ATTACHMENT 2

Duke Energy Carolinas - Cliffside Expansion
Main Boilers - HAP Emission Rates

Main Boiler Heat Input Rate =	7850 MMBtu/hr
Main Boiler Hours of Operation =	8760 Hours/Year
Heat Content of Coal, HHV (design basis) =	12,777 Btu/lb (dry)
Maximum Coal Consumption =	307.2 ton/hr
Total HAPs	**16.60 ton/yr**
Acid Gases	9.38 ton/yr
HAP Metals	1.49 ton/yr
HAP Non-Metals	5.73 ton/yr
Dioxins & Furans	0.00 ton/yr

Acid Gases

Mass Balance Based on Coal Specifications

Average Chloride Conc. In Coal:	3209 ppm (dry)	Control Efficiency for HCl: 99.9%
Average HCl Emission Rate (Controlled):	0.0003 lb/MMBtu	
Average Fluoride Conc. In Coal:	177 ppm (dry)	Control Efficiency for HF: 99.9%
Average HF Emission Rate (Controlled):	0.00001 lb/MMBtu	

CAS No.	TRI Chemical	Uncontrolled Emission Factor (lb/ton coal)	Short-Term Emissions Per Boiler (lb/hr)	Annual Emissions Per Boiler (ton/yr)	Total Annual Emissions (ton/yr)	Emission Factor Reference
7647-01-0	Hydrogen Chloride		2.03	8.88	8.88	Mass Balance
7664-39-3	Hydrogen Fluoride		0.11	0.50	0.50	Mass Balance
					9.38	

Notes:
Hydrogen Chloride and Hydrogen Flouride emissions are based on the maximum chlorine and fluorine concentrations from the parent coals identified for Cliffside Unit 6 fuel supply. Average annual concentrations will be significantly lower and these estimates are conservatively high.

HAP Metals

CAS No.	TRI Chemical	Emission Factor (lb/ton coal)	Short-Term Emissions Per Boiler (lb/hr)	Annual Emissions Per Boiler (ton/yr)	Total Annual Emissions (ton/yr)	Emission Factor Reference
7440-36-0	Antimony	4.29E-07	1.32E-04	5.77E-04	0.00	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7440-38-2	Arsenic	6.62E-06	2.03E-03	8.91E-03	0.01	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7440-41-7	Beryllium	5.93E-07	1.82E-04	7.98E-04	0.00	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7440-43-9	Cadmium	1.12E-05	3.44E-04	1.50E-03	0.00	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7440-47-3	Chromium	1.46E-05	4.49E-03	1.96E-02	0.02	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7440-48-4	Cobalt	3.68E-06	1.13E-03	4.96E-03	0.00	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7439-92-1	Lead	8.06E-06	2.48E-03	1.08E-02	0.01	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7439-96-5	Manganese	1.76E-05	5.41E-03	2.37E-02	0.02	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7439-97-6	Mercury	See Note 1	1.90E-02	8.32E-02	0.08	Cliffside 6 Construction Permit, NC BACT limit
7440-02-0	Nickel	1.38E-05	4.25E-03	1.86E-02	0.02	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
7782-49-2	Selenium	9.77E-04	3.00E-01	1.31E+00	1.31	AP-42 Fifth Edition, Section 1.1, Table 1.1-16
					1.49	

Notes:

1) The mercury emission factors is 0.000019 lb/MWH based on Duke's BACT mercury limit as established in the Cliffside Unit 6 construction permit issued January 29, 2008.
2) Other metals are based on AP-42 methodology using average coal quality data for coal received at Duke Energy Carolinas facilities for the period 2003-2007 and based on the Cliffside 6 allowable filterable particulate emissions limit of 0.012 lb/MMBtu

