667,000**
Mercury Results - Modified EPA Method 30B				
C_{sw}	**Hg^0 - Elemental** Concentration (μg/dscm)	1.20	0.984	**1.09**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (μg/dscm)	<0.042	<0.042	**<0.042**
C_{sw}	**% Hg - Oxidized**	0.0%	0.0%	**0.0%**
C_{sw}	**Hg^t - Total** Concentration (μg/dscm)	1.20	0.984	**1.09**
E_{Fd}	Rate - Fd-based (lb/TBtu)	1.16	0.944	**1.05**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.0125	0.0102	**0.0113**

WILSON GENERATING STATION

Test Overview

Project Description

Objective: Big Rivers Electric Corporation (BREC) utilized dry sorbent injection (DSI) and activated carbon injection (ACI) technology to demonstrate simultaneous compliance for both mercury and particulate matter at Wilson Station. The stack level compliance limits for MATS are 1.2 lbs/TBtu for total Hg and 0.030 lbs/MMBtu for FPM.

Contracted Companies: Nol-Tec supplied injection related equipment and test system design. Mississippi Lime supplied calcium hydroxide (hydrated lime). ADA-Carbon Solutions supplied powdered activated carbon.

Wednesday, April 3rd and Friday, April 12th

Baseline testing of mercury (Hg) and filterable particulate matter (FPM) were performed utilizing USEPA Method 30B and USEPA Method 5 , respectively. A mercury CEMS installed in the stack was used to give a real time indication of mercury levels. A detailed account of these methods can be found in the section of the report labeled "Test Methods" beginning on page 49.

Results from these baseline tests are shown on the following page.

Table W-1: Wilson Station Unit 1
FPM Results - Baseline

Date (2013)		Apr 12
Start Time (approx.)		15:17
Stop Time (approx.)		16:23
Process Conditions		
R_P	Unit Load (MW)	443
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780
Gas Conditions		
O_2	Oxygen (dry volume %)	8.0
CO_2	Carbon dioxide (dry volume %)	11.4
T_s	Sample temperature (°F)	125
B_w	Actual water vapor in gas (% by volume)	13.8
Gas Flow Rate		
Q_a	Volumetric flow rate, actual (acfm)	1,680,000
Q_{std}	Volumetric flow rate, dry standard (dscfm)	1,250,000
FPM Results		
C_{sd}	Particulate Concentration (lb/dscf)	1.34E-06
C_{sd}	Particulate Concentration (gr/dscf)	0.0094
C_{sd}	Particulate Concentration (mg/dscm)	21.4
$E_{lb/hr}$	Particulate Rate (lb/hr)	100
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.0212

Table W-2: Wilson Station Unit 1
Mercury Results - Baseline

				Average
Date (2013)		Apr 3	Apr 3	
Start Time (approx.)		15:07	16:25	
Stop Time (approx.)		16:07	17:25	
Process Conditions				
R_P	Unit Load (MW)	444	442	**443**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	8.2	8.4	**8.3**
T_s	Sample temperature (°F)	124	125	**125**
B_w	Actual water vapor in gas (% by volume)	13.2	13.6	**13.4**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	1,230,000	1,210,000	**1,220,000**
Mercury Results - Modified EPA Method 30B				
C_{sw}	**Hg^0 - Elemental** Concentration (μg/dscm)	0.182	0.206	**0.194**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (μg/dscm)	0.324	0.301	**0.313**
C_{sw}	**% Hg - Oxidized**	64.0%	59.5%	**61.7%**
C_{sw}	**Hg^t - Total** Concentration (μg/dscm)	0.505	0.501	**0.503**
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.507	0.511	**0.509**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.0093	0.0091	**0.0092**

Saturday, April 13th and Sunday, April 14th

Simultaneous injection of lime and carbon was performed on April 13th and April 14th in order to demonstrate compliance of mercury and filterable particulate matter. Hydrated lime and activated carbon were injected. Mississippi Lime supplied their FGT Hydrated Lime product and ADA-Carbon Solutions supplied ACS DEV 2012 BBB.

Hydrated Lime was injected using Wilson Station's existing hydrated lime injection system and PAC was injected using Nol-Tec's dual bulk bag unloader. A more detailed description of the equipment and injection layout can be found in the "Equipment Description" section beginning on page 43.

Three (3) Method 30B and three (3) Method 5 tests were used on both days to demonstrate compliance with MATS emission limitations. The results of these samples are shown on the following pages.

Table W-3: Wilson Station Unit 1
FPM Results - 4/13/13

					Average
Date (2013)		Apr 13	Apr 13	Apr 13	
Start Time (approx.)		08:07	11:16	15:05	
Stop Time (approx.)		10:16	13:32	17:13	
Process Conditions					
R_P	Unit Load (MW)	445	445	445	**445**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.2	8.7	8.1	**8.3**
CO_2	Carbon dioxide (dry volume %)	11.2	10.6	11.4	**11.1**
T_s	Sample temperature (°F)	124	124	125	**125**
B_w	Actual water vapor in gas (% by volume)	13.1	13.3	13.5	**13.3**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	1,670,000	1,660,000	1,670,000	**1,670,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	1,260,000	1,260,000	1,260,000	**1,260,000**
FPM Results					
C_{sd}	Particulate Concentration (lb/dscf)	5.75E-07	7.54E-07	1.39E-06	**9.05E-07**
C_{sd}	Particulate Concentration (gr/dscf)	0.00402	0.00528	0.00970	**0.00633**
C_{sd}	Particulate Concentration (mg/dscm)	9.20	12.1	22.2	**14.5**
$E_{lb/hr}$	Particulate Rate (lb/hr)	43.6	57.0	105	**68.4**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.00925	0.0126	0.0221	**0.0147**

Table W-4: Wilson Station Unit 1
FPM Results - 4/14/13

					Average
Date (2013)		Apr 14	Apr 14	Apr 14	
Start Time (approx.)		07:17	10:23	14:48	
Stop Time (approx.)		09:24	12:54	17:00	
Process Conditions					
R_P	Unit Load (MW)	445	445	445	**445**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.1	8.2	8.3	**8.2**
CO_2	Carbon dioxide (dry volume %)	11.1	10.9	11.2	**11.1**
T_s	Sample temperature (°F)	126	126	126	**126**
B_w	Actual water vapor in gas (% by volume)	13.3	13.8	14.1	**13.7**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	1,660,000	1,640,000	1,660,000	**1,650,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	1,250,000	1,220,000	1,230,000	**1,230,000**
FPM Results					
C_{sd}	Particulate Concentration (lb/dscf)	9.91E-07	1.34E-06	6.52E-07	**9.96E-07**
C_{sd}	Particulate Concentration (gr/dscf)	0.00694	0.00940	0.00456	**0.00697**
C_{sd}	Particulate Concentration (mg/dscm)	15.9	21.5	10.4	**15.9**
$E_{lb/hr}$	Particulate Rate (lb/hr)	74.1	98.7	48.2	**73.7**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.0158	0.0216	0.0106	**0.0160**

Table W-5: Wilson Station Unit 1
Mercury Results - 4/13/13

					Average
Date (2013)		Apr 13	Apr 13	Apr 13	
Start Time (approx.)		08:43	11:54	15:38	
Stop Time (approx.)		11:16	13:55	17:38	
	PAC Type	BBB	BBB	BBB	
Process Conditions					
R_P	Unit Load (MW)	445	445	445	**445**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.2	8.7	8.1	**8.3**
T_s	Sample temperature (°F)	130	129	129	**129**
B_w	Actual water vapor in gas (% by volume)	13.1	13.3	13.5	**13.3**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	1,260,000	1,260,000	1,260,000	**1,260,000**
Mercury Results - Modified EPA Method 30B					
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)	0.165	0.184	0.160	**0.170**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)	0.234	0.283	0.346	**0.288**
C_{sw}	**% Hg - Oxidized**	58.6%	60.6%	68.5%	**62.6%**
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	0.399	0.467	0.506	**0.457**
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.401	0.488	0.504	**0.465**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.00423	0.00495	0.00536	**0.00485**

Table W-6: Wilson Station Unit 1
Mercury Results - 4/14/13

					Average
Date (2013)		Apr 14	Apr 14	Apr 14	
Start Time (approx.)		07:50	10:21	15:23	
Stop Time (approx.)		09:51	12:21	17:23	
	PAC Type	BBB	BBB	BBB	
Process Conditions					
R_P	Unit Load (MW)	445	445	445	**445**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.1	8.2	8.0	**8.1**
T_s	Sample temperature (°F)	134	132	129	**132**
B_w	Actual water vapor in gas (% by volume)	13.3	13.8	13.8	**13.6**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	1,250,000	1,220,000	1,250,000	**1,240,000**
Mercury Results - Modified EPA Method 30B					
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)	0.155	0.247	0.135	**0.179**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)	0.339	0.349	0.364	**0.351**
C_{sw}	**%Hg - Oxidized**	68.7%	58.5%	73.0%	**66.7%**
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	0.494	0.596	0.499	**0.530**
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.492	0.599	0.494	**0.528**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.00519	0.00612	0.00525	**0.00552**

Coleman Generating Station

Test Overview

Project Description

Objective: Big Rivers Electric Corporation (BREC) utilized dry sorbent injection (DSI) and activated carbon injection (ACI) technology to demonstrate simultaneous compliance for both mercury and particulate matter at Coleman 1, Coleman 2 and Coleman 3. The stack level compliance limits for MATS are 1.2 lbs/TBtu for total Hg and 0.030 lbs/MMBtu for FPM.

