

Boiler MACT Update

*Amy Marshall, Steve Gossett, and John
DeRuyter*

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Regulatory Timeline

- 2007 – 2004 Boiler MACT and 2001 CISWI definition vacated, right before compliance
- 2008-2009 – EPA surveys and testing
- 2008 – MACT SSM vacature (2009 mandate)
- 2010 – New Boiler rules and definition of non-hazardous solid waste proposed. Lots of data analysis. Limits largely unachievable, lots of comments and meetings.

Regulatory Timeline

- 2011 – Boiler rules and waste defn finalized in May. We petitioned and had more meetings. EPA reconsidered, stayed compliance dates, then re-proposed.
- 2012 – Stay declared illegal, rules in effect. More comments and meetings. More data analysis. No action assurance letters that expire the end of the year...
- We might have some final rules by end of year (?).
- 2013 – Final rules in Fed Reg. Litigation likely...

Expected Changes from Dec 2011

- Some improvements to limits, especially CO, Hg. One PM limit for coal.
- Revised startup/shutdown definitions, work practices.
- Sources with numerical emission limits will have 3 years from final reconsidered rule to comply. Compliance date may remain March 2014 for units with only work practice requirements.

Recent MATS Proposal

- Startup – requires use of natural gas, synthetic natural gas, propane, distillate oil, syngas, and/or ULSD. Once you start firing solid fuel or residual oil, you must vent emissions to the main stack and engage your APCD, except start limestone injection in FBC, dry scrubber, SNCR, SCR as expeditiously as possible. Startup ends when you produce electricity that is sold or used or when you make useful thermal energy.

MACT Boilers with Emission Limits

Subcategory	Total Units
Biomass Wet Stoker/Sloped Grate/Other	290
Biomass Kiln-Dried Stoker/Sloped Grate/Other	70
Biomass FB	24
Biomass Dutch/Pile	15
Biomass Suspension Burner	48
Biomass Fuel Cell	14
Biomass Hybrid Suspension/ Grate	20
Coal pulverized	185
Coal stoker	387
Coal FB	34
Coal FBHE	1
Oil - Heavy	295
Oil - Light	262
Oil non-continental	19
Gas2	78
	1742

Boiler MACT Controls

- PM – fabric filter or ESP
- HCl – scrubbing
- Hg –carbon adsorption
- CO – improve fuel feed/combustion, add oxidation catalyst

Boiler MACT limits – HCl and Hg

- “Fuel-based HAP” The 2010 proposed rule had separate limits for biomass and coal. **All solid fuels grouped together for 2011 final and reconsideration rules.**

