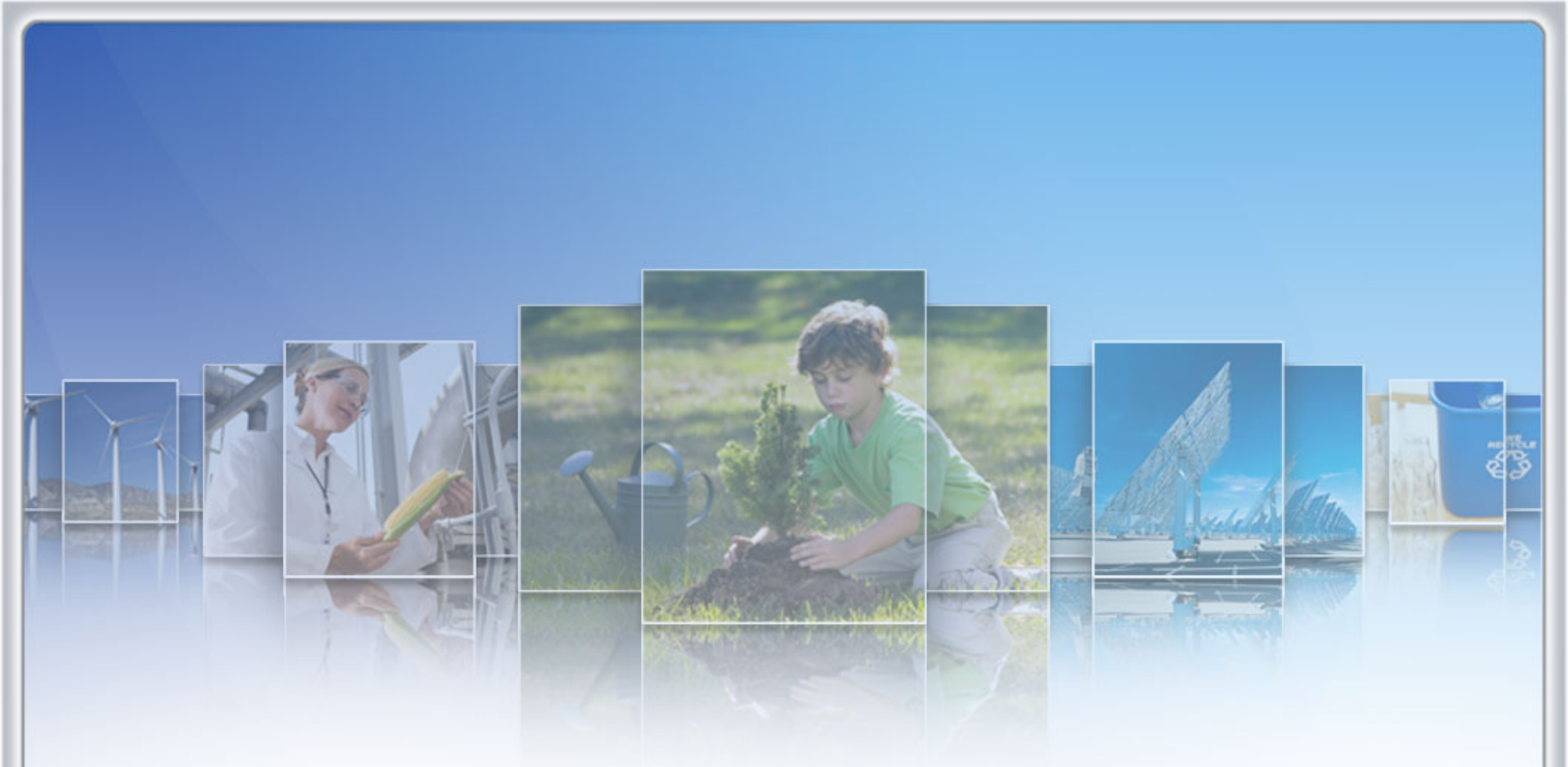
REINHOLD ENVIRONMENTAL Ltd.

2011 APC Round Table
& Expo Presentation

July 11-12, 2011, in Cleveland, OH / Hosted by FirstEnergy

Shaw® a world of Solutions™

30M012011D 01.21.11



Enhanced Mercury Oxidization (EMO™)

Bobby I.T. Chen,
Client Program Manager

The Shaw Group
July 12, 2011

Shaw® a world of Solutions™

EMO™ Overview / Refresher

- Injecting chemical: EMO™ chemical additives (HBr)
  - Mercury Oxidization: Hg(0) → Hg(2+)
  - Mercury Absorption/Adsorption: in existing FGD, or to add powdered activated carbon (PAC) or Trona/alkaline injection for the non-scrubbed systems
- Generally speaking, the Hg(0)/Hg(2+) ratio (native mercury oxidization) at the economizer outlet:
  - Bituminous: 70% Hg(0) / 30% Hg(2+)
  - Sub- Bituminous: 90% Hg(0) / 10% Hg(2+)
  - Lignite: 80% Hg(0) / 20%Hg(2+)
- To reach 90% or above on mercury emission reduction for any coal-fired application

10 lb/TBtu → 0.10 lb/TBtu

- Injection location and temperature: Economizer outlet (650°F)
- After Hg is oxidized, it will be bound with fly ash and scrubbed by the wet FGD, or for un-scrubbed systems, PAC or Trona injection

Regulatory Updates

- **Mercury emission is coming from the mercury content in coal**
- **Bituminous: 10 lb/TBtu, Sub-bituminous: 7 lb/TBtu, Lignite: 20 lb/TBtu**

Subcategory	Total particulate matter	Hydrogen chloride	Mercury
Existing coal-fired unit designed for coal ≥ 8,300 Btu/lb	0.030 lb/MMBtu (0.30 lb/MWh)	0.0020 lb/MMBtu (0.020 lb/MWh)	**1.2** lb/TBtu (**0.009** lb/GWh)
Existing coal-fired unit designed for coal < 8,300 Btu/lb	0.030 lb/MMBtu (0.30 lb/MWh)	0.0020 lb/MMBtu (0.020 lb/MWh)	**4.0** lb/TBtu* (**0.04** lb/GWh*)

30M012011D 01.21.11

Shaw® a world of Solutions™

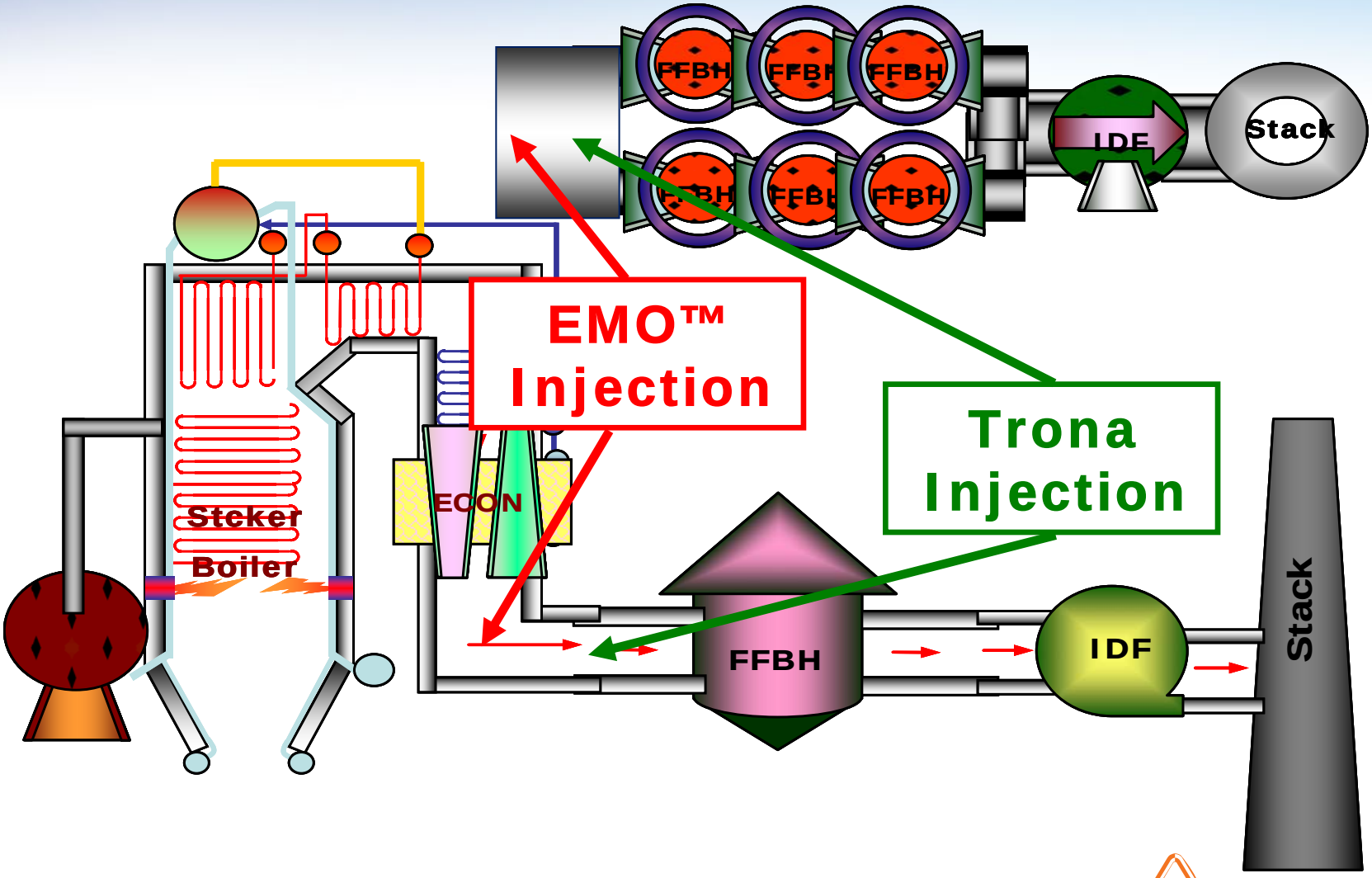
Even Distribution Applying the Effective Chemical

EMO™ System

1st EMO™ Full Scale Data

- Sub-bituminous testing results
  - Stoker unit – 25 MW equivalent burning PRB
  - SNCR + fabric filter baghouse
- Testing performed
  - Baseline tests
  - Varying EMO™ chemical injection rates at the boiler outlet
  - Varying Trona injection rates at the baghouse inlet

EMO™ Field Trial Unit Configuration



Shaw® a world of Solutions™

1st EMO™ Field Demonstration (25 MW)

OHM Stack	2.66	3.05	3.10	3.47	2.66	3.05	3.25	3.43
OHM Stack (3% O2)	6.50	7.46	7.38	8.26	6.32	7.26	7.73	8.17
OHM Stack Hg (lb/TBtu by Fd)	5.34		5.91		5.18		5.83	
SO3 (ppmvd)	0.63		NA		NA		NA	
Boiler Steam Load (klb/hr)	149.2		149.4		149.4		149.4	
CPM (lb/hr)	283.4		215.7		202.0		191.2	
Stack Flow Rate (dscfm)	112,661		111,273		112,193		114,359	
Stack Flow Rate (mmscfh)	7.143		7.029		7.077		7.154	
Stack Flow Rate (mmacfh)	12.198		12.098		12.180		12.313	
NH3 Feed Rate (lb/hr)	122.1		184.3		150.0		150.0	
Trona Feed Rate (lb/hr)	0.0		0.0		250.0		350.0	
SO2 (ppmvd by Shaw CEMS)	27.6		27.5		6.1		5.3	
NOx (ppmvd by Shaw CEMS)	57.5		61.0		72.4		68.6	
NO2 (ppmvd by Shaw CEMS)	NA		5.4		5.4		5.4	
CO (ppmvd by Shaw CEMS)	14.5		14.3		15.7		16.2	
O2 (%vol-dry by Shaw CEMS)	13.58		13.38		13.38		13.38	
CO2 (%vol-wet by Shaw CEMS)	5.94		6.21		6.21		6.21	
Stack temp (°F)	445.1		452.3		452.3		452.3	
%Excess Air	177.2%		170.5%		170.5%		170.5%	
Stack Moisture (%vol)	5.37		5.01		4.87		4.09	
Hg(0)/ Hg(T) ratio at Stack	87.1%		89.3%		87.1%		94.6%	
APCD Hg Removal (ECON - Stack)	NA		NA		8.0%		-3.6%	

X Trona injection: (N/A)

✓ Baseline SO2: 27.6 lb/hr, post-Trona: 2.5 lb/hr, 95% R.E

X Baseline Hg emission: 5.6 lb/TBtu – No removal

X Average CPM: 200 lb/hr – NH3 slip + SO3 to form ABS

1st EMO™ Field Demonstration (25 MW)

OHM Stack	1.38	1.63	1.47	1.74	1.41	1.69
OHM Stack (3% O2)	2.81	3.32	3.23	3.83	3.28	3.94
OHM Stack Hg (lb/TBtu by Fd)	2.37		2.73		2.81	
Appendix K Stack (µg/dscm)	1.85		1.97		1.99	
RD (OHM/App K)	6.2%		6.2%		8.2%	
CPM (lb/hr)	1.9		4.4		5.4	
Boiler Steam Load (klb/hr)	148.8		146.9		150.0	
Stack Flow Rate (dscfm)	116,711		115,592		116,257	
Stack Flow Rate (mmscfh)	7.359		7.304		7.351	
Stack Flow Rate (mmacfh)	12.585		12.552		12.600	
NH3 Feed Rate (lb/hr)	149.4		151.4		156.0	
EMO Concentration (%wt)	0.300		0.395		0.609	
EMO Feed Rate (lb/hr)	7.5		9.9		15.2	
Trona Feed Rate (lb/hr)	350.0		355.0		360.0	
SO2 (ppmvd by Shaw CEMS)	2.3		2.0		1.8	
NOx (ppmvd by Shaw CEMS)	54.6		54.8		51.7	
NO2 (ppmvd by Shaw CEMS)	2.0		2.1		0.3	
CO (ppmvd by Shaw CEMS)	18.7		17.7		13.8	
O2 (%vol-dry by Shaw CEMS)	12.09		12.75		13.22	
CO2 (%vol-wet by Shaw CEMS)	5.7		6.22		6.23	
Stack temp (°F)	446.4		450.8		448.4	
%Excess Air	125.8%		147.6%		164.4%	
Stack Moisture (%vol)	4.84		5.05		5.11	
Hg(0)/ Hg(T) ratio at Stack	84.5%		84.4%		83.2%	
APCD Hg Removal (ECON - Stack)	57.9%		51.5%		50.1%	

- ✓ Trona injection at 400˚F at 350 lb/hr, 30 lb/MMacf
- ✓ Baseline SO2: 27.6 lb/hr, post-Trona: 2.0 lb/hr, 95% R.E
- ✓ Baseline Hg emission: 5.5 lb/TBtu, post-Trona/EMO : 2.6 lb/TBtu, 58% R.E. at 0.2 GPH
- ✓ Average CPM: 200 lb/hr, post-Trona/EMO : 3.0 lb/hr, 97% R.E.