Contracted Companies: Nol-Tec supplied injection related equipment and test system design. Mississippi Lime supplied calcium hydroxide (hydrated lime). ADA-Carbon Solutions supplied powdered activated carbon.

Baseline filterable particulate matter and baseline mercury stack runs were not performed.

Monday, April 29th, Friday, May 31st, Saturday, June 8th and Monday, June 10th, 2013

Simultaneous injection of lime and carbon was performed in order to demonstrate compliance of mercury and filterable particulate matter. Hydrated lime and activated carbon were injected. Mississippi Lime supplied their HR Hydrate product and ADA-Carbon Solutions supplied ACS DEV 2012 BBB. Each of the three units were isolated at the common stack during testing; Unit 3 testing was performed on 4/29, Unit 1 testing was performed on 5/31 and Unit 2 testing was performed on 6/8 and 6/10.

Hydrated Lime was injected using Nol-Tec System's self erecting vertical silo and PAC was injected using Nol-Tec's dual bulk bag unloader. A more detailed description of the equipment and injection layout can be found in the "Equipment Description" section beginning on page 43.

Three (3) paired Method 30B and Method 5 traps were obtained to demonstrate compliance at each isolated unit. The results of these samples are shown on the following pages.

Table C-1: Coleman Station Unit 1
FPM Results - 5/31/13

					Average
Date (2013)		May 31	May 31	May 31	
Start Time (approx.)		09:18	16:04	19:15	
Stop Time (approx.)		10:39	17:25	20:35	
Process Conditions					
R_P	Unit Load (MW)	163	163	163	**163**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.5	8.2	8.9	**8.5**
CO_2	Carbon dioxide (dry volume %)	10.4	10.9	10.1	**10.5**
T_s	Sample temperature (°F)	130	131	131	**131**
B_w	Actual water vapor in gas (% by volume)	15.6	16.0	15.9	**15.8**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	579,000	584,000	590,000	**584,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	426,000	427,000	432,000	**428,000**
FPM Results					
C_{sd}	Particulate Concentration (lb/dscf)	1.64E-06	1.35E-06	1.49E-06	**1.49E-06**
C_{sd}	Particulate Concentration (gr/dscf)	0.0114	0.00948	0.0104	**0.01045**
C_{sd}	Particulate Concentration (mg/dscm)	26.2	21.7	23.9	**23.9**
$E_{lb/hr}$	Particulate Rate (lb/hr)	41.8	34.7	38.6	**38.4**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.0270	0.0218	0.0254	**0.0247**

Table C-2: Coleman Station Unit 2
FPM Results – 6/8/13

				Average
Date (2013)		Jun 8	Jun 8	
Start Time (approx.)		16:18	20:25	
Stop Time (approx.)		17:28	21:36	
Process Conditions				
R_P	Unit Load (MW)	160	160	**160**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	8.2	7.7	**8.0**
CO_2	Carbon dioxide (dry volume %)	10.9	11.3	**11.1**
T_s	Sample temperature (°F)	129	129	**129**
B_w	Actual water vapor in gas (% by volume)	14.5	14.2	**14.3**
Gas Flow Rate				
Q_a	Volumetric flow rate, actual (acfm)	567,000	583,000	**575,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	424,000	434,000	**429,000**
FPM Results				
C_{sd}	Particulate Concentration (lb/dscf)	1.51E-06	1.87E-06	**1.69E-06**
C_{sd}	Particulate Concentration (gr/dscf)	0.0106	0.0131	**0.0118**
C_{sd}	Particulate Concentration (mg/dscm)	24.2	29.9	**27.0**
$E_{lb/hr}$	Particulate Rate (lb/hr)	38.5	48.6	**43.6**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.0243	0.0289	**0.0266**

Table C-3: Coleman Station Unit 2
FPM Results – 6/10/13

Date (2013)		Jun 10
Start Time (approx.)		14:47
Stop Time (approx.)		15:02
Process Conditions		
R_P	Unit Load (MW)	159
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780
Gas Conditions		
O_2	Oxygen (dry volume %)	7.8
CO_2	Carbon dioxide (dry volume %)	10.9
T_s	Sample temperature (°F)	130
B_w	Actual water vapor in gas (% by volume)	15.3
Gas Flow Rate		
Q_a	Volumetric flow rate, actual (acfm)	571,000
Q_{std}	Volumetric flow rate, dry standard (dscfm)	419,000
FPM Results		
C_{sd}	Particulate Concentration (lb/dscf)	7.61E-07
C_{sd}	Particulate Concentration (gr/dscf)	0.00533
C_{sd}	Particulate Concentration (mg/dscm)	12.2
$E_{lb/hr}$	Particulate Rate (lb/hr)	19.1
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.0119

Table C-4: Coleman Station Unit 3
FPM Results – 4/29/13

					Average
Date (2013)		Apr 29	Apr 29	Apr 29	
Start Time (approx.)		12:44	15:34	17:45	
Stop Time (approx.)		14:00	16:55	19:01	
Process Conditions					
R_P	Unit Load (MW)	165	165	156	**162**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	7.9	8.2	7.9	**8.0**
CO_2	Carbon dioxide (dry volume %)	11.2	10.9	11.3	**11.1**
T_s	Sample temperature (°F)	126	126	126	**126**
B_w	Actual water vapor in gas (% by volume)	13.1	13.3	13.7	**13.4**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	540,000	539,000	515,000	**531,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	415,000	414,000	394,000	**408,000**
FPM Results					
C_{sd}	Particulate Concentration (lb/dscf)	8.10E-07	8.69E-07	1.04E-06	**9.06E-07**
C_{sd}	Particulate Concentration (gr/dscf)	0.00567	0.00608	0.00726	**0.00634**
C_{sd}	Particulate Concentration (mg/dscm)	13.0	13.9	16.6	**14.5**
$E_{lb/hr}$	Particulate Rate (lb/hr)	20.2	21.6	24.5	**22.1**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.0127	0.0140	0.0163	**0.0143**

Table C-5: Coleman Station Unit 1
Mercury Results - 5/31/13

					Average
Date (2013)		May 31	May 31	May 31	
Start Time (approx.)		09:18	16:04	19:15	
Stop Time (approx.)		10:18	17:04	20:15	
	PAC Type	BBB	BBB	BBB	
Process Conditions					
R_P	Unit Load (MW)	163	163	163	**163**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	8.5	8.2	8.9	**8.5**
T_s	Sample temperature (°F)	130	131	131	**131**
B_w	Actual water vapor in gas (% by volume)	15.5	14.5	15.8	**15.3**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	426,000	433,000	432,000	**430,300**
Mercury Results - Modified EPA Method 30B					
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)	0.748	0.832	0.628	**0.736**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)	0.154	0.163	0.168	**0.162**
C_{sw}	**% Hg - Oxidized**	17.1%	16.4%	21.1%	**18.2%**
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	0.903	0.995	0.796	**0.898**
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.929	1.00	0.846	**0.925**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.00883	0.00990	0.00790	**0.00888**

Table C-6: Coleman Station Unit 2
Mercury Results - 6/8/13

				Average
Date (2013)		Jun 8	Jun 8	
Start Time (approx.)		16:35	20:43	
Stop Time (approx.)		17:35	21:43	
Process Conditions				
R_P	Unit Load (MW)	160	152	**156**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	**9,780**
Gas Conditions				
O_2	Oxygen (dry volume %)	8.2	7.7	**8.0**
T_s	Sample temperature (°F)	133	133	**133**
B_w	Actual water vapor in gas (% by volume)	14.6	15.0	**14.8**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	400,000	400,000	**400,000**
Mercury Results - Modified EPA Method 30B				
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)	0.475	0.618	**0.546**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)	0.217	0.228	**0.222**
C_{sw}	**% Hg - Oxidized**	31.3%	26.9%	**29.1%**
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	0.692	0.846	**0.769**
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.695	0.817	**0.756**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.00647	0.00833	**0.00740**

Table C-7: Coleman Station Unit 2
Mercury Results - 6/10/13

Date (2013)		Jun 10
Start Time (approx.)		15:11
Stop Time (approx.)		16:11
Process Conditions		
R_P	Unit Load (MW)	159
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780
Gas Conditions		
O_2	Oxygen (dry volume %)	7.9
T_s	Sample temperature (°F)	134
B_w	Actual water vapor in gas (% by volume)	15.3
Q_{std}	Volumetric flow rate, dry standard (dscfm)	418,600
Mercury Results - Modified EPA Method 30B		
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)	0.910
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)	0.095
C_{sw}	**% Hg - Oxidized**	9.4%
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	1.00
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.986
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.00990