HAP Non-Metals

CAS No.	TRI Chemical	Emission Factor (lb/ton coal)	Short-Term Emissions Per Boiler (lb/hr)	Annual Emissions Per Boiler (ton/yr)	Total Annual Emissions (ton/yr)	Emission Factor Reference	Factor Rating
75-07-0	Acetaldehyde	8.18E-05	2.51E-02	1.10E-01	0.11	EPRI Emission Factor Handbook - 1995, revised 2002	A
98-86-2	Acetophenone	3.07E-05	9.42E-03	4.13E-02	0.04	EPRI Emission Factor Handbook - 1995, revised 2002	A
107-02-8	Acrolein	4.86E-05	1.49E-02	6.53E-02	0.07	EPRI Emission Factor Handbook - 1995, revised 2002	B
120-12-7	Anthracene	2.10E-07	6.45E-05	2.83E-04	0.00	AP-42 Fifth Edition, Section 1.1, Supplement B	B
71-43-2	Benzene	9.97E-05	3.06E-02	1.34E-01	0.13	EPRI Emission Factor Handbook - 1995, revised 2002	A
191-24-2	Benzo(g,h,i)perylene	3.83E-08	1.18E-05	5.16E-05	0.00	EPRI Emission Factor Handbook - 1995, revised 2002	B
100-44-7	Benzyl Chloride	7.16E-06	2.20E-03	9.63E-03	0.01	EPRI Emission Factor Handbook - 1995, revised 2002	C
92-52-4	Biphenyl	4.09E-06	1.26E-03	5.50E-03	0.01	EPRI Emission Factor Handbook - 1995, revised 2002	B
117-81-7	Bis(2-ethylhexyl)phthalate	9.20E-05	2.83E-02	1.24E-01	0.12	EPRI Emission Factor Handbook - 1995, revised 2002	A
75-25-2	Bromoform	0.00E+00	0.00E+00	0.00E+00	0.00	EPRI Emission Factor Handbook - 1995, revised 2002	
75-15-0	Carbon Disulfide	2.81E-05	8.64E-03	3.78E-02	0.04	EPRI Emission Factor Handbook - 1995, revised 2002	B
532-27-4	2-Chloroacetophenone	7.00E-06	2.15E-03	9.42E-03	0.01	AP-42 Fifth Edition, Section 1.1, Supplement B	
108-90-7	Chlorobenzene	4.09E-06	1.26E-03	5.50E-03	0.01	EPRI Emission Factor Handbook - 1995, revised 2002	D
67-66-3	Chloroform	2.04E-05	6.28E-03	2.75E-02	0.03	EPRI Emission Factor Handbook - 1995, revised 2002	D
98-82-8	Cumene	5.30E-06	1.63E-03	7.13E-03	0.01	AP-42 Fifth Edition, Section 1.1, Supplement B	
N106	Cyanide*	2.50E-03	7.68E-01	3.36E+00	3.36	AP-42 Fifth Edition, Section 1.1, Supplement B	D
121-14-2	2,4-Dinitrotoluene	5.11E-06	1.57E-03	6.88E-03	0.01	EPRI Emission Factor Handbook - 1995, revised 2002	C
77-78-1	Dimethyl Sulfate	4.80E-05	1.47E-02	6.46E-02	0.06	AP-42 Fifth Edition, Section 1.1, Supplement B	
100-41-4	Ethyl benzene	2.04E-05	6.28E-03	2.75E-02	0.03	EPRI Emission Factor Handbook - 1995, revised 2002	C
75-00-3	Ethyl Chloride (Chloroethane)	1.35E-05	4.16E-03	1.82E-02	0.02	EPRI Emission Factor Handbook - 1995, revised 2002	D
107-06-2	Ethylene Dichloride	4.00E-05	1.23E-02	5.38E-02	0.05	AP-42 Fifth Edition, Section 1.1, Supplement B	
106-93-4	Ethylene Dibromide	1.20E-06	3.69E-04	1.61E-03	0.00	AP-42 Fifth Edition, Section 1.1, Supplement B	
50-00-0	Formaldehyde	6.64E-05	2.04E-02	8.94E-02	0.09	EPRI Emission Factor Handbook - 1995, revised 2002	B