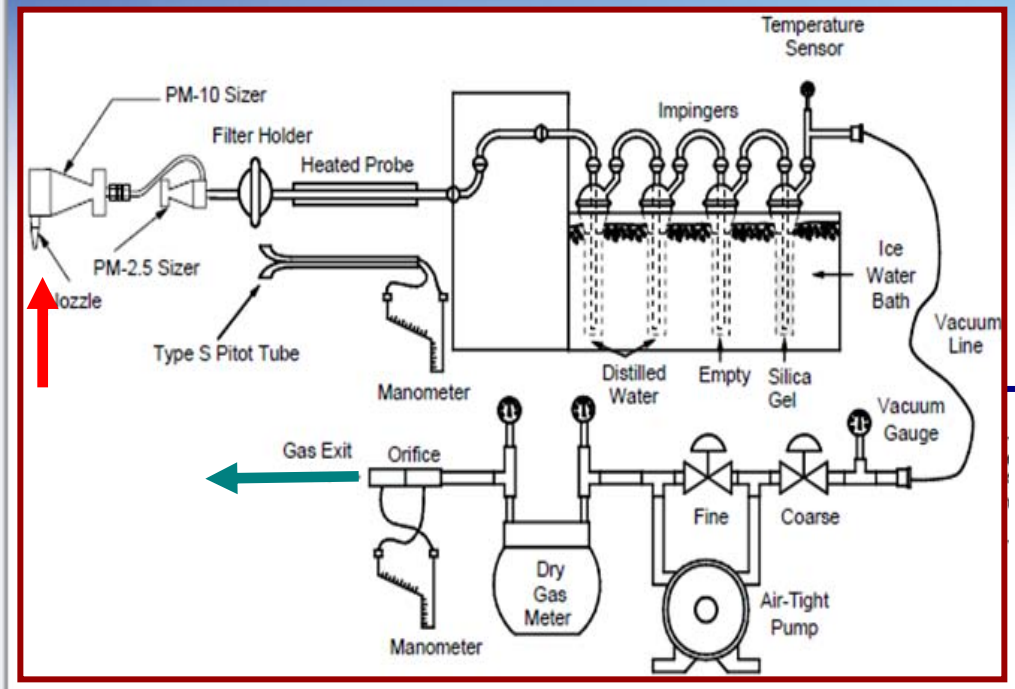
HCl Emission Reduction Applying Trona

	HCl (lb/hr)	HCl (ppmvd)	HCl (lb/MMBtu)
Baseline	0.62	0.97	0.0026
	0.36	0.55	0.0014
	0.57	0.85	0.0024
Average	0.52	0.79	0.0021

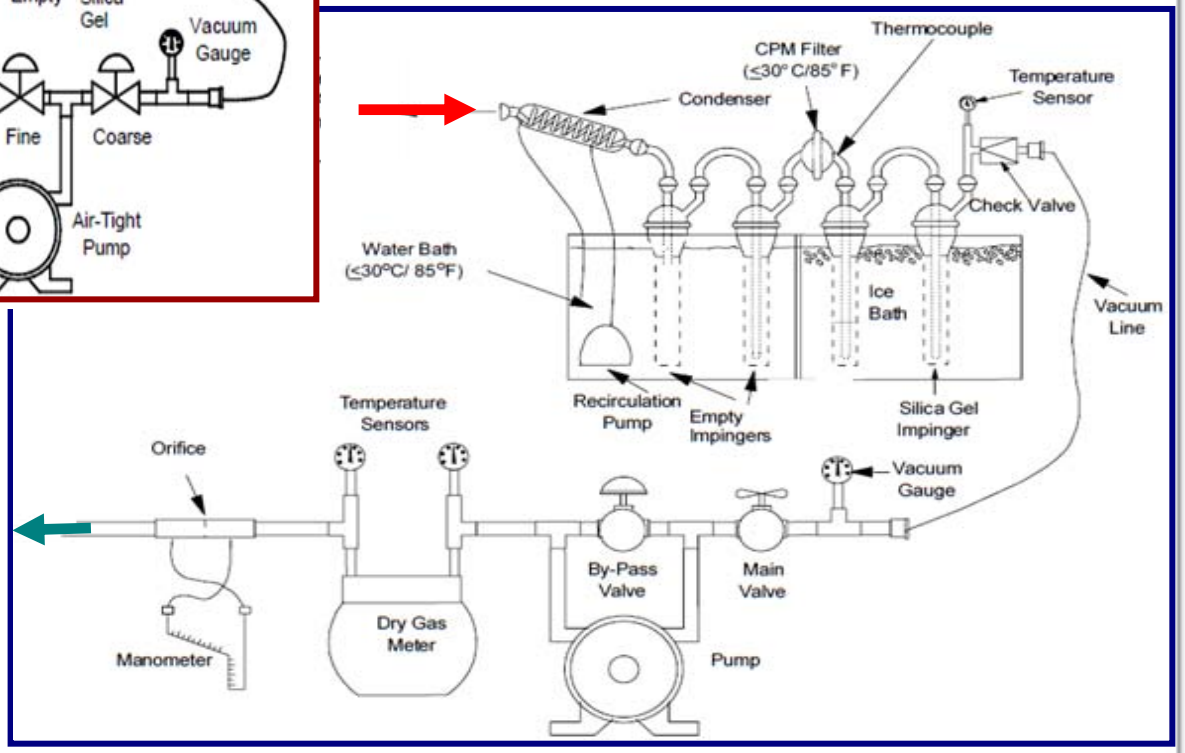
Trona at 150 lb/hr, at 12.5 lb/Mmacf	0.07	0.10	0.0003
	0.07	0.11	0.0003
	0.07	0.11	0.0003
Average	0.07	0.11	0.0003
HCl Removal Efficiency	86%		

Trona at 250 lb/hr, at 20 lb/Mmacf	0.04	0.06	0.0002
	0.04	0.06	0.0002
	0.00	0.00	0.0000
Average	0.03	0.04	0.0001
HCl Removal Efficiency	94%		

Onsite Observation – PM2.5/10 CPM SO2 Bias



Free NH3 in the samples can increase the amount of dissolved SO2, and, thereby, increase artifact sulfate formation since it instantly reacts in aqueous solution forming ammonium sulfite/sulfate ions and the additional SO2 must dissolve to maintain equilibrium.



- ✓ The true CPM = CPM - SOx interference
- ✓ SOx interference = SO2 +NH3
- ✓ The OTM 28 eliminates the testing SO2 bias because the NH3 and SO2 can be separated properly

Shaw® a world of Solutions™

Method Comparison

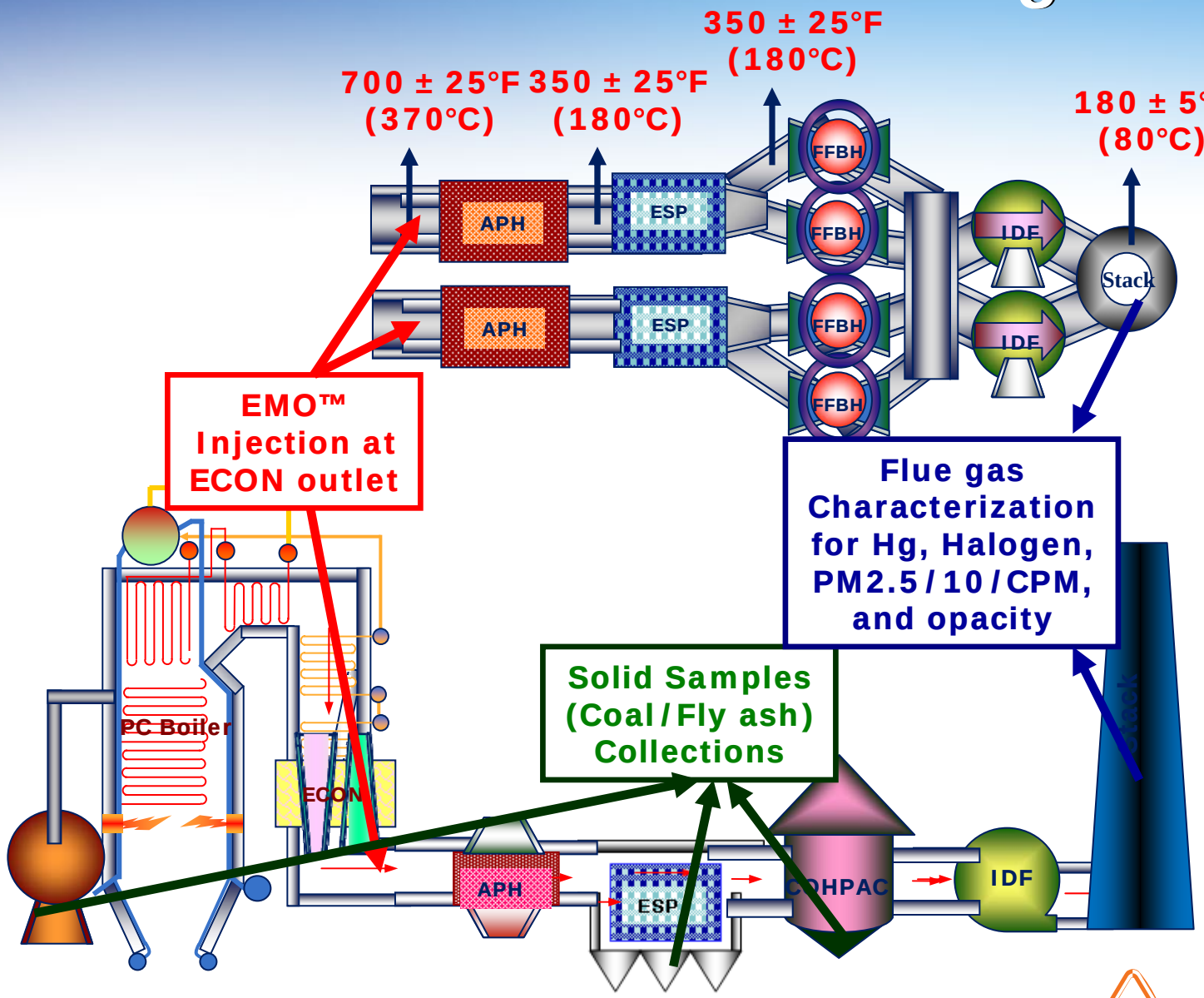
Date	NH3 Injection (lb/hr)	Trona Injection (lb/hr)	CPM (OTM28) (lb/hr)	Average		CPM (EPA 202) (lb/hr)	Average	Bias Reduction
8/19/2009	155.0	250.0	23.1		7/20/2009	38.8		40.5%
8/19/2009	155.0	250.0	15.6	19.4	7/20/2009	39.6	39.2	60.6%
8/20/2009	155.0	100.0	12.9		7/18/2009	42.3		69.4%
8/20/2009	155.0	200.0	11.0		7/20/2009	38.8		71.7%
8/20/2009	155.0	300.0	21.5		7/20/2009	39.6		45.8%
8/21/2009	155.0	300.0	15.0		7/17/2009	38.9		61.5%
8/21/2009	155.0	300.0	8.7		7/19/2009	54.2		84.0%
8/21/2009	155.0	300.0	4.8	9.5	7/20/2009	39.6	44.2	88.0%