Table C-8: Coleman Station Unit 3
Mercury Results - 4/29/13

					Average
Date (2013)		Apr 29	Apr 29	Apr 29	
Start Time (approx.)		12:44	15:34	17:44	
Stop Time (approx.)		13:44	16:34	18:44	
	PAC Type	BBB	BBB	BBB	
Process Conditions					
R_P	Unit Load (MW)	165	165	164	**165**
F_d	Oxygen-based F-factor (dscf/MMBtu)	9,780	9,780	9,780	**9,780**
Gas Conditions					
O_2	Oxygen (dry volume %)	7.9	8.2	7.9	**8.0**
T_s	Sample temperature (°F)	127	127	127	**127**
B_w	Actual water vapor in gas (% by volume)	13.1	13.3	13.7	**13.4**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	415,000	414,500	394,000	**407,800**
Mercury Results - Modified EPA Method 30B					
C_{sw}	**Hg^0 - Elemental** Concentration (µg/dscm)	0.829	0.783	0.714	**0.775**
C_{sw}	**Hg^{+2} - Oxidized** Concentration (µg/dscm)	0.180	0.264	0.213	**0.219**
C_{sw}	**% Hg - Oxidized**	17.9%	25.2%	23.0%	**22.0%**
C_{sw}	**Hg^t - Total** Concentration (µg/dscm)	1.01	1.05	0.927	**0.994**
E_{Fd}	Rate - Fd-based (lb/TBtu)	0.991	1.05	0.910	**0.984**
E_{Rp}	Rate - Electrical Output-based (lb/GWh)	0.00950	0.00984	0.00834	**0.00923**

Equipment Description

Green #1 and Green #2 Set Up

Unit Description

Robert D. Green Station is located near Robards, KY and has two generating units with a combined net capacity of 454 MW.

Green Unit 1 has a Babcock Wilcox boiler with a General Electric turbine generator that went commercial in 1979. It has a gross capacity of 250 MW with a net capacity of 231 MW. The B&W boiler is a balanced draft front and rear wall fired boiler with 24 B&W burners. Each wall has 12 burners arranged in a 3 column by 4 row configuration. It has four vertical spindle coal pulverizers with each pulverizer feeding six burners. The steam flow rating (MCR) is 1,930,000 lb/hr with a turbine throttle pressure of 1800 PSIG at 1005 F. The reheat design temperature is 1005 F. Green Unit 1 was supplied with an American Air Filter wet hydrated lime inhibited oxidation twin absorber spray tower flue gas desulfurization (FGD) system. The FGD system removes 96 - 98% of the inlet SO2. Also, Green 1 has a General Electric Energy and Environmental Research (GEER) coal reburn system installed.

Green Unit 2 has a Babcock Wilcox boiler with a Westinghouse turbine generator that went commercial in 1981. It has a gross capacity of 242 MW with a net capacity of 223 MW. The B&W boiler is a balanced draft front and rear wall fired boiler with 24 B&W burners. Each wall has 12 burners arranged in a 3 column by 4 row configuration. It has four vertical spindle coal pulverizers with each pulverizer feeding six burners. The steam flow rating (MCR) is 1,930,000 lb/hr with a turbine throttle pressure of 1800 PSIG at 1005 F. The reheat design temperature is 1005 F. Green Unit 2 was supplied with an American Air Filter wet hydrated lime inhibited oxidation twin absorber spray tower flue gas desulfurization (FGD) system. The FGD system removes 96 - 98% of the inlet SO2. Also, Green 2 has a General Electric Energy and Environmental Research (GEER) coal reburn system installed.

Lime Injection System Description

Material is unloaded from a PD blower truck directly into a 1,600 cu. Ft. silo. The top of the silo is fitted with filters and a vent for removing displaced air. The bottom of the silo has aeration pistons and pneumatic vibrators that are used for promoting material flow. A butterfly valve sits below the aerators that discharge into a 2-way refill system.

Below the silo rests two identical weigh hoppers that can hold up to 25 cu. Ft. of material. Each weigh hopper feeds two drop through rotary airlocks. From the airlocks, material is then metered into the pneumatic convey line.

Lime Convey/Injection Set Up

Each weigh hopper discharged material to a 4" convey line. Each line had its own 40 HP PD blower capable of generating up to 500 CFM of air. These two 4" convey lines ran from the silo (ground level, east side of Green Unit 2) to a catwalk sitting above the airheaters on the 7th floor of Unit 1.

Here, each 4" convey line was split into four (4) 2" convey hoses. These convey hoses were connected to 5' long injection lances that were installed in 4" diameter ports resting above the air preheater.

Carbon Injection System Description

The carbon was supplied in super sacks weighing 750 lbs each. The supersacks were lifted with an electric hoist to an unloading platform. Mechanical agitators are installed on this platform to assist in getting material out of the bags.

The material falls out of the bag into a confinement hopper. The bottom of the confinement hopper has aeration jets installed on it to influence material flow. Material flows out of the confinement hopper into a loss in weight feeder hopper through an air operated butterfly valve.

Once in the feeder hopper, a screw feeder controlling the injection rate feeds into a drop through rotary airlock. Both the feeder hopper and the airlock have dust filters mounted on top of them.

Carbon Convey/Injection Set Up

The discharged material fell into a 4" convey line. The material in the convey line was carried using an identical blower package as the silo unit. The 4" convey line went from the bulk bag unloader (ground floor between units 1 and 2) to the ESP inlet on the 3rd floor. From here, the line split into two (2) 3" convey lines. Each 3" convey line split to four (4) 1.5" hoses. These hoses were connected to 18' injection lances sitting at the inlet to the ESP.

Wilson Set Up

Unit Description

D. B. Wilson Station is located near Centertown, KY and has one generating unit with a net capacity of 417 MW.

Wilson Unit 1 has a Foster Wheeler boiler with a Westinghouse turbine generator that went commercial in 1986. It has a gross capacity of 440 MW with a net capacity of 417 MW. The Foster Wheeler boiler is a balanced draft front and rear wall fired boiler with 25 FW low NOx burners. Each burner row has five burners and there are three rows of burners (15 burners) on the front wall and two rows of burners (10 burners) on the rear wall. It has five vertical spindle coal pulverizers with each pulverizer feeding five burners. The steam flow rating (MCR) is 3,484,000 lb/hr with a turbine throttle pressure of 2400 PSIG at 1005 F. The reheat design temperature is 1005 F. Wilson Unit 1 has a MW Kellogg horizontal wet limestone inhibited oxidation flue gas desulfurization (FGD) system. The FGD system removes 90% of the inlet SO2. Also, it has a Babcock Borsig delta wing design selective catalytic reduction (SCR) system.

Lime Injection System Description

Material is unloaded from a PD blower truck directly into a horizontal storage bin. The bottom of the silo has aeration pistons and pneumatic vibrators that are used for promoting material flow. A butterfly valve sits below the aerators that discharge into a 2-way refill system.

Below the silo rests two identical weigh hoppers that can hold up to 25 cu. Ft. of material. Each weigh hopper feeds two drop through rotary airlocks. From the airlocks, material is then metered into the pneumatic convey line.

Lime Convey/Injection Set Up

Each weigh hopper discharged material to a 4" convey line. Each line had its own 40 HP PD blower capable of generating up to 500 CFM of air. These two 4" convey lines ran from the silo (ground level, east side of Wilson Station) to a catwalk sitting above the airheaters on the 9th floor of the Unit.

Here, each 4" convey line was split into four (4) 2" convey hoses. These convey hoses were connected to 6' long injection lances that were installed in 4" diameter ports resting above the air preheater.

Carbon Injection System Description

The carbon was supplied in super sacks weighing 750 lbs each. The supersacks were lifted with an electric hoist to an unloading platform. Mechanical agitators are installed on this platform to assist in getting material out of the bags.

The material falls out of the bag into a confinement hopper. The bottom of the confinement hopper has aeration jets installed on it to influence material flow. Material flows out of the confinement hopper into a loss in weight feeder hopper through an air operated butterfly valve.

Once in the feeder hopper, a screw feeder controlling the injection rate feeds into a drop through rotary airlock. Both the feeder hopper and the airlock have dust filters mounted on top of them.

Carbon Convey/Injection Set Up

The discharged material fell into a 4" convey line. The material in the convey line was carried using an identical blower package as the silo unit. The 4" convey line went from the bulk bag unloader (ground floor on west side of Unit) to the ESP inlet on the 3rd floor. From here, the line split into two

(2) 3" convey lines. Each 3" convey line split to four (4) 1.5" hoses. These hoses were connected to 5.5' injection lances sitting at the inlet to the ESP.

