

Attachment 3

January 24, 2014 Response to EFSEC and EPA Comments

Cleaver-Brooks Boiler Expected Emission Data

Producing Steam Firing		Nat Gas		Boiler Model	CBEX Elite
BACKGROUND INFORMATION					
Date	07/29/13			Altitude (feet)	700
Author	L.C. Banks			Operating Pressure (psig)	125.00
Customer	ICPE			Furnace Volume (cuft)	507.00
City & State	---			Furnace Heat Release (btu/hr/cu ft)	121,785
				Heating Surface (sqft)	4466
				Nox System	9

Nat Gas		Firing Rate			
		25%	50%	75%	100%
Horsepower		375	750	1125	1500
Input , Btu/hr		15,389,000	30,672,000	46,050,000	61,745,000
CO	ppm	50	50	50	50
	lb/MMBtu	0.036	0.036	0.036	0.036
	lb/hr	0.56	1.12	1.68	2.25
	tpy	2.460	4.903	7.361	9.870
NOx	ppm	9	9	9	9
	lb/MMBtu	0.0106	0.0106	0.0106	0.0106
	lb/hr	0.16	0.32	0.49	0.65
	tpy	0.714	1.422	2.136	2.864
NO	ppm	7.7	7.7	7.7	7.7
	lb/MMBtu	0.009	0.009	0.009	0.009
	lb/hr	0.14	0.28	0.41	0.56
	tpy	0.57	1.14	1.71	2.29
NO₂	ppm	1.4	1.4	1.4	1.4
	lb/MMBtu	0.002	0.002	0.002	0.002
	lb/hr	0.02	0.05	0.07	0.10
	tpy	0.14	0.28	0.43	0.57
SOx	ppm	1.00	1.00	1.00	1.00
	lb/MMBtu	0.0017	0.0017	0.0017	0.0017
	lb/hr	0.0264	0.0526	0.0789	0.1058
	tpy	0.116	0.230	0.346	0.464
VOCs (Non-Methane Only)	ppm	12.5	12.5	12.5	12.5
	lb/MMBtu	0.005	0.005	0.005	0.005
	lb/hr	0.077	0.153	0.230	0.309
	tpy	0.337	0.672	1.008	1.352
VOCs does not include any background VOC emissions.					
PM10 (Filterable)	ppm	N/A	N/A	N/A	N/A
	lb/MMBtu	0.00750	0.00750	0.00750	0.00750
	lb/hr	0.115	0.230	0.345	0.463
	tpy	0.506	1.008	1.513	2.028
PM10 (Condensable)	lb/MMBtu	0.00250	0.00250	0.00250	0.00250
	tpy	0.011	0.34	0.011	0.68
PM2.5 (Filterable)	lb/MMBtu	0.008	0.008	0.008	0.008
	tpy	0.033	1.01	0.033	2.03
PM2.5 (Condensable)	lb/MMBtu	0.0025	0.0025	0.0025	0.0025
	tpy	0.011	0.34	0.011	0.68
Exhaust Data					
Temperature, F		377	401	424	448
Flow	ACFM	5,036	9,938	14,738	20,304
	SCFM (70 Degrees Fah.)	3,266	6,263	9,033	12,112
	DSCFM	2,928	5,589	8,021	10,755
	lb/hr	14,697	28,183	40,649	54,503
Velocity	ft/sec	8.72	17.21	25.53	35.17
	ft/min	523	1,033	1,532	2,110

- Notes:**
- 1) All ppm levels are corrected to dry at 3% oxygen.
 - 2) Emission data based on actual boiler efficiency.
 - 3) % H₂O , by volume in exhaust gas is **17.24** % O₂, by volume **2.47**
 - 4) Water vapor in exhaust gas is **98.91** lbs/MMBtu of fuel fired
 - 5) CO₂ produced is **116.31** lbs/MMBtu of fuel fired
 - 6) Particulate is exclusive of any particulates in combustion air or other sources of residual particulates from mater
PM level indicated on this form is based on combustion air and fuel being clean and turndown up to 4:1.
 - 7) Heat input is based on high heating value (HHV).
 - 8.) Emission produced in tons per year (tpy) is based on 24 hours per day for 365 days = 8,760 hours per year
 - 9.) Exhaust data is based on a clean and properly sealed boiler.
 - 10.) Emission data is based on a burner turndown of 4 to 1.
 - 11.) Maximum flame temperature is 2800 degrees fahrenheit.