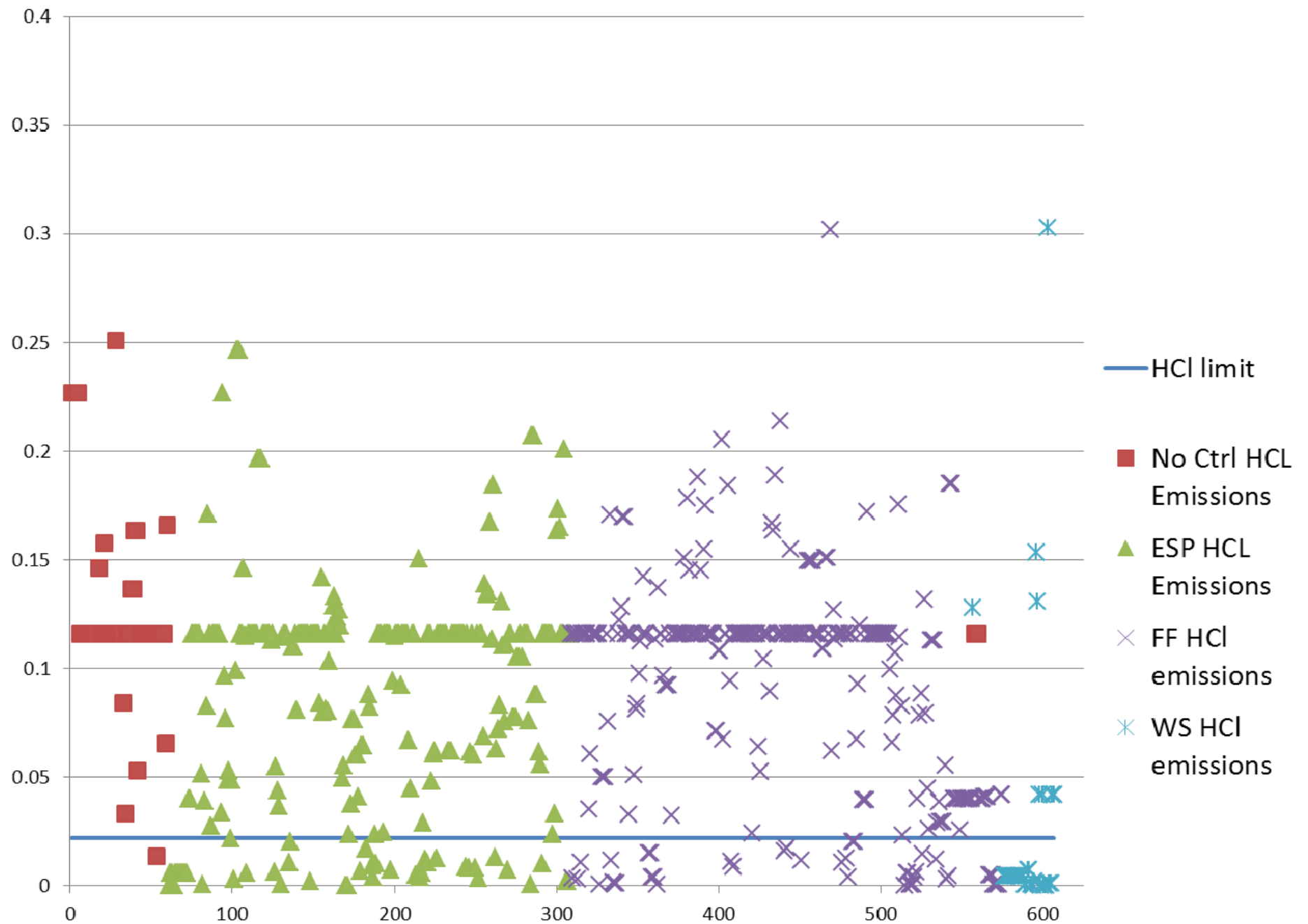
<u>HAP/Fuel</u>	<u>Re-proposal</u>	<u>Possible Final '12</u>	<u>Factor Better</u>	<u>Re-proposal</u>	<u>Possible Final '12</u>	<u>Factor Better</u>	<u>Units</u>
	Existing Boilers			New Boilers			
Hg Solid Fuel	3.1	5.7	1.8	0.86	0.8	0.9	lb/TBtu
HCl Solid Fuel	0.022	0.022	1.0	0.022	0.022	1.0	lb/MMBtu
Hg Oil	26	2.0	0.1	0.49	0.48	1.0	lb/TBtu
Hg Oil non-continental	26	2.0	0.1	0.49	0.48	1.0	lb/TBtu
HCl Oil	0.0012	0.0011	0.9	0.0012	0.00044	0.4	lb/MMBtu

2004 limits: 9/3 lb Hg/TBtu, 0.09/0.02 lb HCl/MMBtu for existing/new solid fuel.

CIBO Control Cost Estimates

Fuel	HCl Upgrade Cost	Alt HCl Method	Hg Upgrade Cost
Bagasse	\$0	\$0	\$1M
Coal	\$3.1 B	\$2.8B	\$71M
Dry Biomass	\$28M	\$21M	\$5M
Heavy Liquid	\$1.4B	\$1.4B	\$303M
Light Liquid	\$1.2B	\$1.2B	\$254M
Process Gas	\$28M	\$28B	\$1M0
Wet Biomass	\$119M	\$73M	\$6M
Grand Total	\$5.9B	\$5.5B	\$641M

Alt HCl Method is lower cost sorbent injection if only marginal % reduction needed.