Coleman 1, 2 and 3 Set Up

Unit Description

Coleman Station is located near Hawesville, KY and has three generating units with a combined net capacity of 443 MW. All three units combine and feed a common Wheelabrator (now Siemens) wet limestone flue gas desulfurization (FGD) system. The single absorber tower with dual flow trays and 5 recycle spray headers remove 95 – 97% of the inlet SO2. The absorber has forced oxidation and produces market grade gypsum. The auxiliary power (12 MW) for the FGD is usually fed from Coleman Unit 2.

Coleman Unit 1 has a Foster Wheeler boiler with a Westinghouse turbine generator that went commercial in 1969. It has a gross capacity of 160 MW with a net capacity of 150 MW. The Foster Wheeler boiler is a positive pressure front walled fired boiler with 8 low NOx B&W burners arranged in a 4 column by 2 row configuration. It has four vertical spindle coal pulverizers with each pulverizer feeding two burners. The steam flow rating (MCR) is 1,160,000 lb/hr with a turbine throttle pressure of 1800 PSIG at 1005 F. The reheat design temperature is 1005 F. Also, Coleman Unit 1 has a MoboTec rotating over fire air (ROFA) system installed.

Coleman Unit 2 is a sister unit to Coleman Unit 1; it has a Foster Wheeler boiler with a Westinghouse turbine generator that went commercial in 1970. It has a gross capacity of 160 MW with a net capacity of 138 MW. The Foster Wheeler boiler is a positive pressure front walled fired boiler with 8 low NOx B&W burners arranged in a 4 column by 2 row configuration. It has four vertical spindle coal pulverizers with each pulverizer feeding two burners. The steam flow rating (MCR) is 1,160,000 lb/hr with a turbine throttle pressure of 1800 PSIG at 1005 F. The reheat design temperature is 1005 F. Also, Coleman Unit 2 has a General Electric over fire air (OFA) system installed.

Coleman Unit 3 has a Riley boiler with a General Electric turbine generator that went commercial in 1972. It has a gross capacity of 165 MW with a net capacity of 155 MW. The Riley boiler is a positive pressure rear wall fired boiler with 8 low NOx B&W burners arranged in a 3 x 3 x 2 array. It has two coal ball mills with each ball mill feeding four burners. The steam flow rating (MCR) is 1,160,000 lb/hr with a turbine throttle pressure of 1800 PSIG at 1005 F. The reheat design temperature is 1005 F. Also, Coleman Unit 3 has a Foster Wheeler over fire air (OFA) system installed.

Lime Injection System Description

Material is unloaded from a PD blower truck directly into a 1,600 cu. Ft. silo. The top of the silo is fitted with filters and a vent for removing displaced air. The bottom of the silo has aeration pistons and pneumatic vibrators that are used for promoting material flow. A butterfly valve sits below the aerators that discharge into a 2-way refill system.

Below the silo rests two identical weigh hoppers that can hold up to 25 cu. Ft. of material. Each weigh hopper feeds two drop through rotary airlocks. From the airlocks, material is then metered into the pneumatic convey line.

Lime Convey/Injection Set Up

The lime injection system was staged in the courtyard between Coleman Units 2 and 3.

Unit 1: A 4" diameter convey hose ran from the silo to the walkway at the air heater inlet on the 4th floor of the generating unit. An 8 way splitter was used to go to eight 1.25" diameter lance hoses. Each lance hose connected to a 1.25" diameter, 8' long injection lance that was installed vertically in the existing ports at the air heater inlet. The lances had two 4' sections to them that had to be threaded together during the installation due to limited vertical access. Two of the eight lances were installed 4' into the duct due to a plate obstruction resting below the two existing ports in the middle of the duct.

Unit 2: A 4" diameter convey hose ran from the silo to the walkway at the air heater inlet on the 4th floor of the generating unit. An 8 way splitter was used to go to eight 1.25" lance hoses. Each lance hose connected to a 1.25" diameter injection lance. Four of the eight lances were 8' long and installed horizontally in the economizer outlet. The other four lances were 4' long and installed vertically in the existing ports above the air heater inlet. These lances could not be extended to 8' due to turning vanes obstructing the installation below the air heater inlet ports.

Unit 3: A 4" diameter convey hose ran from the silo to the walkway at the air heater inlet on the 4th floor of the generating unit. An 8 way splitter was used to go to eight 1.25" lance hoses. Each lance hose connected to a 1.25" diameter injection lance. Four of the eight lances were 5.5' long and the other four were 3.5' long; all eight were installed horizontally and alternated in length when installed.

Carbon Injection System Description

The carbon was supplied in super sacks weighing 750 lbs each. The supersacks were lifted with an electric hoist to an unloading platform. Mechanical agitators are installed on this platform to assist in getting material out of the bags.

The material falls out of the bag into a confinement hopper. The bottom of the confinement hopper has aeration jets installed on it to influence material flow. Material flows out of the confinement hopper into a loss in weight feeder hopper through an air operated butterfly valve.

Once in the feeder hopper, a screw feeder controlling the injection rate feeds into a drop through rotary airlock. Both the feeder hopper and the airlock have dust filters mounted on top of them.

Carbon Convey/Injection Set Up

Unit 1/Unit 2: The discharged material fell into a 4" diameter convey line. This line split into eight 1.25" diameter hoses near the existing vertical ports on the ground floor of the unit. Each 1.25" diameter hose connected to a 5.5' long, 1.25" diameter injection lance installed vertically into the existing ports.

Unit 3: The discharged material fell into a 4" diameter convey line. This line split into eight 1.25" diameter hoses near the 6' long ports at the ESP inlet on the 3rd floor of the unit. Each 1.25" diameter hose connected to a 18' long, 1.25" diameter injection lance installed diagonally into the existing ports.

Test Methods

EPA METHOD 30B FOR MERCURY SPECIATION

Mercury measurements were made using sorbent trap technology and EPA Reference Method 30B procedures, modified for the use of speciated 5-section sorbent traps (Modified EPA 30B). In addition to the use of speciated sorbent traps, other sampling parameters, hardware, QA/QC requirements and analytical methods were revised from EPA 30B procedures and specifications. The following sections highlight the modifications to EPA 30B in order to allow speciation of the mercury flue gas constituents.

Complete procedures and requirements of EPA 30B can be found at http://www.epa.gov/ttn/emc/promgate/Meth30B.pdf

EPA Method 30B sampling procedures, modified for the use of multi-section speciation sorbent traps, were used for the sorbent trap mercury measurements. Sorbent traps were supplied by Ohio Lumex. Known volumes of flue gas were extracted from a single point and passed through mercury sorbent traps utilizing potassium chloride-coated quartz (KCl) and iodated powdered activated carbon. The KCl and the iodated activated carbon provide for speciation of gaseous oxidized and elemental mercury, respectively. All sampling was performed using simultaneous, collocated, paired sampling systems as per EPA 30B specifications.

The sorbent trap sampling system consisted of a single heated sample probe and external heated compartment capable of maintaining the sample gas in the range 200ºF -250ºF. After passing through the sorbent traps the sample gas was transferred through flexible heated Teflon sample lines and water knockout vessels and silica gel to remove flue gas moisture. After conditioning the sample gas volume for each sample system was measured using dry gas meters. The two independent sampling systems are identified as A and B.

Sample flow rate and system operating parameters were controlled and recorded during each test run. The target sample flow rate was determined based on the expected flue gas concentration and the sample duration. Typical flow rates range from 0.1 to 0.6 lpm for speciation sorbent traps. A constant flow rate was maintained (+/- 10%) for each sample run. Average sampling data was recorded every 5 minutes during each sample run.

Sorbent traps were analyzed using direct thermal desorption. Analysis was on-site by CleanAir using an Ohio Lumex Lumex RA-915+ analyzer and RP 324 detector.

1.1 Sampling System

Figure 30B-1 contains a diagram of the sampling system used for Modified EPA 30B sampling. The following sections describe key components to the system as well as modifications for mercury speciation testing.

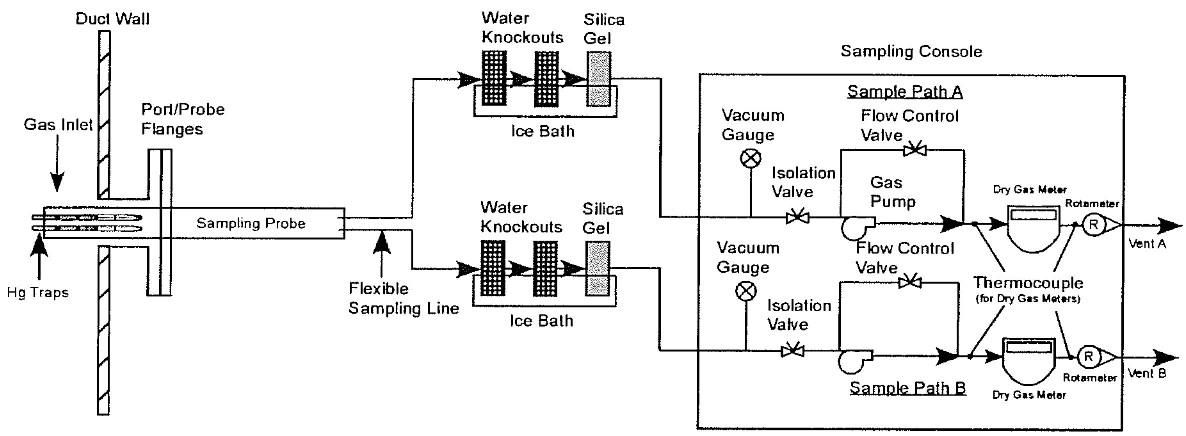

Figure 30B-1: Modified EPA 30B Sampling System

1.1.1 Speciated Sorbent Traps

EPA 30B, Section 6.1.1, includes the specification for mercury sampling using sorbent traps that contain at least two sections and are capable of capturing gaseous total vapor phase mercury. In order to speciate mercury composition, sorbent traps containing 5 sections are used. The 5 sections of speciated sorbent traps including applicable sorbent material are identified in Table 30B-1. Gas flow is through Section 1 and then each subsequent section. Each section is separated by quartz wool.

