

Enclosure 9 to
LTR-RAC-20-94
Date: December 18, 2020

Enclosure 9

Response to Request for Additional Information

Table 6 - Industrial Incinerator; Emission Calculations for Metals,
Acid Gases, and Dioxin/Furans

Table 6 - Industrial Incinerator; Emission Calculations for Metals, Acid Gases, and Dioxin/Furans
Westinghouse Electric Company LLC
Hopkins, South Carolina
prepared by GEL Engineering, LLC September 2, 2019

Source	A Waste Charge Rate (tons/hr)	B Maximum Annual Throughput (tons/year)	Pollutant	C AP-42 Emission Factor (lbs/ton) ^{1,2}	D Hourly Emissions (lbs/hr) ³	E Annual Emissions (tons/yr) ³
Industrial Incinerator	0.25	2,190	Arsenic	4.23E-06	1.06E-06	4.63E-06
			Cadmium	2.71E-05	6.78E-06	2.97E-05
			Chromium	3.00E-05	7.50E-06	3.29E-05
			Mercury	2.20E-03	5.50E-04	2.41E-03
			Nickel	5.16E-05	1.29E-05	5.65E-05
			Lead	2.61E-04	6.53E-05	2.86E-04
			HCl	2.11E-01	5.28E-02	2.31E-01
			Dioxin/Furans	6.23E-08	1.56E-08	6.82E-08

Footnotes:

¹ AP-42 Chapter 2.1, Refuse Combustion, Table 2.1-12 does not list HAP emission factors for the Industrial/Commercial Multiple Chamber Combuster source category. Therefore, the emission factors for Mass Burn/Modular Excess Air Combustors (Tables 2.1-2 and 2.1-7) are shown above. As these emission factors are for mass burning of municipal solid waste, they are believed to be conservative (i.e. they should overestimate emissions from the small incinerator operated at Westinghouse).

² The incinerator is equipped with multi-layered inherent radiological controls for the purpose for recovering uranic materials. These controls include quenching/wet scrubbing/absorption/demisting/HEPA filtration prior to discharge to the atmosphere. Therefore, the highly controlled SD/FF (spray dryer/fabric filter) and DSI/FF (duct sorbent injection/fabric filter) emission factors have been selected from Tables 2.1-2 and 2.1-7, respectively.

³ These are preliminary emission estimates based on best available data from AP-42. The renewed permit will include a condition to test and determine actual emissions from the incinerator.

Example Calculation:

$$\boxed{A} \frac{\text{tons throughput}}{\text{hour}} \times \boxed{C} \frac{\text{lbs emissions}}{\text{ton throughput}} = \boxed{D} \frac{\text{lbs emissions}}{\text{hour}}$$

$$\boxed{B} \frac{\text{tons throughput}}{\text{year}} \times \boxed{C} \frac{\text{lbs emissions}}{\text{ton throughput}} \times \frac{1 \text{ ton}}{2000 \text{ lbs}} = \boxed{E} \frac{\text{tons emissions}}{\text{year}}$$

Table 1
Facility-Wide Emissions Summary
Westinghouse Electric Company LLC
Hopkins, South Carolina

prepared by GEL Engineering, LLC, May 30, 2019 (updated September 2, 2019)