Coal SO2 and HCl Data

Control Category	Total # of Units in Sub- Category	HCl lb/ MMBtu	HCl # of Data Points	SO2 (ppm @ 3% O2)	SO2 # of Data Points
Wet scrubber/ spray dryer	20	0.042	14	72.6	9
Dry scrubber	16	0.006	2	110.7	9
Sorbent injection	41	0.040	17	204.3	22
Venturi scrubber	19	0.005	5	100.9	1
None/dry PM only	520	0.116	228	852.9	73
<u>852.9</u> *	0.021	=	155	82% reduction	
1.16E-01			ppm SO2		

Other HCl Analyses for Solid Fuel Boilers

HCl Limit	HCl Upgrade Cost	Alternate* HCl Upgrade Cost	Alternate HCl Upgrade Cost with Coal Chloride Cap of 0.12%**
0.022	\$3.1B	\$2.8B	\$2.2B
0.04	\$2.9B	\$1.9B	\$1.9B
0.05	\$2.8B	\$1.8B	\$748M
0.06	\$2.7B	\$912M	\$704M

*Assume sorbent injection if have ESP and need 50% control or have FF and need 80% control.

**0.095 lb/MMBtu HCl

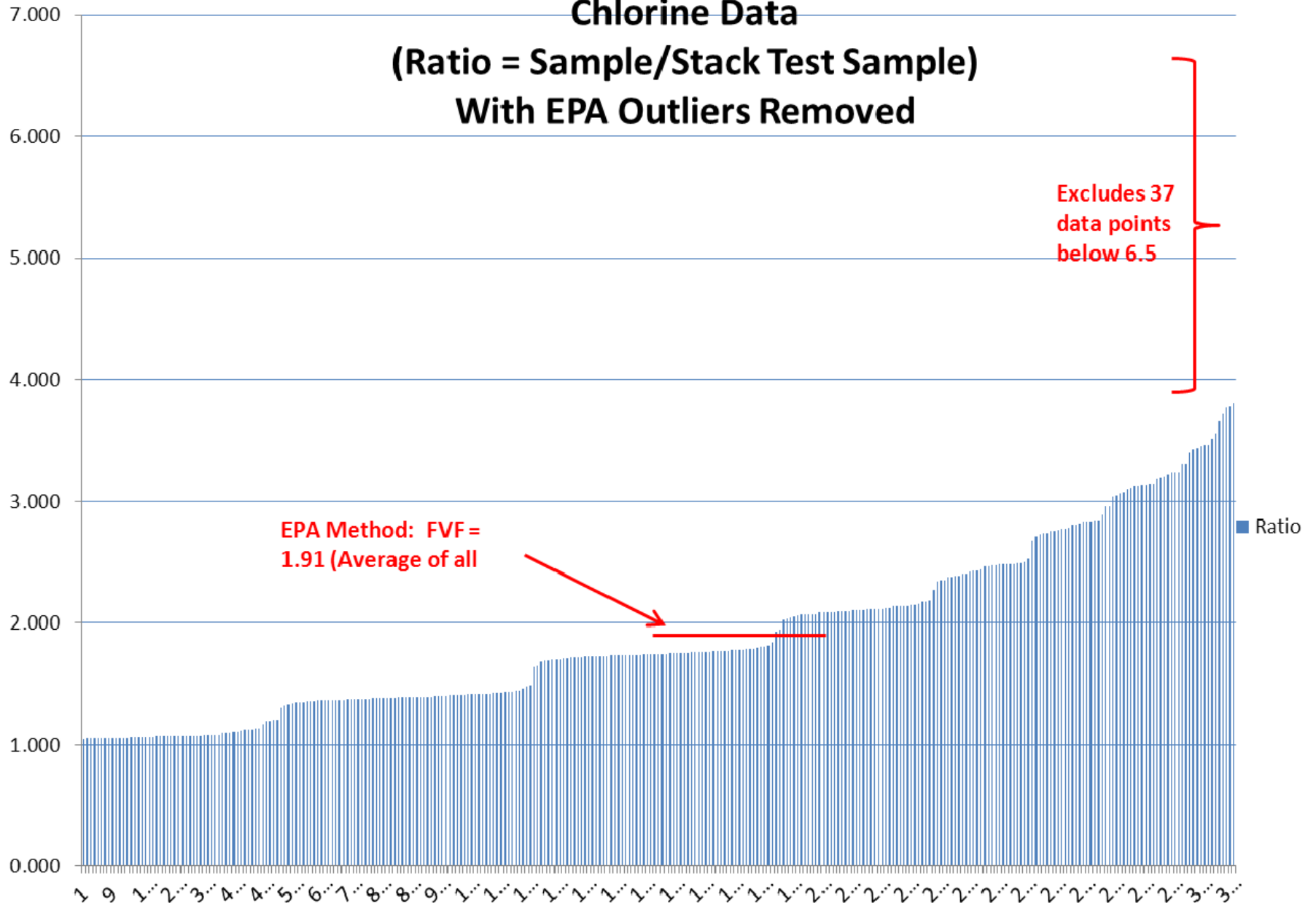
Fuel Variability Factor Incorporated for Solid Fuel Hg and HCl