Table 30B-1:
Summary of Modified EPA 30B Speciation Sorbent Trap Construction

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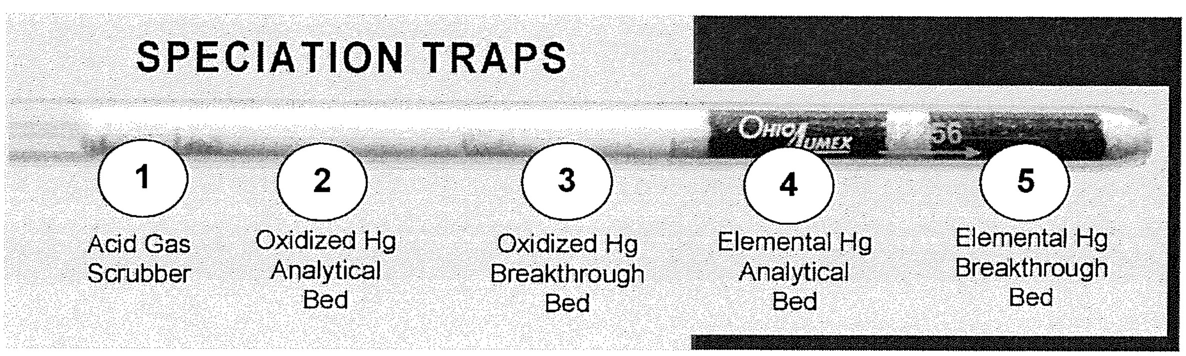
A diagram of the sorbent traps used during the test program is shown in Figure 30B-2



(photo co Ohio Lumex)

Figure 30B-2: Modified EPA 30B Speciation Sorbent Trap

1.1.2 Heated Sorbent Trap Compartment

EPA 30B requires sorbent traps to be operated in direct contact with the flue gas at a temperature sufficient to prevent moisture condensation. Due to the physical properties of the KCl sorbent material, the mercury capture mechanism and breakthrough considerations, EPA 30B procedures are modified in order to maintain the sorbent traps at approximately 200 ºF (95ºC) and no higher than 250 ºF during sampling. Due to the flue gas temperature and saturated moisture content at 125 ºF, the sample temperature was monitored and controlled by an automated control system at approximately 225 ºF for all test runs.

1.2 Sampling Procedures

Sampling was performed using EPA Method 30B procedures modified for the requirements of speciated mercury sorbent trap sampling. The operational details of the sampling procedures are shown in Table 30B-2.

Table 30B-2:
Summary of Modified EPA 30B Operational Parameters

Method	Modified EPA Method 30B (Speciation)
Analyte Measured by Method	Total vapor-phase mercury ($Hg^0 + Hg^{+2}$)
Length of Runs	30 – 120 minutes
Reference Method Traverse Points	One (1) point in one (1) port
Reference Method Time per Point	30 – 120 minutes
Reference Method Sampling Rate	0.1 - 0.5 lpm (nominal) for Mod. 30B
Number of RM Samples per Run	Two (paired samples), identified as samples A and B
Sorbent Trap Manufacturer	Ohio Lumex Inc.
Number of Sections in Sorbent Trap	5
Sorbent Material	Quartz Wool, AG Scrubber, KCL and Iodinated, activated charcoal
Sorbent Trap Tube Material	Glass
Spiked Section in Sorbent Trap	Spike section not included
Spike Level	30 (if applicable)
Sample Line Material	PTFE

Table 30B-2:
Summary of Modified EPA 30B Operational Parameters (Continued)

Method	**Modified EPA Method 30B (Speciation)**
Probe Temperature Control	225F +/- 5 ºF
Gas Dryer Device	Water knockouts immersed in ice bath followed by silica gel
Temperature of Gas Dryer Device	≤ 68ºF
Source of Moisture Measurement	Saturated vapor pressure at flue gas temperature
Frequency of Moisture Measurement	Concurrent with mercury runs – EPA Method 5 testing

1.3 EPA Method 30B Revisions

QA/QC specifications for EPA Method 30B are summarized in Table 9-1 of the method (Table 30B-3). These specifications range from hardware and sampling procedures to analytical requirements. Modification of EPA Method 30B for speciation traps is not a published reference method, but based on the technology developed by Frontier Geosciences (i.e Flue Gas Adsorbent Mercury Speciation or FAMS). The sampling approach used by CleanAir was based fundamentally on EPA Method 30B and the FAMS method with the following revisions:

1. Spike traps were used during several sampling runs throughout the test program. EPA Method 30B includes a spike comparison between at least three concurrent spiked and unspiked sorbent traps. Only sample runs that met Method 30B spike recovery QA/QC criteria were considered valid test runs.
2. Sampling was not performed isokinetically (FAMS)
3. Sorbent traps were located in-situ.
4. KCl breakthrough determination is not a requirement but was measured and evaluated.
5. Minimum sample mass requirements of 10ng were targeted and based on the total mercury collected on the sorbent trap.

1.4 EPA Method 30B QA/QC

QA/QC specifications for EPA Method 30B are summarized in Table 9-1 of the method (Table 30B-3).

Table 30B-3:
EPA Method 30B – Table 9-1 QA/QC Criteria

Table 9-1. Quality Assurance/Quality Control Criteria for Method 30B

QA/QC Test or Specification	Acceptance Criteria	Frequency	Consequences if Not Met
Gas flow meter calibration (At 3 settings or points)	Calibration factor (Y_i) at each flow rate must be within ± 2% of the average value (Y)	Prior to initial use and when post-test check is not within ± 5% of Y	Recalibrate at 3 points until the acceptance criteria are met
Gas flow meter post-test calibration check (Single-point)	Calibration factor (Y_i) must be within ± 5% of the Y value from the most recent 3-point calibration	After each field test. For mass flow meters, must be done on-site, using stack gas	Recalibrate gas flow meter at 3 points to determine a new value of Y. For mass flow meters, must be done on-site, using stack gas. Apply the new Y value to the field test data
Temperature sensor calibration	Absolute temperature measured by sensor within ± 1.5% of a reference sensor	Prior to initial use and before each test thereafter	Recalibrate; sensor may not be used until specification is met
Barometer calibration	Absolute pressure measured by instrument within ± 10 mm Hg of reading with a mercury barometer	Prior to initial use and before each test thereafter	Recalibrate; instrument may not be used until specification is met
Pre-test leak check	≤ 4% of target sampling rate	Prior to sampling	Sampling shall not commence until the leak check is passed
Post-test leak check	≤ 4% of average sampling rate	After sampling	Sample invalidated*

Table 30B-3:
EPA Method 30B – Table 9-1 QA/QC Criteria (Continued)

QA/QC Test or Specification	Acceptance Criteria	Frequency	Consequences if Not Met
Analytical matrix interference test (wet chemical analysis, only)	Establish minimum dilution (if any) needed to eliminate sorbent matrix interferences	Prior to analyzing any field samples; repeat for each type of sorbent used	Field sample results not validated
Analytical bias test	Average recovery between 90% and 110% for Hg^0 and $HgCl_2$ at each of the 2 spike concentration levels	Prior to analyzing field samples and prior to use of new sorbent media	Field samples shall not be analyzed until the percent recovery criteria has been met
Multipoint analyzer calibration	Each analyzer reading within $\pm$ 10% of true value <u>and</u> $r^2 \geq 0.99$	On the day of analysis, before analyzing any samples	Recalibrate until successful
Analysis of independent calibration standard	Within $\pm$ 10% of true value	Following daily calibration, prior to analyzing field samples	Recalibrate and repeat independent standard analysis until successful
Analysis of continuing calibration verification standard (CCVS)	Within $\pm$ 10% of true value	Following daily calibration, after analyzing ≤ 10 field samples, and at end of each set of analyses	Recalibrate and repeat independent standard analysis, reanalyze samples until successful, if possible; for destructive techniques, samples invalidated
Test run total sample volume	Within $\pm$ 20% of total volume sampled during field recovery test	Each individual sample	Sample invalidated

Table 30B-3:
EPA Method 30B – Table 9-1 QA/QC Criteria (Continued)