OTM 28 was observed to yield better CPM reading without measurement bias

30W012011D 01.21.11

Shaw® a world of Solutions™

2nd EMO™ Field Trial Unit Configuration



30M012011D 01.21.11

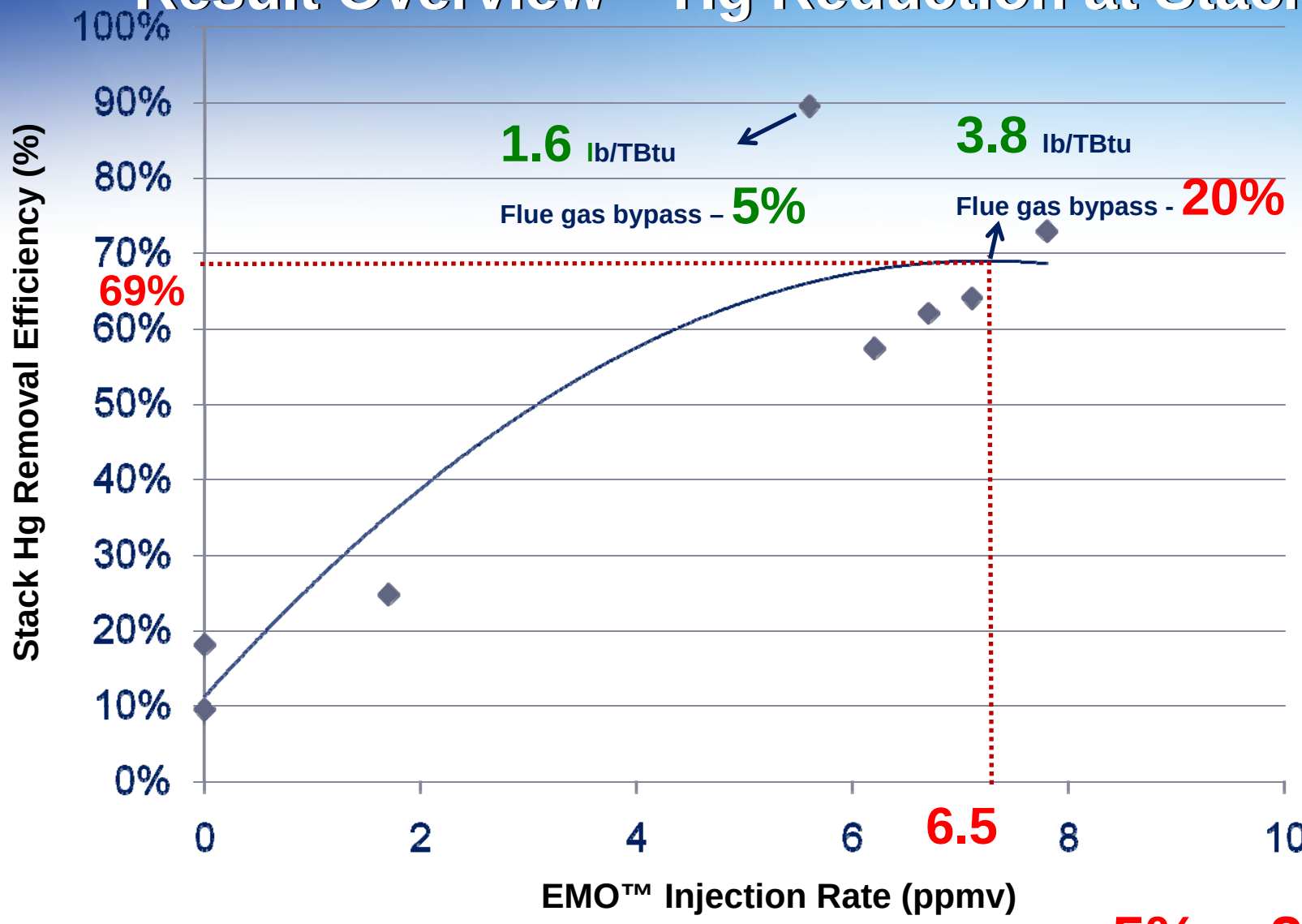
Shaw® a world of Solutions™

2nd EMO™ Full Scale Data

- Sub-bituminous/Lignite testing results
  - PC unit – 600 MW equivalent burning PRB/Lignite
  - SNCR + COHPAC (**5%** to **15%** flue gas bypasses the COHPAC)
- Testing performed
  - Baseline tests
  - Varying EMO™ chemical injection rates at the boiler outlet

Date	Unit Load	PRB blending by Weight	Max. Hg From Lignite	Max. Hg From PRB	Max. Hg From Coal	Total Flue Gas Bypass	EMO Injection Rate	PAC Injection Rate	COHPAC Inlet Hg	Hg Oxidization at COHPAC inlet	Stack Hg	Hg Oxidization at Stack	Hg Removal across COHPAC	Overall Hg Removal
mm/dd/yy	(MW)	(%)	(lb/TBtu)	(lb/TBtu)	(lb/TBtu)	(%)	(ppmvd)	lb/mmacf	(lb/TBtu)	(%)	(lb/TBtu)	(%)	(%)	(%)
4/11/11	635	50.0%	22.6	17.0	19.79	**14.2%**	0	0	15.73	16.4%	11.31	11.1%	28.1%	**42.9%**
	635	50.0%	22.6	17.0	19.79	**14.2%**	0	0	14.18	5.6%	12.84	5.2%	9.4%	**35.1%**
4/12/11	637	49.8%	34.8	22.5	28.69	**14.7%**	7	0	15.07	22.6%	9.6	39.0%	35.8%	**66.5%**
	556	56.2%	34.8	22.5	27.90	**5.2%**	7.8	0	6.05	68.2%	**4.06**	**87.4%**	72.9%	**85.4%**
	557	55.9%	34.8	22.5	27.94	**5.1%**	5.6	0	**3.69**	**89.3%**	**1.58**	**94.1%**	**89.4%**	**94.3%**

Result Overview – Hg Reduction at Stack



Flue gas bypasses the wet scrubber was determined to be between 5% and 20%

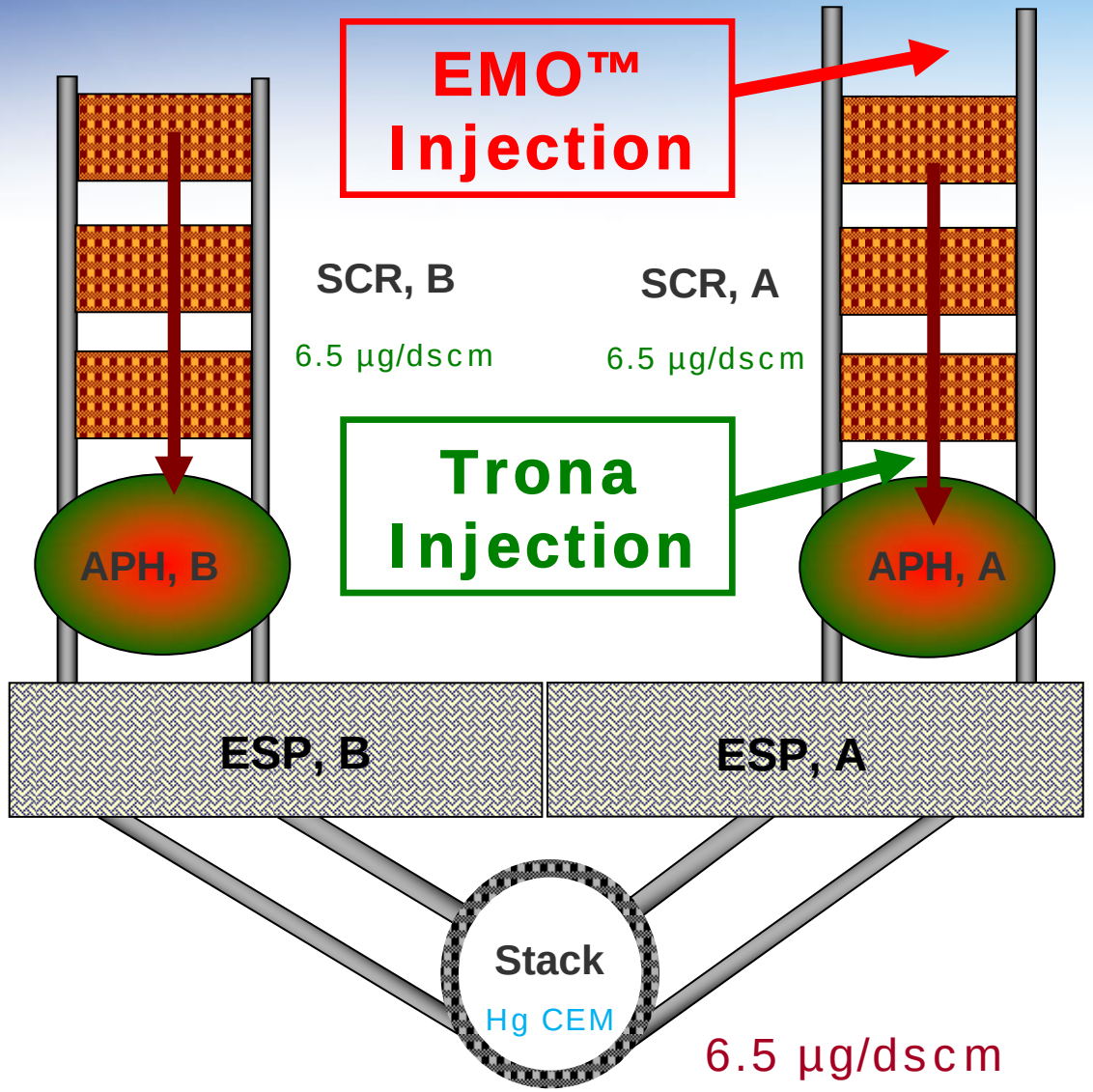
Shaw® a world of Solutions™

30M012011D 01.21.11

3rd EMO™ Full Scale Data

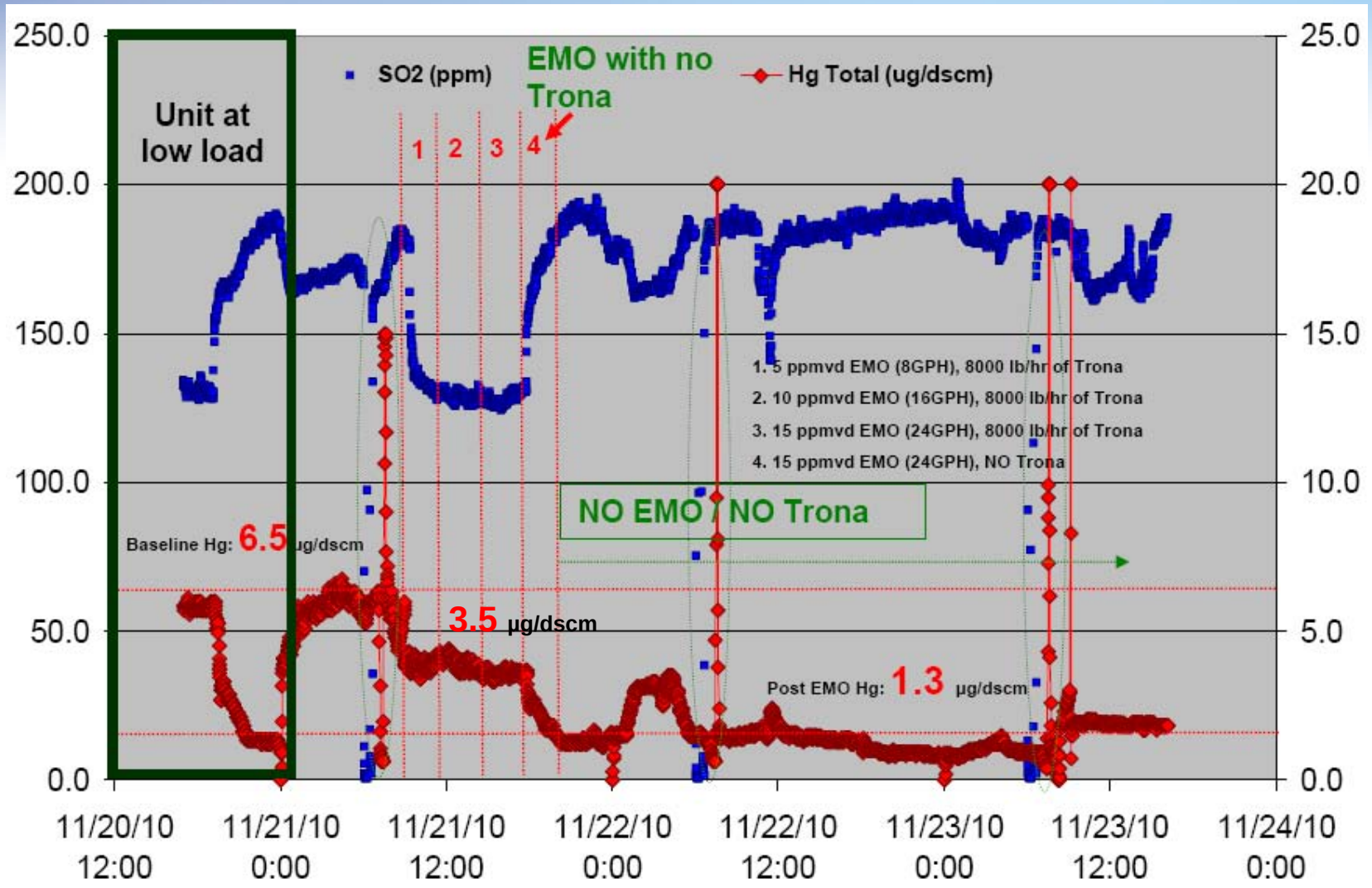
- Unit configuration
  - PC Unit - 660 MW equivalent burning PRB
  - SCR + electric-static precipitator
- Testing performed only on Duct A (one side)
  - Baseline tests
  - Varying EMO™ chemical injection rates at the SCR inlet
  - Varying Trona injection rates at the SCR outlet

3rd EMO™ Field Trial Unit Configuration



- The flue gas mercury level was determined to be around 6.5 µg/dscm with more than 95% of it existing in the form of elemental mercury, which was common for the PRB-fired application due to the low chlorine content in the PRB coal.