Source	PM/PM ₁₀ /PM _{2.5}		SO ₂		CO		NO _x		VOCs		Pb		CO ₂		CH ₄		N ₂ O		CO ₂ e		Sb		As		Be	
	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
24.5 MMBTU/HR Cleaver Brooks Boiler (1 of 2) ¹	0.555	2.43	0.034	0.15	0.458	2.01	2.683	11.75	0.088	0.39	2.12E-05	9.28E-05	3,837.6	16,809	0.03	0.14	0.16	0.68		17,015						
24.5 MMBTU/HR Cleaver Brooks Boiler (2 of 2) ¹	0.555	2.43	0.034	0.15	0.458	2.01	2.683	11.75	0.088	0.39	2.12E-05	9.28E-05	3,837.6	16,809	0.03	0.14	0.16	0.68		17,015						
Industrial Incinerator ²	0.88	3.83	0.63	2.74	2.50	10.95	0.75	3.29	0.75	3.29	6.53E-05	2.86E-04	-	-	-	-	-	-		-	-	-	1.06E-06	4.63E-06	-	-
Calcliner Combustion Emissions (1 of 5) ³	4.25E-03	0.02	3.35E-04	1.47E-03	0.05	0.21	0.06	0.24	3.07E-03	1.35E-02	2.79E-07	1.22E-06	67.1	294	1.29E-03	5.63E-03	1.23E-03	5.38E-03		295.46						
Calcliner Combustion Emissions (2 of 5) ³	4.25E-03	0.02	3.35E-04	1.47E-03	0.05	0.21	0.06	0.24	3.07E-03	1.35E-02	2.79E-07	1.22E-06	67.1	294	1.29E-03	5.63E-03	1.23E-03	5.38E-03		295.46						
Calcliner Combustion Emissions (3 of 5) ³	4.25E-03	0.02	3.35E-04	1.47E-03	0.05	0.21	0.06	0.24	3.07E-03	1.35E-02	2.79E-07	1.22E-06	67.1	294	1.29E-03	5.63E-03	1.23E-03	5.38E-03		295.46						
Calcliner Combustion Emissions (4 of 5) ³	4.25E-03	0.02	3.35E-04	1.47E-03	0.05	0.21	0.06	0.24	3.07E-03	1.35E-02	2.79E-07	1.22E-06	67.1	294	1.29E-03	5.63E-03	1.23E-03	5.38E-03		295.46						
Calcliner Combustion Emissions (5 of 5) ³	4.25E-03	0.02	3.35E-04	1.47E-03	0.05	0.21	0.06	0.24	3.07E-03	1.35E-02	2.79E-07	1.22E-06	67.1	294	1.29E-03	5.63E-03	1.23E-03	5.38E-03		295.46						
S-4025 Scrubber ⁴	-	-	-	-	-	-	-	-	-	-	5.65E-05	2.47E-04	-	-	-	-	-	-		-	1.58E-05	6.90E-05	1.65E-05	7.21E-05	3.62E-06	1.58E-05
S-1030 Scrubber ⁴	-	-	-	-	-	-	0.36	1.58	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
S-958 Scrubber ⁴	-	-	-	-	-	-	3.52	15.42	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
S-1190 Scrubber ⁴	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
S-2A/2B Scrubber ⁴	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
S-1008 Scrubber ⁴	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Perchloroethylene Evaporative Losses	-	-	-	-	-	-	-	-	0.85	3.72	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	2.01	8.79	0.69	3.04	3.65	16.00	10.28	45.00	1.79	7.85	0.00017	0.00073	8,010	35,087	0.066	0.308	0.326	1.39		35,507	1.58E-05	6.90E-05	1.75E-05	7.67E-05	3.62E-06	1.58E-05
SC TAP De minimis Analysis																										
Facility-Wide TAP Emissions (lbs/day)																				0.0004		0.0004		0.00009		
SC Standard No. 8 De minimis (lbs/day)																				0.030		0.012		0.000		
Modeling Required?																				No		No		Yes		
																				Sb		As		Be		

Footnotes:

¹ Cleaver Brooks Boiler combustion emissions are based on AP-42 emission factors. See attached *Air Quality Construction Permit Application* prepared by AECOM, AECOM Project No. 60571157, June 2018, for further details.

² Industrial Incinerator emissions are based on AP-42 emission factors. See attached Tables 2 and 6 for further details.

³ Calcliner natural gas combustion emissions are based on AP-42 emission factors. See attached Table 3 for further details.

⁴ Scrubber emissions are derived from engineering testing conducted by CleanAir Engineering in February 2019 (*Report on Engineering Evaluation Testing*, CleanAir Project No. 13754, March 27, 2019). See attached Table 4 for further details.

Table 1
Facility-Wide Emissions Summary
Westinghouse Electric Company LLC
Hopkins, South Carolina

prepared by GEL Engineering, LLC, May 30, 2019 (updated September 2, 2019)