- Same outlier approach used as before, therefore discarding data and lowering the FVFs. Average FVF, not max FVF, used.
 - Solid Hg FVF: 1.67
 - Liquid Hg FVF: 1.04
 - Solid HCl FVF: 1.91
 - Liquid HCl FVF: 2.46
 - Coal TSM FVF: 1.14
 - Heavy Liquid TSM FVF: 1.13

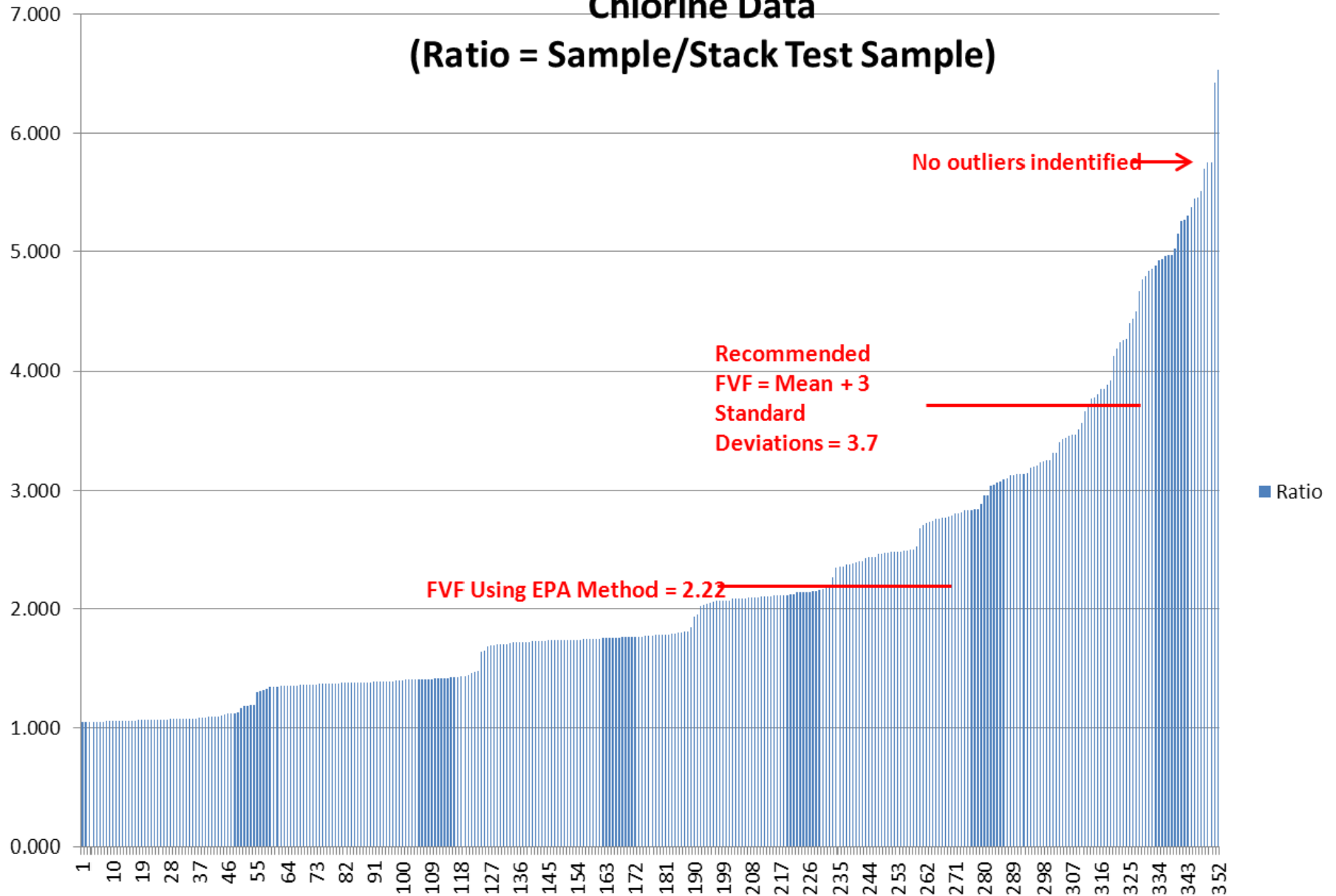
Plot of Solid Fuel Sub-Category HCl Top Performers