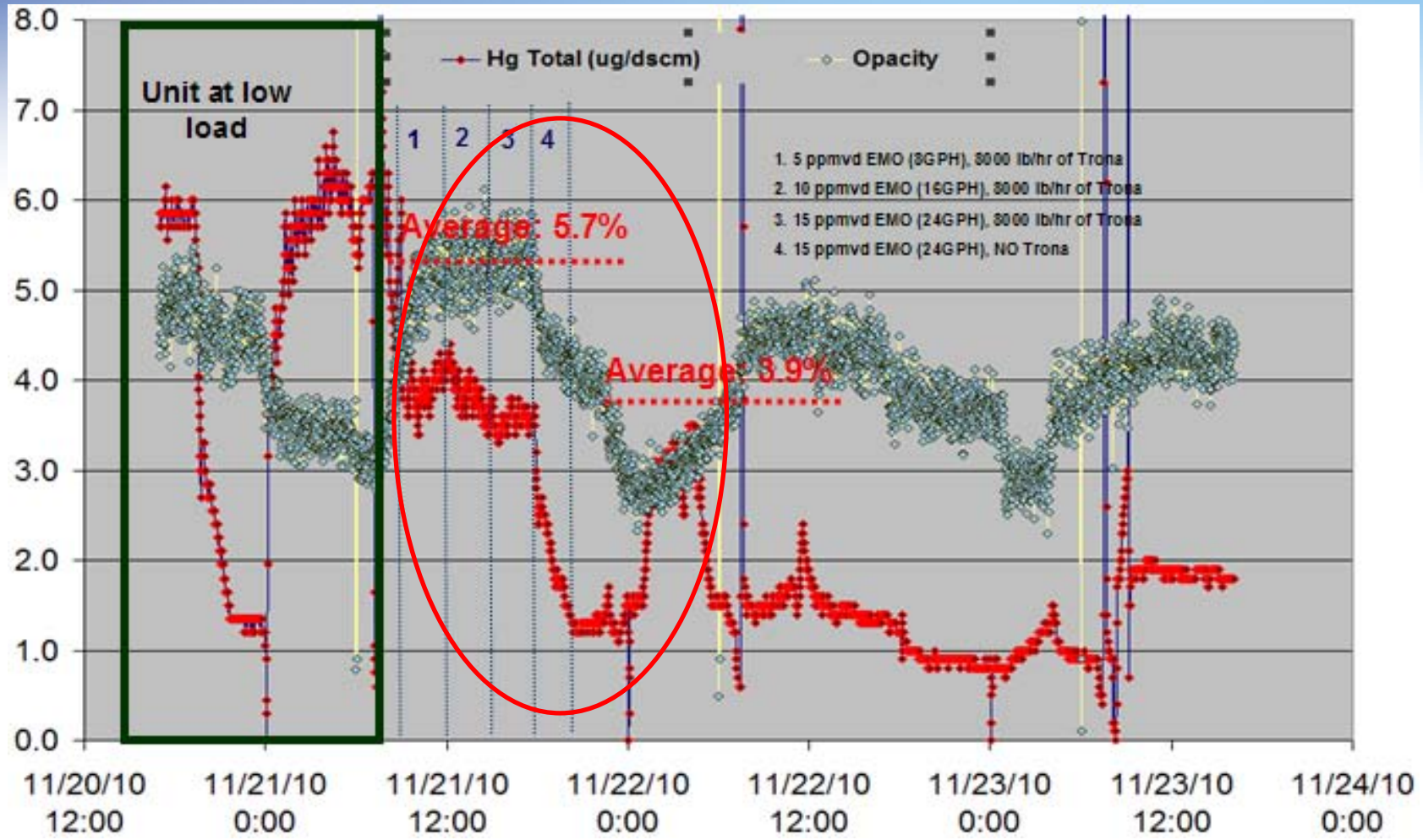
Result Overview – Hg/SO2 (Stack CEMs)



30M012011D 01.21.11

Shaw® a world of Solutions™

The Impact of EMO™ on Opacity

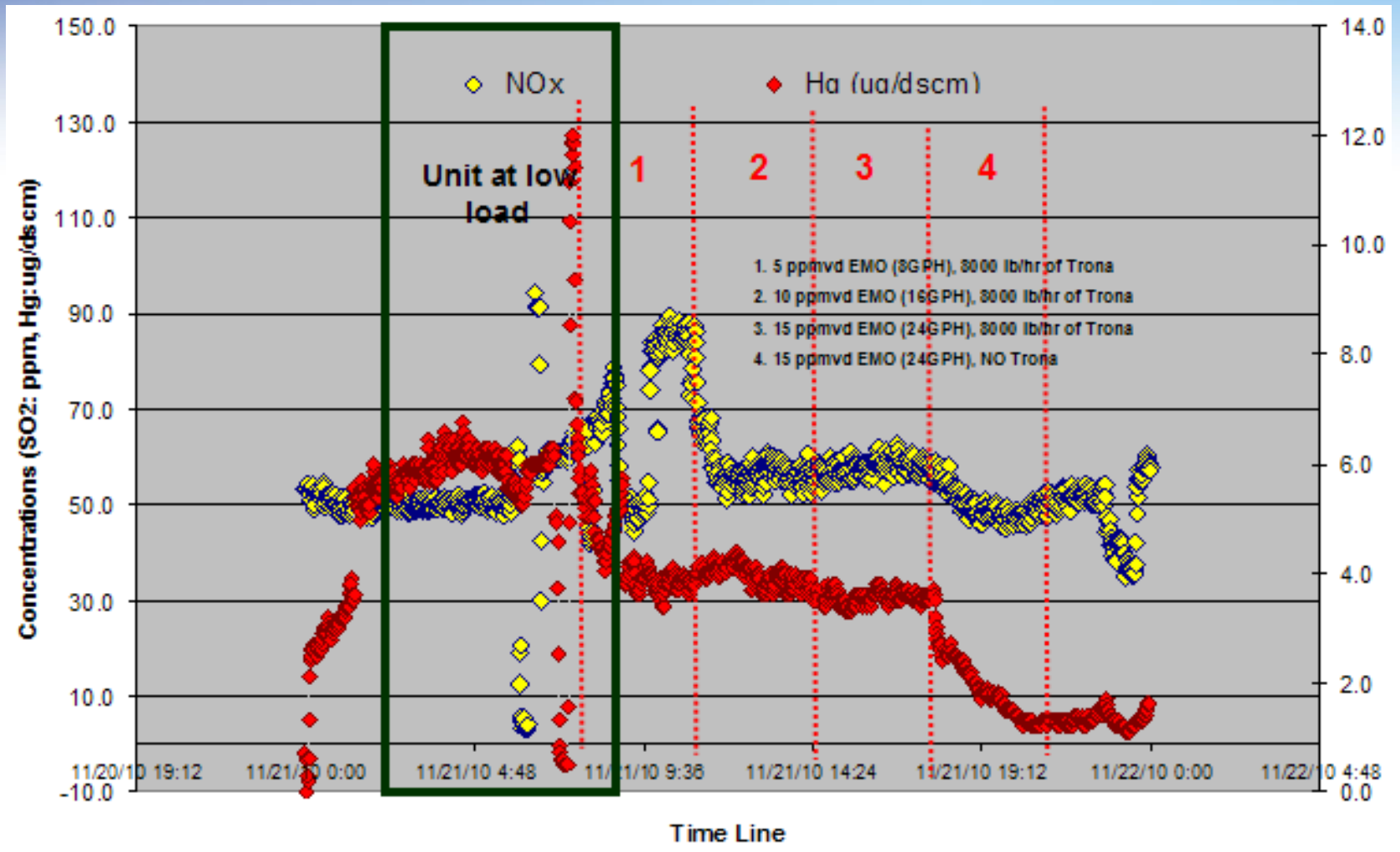


During Run 4 (EMO™ only, no Trona), while the Stack Hg reduction was observed to be above 95%, the Stack opacity was also observed to improve from 5.7% down to 3.9%

30M012011D 01.21.11

Shaw® a world of Solutions™

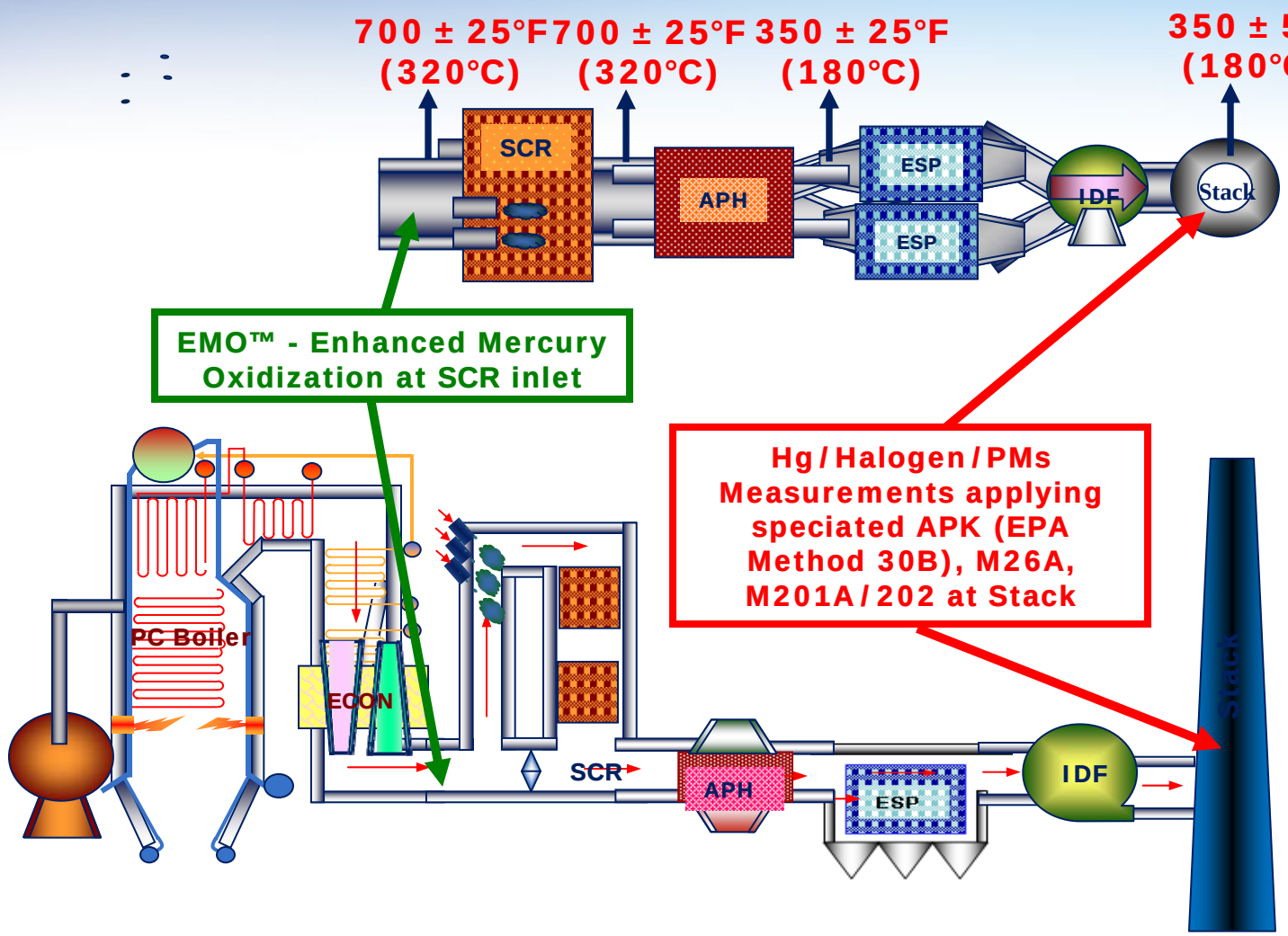
The Impact of EMO™ on NOx



During Run 4 (EMO™ only, no Trona), it was observed that EMO™ yielded no negative impact on NOx emission reduction.

Shaw® a world of Solutions™

4th EMO™ Field Trial Unit Configuration



30M012011D 01.21.11

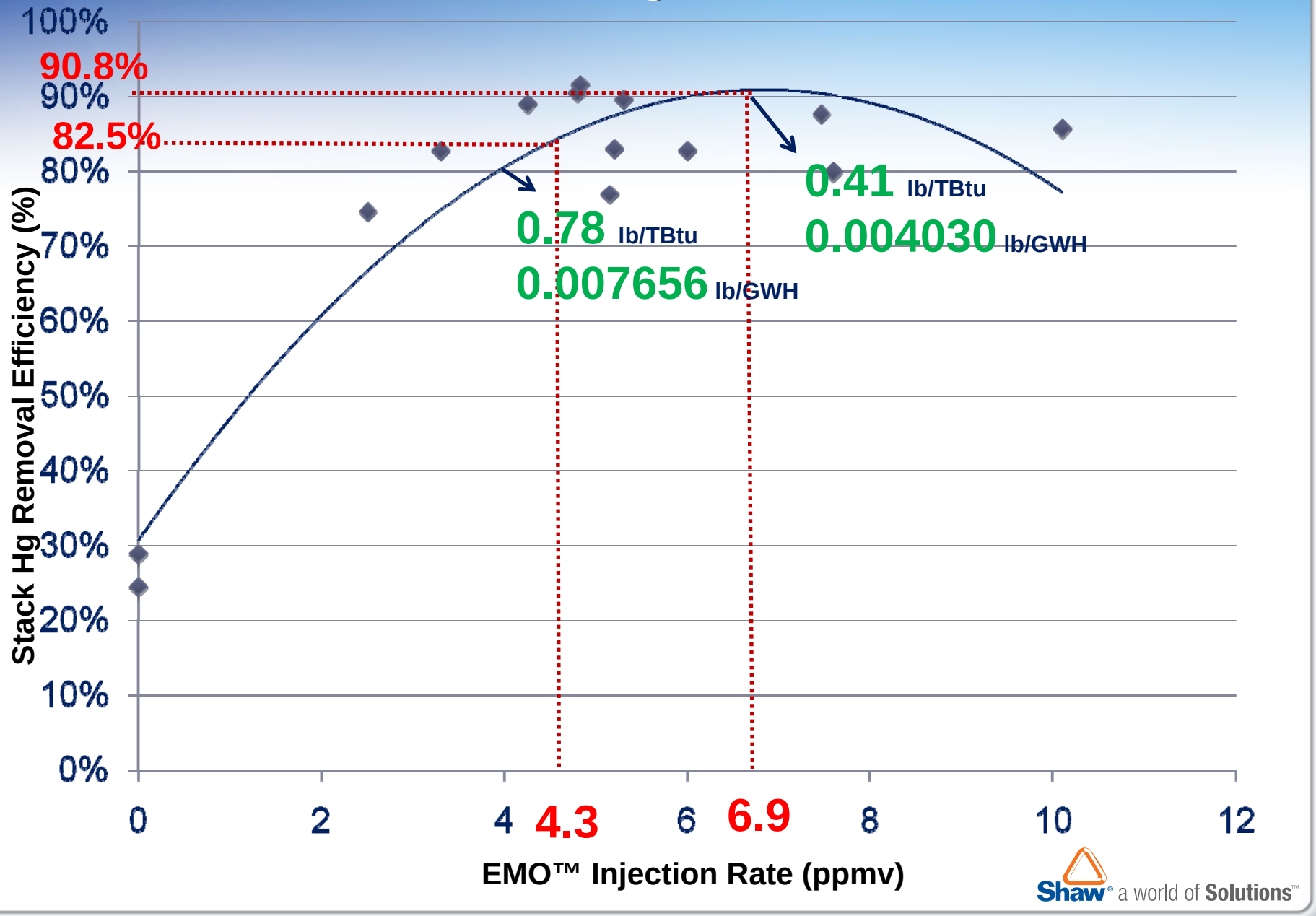
Shaw® a world of Solutions™

4th EMO™ Full Scale Data

- Unit configuration
  - PC Unit - 340 MW equivalent burning PRB
  - SCR+ Electric-static precipitator
- Testing performed
  - Baseline tests
  - Varying EMO™ chemical injection rates at the Economizer outlet