Cd		Cr		Co		Mn		Ni		P		Se		Hg		Dioxin/Furans		Perchloroethylene		HF		HNO3		HCl		H2SO4	
lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
6.78E-06	2.97E-05	7.50E-06	3.29E-05	-	-	-	-	1.29E-05	5.65E-05	-	-	-	-	5.50E-04	2.41E-03	1.56E-08	6.82E-08	-	-	-	-	-	-	5.28E-02	2.31E-01	-	-
4.67E-04	2.04E-03	5.45E-05	2.39E-04	1.49E-05	6.53E-05	9.50E-05	4.16E-04	7.15E-04	3.13E-03	2.66E-03	1.17E-02	3.13E-04	1.37E-03	-	-	-	-	-	-	0.0465	0.2037	0.3270	1.4323	0.0375	0.1643	0.1425	0.6242
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0100	0.0438	0.0500	0.2190	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0040	0.0175	0.1870	0.8191	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0045	0.0197	0.0110	0.0482	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0030	0.0131	0.0070	0.0307	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0015	0.0066	0.0045	0.0197	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.85	3.72	-	-	-	-	-	-	-	-
4.73E-04	2.07E-03	6.20E-05	2.72E-04	1.49E-05	6.53E-05	9.50E-05	4.16E-04	7.28E-04	3.19E-03	2.66E-03	1.17E-02	3.13E-04	1.37E-03	5.50E-04	2.41E-03	1.56E-08	6.82E-08	0.85	3.72	0.0695	0.3044	0.5865	2.5689	0.0903	0.3953	0.1425	0.6242
0.0114		0.0015		0.0004		0.0023		0.0175		0.0638		0.0075		0.0132		0.0000004		20.400		1.67		14.08		2.167		3.42	SC TAP De minimis Analysis Facility-Wide TAP Emissions (lbs/day) SC Standard No. 8 De minimis (lbs/day) Modeling Required?
0.003		0.030		0.003		0.300		0.006		0.006		0.012		0.003		0.000		40.200		0.025		1.500		2.100		0.120	
Yes		No		No		No		Yes		Yes		No		Yes		No		No		Yes		Yes		Yes		Yes	
Cd		Cr		Co		Mn		Ni		P		Se		Hg		D/F		Perc		HF		HNO3		HCl		H2SO4	

Total HAPs tpy
7.63

Table 1 (September 2, 2019 update)
Permitted Emission Sources - Stack Parameters

Westinghouse Electric Company LLC
Columbia Fuel Fabrication Facility
Hopkins, South Carolina

Permit Unit ID	Source Description	Stack ID No.	UTM Easting	UTM Northing	Stack Height (ft)	Temperature (°F)	Stack Velocity (fps)	Modeled Velocity (fps)	Stack Diameter (ft)	Horizontal / Vertical Discharge	Rain Cap (YES/NO)
01	2.51 MMBtu/hr Industrial Incinerator	6A	507413	3749074	58	170	61	61	0.83	Vertical	NO
02	24.5 MMBtu/hr Cleaver Brooks Boiler	S22	507420.3	3748990	25	322	27.38	27.38	2.0	Vertical	NO
03	24.5 MMBtu/hr Cleaver Brooks Boiler	S23	507429.1	3748987	25	322	27.38	27.38	2.0	Vertical	NO
09	Calciner #1 - 0.57 MMBtu/hr	C1	507478	3749056	38.3	400	6.4	0.003281	1.0	Vertical	YES
10	Calciner #2 - 0.57 MMBtu/hr	C2	507485	3749054	38.3	400	6.4	0.003281	1.0	Vertical	YES
11	Calciner #3 - 0.57 MMBtu/hr	C3	507490	3749053	38.3	400	6.4	0.003281	1.0	Vertical	YES
12	Calciner #4 - 0.57 MMBtu/hr	C4	507505	3749048	38.3	400	6.4	0.003281	1.0	Vertical	YES
13	Calciner #5 - 0.57 MMBtu/hr	C5	507456	3749062	38.3	400	6.4	0.003281	1.0	Vertical	YES
14	S-1030 Process Scrubber	S-1030	507480	3749056	64	86.7	25.45	25.45	3.5	Vertical	NO
15,16	S-2A/2B Process Scrubber	S-2A/2B	507455	3749061	48	122	25.3	0.003281	2.5	Horizontal	NO
17	S-1008 Process Scrubber	S-1008	507453	3749049	51	107	31.14	0.003281	1.5	Horizontal	NO
18	S-1190 Process Scrubber	S-1190	507410	3748977	46	57.3	32.90	32.90	2.0	Vertical	NO
19	S-4025 Plating Process Scrubber	S-4025	507490	3749211	46	62.0	58.34	58.34	2.33	Vertical	NO
20	S-958 Process Scrubber	S-958	507397	3749099	55.5	119	51.05	51.05	2.0	Vertical	NO

NOTES:

- 1) Incinerator - temperature, velocity, and diameter taken from DHEC BAQ Modeling Summary Sheet, June 19, 2018. UTM coordinates and height provided by Westinghouse.
- 2) Two New Boilers - stack parameters taken from BEEST modeling file created by AECOM and submitted with construction permit application for two new boilers.
- 3) Calciners - stack parameters except height taken from DHEC BAQ Modeling Summary. Height taken from Westinghouse Plant Ventilation System document.
- 4) All Scrubber Stacks - velocity and temperature data taken from CleanAir Engineering March 2019 stack test report. Heights taken from data provided by Westinghouse Plant Ventilation System or confirmed by Westinghouse staff.
- 5) All Stacks - discharge direction and rain cap information provided by Westinghouse.
- 6) Only stacks highlighted on table are required to be modeled based on current emission estimates.
- 7) S-958 Scrubber exhaust parameters after modifications to optimize atmospheric dispersion.

Table 2 (September 2, 2019 Update)
Modeled Pollutant Emissions Rates

Westinghouse Electric Company LLC
Columbia Fuel Fabrication Facility
Hopkins, South Carolina

Equipment Description	Stack ID No.	NO ₂ (lbs/hr)	7440-41-7	7440-43-9	7440-02-0	7723-14-0	7439-97-6	7664-39-3	7697-37-2	7647-01-0	7664-93-9
			Beryllium (lbs/hr)	Cadmium (lbs/hr)	Nickel (lbs/hr)	Phosphorus (lbs/hr)	Mercury (lbs/hr)	HF (lbs/hr)	HNO ₃ (lbs/hr)	HCl (lbs/hr)	H ₂ SO ₄ (lbs/hr)
24.5 MMBtu/hr Cleaver Brooks Boiler	S22	2.683	-	-	-	-	-	-	-	-	-
24.5 MMBtu/hr Cleaver Brooks Boiler	S23	2.683	-	-	-	-	-	-	-	-	-
2.51 MMBtu/hr Industrial Incinerator	6A	0.75 (Below De Minimis)	-	6.78E-06	1.29E-05	-	5.50E-04	-	-	5.28E-02	-
S-1030 Process Scrubber	S-1030	-	-	-	-	-	-	0.01	0.05	-	-
S-2A/2B Process Scrubber	S-2A/2B	-	-	-	-	-	-	0.003	0.007	-	-
S-1008 Process Scrubber	S-1008	-	-	-	-	-	-	0.0015	0.0045	-	-
S-1190 Process Scrubber	S-1190	-	-	-	-	-	-	0.0045	0.011	-	-
S-4025 Plating Process Scrubber	S-4025	-	3.62E-06	4.67E-04	7.15E-04	2.66E-03	-	0.0465	0.327	0.0375	0.1425
S-958 Process Scrubber	S-958	3.52	-	-	-	-	-	0.004	0.187	-	-

NOTES:

1) Criteria pollutants modeling exemption rates are per source as listed on Table 2.1 in DHEC BAQ's *Modeling Guidelines for Air Quality Permits*, October 2018, and shown below:

- i) PM₁₀, PM_{2.5}, NO_x, SO₂ < 1.14 lbs/hr/source
- ii) CO < 10 lbs/hr/source
- iii) Lead < 0.114 lbs/hr or 0.5 tons/year facility-wide

2) De minimis rate listed for Beryllium in DHEC BAQ Modeling Guidelines is 0.000.

Table 4 (September 2, 2019 Update)
Comparison of Air Dispersion Modeling Results with
South Carolina Standard No. 8

Westinghouse Electric Company LLC
Columbia Fuel Fabrication Facility
Hopkins, South Carolina

Pollutant	Averaging Period	Modeled Concentration (µg/m³)	Allowable Concentration (µg/m³)	Facility in Compliance? (YES/NO)
Beryllium	24-Hour	0.00001	0.01	YES
Cadmium	24-Hour	0.00155	0.25	YES
Nickel	24-Hour	0.00238	0.50	YES
Phosphorus	24-Hour	0.00879	0.50	YES
Mercury	24-Hour	0.00127	0.25	YES
HF	24-Hour	0.184	2.05	YES
HNO ₃	24-Hour	1.33	125.00	YES
HCl	24-Hour	0.193	175.00	YES
H ₂ SO ₄	24-Hour	0.471	10.00	YES