QA/QC Test or Specification	Acceptance Criteria	Frequency	Consequences if Not Met
Sorbent trap section 2 breakthrough	≤ 10% of section 1 Hg mass for Hg concentrations > 1 µg/dscm; ≤ 20% of section 1 Hg mass for Hg concentrations ≤ 1 µg/dscm	Every sample	Sample invalidated*
Paired sorbent trap agreement	≤ 10% Relative Deviation (RD) mass for Hg concentrations > 1 µg/dscm; ≤ 20% RD or ≤ 0.2 µg/dscm absolute difference for Hg concentrations ≤ 1 µg/dscm	Every run	Run invalidated*
Sample analysis	Within valid calibration range (within calibration curve)	All Section 1 samples where stack Hg concentration is ≥ 0.5 µg/dscm	Reanalyze at more concentrated level if possible, samples invalidated if not within calibrated range
Sample analysis	Within bounds of Hg^0 and $HgCl_2$ Analytical Bias Test	All Section 1 samples where stack Hg concentration is ≥ 0.5 µg/dscm	Expand bounds of Hg^0 and $HgCl_2$ Analytical Bias Test; if not successful, samples invalidated
Field recovery test	Average recovery between 85% and 115% for Hg^0	Once per field test	Field sample runs not validated without successful field recovery test

* And data from the pair of sorbent traps are also invalidated.

Continuous Mercury Monitoring – Hg CEMS (Ohio Lumex IRM-915)

In addition to Modified EPA 30B measurements, CleanAir used the Ohio Lumex IRM-915 Mercury Stack Monitor for the semi-continuous monitoring of total and elemental mercury. This instrument is designed for temporary installation and provides real-time continuous measurement capability.

The IRM-915 includes a dual path sample mode that allows either measurement of total vapor phase mercury or elemental mercury. Flue gas is withdrawn using a heated probe and heated filter with dilution/conversion assembly (30:1). Depending on the sample mode selected, the sample gas either passes through a high temperature convertor for measurement of total mercury, or bypasses the convertor for measurement of elemental mercury only. The probe/filter assemblies included an automated air blow-back system to prevent sample paths from becoming plugged with particulate matter. Blowback events occur for 5minutes each hour. During each blowback the zero response was checked and the data from previous hour adjusted for any analyzer drift.

The sample gas is transferred from the probe assembly to the analyzer detector through a 25' heated umbilical line. Mercury concentration is determined using Zeeman atomic absorption (AA) spectroscopy. This approach includes no pre-concentration and uses a multipath cell combined with a "dry" converter (700°C) to minimize interferences from the flue gas matrix.

A diagram of the Hg CEMS system used for testing is shown in Figure CEMS-1.

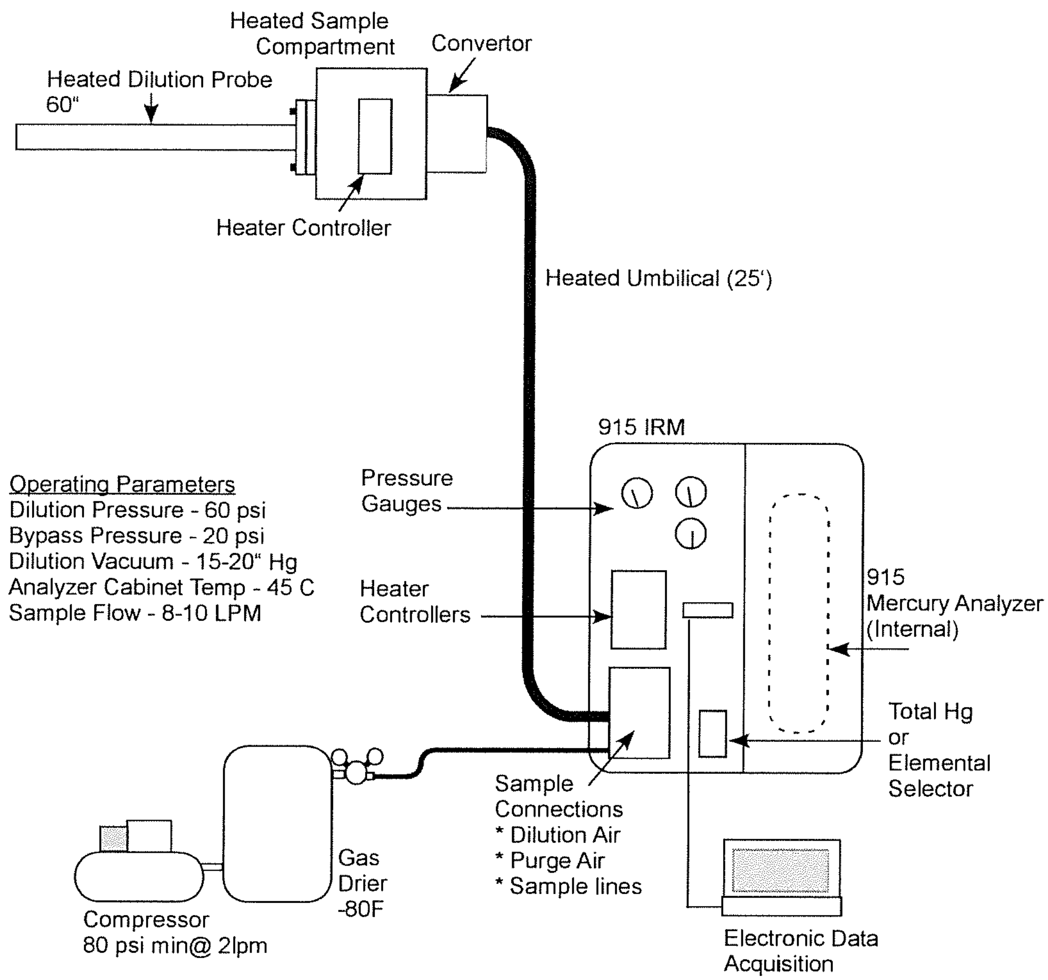


Figure CEMS-1: Hg CEMS Sampling System

All sample components prior to analysis are heated and automatically controlled to the following setpoints

- Sample Probe – 230°C
- Sample Frit - 180°C
- Sample Convertor - 560°C
- Sample Line - 100°C
- M324 Analyzer - 45°C

IRM-915 mercury concentrations were measured on a wet basis in microgram per standard cubic meter (μg/scm) units. Data can be viewed in real time as shown in Figure CEMS-2.

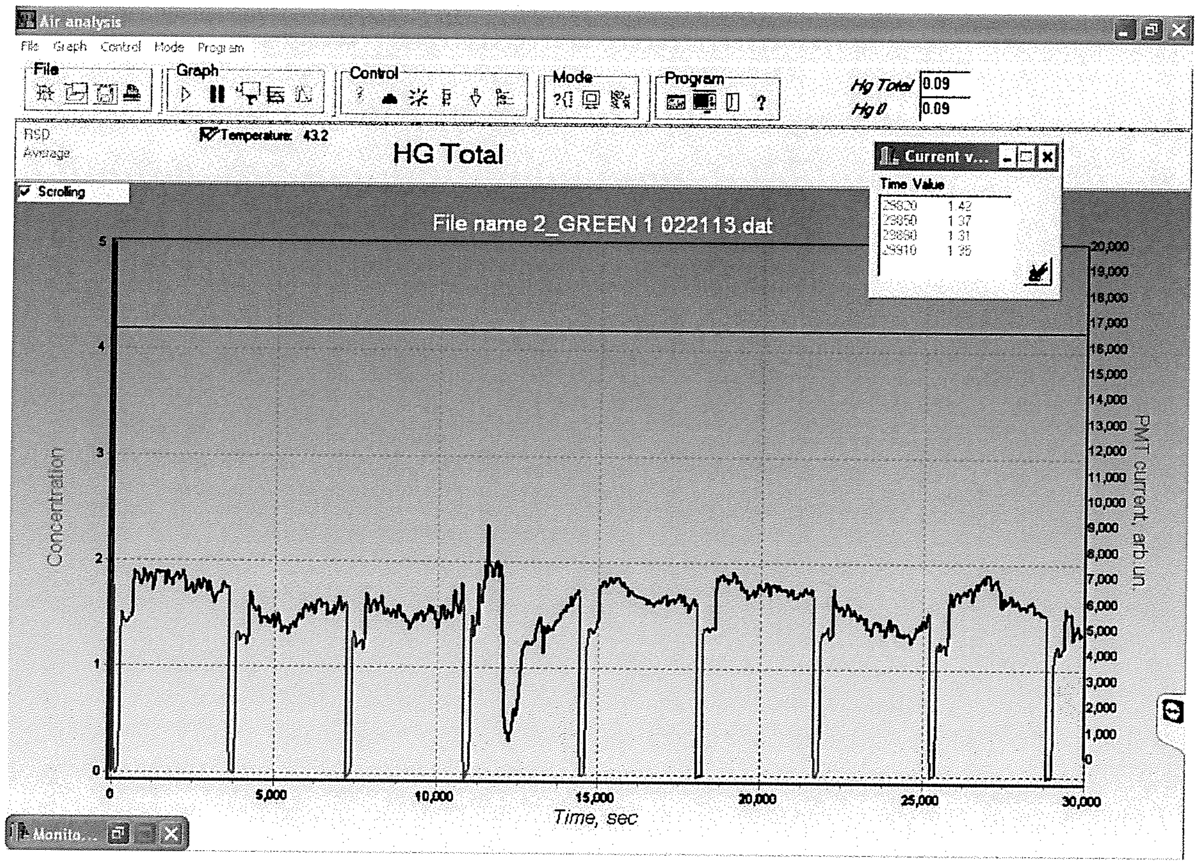


Figure CEMS-2: Hg CEMS Real-Time Data Acquisition Screen

Concentrations were converted to a dry basis using moisture content determined though EPA Method 5 testing. Emission rates were calculated using EPA Method 19 and equations included in Appendix A of the MATS rule.