CAS No.	TRI Chemical	Emission Factor (lb/ton coal)	Short-Term Emissions Per Boiler (lb/hr)	Annual Emissions Per Boiler (ton/yr)	Total Annual Emissions (ton/yr)	Emission Factor Reference	Factor Rating
110-54-3	Hexane	6.70E-05	2.06E-02	9.01E-02	0.09	AP-42 Fifth Edition, Section 1.1, Supplement B	D
78-59-1	Isophorone	3.07E-05	9.42E-03	4.13E-02	0.04	EPRI Emission Factor Handbook - 1995, revised 2002	D
74-83-9	Methyl Bromide (Bromomethane)	2.27E-05	6.99E-03	3.06E-02	0.03	EPRI Emission Factor Handbook - 1995, revised 2002	C
74-87-3	Methyl Chloride (Chloromethane)	2.81E-05	8.64E-03	3.78E-02	0.04	EPRI Emission Factor Handbook - 1995, revised 2002	C
78-93-3	Methyl Ethyl Ketone	3.90E-04	1.20E-01	5.25E-01	0.52	AP-42 Fifth Edition, Section 1.1, Supplement B	D
60-34-4	Methyl Hydrazine	1.70E-04	5.22E-02	2.29E-01	0.23	AP-42 Fifth Edition, Section 1.1, Supplement B	
80-62-6	Methyl Methacrylate	2.81E-05	8.64E-03	3.78E-02	0.04	EPRI Emission Factor Handbook - 1995, revised 2002	D
1634-04-4	Methyl tert-butyl ether	3.50E-05	1.08E-02	4.71E-02	0.05	AP-42 Fifth Edition, Section 1.1, Supplement B	
75-09-2	Methylene Chloride	9.20E-05	2.83E-02	1.24E-01	0.12	EPRI Emission Factor Handbook - 1995, revised 2002	C
91-20-3	Naphthalene	1.58E-05	4.87E-03	2.13E-02	0.02	EPRI Emission Factor Handbook - 1995, revised 2002	A
85-01-8	Phenanthrene	1.07E-05	3.30E-03	1.44E-02	0.01	EPRI Emission Factor Handbook - 1995, revised 2002	A
108-95-2	Phenol	8.43E-05	2.59E-02	1.13E-01	0.11	EPRI Emission Factor Handbook - 1995, revised 2002	B
123-38-6	Propionaldehyde	4.86E-05	1.49E-02	6.53E-02	0.07	EPRI Emission Factor Handbook - 1995, revised 2002	B
100-42-5	Styrene	1.79E-05	5.50E-03	2.41E-02	0.02	EPRI Emission Factor Handbook - 1995, revised 2002	C
127-18-4	Tetrachloroethylene	1.07E-05	3.30E-03	1.44E-02	0.01	EPRI Emission Factor Handbook - 1995, revised 2002	C
108-88-3	Toluene	4.34E-05	1.33E-02	5.85E-02	0.06	EPRI Emission Factor Handbook - 1995, revised 2002	A
71-55-6	1,1,1-Trichloroethane	2.00E-05	6.14E-03	2.69E-02	0.03	AP-42 Fifth Edition, Section 1.1, Supplement B	
108-05-4	Vinyl Acetate	7.92E-06	2.43E-03	1.07E-02	0.01	EPRI Emission Factor Handbook - 1995, revised 2002	D
1330-20-7	Xylene	1.12E-05	3.45E-03	1.51E-02	0.02	EPRI Emission Factor Handbook - 1995, revised 2002	C
	PAC Category	1.12E-06	3.44E-04	1.51E-03	0.00	AP-42 Fifth Edition, Section 1.1, Supplement B	
					5.73		

Dioxins & Furans

CAS No.	TRI Chemical	Emission Factor (lb/ton)	Short-Term Emissions Per Boiler (lb/hr)	Annual Emissions Per Boiler (ton/yr)	Total Annual Emissions (ton/yr)	Emission Factor Reference
	Total PCDD/PCDF	1.76E-09	5.41E-07	2.37E-06	2.37E-06	AP-42 Fifth Edition, Section 1.1, Supplement B
					16.6	

* Cyanide does not appear in EPRI documentation as a pollutant from coal burning boilers nor does EPA reference coal combustion as a potential source of cyanide[1]. The AP-42 emission factor comes from only two test sites (out of many) that indicated cyanide. One was a cyclone burning bituminous coal, the other was a lignite burning boiler.

EPRI Rating Definitions

A	5 or more detected values, no more than 50% non detects
B	4 or more detected values, no more than 67% non detects
C	2 or more detected values, no more than 75% non detects
D	1 or more detected values, no limit on non detects
E	substance has not been detected

Up to 26 sites tested

AP-42 Rating Definitions

A = Excellent. Emission factor is developed primarily from A and B rated source test data taken from many randomly chosen facilities in the industry population. The source category population is sufficiently specific to minimize variability.
B = Above average. Emission factor is developed primarily from A or B rated test data from a moderate number of facilities. Although no specific bias is evident, is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.
C = Average. Emission factor is developed primarily from A, B, and C rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.
D = Below average. Emission factor is developed primarily from A, B and C rated test data from a small number of facilities, and there may be reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source population.
E = Poor. Factor is developed from C and D rated test data from a very few number of facilities, and there may be reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population.

Basis For HAPS Emissions Calculations

HAP Metals

Calculations are based on AP-42 emission factor methodology for metals. All metals except mercury and selenium are assumed to be collected primarily as a function of filterable particulate emissions, ash content of the coal, and trace element concentrations in the coal. The particulate emissions are defined by the Cliffsdie 6 permit. Ash and trace element concentration are based on typical fuel analyses from actual fuel deliveries to Duke Energy plants in NC and SC.