Date	Unit Load	PRB blending by Weight	Max. Hg From PRB	EMO™ Injection Rate	PAC Injection Rate	SO3 Injection Rate	NH3 Injection Rate	Stack Hg	Stack Hg	Hg Oxidization at Stack	Overall Hg Removal	NOx	Opacity
mm/dd/yy	(MW)	(%)	(lb/TBtu)	(ppmvd)	(lb/mmacf)	(ppmvd)	(lb/hr)	(lb/TBtu)	(lb/GWh)	(%)	(%)	(lb/MMBtu)	(%)
5/2/11	329	100.0%	7.0	0.0	0	4	223	3.20	0.03122	0.0%	54.3%	0.044	23.9
	329	100.0%	7.0	0.0	0	4	216	3.40	0.03317	0.0%	51.4%	0.042	23.7
5/3/11	338	100.0%	7.0	7.6	0	4	232	0.91	0.00888	82.7%	87.0%	0.043	19.0
	338	100.0%	7.0	5.2	0	0	236	0.77	0.00751	81.5%	89.0%	0.045	17.4
	338	100.0%	7.0	10.1	0	0	250	0.65	0.00634	85.8%	90.7%	0.045	15.0
5/4/11	348	100.0%	7.0	4.3	0	0	252	0.50	0.00488	87.6%	92.9%	0.045	17.0

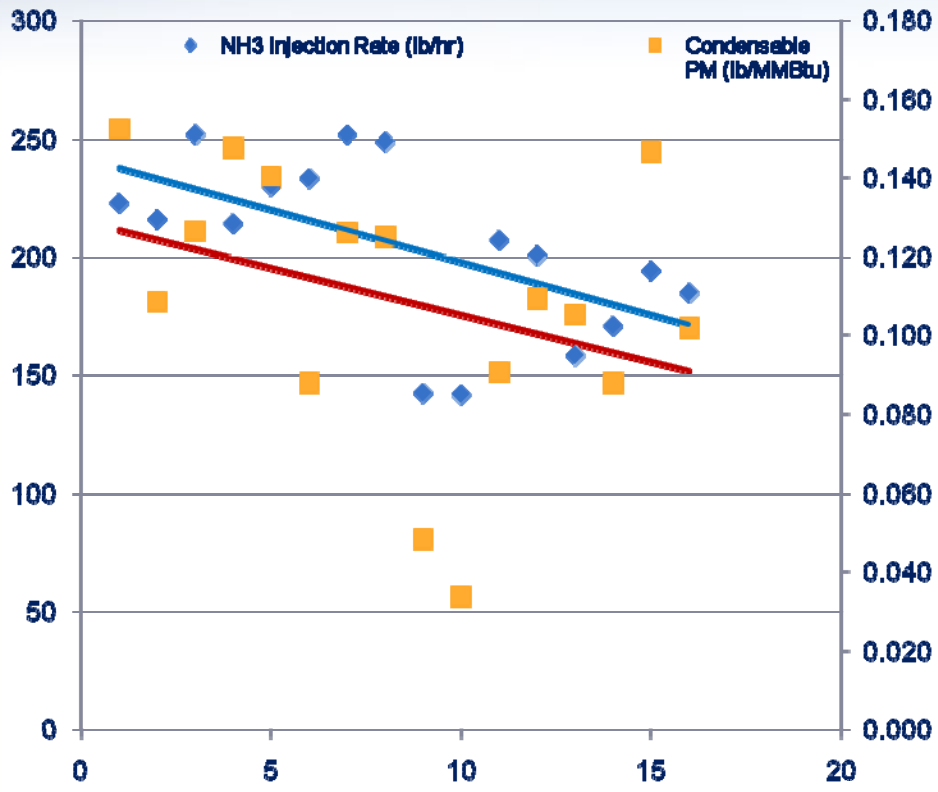
Result Overview – Hg Reduction at Stack

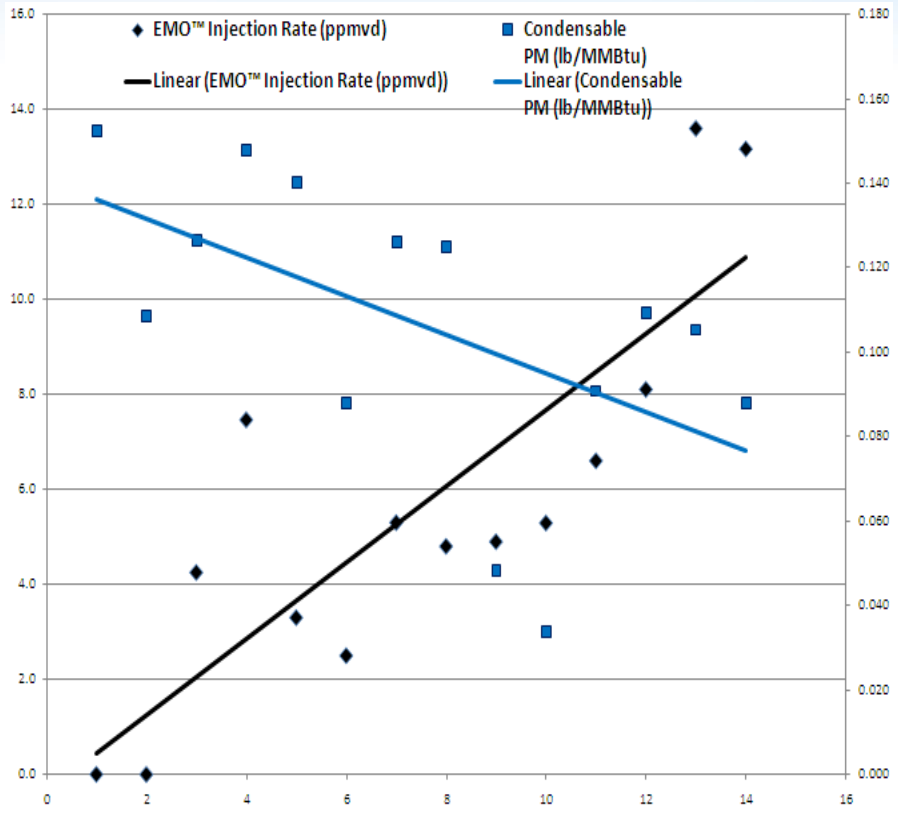


30M012011D 01.21.11

Shaw® a world of Solutions™

EMO™ Data Overview (Condensable Particle Matters)

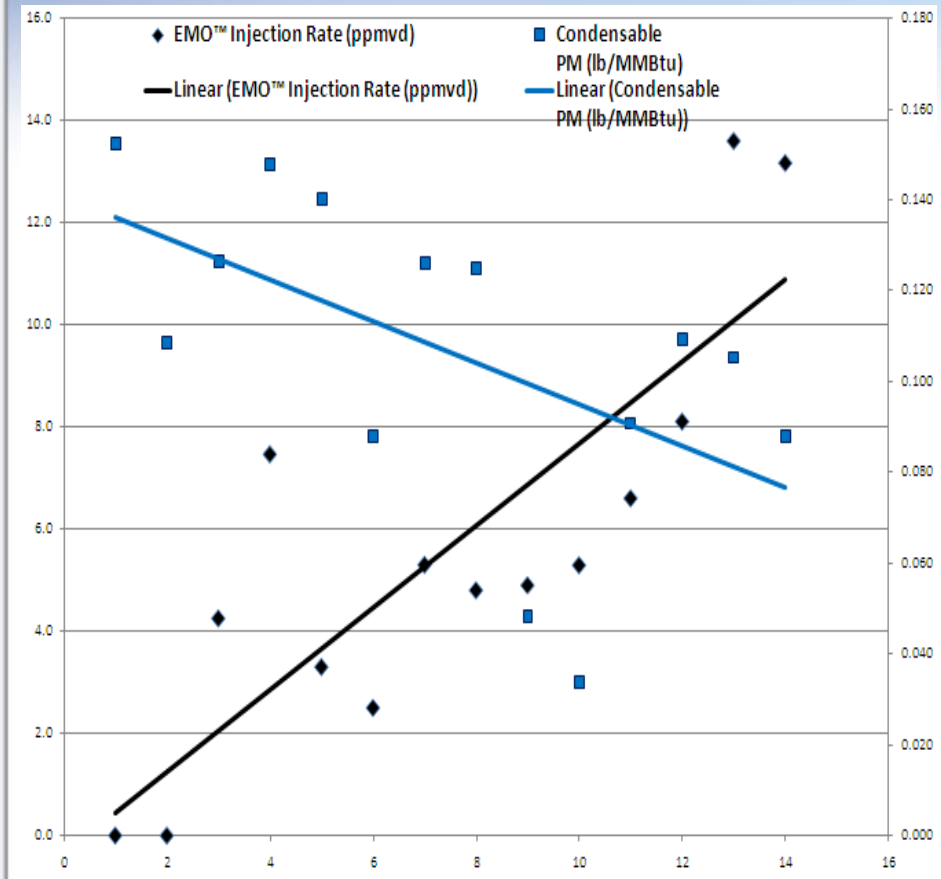


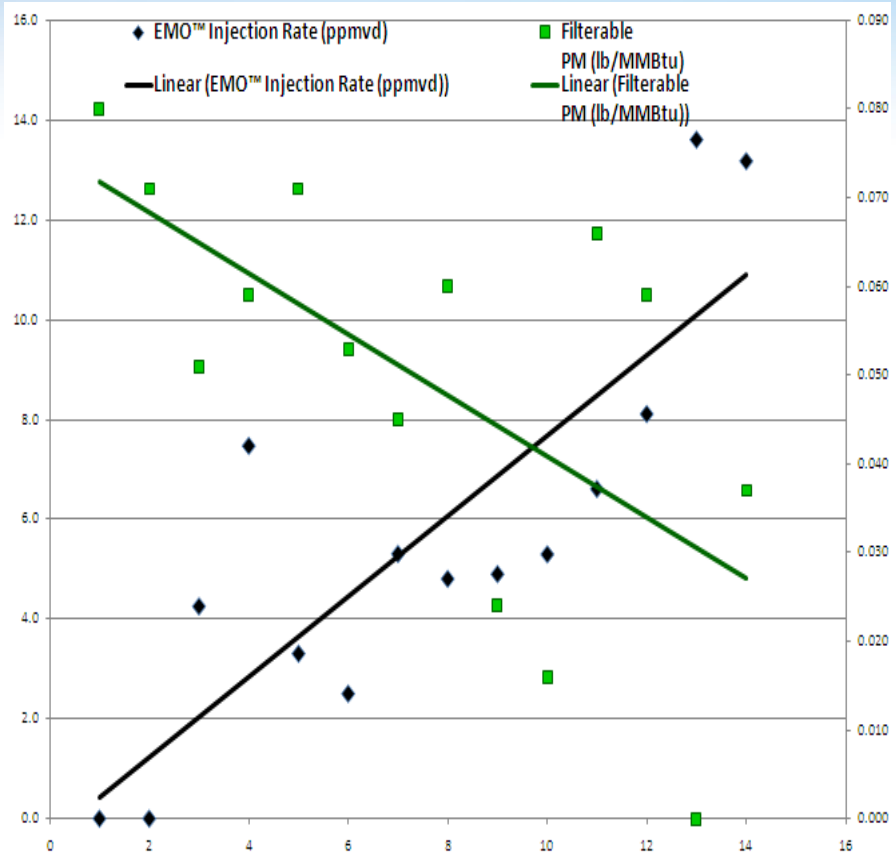


30M012011D 01.21.11

Shaw® a world of Solutions™

EMO™ Data Overview (Particle Matters, FPM/CPM)

