



# CEMS Alternatives

A Different Way



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# Background

- AECC has had CEMS installed since mid-1990's
- Currently AECC maintains 6 CEMS & 7 PEMS
- I have managed AECC CEMS for 11 years
- I have been involved in CEMS for 29 years



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# 3 Ways to Monitor Emissions

- Continuous Process Monitoring (CPM)
- Continuous Emission Monitoring Systems (CEMS)
- Predictive Emission Monitoring System (PEMS)



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# Elkins Generating Station



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# Process Instrumentation

RUN 3 Elkins U1

Timestamp	GAS FLOW	Kilowatts	Water/Fuel Ratio	Water GPM
7/13/17 12:03	4041.999837	21879	4.550570641	18.4087
7/13/17 12:04	4038.720571	21840	4.55036084	18.45566
7/13/17 12:05	4037.315222	21883	4.527602673	18.36953
7/13/17 12:06	4028.099565	21740	4.570445278	18.3152
7/13/17 12:07	4019.992726	21871	4.528708416	18.13672
7/13/17 12:08	4032.511726	21861	4.531507108	18.41023
7/13/17 12:09	4028.31881	21840	4.568971388	18.40052
7/13/17 12:10	4021.333733	21862	4.565976709	18.3904
7/13/17 12:11	4022.059296	21840	4.543674374	18.32476
7/13/17 12:12	4022.668369	21817	4.543415532	18.14825
7/13/17 12:13	4022.250361	21849	4.518070325	18.31223
7/13/17 12:14	3813.142948	20354	4.46126835	16.92349
7/13/17 12:15	3788.830121	20435	4.394152634	16.59388
7/13/17 12:16	3762.374756	20311	4.361649513	16.46382
7/13/17 12:17	3743.788394	20237	4.361891337	16.34522
7/13/17 12:18	3776.699799	20368	4.324222878	16.45014
7/13/17 12:19	3768.04602	20373	4.361152127	16.38951
7/13/17 12:20	3748.611395	20305	4.364216632	16.30488
7/13/17 12:21	3745.634098	20259	4.34687037	16.32327
7/13/17 12:22	3747.076917	20364	4.361018807	16.32518
7/13/17 12:23	3772.44664	20118	4.361959347	16.46524
	3903.901014	21114.57143	4.461795965	17.4408 Avg

scfm 21 MW

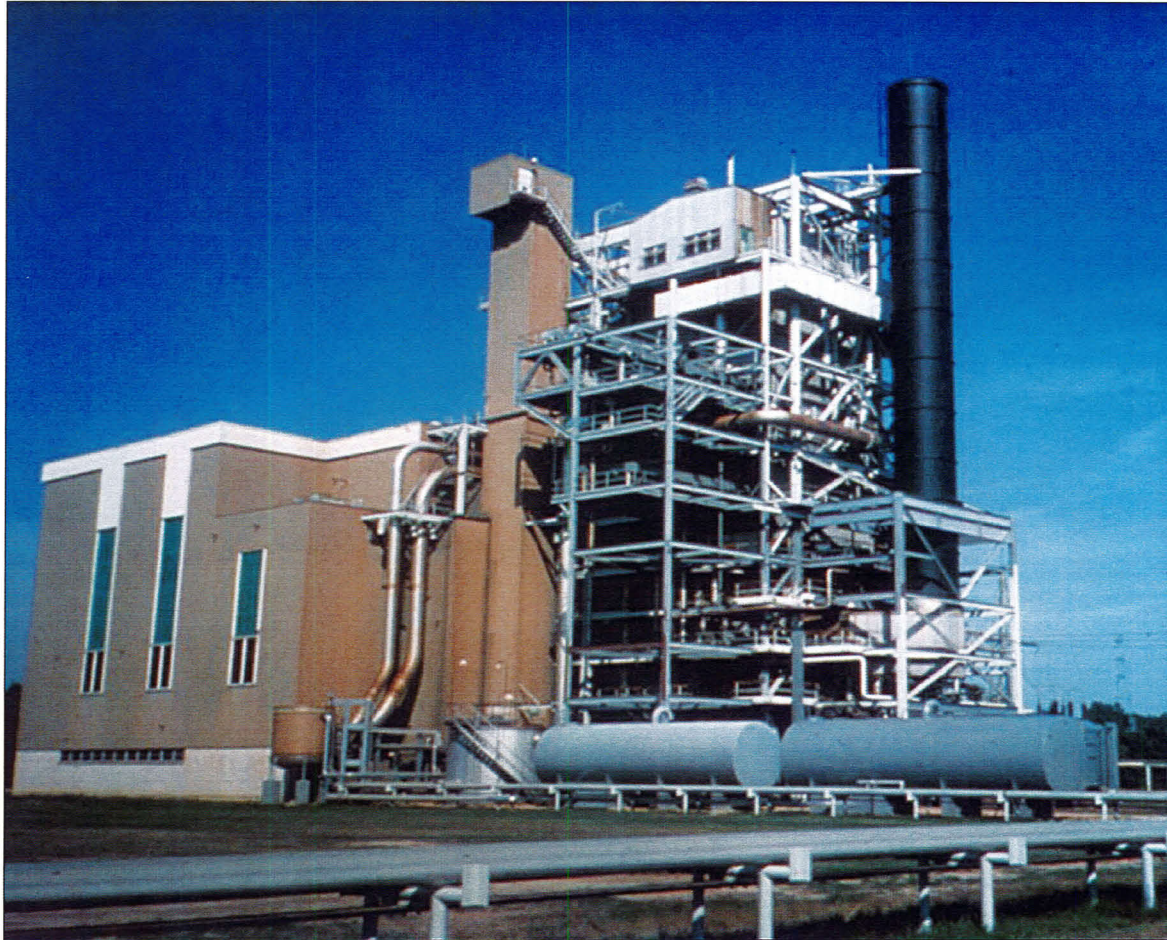
Water injection/  
Fuel flow ratio  
must be 3.9 or  
higher to  
demonstrate  
compliance. NO<sub>x</sub>  
was 18.2 ppm  
corrected to 15%  
O<sub>2</sub> for this run.