AP-42 Section 1.1 Table 1.1-16

(Also, EPRI Emission Factor Handbook - 1995, revised 2002)

All emission factors listed have "A" ratings

$$E = a \times \left(\frac{coal, ppm}{ashfraction} \times PM \right)^{A}$$

E=lb/Tbtu

PM=	0.012 lb/mmBtu	BACT Limit
ashfraction=	0.116	last 5-yr average
Coal	12,777 Btu/lb	Average, Dry Basis for Parent Fuels
Burn	307.2 ton/hr	Coal Rate at 7850 MMBtu/hr
	8760 hr	Operating Hours Per Year

TRI Chemical	a	b	ppm*	lb/ton in	E	E in lb/ton	E in ton/yr	
Sb	0.92	0.63	0.65		0.167957	4.29E-07	0.001	
As	3.1	0.85	7.83		2.591636	6.62E-06	0.009	
Be	1.2	1.1	2.17		0.231997	5.93E-07	0.001	
Cd	3.3	0.5	0.17		0.437623	1.12E-06	0.002	
Cr	3.7	0.58	20.45		5.714041	1.46E-05	0.020	
Co	1.7	0.69	7.61		1.44133	3.68E-06	0.005	
Pb	3.4	0.8	8.8		3.153869	8.06E-06	0.011	
Mn	3.8	0.6	26.09		6.894488	1.76E-05	0.024	
Hg			0.08				0.083	(unchanged)
Ni	4.4	0.48	14.9		5.415633	1.38E-05	0.019	
Se**			4.07	0.00814	0.12	9.77E-04	1.314	
						Total	1.487	

* Last 5-year average actual coal constituents

** Uses 88% reduction w/ ESP and FGD (12% of total is released), EPRI referenced document

HAP Non-Metals

Calculations are based on emission factors from AP-42 or from emission factors derived from the extensive data base developed by EPRI for the EPRI Emission Factor Handbook - 1995, revised 2002. Factors are selected for each pollutant based on the boiler and fuel type and the pollution control equipment to be used. For Cliffside 6, the factors are based on a pulverized coal-fired boiler burning primarily eastern bitumonous coal, and employing SCR, spray dry scrubber for acid gas removal, fabric filter, and wet FGD system.

These factors are used to determine the appropriate emissions rate in pounds per hour. Emissions are calculated by multiplying the emissions factor (pounds per ton of coal) times the fuel firing rate (maximum coal consumption).

Short Term Emissions Rate (lb/hr) = Emission Factor (lb/ton coal) x Fuel Firing Rate (tons per hour)
Tons per Year = Short Term Emissions Rate (lb/hr) x 8760 hours per year / 2000 pounds per ton

Example:
Acetaldehyde Emissions:
Emission Factor: 8.18 E-05 lb/ton coal
Fuel Firing Rate: 307.2 tons/hr (Maximum Fuel Consumption

Short Term Acetaldehyde Emissions:
8.25 E-06 lb/ton x 307.2 tons/hr = 2.51 E-02 lb/hr

Annual Acetaldehyde Emissions:
2.51 E-02 lb/hr x 8760 hours per year / 2000 lb/ton = 0.11 tons per year

Duke Energy - Carolinas
New Generation Design Basis Coal Specification - Parent Coals
By: B.T. Nguyen
Date: 4/20/2006
Revised Date: 9/10/2008 (by Kris Knudsen)
Notes:

Parent Coals are individual coals that may be received at Cliffside Station for use in Unit 6. With the exception of the sub-bituminous coals (PRB_3 and PRB_4), each coal may be burned directly in the boiler or may be blended with other coals. The sub-bituminous coals will not be burned individually but must be blended with other bituminous coals at a ratio of no more than 50% sub-bituminous. Actual fuel burned in Unit 6 will depend on fuel supply market conditions.