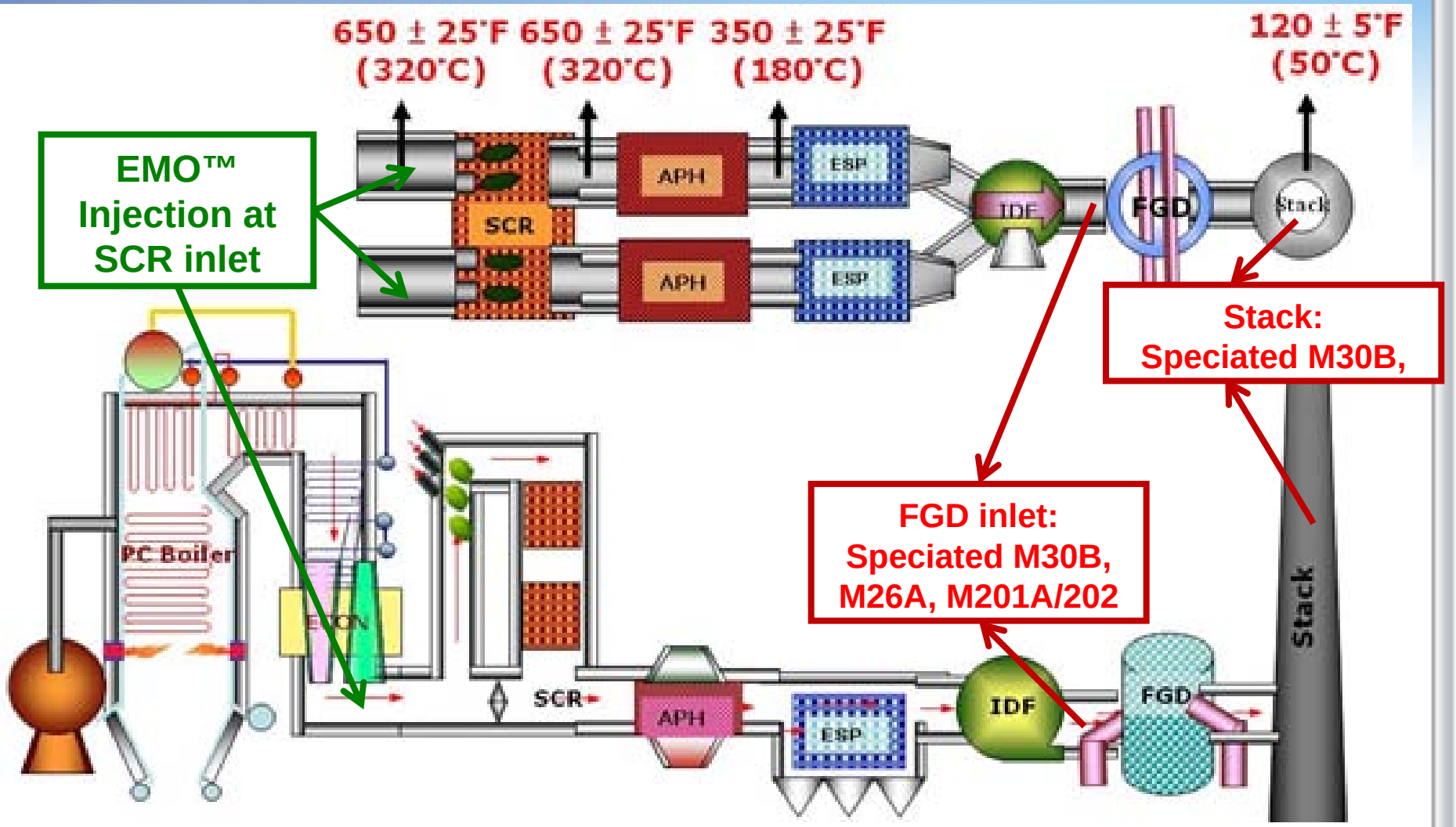




30M012011D 01.21.11

Shaw® a world of Solutions™

5th EMO™ Field Trial Unit Configuration



Flue gas bypasses the wet scrubber was determined to be between 20% and 25%

Shaw® a world of Solutions™

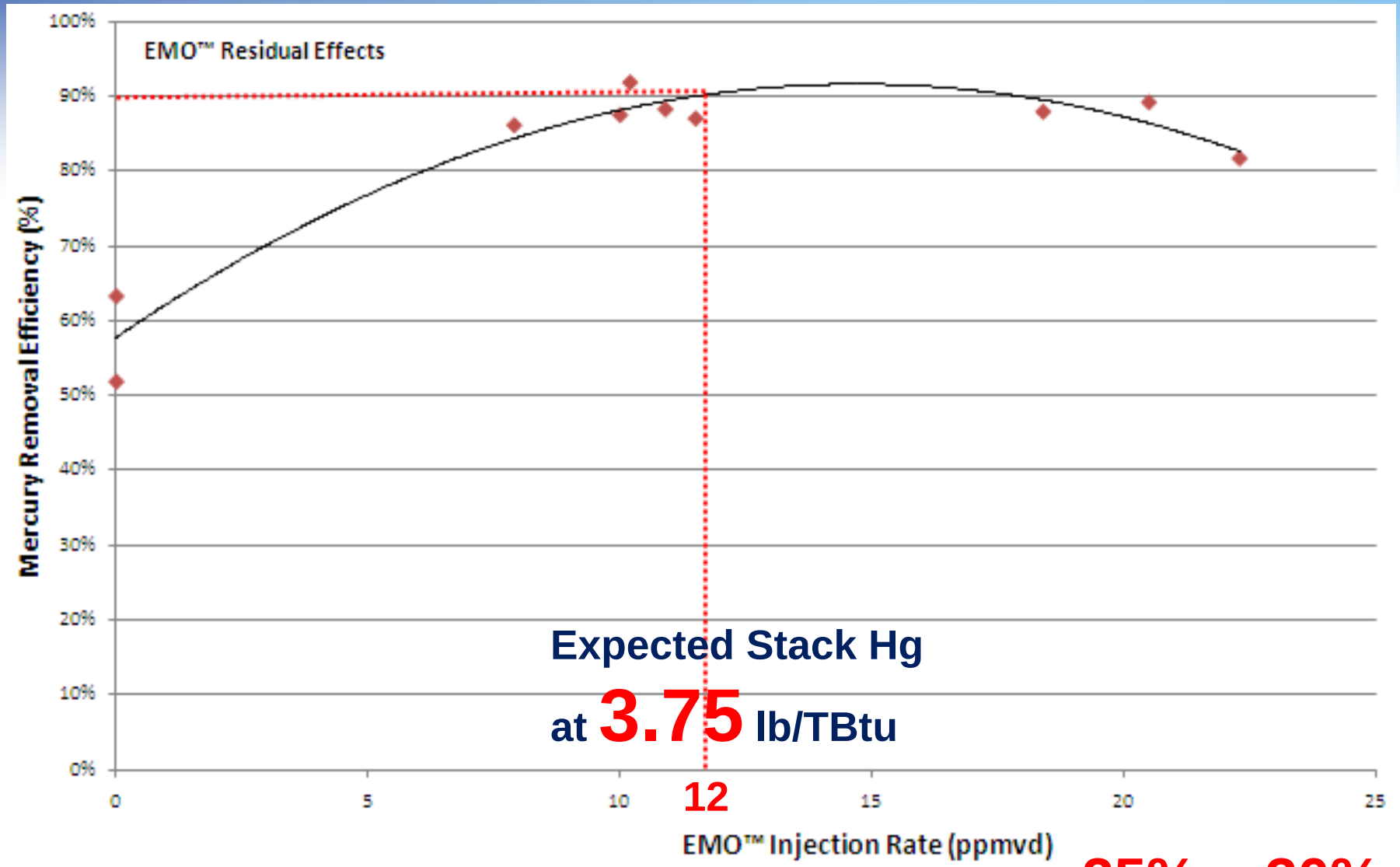
30M012011D 01.21.11

5th EMO™ Full Scale Data

- Unit configuration
  - PC Unit - 650 MW equivalent burning Lignite
  - SCR+ Electric-static precipitator + Wet Scrubber (**25%** to **30%** flue gas bypasses the FGD)
- Testing performed
  - Baseline tests
  - Varying EMO™ chemical injection rates at the Economizer outlet

Date	Unit Load	Flue Gas By-pass	Max. Hg in Coal	PRB blending by Weight	EMO Injection Rate	PAC Injection Rate	FGD Inlet Hg	ESP Hg Removal	Stack Hg	Hg Oxidization at Stack	Overall System Hg Removal	Opacity
mm/dd/yy	(MW)	(%)	(lb/TBtu)	(%)	(ppmvd)	lb/mmacf	(lb/TBtu)	(%)	(lb/TBtu)	(%)	(%)	(%)
3/30/11	632	20.2	29.2	0.0	0	0	32.31	-10.8%	14.22	49.6%	51.2%	11.2
	632	19.0	29.2	0.0	0	0	34.77	-19.2%	10.39	45.0%	64.4%	11.3
3/31/11	536	22.0	33.8	0.0	0	0	35.89	-6.3%	8.46	49.7%	74.9%	8.6
	536	21.2	33.8	0.0	0	0	38.41	-13.8%	10.29	45.0%	69.5%	11.3
4/1/11	534	20.9	49.5	0.0	10.0	0	26.31	46.8%	4.92	97.0%	90.1%	7.5
	472	23.1	49.5	0.0	18.4	0	22.95	53.6%	4.75	99.0%	90.4%	7.2
4/3/11	536	24.6	33.4	0.0	10.2	0	21.68	35.1%	3.21	98.1%	90.4%	8.4

Result Overview – Hg Reduction at Stack

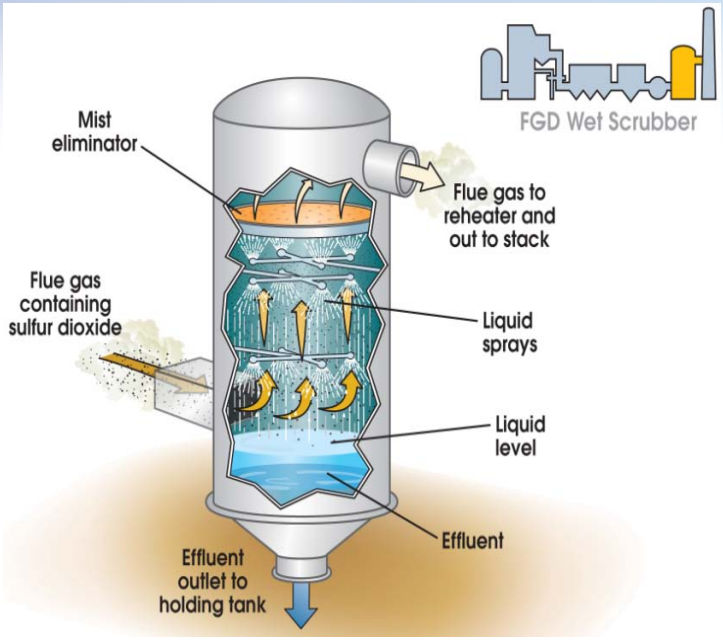


Flue gas bypasses the wet scrubber was determined to be between 25% and 30%

Shaw® a world of Solutions™

30M012011D 01.21.11

Factors Causing Hg Control Efficiency Variation - Flue Hg Reemission Crossing FGD



- 90% or above for SO_2 control
- 10 – 40% for total mercury capture (90% or above for Hg(2++) control)
- 5-10% for SO_3 control

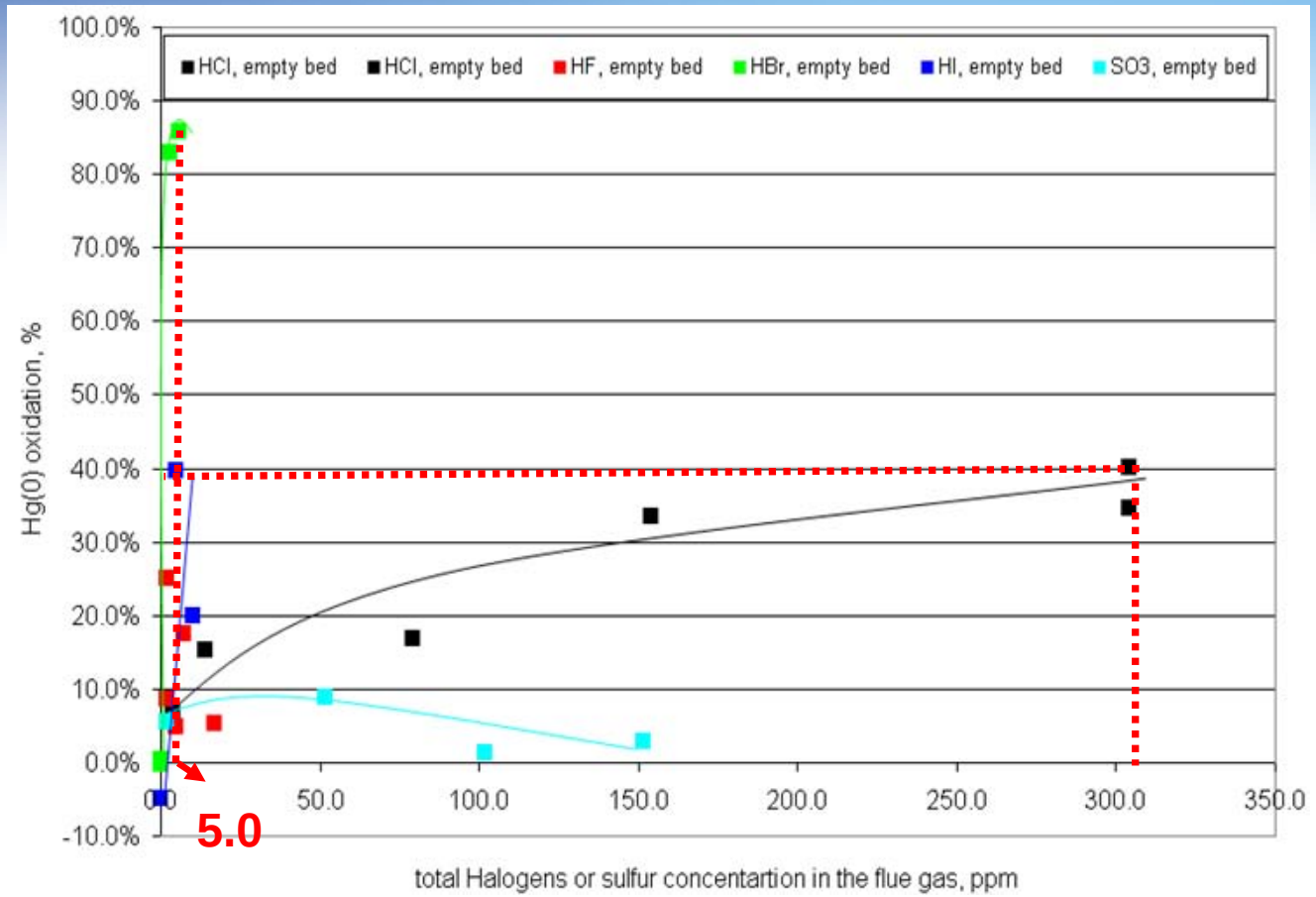
$CaO + SO_2 \longrightarrow CaSO_3$ (Oxidization)

$CaO + O_2 + SO2 \longrightarrow CaSO_4$ (Forced Oxidization)

The predominant form of oxidized Hg is HgCl, $HgCl_2$

$(HgCl, HgCl_2) \longrightarrow$ Hg(0) (Reducing Reaction – Hg Reemission)

Shaw EMO™ -- Potential Mercury Reemission Solution



- ✓ The Gibbs free energy index shows that the Δgf of HgCl is **15** while the Δgf of HgBr2 is **-36.6**
- ✓ The bigger the negative number, the more stable the chemical compound is, also the more energy it requires to break the compound apart.