Specification Sheet for EPA Method 5

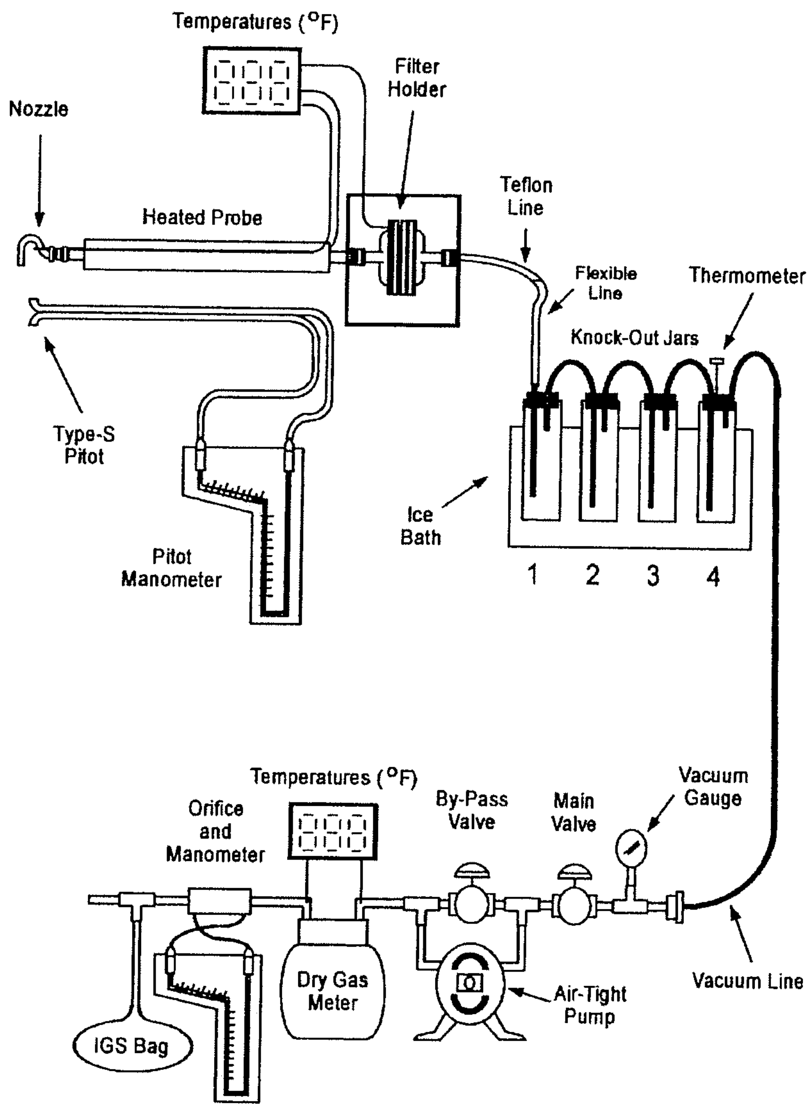
Source Location Name(s)	Green 1 and 2, Wilson 1 and Coleman 3
Pollutant(s) to be Determined	Particulate Matter (PM)
Other Parameters to be Determined from Train	Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	60 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	2.5 or 5
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Stainless Steel or Glass	Borosilicate Glass / Stainless Steel (12' probe)
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass / Stainless Steel (12' probe)
Effective Probe Length	N/A	6, 10 or 12
Probe Temperature Set-Point	248°F±25°F	320°F±25°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	varied
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Quartz	Borosilicate Glass
Filter Support Material	Glass Frit	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	248°F±25°F	320°F±25°F
Filter Material	Glass Fiber	Quartz Fiber
Other Components		
Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

Specification Sheet for EPA Method 5

	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	Ground Glass or Equivalent	Screw Joint with Silicone Gasket
Connection to Probe or Filter by	Direct Glass Connection	Direct Glass Connection
Number of Impingers	4	4
Impinger Stem Types		
Impinger 1	Modified Greenburg-Smith	Knock-Out
Impinger 2	Greenburg-Smith	Knock-Out
Impinger 3	Modified Greenburg-Smith	Knock-Out
Impinger 4	Modified Greenburg-Smith	Knock-Out
Impinger 5		0
Impinger 6		0
Impinger 7		0
Impinger 8		0
Gas Density Determination		
Sample Collection	Multi-point integrated	Multi-Point Integrated
Sample Collection Medium	Flexible Gas Bag	Vinyl Bag
Sample Analysis	Orsat or Fyrite Analyzer	CEM
Sample Recovery Information		
Probe Brush Material	Nylon Bristle	Nylon Bristle
Probe Rinse Reagent	Acetone	Acetone
Probe Rinse Wash Bottle Material	Glass or Polyethylene	Teflon
Probe Rinse Storage Container	Glass or Polyethylene	Glass
Filter Recovered?	Yes	Yes
Filter Storage Container	N/A	Polystyrene
Impinger Contents Recovered?	Provision	Archived
Impinger Rinse Reagent	Deionized Distilled Water	N/A
Impinger Wash Bottle	Glass or Polyethylene	N/A
Impinger Storage Container	Glass or Polyethylene	N/A
Analytical Information		
Method 4 H_2O Determination by	Volumetric or Gravimetric	Gravimetric and Volumetric
Filter Preparation Conditions	Dessicate 24 hours minimum at ambient temperature	Dessicate 24 hours minimum at ambient temperature
Front-Half Rinse Preparation	Evaporate at ambient temperature and pressure	Evaporate at ambient temperature and pressure
Back-Half Analysis	N/A	N/A
Additional Analysis	N/A	None

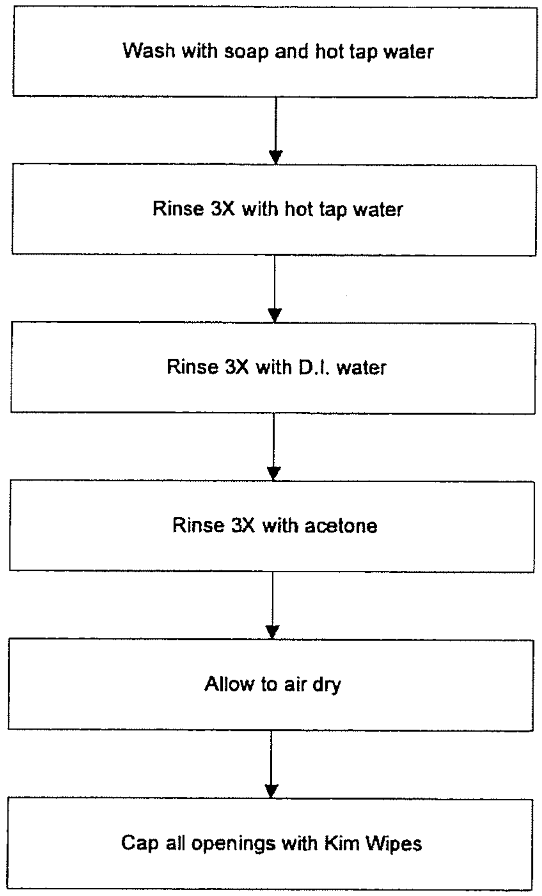
EPA Method 5
Sampling Train Configuration