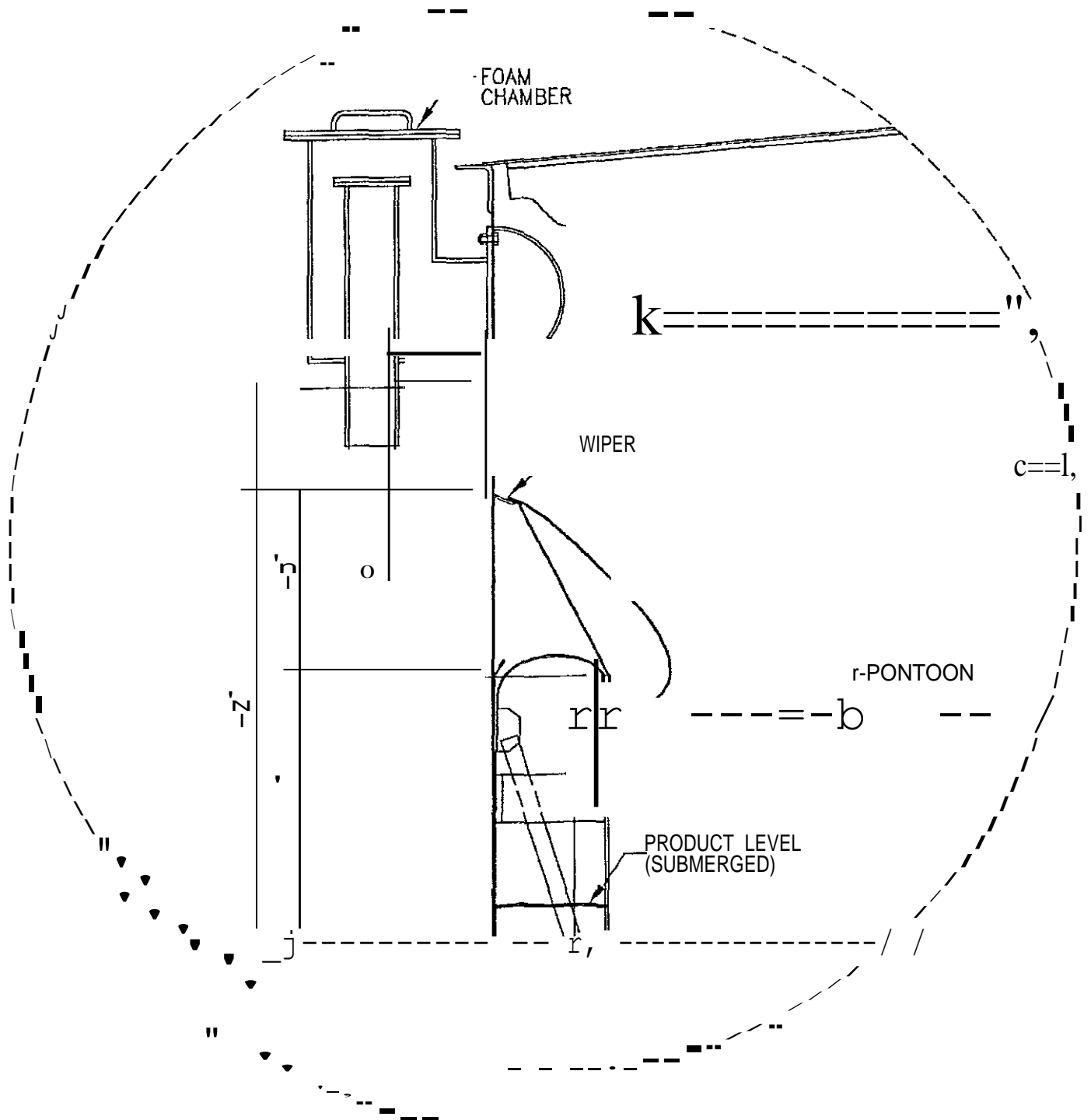
14) Fuel High Heating Value = **1000** Btu/FT³