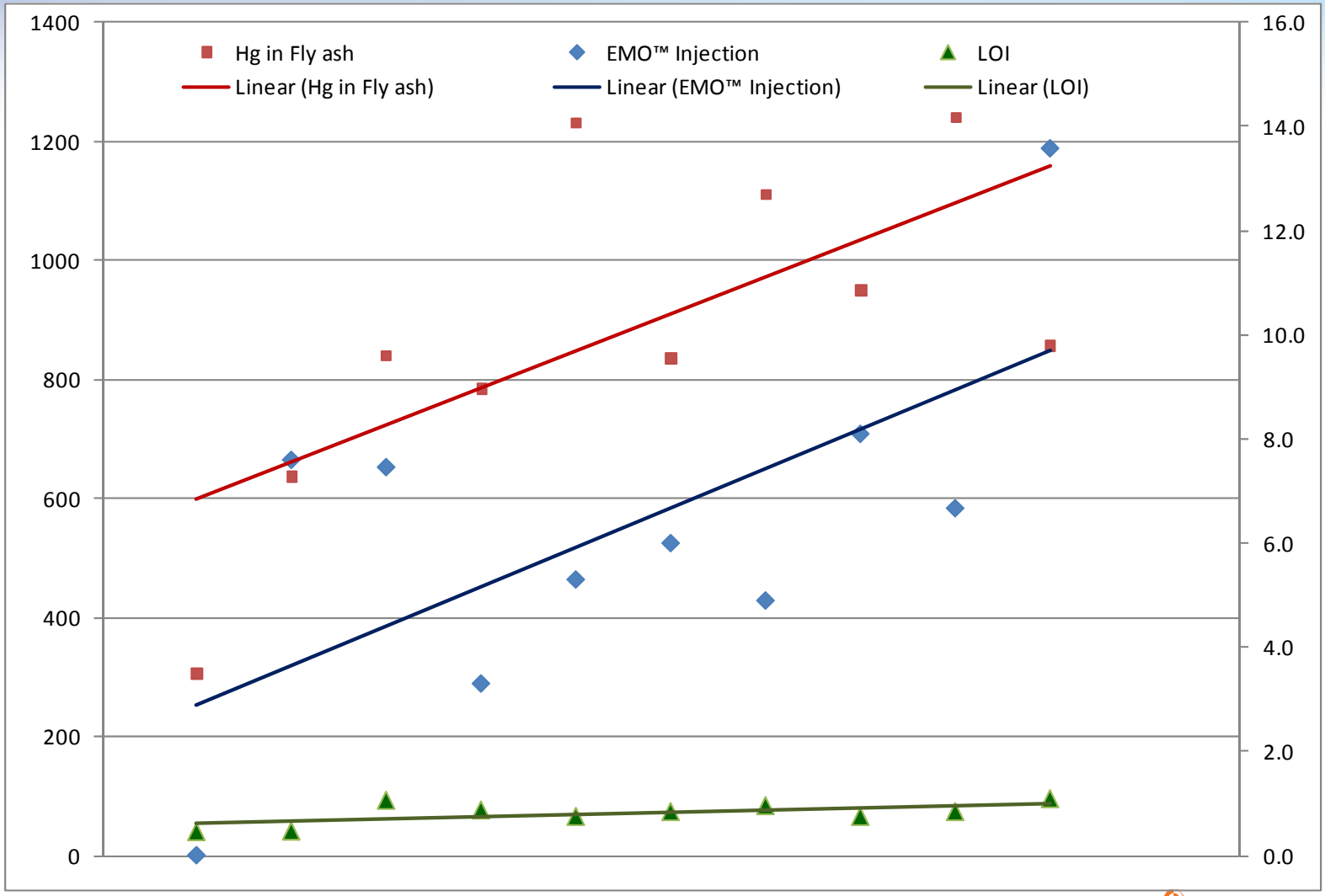
30M012011D 01.21.11

Shaw® a world of Solutions™

Fly Ash Hg Analysis

Sample ID	Analyte	Report Matrix	LOI (%)	Result	Units
X-031911	Hg	Baseline	0.03	0.046	mg/Kg
X-032011	Hg	EMO-Parametric	0.03	0.104	mg/Kg
X-032111	Hg	EMO-Parametric	0.03	0.132	mg/Kg
X-032211	Hg	EMO-Optimal	0.06	0.251	mg/Kg
X-032311	Hg	EMO-Optimal	0.06	0.147	mg/Kg
Y-033011	Hg	Baseline	0.48	0.069	mg/Kg
Y-033111	Hg	Baseline	0.22	0.234	mg/Kg
Y-040111	Hg	EMO-Parametric	0.34	0.234	mg/Kg
Y-040211	Hg	EMO-Parametric	0.34	0.261	mg/Kg
Y-040311	Hg	EMO-Optimal	0.41	0.334	mg/Kg
Z-001	Hg	Baseline	<0.01	0.014	mg/Kg
Z-002	Hg	EMO-Parametric	<0.01	0.406	mg/Kg
Z-003	Hg	EMO-Parametric	<0.01	0.481	mg/Kg
Z-004	Hg	EMO-Optimal	<0.01	0.489	mg/Kg
Z-005	Hg	EMO-Optimal w/ACI	<0.01	1.04	mg/Kg

Hg Content in the Fly Ash VS EMO™



TCLP Analysis

Sample ID	Condition	Sample Date	Hg	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
X-031911	Baseline	3/19/2011	BRL	BRL	0.69	BRL	0.143	BRL	0.0615	BRL
X-032011	EMO-Parametric	3/20/2011	BRL	BRL	0.719	BRL	0.14	BRL	0.0566	BRL
X-032111	EMO-Parametric	3/21/2011	BRL	BRL	0.791	BRL	0.12	BRL	0.0638	BRL
X-032211	EMO-Optimal	3/22/2011	BRL	BRL	0.893	BRL	0.276	BRL	0.0994	BRL
X-032311	EMO-Optimal	3/23/2011	BRL	BRL	0.923	BRL	0.111	BRL	0.0899	BRL
Y-033011	Baseline	3/30/2011	BRL	BRL	0.715	0.0131	0.0577	BRL	0.0686	BRL
Y-033111	Baseline	3/31/2011	BRL	0.0248	1.38	BRL	0.0125	BRL	0.075	BRL
Y-040111	EMO-Parametric	4/1/2011	BRL	BRL	2.34	BRL	BRL	BRL	0.0793	BRL
Y-040211	EMO-Parametric	4/2/2011	BRL	0.0226	0.925	BRL	0.0425	BRL	0.132	BRL
Y-040311	EMO-Optimal	4/3/2011	BRL	0.0406	0.0571	BRL	0.0651	BRL	0.303	BRL
Z-001	Baseline	4/11/2011	BRL	0.349	0.793	BRL	0.235	BRL	**1.24**	BRL
Z-002	EMO-Parametric	4/12/2011	BRL	0.154	2.21	BRL	0.0201	BRL	0.454	BRL
Z-003	EMO-Parametric	4/13/2011	BRL	0.598	0.611	BRL	0.554	BRL	0.751	BRL
Z-004	EMO-Optimal	4/14/2011	BRL	0.559	0.833	BRL	0.612	BRL	0.609	BRL
Z-005	EMO-Optimal w/ACI	4/15/2011	BRL	0.424	0.82	BRL	0.49	BRL	0.536	BRL
Z-006 ESP	Baseline	4/11/2011	BRL	0.0863	2.41	BRL	0.0972	BRL	0.419	BRL
Z-007 ESP	EMO-Parametric	4/12/2011	BRL	0.126	2.38	BRL	0.219	BRL	0.377	BRL
Z-008 ESP	EMO-Parametric	4/13/2011	BRL	0.0238	0.183	BRL	BRL	BRL	0.0905	BRL
Z-009 ESP	EMO-Optimal	4/14/2011	BRL	0.14	2.19	BRL	0.0789	BRL	0.442	BRL
Z-010 ESP	EMO-Optimal w/ACI	4/15/2011	BRL	0.0833	2.08	BRL	0.0605	BRL	0.428	BRL

Limits	Hg	Arsenic	Barium	Cadmium	Chromium	Lead	Seleniu m	Silver
Regulated Level (mg/l) or (ppm)	**0.2**	**5**	**100**	**1**	**5**	**5**	**1**	**5**