Chlorine Data

(Ratio = Sample/Stack Test Sample)
With EPA Outliers Removed



Plot of Solid Fuel Sub-Category HCl Top Performers Chlorine Data (Ratio = Sample/Stack Test Sample)



HCl Unit Data

	Count	Max
ARAnthonyForestProductsSN-12	9	2.34
EastmanBoiler 30	1322	3.80
GAGPMadisonPly800 Wood Waste Boiler	12	0.95
IAArchersDanielsMidlandDesMoinesAsea Boiler #1	12	1.03
IARoquetteAmericaCirculating Fluidized Bed Boiler (121)	11	2.03
INAlcoaWarrickUnit #3	21	1.19
MSWeyerhaeuserBruceAA-002 No. 2 Boiler	15	1.41
NDCargillWestFargoFoster Wheeler Boiler (EU43)	9	1.00
SCCogenSouthB001 - Main Boiler	9	1.12
SCMarlboroPaperHogged Fuel Boiler	12	0.92
VASmurfitStoneWestptPB08	25	1.04
VAUniversityofVirginia7103-1-01R	9	0.91
WINewPageBironB24	9	2.14

Selected CO Stack Test/CEMS Limits

<u>HAP/Fuel</u>	<u>Re-proposal</u>	<u>Possible Final '12</u>	<u>Re-proposal</u>	<u>Possible Final '12</u>	<u>Units</u>
	Existing Boilers		New Boilers		
CO Biomass Wet Stoker	790/410	1500/720	590/410	620/390	ppm at 3%O ₂
CO Biomass FB	370/180	470/310	230/180	230/310	ppm at 3%O ₂
CO Biomass Hybrid Suspension/ Grate	3900/730	2800/900	1500/730	1100/900	ppm at 3%O ₂
CO Coal pulverized	41/28	130/320	9/28	130/320	ppm at 3%O ₂
CO Coal stoker	220/34	160/340	19/34	130/340	ppm at 3%O ₂
CO Coal FB	56/59	130/230	17/59	130/230	ppm at 3%O ₂
CO Coal FBHE	NA	140/150	NA	140/150	ppm at 3%O ₂
CO Oil - Heavy	10/18	130	10/18	130	ppm at 3%O ₂
CO Oil - Light	7/60	130	3/60	130	ppm at 3%O ₂

You can comply with CO stack test limit or install CO CEMS and have 10 or 30-day avg limits.