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# McClellan Generating Station



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# Traditional CEMS



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# Oswald Generating Station



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# PEMS Advantages

- Initial cost same as hardware CEMS
- Lower operating cost
- Operates on existing plant control system instrumentation
- Less preventative maintenance
- Less downtime (higher reliability)



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# PEMS Disadvantages

- Lengthy process to install
- Assumes process is operating correctly downstream of the measuring device
- May require additional model training if plant conditions change
- Vendor support needed during RATAs





# Requirements for PEMS

- Determine applicable regulation (Part 60 or 75)
- Select plant/unit inputs to monitor
- Train the models
- Statically compare 720 hours of operation
- Submit report to EPA
- Receive EPA approval



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# GE LM 6000 Sensor Inputs

## GE LM 6000 Combustion Turbines (G1 thru G6) Sensor Model Inputs

Sensor Description	Instrument Range	Units	PEMS Set-point		Instrument Type
			Min	Max	
*Duct Burner (DB) Gas Flow	0 - 200,000	scfh	0	200,000	Invensys
HRSG BMS	0 - 1	1=DB On	n/a	n/a	Action
HRGS Inlet Temp	0 - 1600	DegF	77	1400	Action
HRSG High Pressure Steam Flow	0 - 375	Klbs	0	236	Rosemount
CT HP Compressor Discharge Pressure	0 - 600	PSIA	14	452	Ametek and Druck
HP Compressor Discharge Temp	-50 - 2000	DegF	74	1016	GE
CT Flame Detector	0 - 1	1=Flame	n/a	n/a	Ametek
*CT Gas Flow	0 - 504,000	scfh	0	504,000	Yokogawa
CT Inlet Air Pressure	0 -16	PSIA	13.8	14.82	Yokogawa
CT Inlet Air Temp	-60 - 150	DegF	43	81	GE
CT Mega Watt (MW)	0 - 60	MW	n/a	n/a	GE
*CT Steam Injection	0 - 60,000	lbs	0	38,860	Rosemount
CT Thrust Balance Value Position	0 - 100	%	0	45.89	Honeywell
CT Exhaust Pressure	0 - 150	PSIA	14	111	AmeteK
CT Exhaust Temp	0 - 2000	DegF	87	1615	GE
*CT By-Pass Vane Position	0 - 100	%	0	100	GE
CT Inlet Guide Vane Position	0 - 100	%	0	100	GE
CT Stator Vane Position	0 - 100	%	1	97	Arkin
*CT Sprint Water Flow	0-60	gpm	0	17	GE



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# GE 7EA & Shared Sensor Inputs

## GE 7EA Combustion Turbine (G7) Sensor Model Inputs

Sensor Description	Instrument Range	Units	PEMS Set-point		Instrument Type
			Min	Max	
*Duct Burner Gas Flow	0 - 270,000	scfh	0	270,000	Invensys
HRSG BMS	0 - 1	1=DB On	n/a	n/a	Action
HRGS Inlet Temp	0 - 1600	DegF	0	1593	Action
*HRSG High Pressure Steam Flow	0 - 812	Klbs	0	546	Rosemount
*CT HP Compressor Discharge Pressure	0 - 300	PSIA	0	187	Ametek
*HP Compressor Discharge Temp	0 - 1000	DegF	0	846	GE
Flame Detector	0 - 1	1=Flame	n/a	n/a	Ametek
*CT Gas Flow	0 - 1,008,000	scfh	0	1,069,937	Rosemount
CT Inlet Air Pressure	0 - 11	PSIA	0	6.7	Rosemount
CT Inlet Air Temp	-50 - 150	DegF	61	129	GE
CT Mega Watt (MW)	0 - 70	MW	0	70	GE
CT Exhaust Pressure	0 - 150	inH <sub>2</sub> O	0	187	Rosemount
*CT Combustion Reference Temp	0 - 2500	DegF	0	2500	GE
*CT Inlet Guide Position	0 - 100	%	24	94	GE

Sensor Description (Used by all 7 Units)	Instrument Range	Units	Instrument Type
Barometric Pressure	913 - 1113	mBar	Nova Lynx
*Relative Humidity	0 - 100	%	Nova Lynx
Dry Bulb Temp	-50 - 150	DegF	1313Young



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# PEMS QA/QC Requirements

- Daily – 1 validation check
- Quarterly – RAA every QA quarter
- Annually – RATA every 4 QA quarters



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# Reported & Estimated NO<sub>x</sub> Plant Emissions

## Oswald CEMS Reported

- 2010 – 125.2 tons
- 2011 – 196.3 tons
- 2012 – 103.7 tons
- 2013 – 97.0 tons

## Oswald PEMS (estimated)

- 2010 – 129.9 tons
- 2011 – 194.0 tons
- 2012 – 105.1 tons
- 2013 – 99.9 tons



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# Questions?

## Contact Information

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