<u>Knock Out Jar Contents</u>

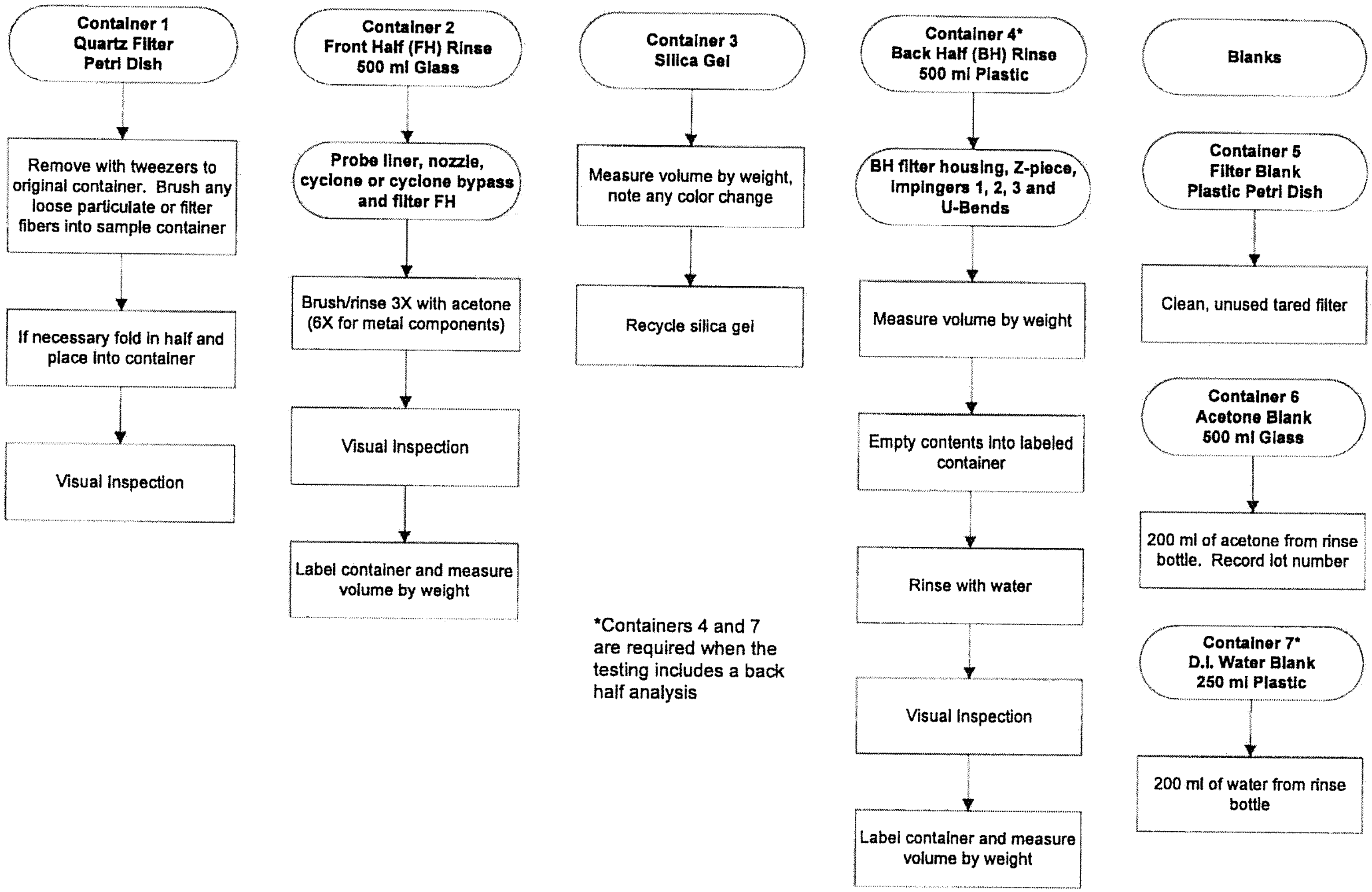
Knock Out Jar 1	100 ml H_2O
Knock Out Jar 2	100 ml H_2O
Knock Out Jar 3	Empty
Knock Out Jar 4	Silica gel

EPA Method 5
Glassware Preparation Procedures

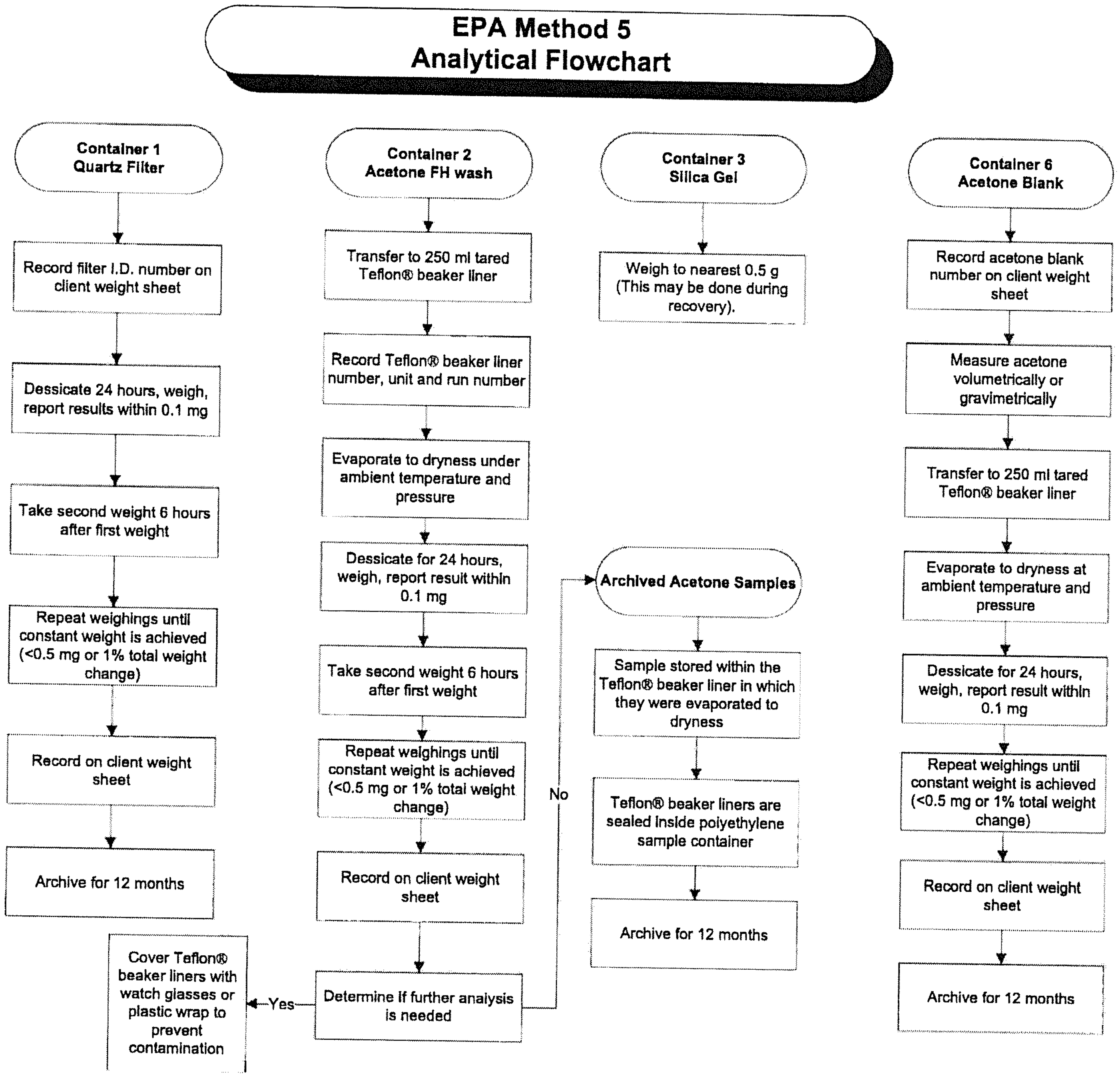


EPA Method 5
Sample Recovery Flowchart

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)



*Containers 4 and 7 are required when the testing includes a back half analysis



EPA Method 5
Analytical Flowchart
Container 1
Quartz Filter
Record filter I.D. number on client weight sheet
Dessicate 24 hours, weigh, report results within 0.1 mg
Take second weight 6 hours after first weight
Repeat weighings until constant weight is achieved (<0.5 mg or 1% total weight change)
Record on client weight sheet
Archive for 12 months
Container 2
Acetone FH wash
Transfer to 250 ml tared Teflon® beaker liner
Record Teflon® beaker liner number, unit and run number
Evaporate to dryness under ambient temperature and pressure
Dessicate for 24 hours, weigh, report result within 0.1 mg
Take second weight 6 hours after first weight
Repeat weighings until constant weight is achieved (<0.5 mg or 1% total weight change)
Record on client weight sheet
Determine if further analysis is needed
Yes
Cover Teflon® beaker liners with watch glasses or plastic wrap to prevent contamination
No
Container 3
Silica Gel
Weigh to nearest 0.5 g (This may be done during recovery).
Archived Acetone Samples
Sample stored within the Teflon® beaker liner in which they were evaporated to dryness
Teflon® beaker liners are sealed inside polyethylene sample container
Archive for 12 months
Container 6
Acetone Blank
Record acetone blank number on client weight sheet
Measure acetone volumetrically or gravimetrically
Transfer to 250 ml tared Teflon® beaker liner
Evaporate to dryness at ambient temperature and pressure
Dessicate for 24 hours, weigh, report result within 0.1 mg
Repeat weighings until constant weight is achieved (<0.5 mg or 1% total weight change)
Record on client weight sheet
Archive for 12 months

EPA Method 30B
Sampling Train Configuration