Selected Fossil PM Limits

<u>HAP/Fuel</u>	<u>Final</u>	<u>Re-proposal</u>	<u>Possible Final '12</u>	<u>Factor Better</u>	<u>Final</u>	<u>Re-proposal</u>	<u>Possible Final '12</u>	<u>Factor Better</u>	<u>Units</u>
	Existing Units				New Units				
PM Coal pulverized	0.039	0.044	0.040	0.9	0.001	0.0013	0.0017	1.3	lb/ MMBtu
PM Coal stoker	0.039	0.028	0.040	1.4	0.001	0.028	0.0017	0.1	lb/ MMBtu
PM Coal FB	0.039	0.088	0.040	0.4	0.001	0.0011	0.0017	1.5	lb/ MMBtu
PM Oil - heavy	0.0075	0.062	0.062	1.0	0.0013	0.013	0.013	1.0	lb/ MMBtu
PM Oil - light	0.0075	0.0034	0.0079	2.3	0.0013	0.0011	0.0011	1.0	lb/ MMBtu

Biomass PM Limits

<u>HAP/Fuel</u>	<u>Final</u>	<u>Re-proposal</u>	<u>Possible Final '12</u>	<u>Factor Better</u>	<u>Final</u>	<u>Re-proposal</u>	<u>Possible Final '12</u>	<u>Factor Better</u>	<u>Units</u>
	Existing Boilers				New Boilers				
PM Biomass Wet Stoker	0.039	0.029	0.037	1.3	0.001	0.029	0.030	1.0	lb/MMBtu
PM Biomass Dry Stoker	0.039	0.32	0.32	1.0	0.001	0.32	0.030	0.1	lb/MMBtu
PM Biomass FB	0.039	0.11	0.11	1.0	0.001	0.0098	0.0098	1.0	lb/MMBtu
PM Biomass Dutch/Pile	0.039	0.036	0.18	5.0	0.001	0.036	0.0032	0.1	lb/MMBtu
PM Biomass Suspension Burner	0.039	0.051	0.051	1.0	0.001	0.051	0.030	0.6	lb/MMBtu
PM Biomass Fuel Cell	0.039	0.033	0.020	0.6	0.001	0.011	0.020	1.8	lb/MMBtu
PM Biomass Hybrid Suspension/ Grate	0.039	0.44	0.44	1.0	0.001	0.026	0.026	1.0	lb/MMBtu

CIBO PM Capital Cost Est.

Fuel	PM Upgrade Cost
Bagasse	\$ -
Coal	\$ 1.2B
Dry Biomass	\$ -
Heavy Liquid	\$ 1.1B
Light Liquid	\$ 878M
Process Gas	\$ -
Wet Biomass	\$ 830M
Grand Total	\$ 4.05B

Industry Controls Cost Study Results

PM Upgrade Cost	HCl Upgrade Cost	Hg Upgrade Cost	CO Upgrade Cost
\$ 4.1 B	\$ 5.9 B	\$ 641M	\$ 1.4B

	Total Industry Capital Cost
Fuel	
Bagasse	\$ 50 M
Coal	\$ 5.3 B
Dry Biomass	\$ 44 M
Heavy Liquid	\$ 3.3 B
Light Liquid	\$ 2.3 B
Process Gas	\$ 29M
Wet Biomass	\$ 1 B
Grand Total	\$ 12 B

EPA estimates cost of rule is about \$5B

Summary

- These rules will have a big economic impact (larger than EPA estimates) and are not the only rules affecting facilities.
- Few units in the fossil unit subcategories comply with all 4 limits with no capital cost.
- Facilities will likely need extra time to comply given the large number of units that need emissions reductions (either addition of controls or conversion to gas).
- Need flexibility in NHSM rule so more materials are fuels not waste (don't want to get caught under CISWI rule).

Christmas Wish List

- CO limits – 130 ppm cutoff for fossil and other limits as advertised
- Language on easy granting of extra year for states
- Fresh three years to comply for all existing sources
- Fuel variability factors for Hg and HCl
- Startup and shutdown procedures that are clear and that we can live with
- Good definition of natural gas curtailment
- No PM CEMS for biomass or multi-fuel boilers
- Retaining dioxin work practice and any clarification of how it would be implemented
- NHSM: lots of things are fuel not solid waste
- GACT: date for tune-up is beyond 2013