Cleaver-Brooks Boiler Expected Emission Data

Producing Steam Firing						Nat Gas					
BACKGROUND INFORMATION											
Date	06/17/13					Boiler Model	CBEX Elite				
Author	L.C. Banks					Altitude (feet)	700				
Customer	----					Operating Pressure (psig)	125.00				
City & State	----					Furnace Volume (cuft)	110.00				
						Furnace Heat Release (btu/hr/cu ft)	113,809				
						Heating Surface (sqft)	860				
						Nox System	7				
Nat Gas		Firing Rate									
		25%	50%	75%	100%						
Horsepower		75	150	225	300						
Input , Btu/hr		3,080,000	6,176,000	9,323,000	12,519,000						
CO	ppm	50	50	50	50						
	lb/MMBtu	0.036	0.036	0.036	0.036						
	lb/hr	0.11	0.23	0.34	0.46						
	tpy	0.492	0.987	1.490	2.001						
NOx	ppm	7	7	7	7						
	lb/MMBtu	0.0082	0.0082	0.0082	0.0082						
	lb/hr	0.03	0.05	0.08	0.10						
	tpy	0.111	0.223	0.336	0.452						
NO	ppm	6.0	6.0	6.0	6.0						
	lb/MMBtu	0.007	0.007	0.007	0.007						
	lb/hr	0.02	0.04	0.07	0.09						
	tpy	0.09	0.18	0.27	0.36						
NO₂	ppm	1.1	1.1	1.1	1.1						
	lb/MMBtu	0.001	0.001	0.001	0.001						
	lb/hr	0.00	0.01	0.01	0.02						
	tpy	0.02	0.04	0.07	0.09						
SOx	ppm	1.00	1.00	1.00	1.00						
	lb/MMBtu	0.0017	0.0017	0.0017	0.0017						
	lb/hr	0.0053	0.0106	0.0160	0.0215						
	tpy	0.023	0.046	0.070	0.094						
VOCs	ppm	4.0	4.0	4.0	4.0						
(Non-Methane Only)	lb/MMBtu	0.002	0.002	0.002	0.002						
VOCs does not include any background VOC emissions.	lb/hr	0.006	0.012	0.019	0.025						
	tpy	0.027	0.054	0.082	0.110						
PM10 (Filterable)	ppm	N/A	N/A	N/A	N/A						
	lb/MMBtu	0.00750	0.00750	0.00750	0.00750						
	lb/hr	0.023	0.046	0.070	0.094						
	tpy	0.101	0.203	0.306	0.411						
PM10 (Condensable)	lb/MMBtu	0.00250	0.00250	0.00250	0.00250						
	tpy	0.011	0.07	0.011	0.14						
PM2.5 (Filterable)	lb/MMBtu	0.008	0.008	0.008	0.008						
	tpy	0.033	0.20	0.033	0.41						
PM2.5 (Condensable)	lb/MMBtu	0.0025	0.0025	0.0025	0.0025						
	tpy	0.011	0.07	0.011	0.14						
Exhaust Data											
Temperature, F		379	404	430	455						
Flow	ACFM	1,049	2,169	3,373	4,662						
	SCFM (70 Degrees Fah.)	679	1,361	2,055	2,759						
	DSCFM	611	1,225	1,849	2,482						
	lb/hr	3,055	6,126	9,248	12,417						
Velocity	ft/sec	8.01	16.56	25.76	35.60						
	ft/min	481	994	1,546	2,136						

- Notes:**
- 1) All ppm levels are corrected to dry at 3% oxygen.
 - 2) Emission data based on actual boiler efficiency.
 - 3) % H₂O , by volume in exhaust gas is **15.51** % O₂, by volume **4.41**
 - 4) Water vapor in exhaust gas is **99.62** lbs/MMBtu of fuel fired
 - 5) CO₂ produced is **116.31** lbs/MMBtu of fuel fired
 - 6) Particulate is exclusive of any particulates in combustion air or other sources of residual particulates from mater
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 - 11.) Maximum flame temperature is 2800 degrees fahrenheit.

14) Fuel High Heating Value = **1000** Btu/FT³



From: Phanindra Kondagari [<mailto:PKondagari@flareindustries.com>]
Sent: Tuesday, July 23, 2013 3:06 PM
To: Russ Bafford
Cc: Jon Sachs; Dave Gibson; Timothy Egan
Subject: 497-005 TSPT marine vapor control system using CEB combustion technology

Dear Mr. Bafford,

Per your request here are the emission numbers for the CEB.

	Guaranteed
Nox Emissions	≤ 0.023 lb/MMBTU
CO Emissions	≤ 0.01 lbs./MMBTU

Please let me know if you need any additional information.

Thanks & Regards

Phanindra Kondagari
Sr.Project Manager
Enclosed Combustion Group



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Products: Flares | Thermal Oxidizers | Ignition Systems | Rental Flares | Spare Parts & Service

Flare Industries welcomes your feedback. Please tell us how we are doing at feedback@flareindustries.com

From: Phanindra Kondagari [mailto:PKondagari@flareindustries.com]
Sent: Friday, December 13, 2013 12:28 PM
To: Chris S Drechsel (Christopher.S.Drechsel@tsocorp.com)
Cc: Dave Gibson; Jon Sachs; Timothy Egan; davidcorpron@savageservices.com; Irina Makarow (Irina.Makarow@abam.com); Eric Albright; Eric Hansen; Price, Douglas B (Douglas.B.Price@tsocorp.com)
Subject: Tesoro Savage Vancouver Energy Distribution Terminal VCU Emission Factors - Particulate Matter

Hello Chris,

Due to the nature of the equipment (CEB), Flare Industries does not guarantee PM emissions as the PM rate is largely dependent on the Particulate loading in the combustion air, however based on our past experience we believe that using EPA AP-42 PM emission factors (Section 1.4 for Natural Gas Combustion) of 7.6 Lb/MMSCF will provide a conservative estimate.

Please let us know if you need any additional information.

Thanks & Regards

Phanindra Kondagari
Sr.Process Engineer
Enclosed Combustion Group



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