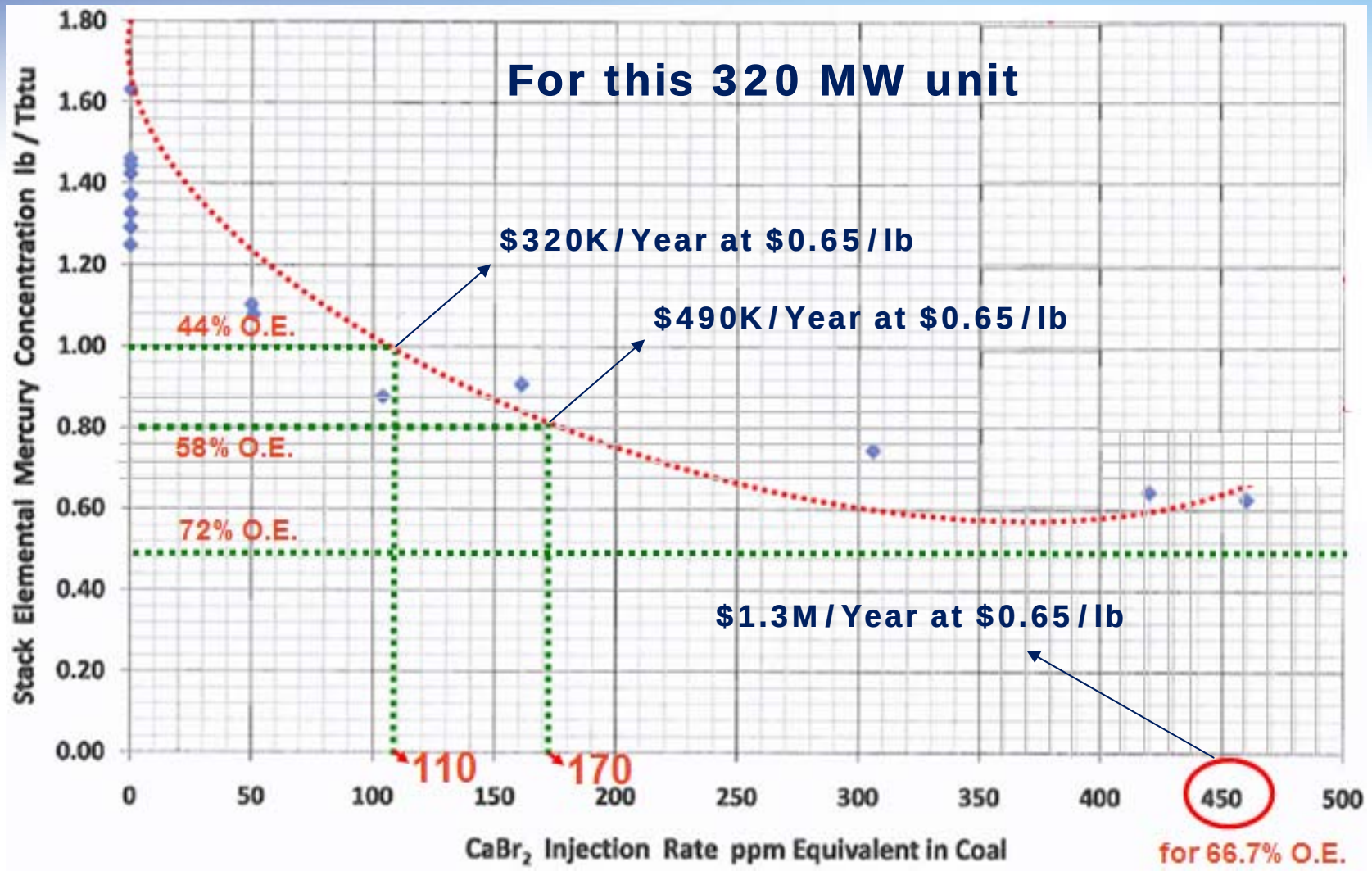
30M012011D 01.21.11

Shaw® a world of Solutions™

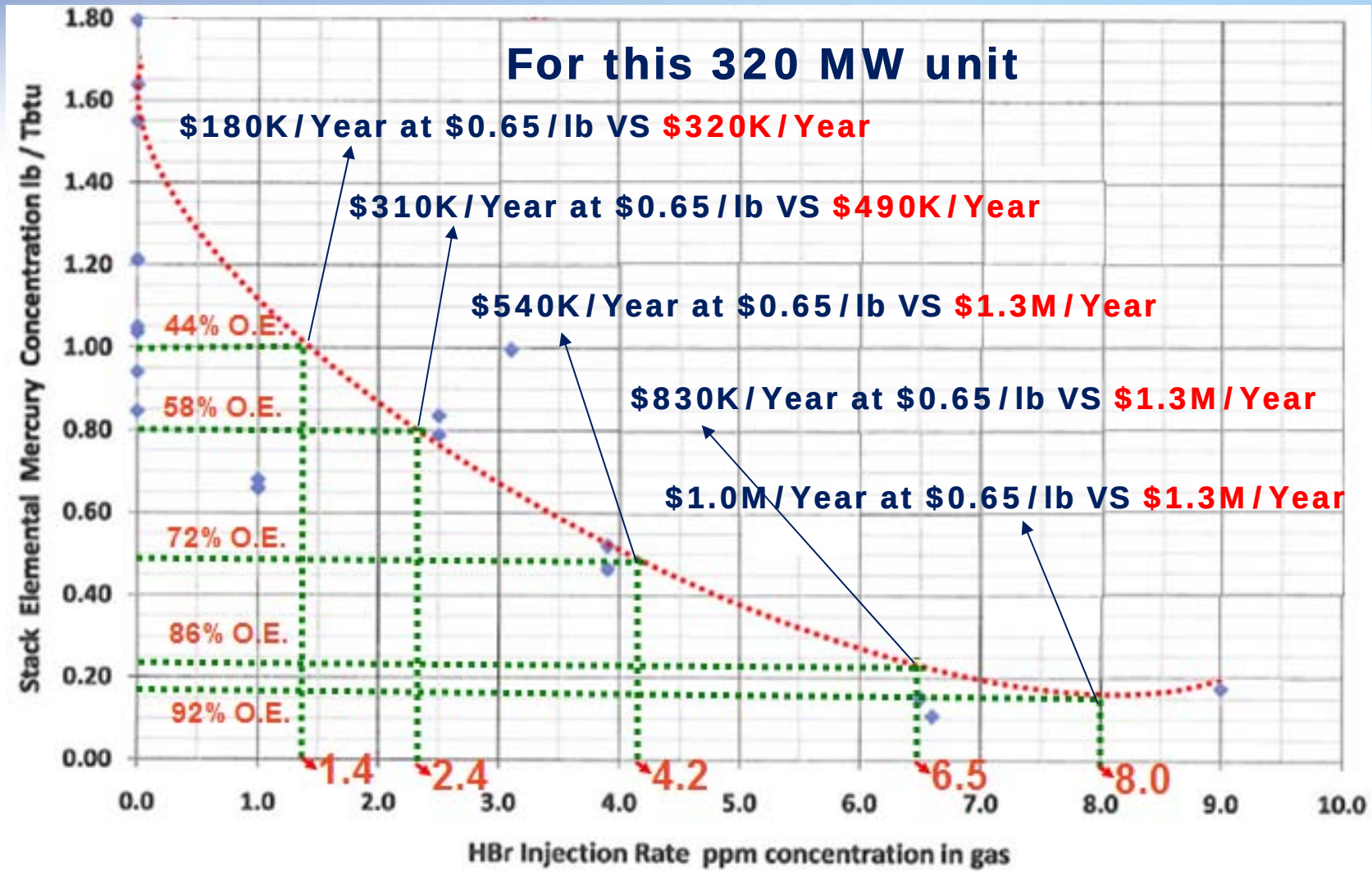
Factors that Define this Technology

- Even chemical dispersion and complete mixture with the flue gas – Injection nozzles designed to control to desired residence time, and the proper cooling system to optimize system performance
  - Shaw EMO™ employs Shaw's liquid-spraying nozzle, pumping and the system cooling to optimize the system performance model
- Selection for the injection location – Combustion zone, post-combustion hot side/cold side
  - Shaw EMO™ suggests injection to be carried out at the economizer (680 °F – 850 °F) post-combustion zone which yields no impact to the fuel combustion processes
- Chemical properties/composition – HBr, Br_2, HCl, or Cl_2 where Cl_2 and Br_2 yield only little effect promoting Hg oxidization
  - Shaw EMO™ employs HBr as the injection additive which has been demonstrated as an effective chemical reagent promoting mercury oxidization
- Corrosion-resistance system construction and leakage free protection, material handling and transportation.

$CaBr_2$ Performance on Hg Oxidization



EMO™ Performance on Hg Oxidization

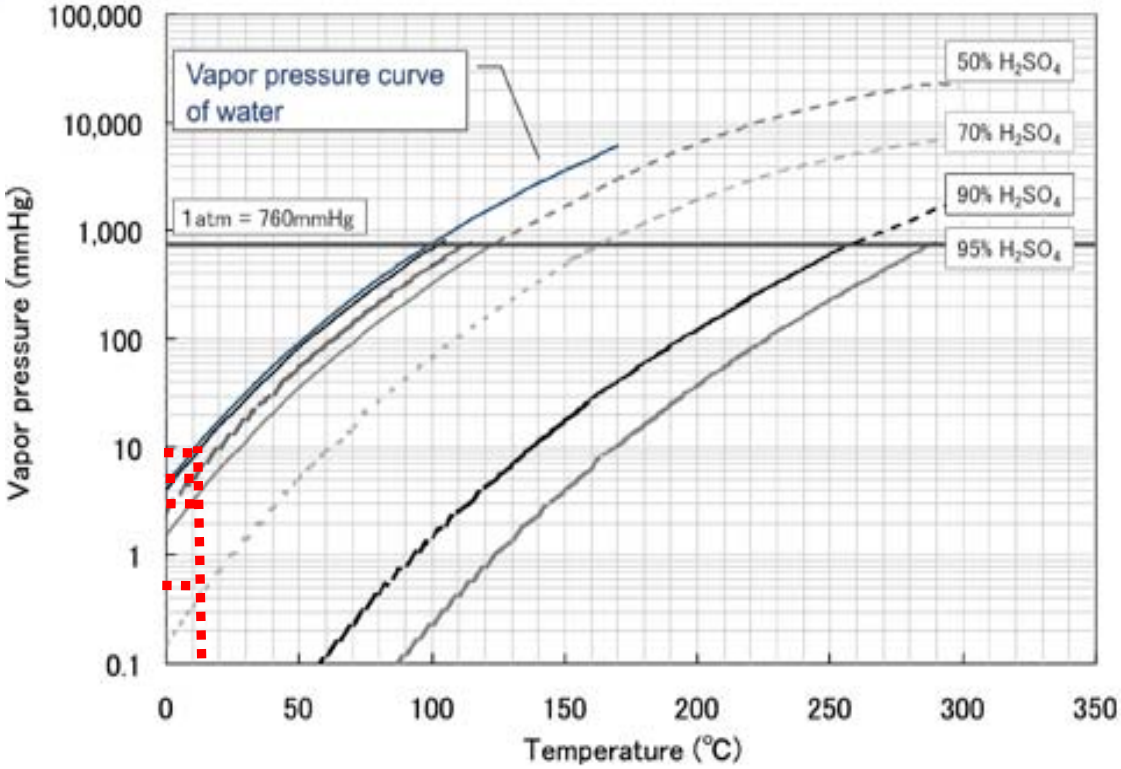


30M012011D 01.21.11

Shaw® a world of Solutions™

Long Term Corrosion Issues

- Acid gas dew point for SO3 : 270 ˚F to 290˚F (This is why flue gas temperature is kept above 300˚F - to prevent SO3 condensation)
- Boiling point of pure HBr is at -88˚F, acid gas dew point for 48% HBr : 160 ˚F



- Vapor pressure of pure HBr at 62˚F is 20 atm or 15,200 mmHg. Vapor pressure of pure HCl at 68˚F is 42 atm or 31,650 mmHg (Again, HBr exists in vapor phase at atmospheric pressure)

Proposed EMO™ Demo

Testing Schedule																		
Unit Number			- Phase 1 Paramteric Testing															
Date	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7		Day 8		Day 9	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Testing Activity	Travel & Mobilization		Shaw testing team will spend three days to set up/test run injection skid/equipments and other monitoring/testing instrumentation.				Set-up / Baseline		Parametric Testing								Contingency	
									EMO™ Flue Gas Treatment (IR: Injection Rates)									
Sorbet Type _ EMO™									1st, 2nd, 3rd Injeciton Rates		4th, 5th, 6th Injeciton Rates		EMO at the Optimal Rate		EMO at the Optimal Rate+ACI			
Speciated APK at Stack							● ● ● ●		● ● ● ● ● ●		● ● ● ● ● ●		● ● ● ●		● ● ● ●			
M26A at Stack							● ●		● (Highest Rate)		● (Highest Rate)		● ●		● ●			
M201A/202 at Stack							● ●		● (Highest Rate)		● (Highest Rate)		● ●		● ●			
Caol Sample							● (at noon)		● (at noon)		● (at noon)		● (at noon)		● (at noon)			
Fly Ash Sample							● (at noon)		● (Highest Rate)		● (Highest Rate)		● (Highest Rate)		● (Highest Rate)			

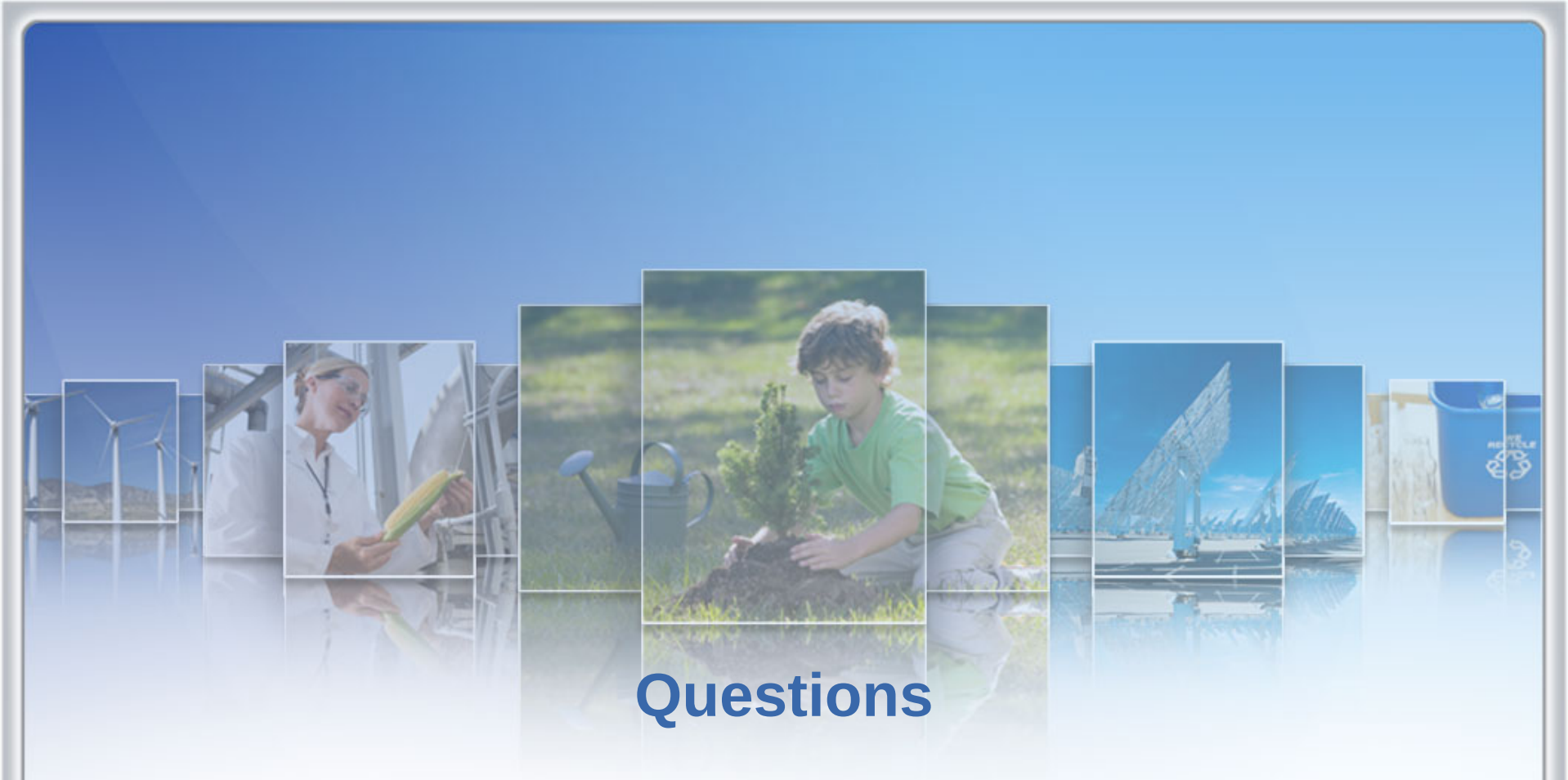
- ✓ Phase one contains one day of baseline testing (day 4), two days of Parametric testing at various EMO injection rates (days 5 and 6), one day for a repeated testing applying the optimal EMO rate for data validation, one day to see the combined impact from ACI and EMO, and the last day is scheduled for contingency

Testing Schedule																		
Unit Number	- Phase 2 Long Term Confirmatory Testing																	
Date	Day 10		Day 11		Day 12		Day 13		Day 14		Day 15		Day 16		Day 17		Day 18	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Testing Activity	Long Term Confirmatory Testing														Data Review, Inst. Take-down & Demobilization			
	EMO™ Flue Gas Treatment (IR: Injection Rates)																	
Sorbet Type _ EMO™	EMO at the Optimal Rate for Continuous Operations																	
Speciated APK at Stack	● ● ● ●		● ● ● ●		● ● ● ●		● ● ● ●		● ● ● ●		● ● ● ●		● ● ● ●					
M26A at Stack	● ●						● ●						● ●					
M201A/202 at Stack	● ●						● ●						● ●					
Caol Sample	● (at noon)		● (at noon)		● (at noon)		● (at noon)		● (at noon)		● (at noon)		● (at noon)					
Fly Ash Sample	● (at noon)		● (at noon)		● (at noon)		● (at noon)		● (at noon)		● (at noon)		● (at noon)					

- ✓ If Phase 1 shows promising results, Shaw will propose to stay testing for another 7 days which is the long term confirmatory testing applying EMO at the predetermined optimal rate for continuous operations

30M012011D 01.21.11

Shaw® a world of Solutions™



Questions

Bobby I.T. Chen
Client Program Manager
865.670.2687 (direct)
270.799.6833 (cell)
bobby.chen@shawgrp.com

Terry Marsh
Vice President
865.690.3211 (office)
865.599.3274 (cell)
terry.marsh@shawgrp.com