STATISTICAL ANALYSIS:

Description	HHV_Dry (Btu/lb)	Mercury_Dry (ppm)	Chlorine_Dry (ppm)	Mercury in coal (lbm Hg/Tbtu)	Flourine_Dry (ppm)
Mean =	12,777	0.103	1,102	8.036	94.7
Maximum =	13,905	0.201	3,209	15.597	177.0
Minimum =	10,484	0.040	100	3.025	29.6

SUMMARY AND CALCULATED COAL QUALITY DATA:

HHV_Dry (Btu/lb)	13,905	13,061	12,746	12,649	13,003	10,529	10,484	13,223	12,153	12,122	13,395	13,467	13,493	13,680	12,887	13,635
Mercury_Dry (ppm)	0.080	0.100	0.060	0.130	0.180	0.100	0.070	0.040	0.080	0.050	0.100	0.080	0.110	0.070	0.201	0.193
Chlorine_Dry (ppm)	921	500	1,316	1,040	1,152	503	563	183	100	100	3,100	1,400	1,800	3,209	697	1,050
Flourine_Dry (ppm)	80.0	132.5	92.0	94.0	75.0	159.0	177.0	29.6	64.0	107.0			54.5	72.0		
Mercury in coal (lbm Hg/Tbtu)	5.754	7.656	4.708	10.278	13.843	9.497	6.677	3.025	6.583	4.125	7.465	5.940	8.153	5.117	15.597	14.155

Note: Dry Heat Value (HHV) is equal to the wet basis heat value from the Proximate Analysis divided by 1 minus the fractional Moisture Content(%/100)

COAL QUALITY DATA:

Coal case	Blacksville	NA_New	ILLBS_3	CA1	CA2	CA3	CA4	COL	PRB_3	PRB_4	ILLBS_5	ILLBS_6	ILLBS_8	ILLBS_9	OH - ICR	PA - ICR
Proximate Analysis (As Received)																
HHV (Btu/lb)	13,162	12,173	11,132	11,676	12,289	10048	9,772	11517	8,861	8,810	12,026	12,289	12,339	12,722		
Moisture (%)	5.34	6.80	12.66	7.69	5.49	4.57	6.79	12.91	27.09	27.32	10.22	8.75	8.55	7.00		
Ash (%)	7.28	12.66	8.45	12.61	12.74	27.36	26.76	5.26	5.24	4.45	7.82	7.96	8.34	8.60		
Sulfur (%)	2.47	3.29	3.06	1.16	0.80	0.67	0.61	0.52	0.30	0.17	2.46	2.62	2.83	2.48		
Volatile Matter (%)	35.93	36.88	36.30	32.67	32.15	25.7	25.64	35.90	31.45	31.17	34.28	35.12	36.48	36.40		
Fixed Carbon (%)	51.45	43.66	42.59	47.03	49.62	42.37	40.81	45.94	36.22	37.06	47.68	48.17	46.65	48.00		
Ash Loading (lbm/Mbtu)	5.53	10.40	7.59	10.80	10.37	27.23	27.38	4.56	5.91	5.05	6.50	6.48	6.76	6.76		
Calculated SO2	3.75	5.41	5.50	1.99	1.30	1.33	1.25	0.91	0.68	0.39	4.09	4.26	4.59	3.90		
Ultimate Analysis (Dry)																
Carbon (%)	79.56	71.34	71.05	73.57	73.89	62.62	60.72	73.87	69.26	69.88	74.13	74.23	74.42	75.60		
Hydrogen (%)	5.02	4.71	5.05	4.75	4.77	4.10	3.79	4.98	4.99	4.85	5.09	5.03	5.29	5.20		
Nitrogen (%)	1.41	1.30	1.29	1.41	1.39	1.04	1.09	1.53	0.94	0.92	1.52	1.55	1.57	1.60		
Ash Mineral Analysis																
Silica (SiO2) - %	44.22	48.09	51.88	56.33	56.19	62.86	61.84	56.4	37.8	35.45	48.42	49.47	47.97	49.00		
Alumina (Al2O3) - %	21.95	19.76	19.3	26.54	30.78	26.43	24.62	22.17	15.83	17.49	20.49	20.39	18.83	20.60		
Titania (TiO2) - %	0.97	0.84	0.96	1.54	1.82	1.59	1.67	0.90	1.25	1.38	1.06	1.11	1.00	1.10		
Iron Oxide (Fe2O3) - %	18.97	18.07	16.33	6.68	4.36	2.57	2.76	8.04	5.64	5.26	19.64	18.68	21.89	20.30		
Magnesia (MgO) - %	0.82	1.23	0.91	0.83	0.77	0.84	0.93	1.61	3.74	5.09	0.92	1.22	0.90	1.20		
Lime (CaO) - %	4.8	4.23	3.93	1.17	0.87	0.26	0.4	3.85	19.58	21.11	3.54	4.18	3.83	2.70		
Potassium Oxide (K2O) - %	1.46	2.37	2.09	2.19	2.2	2.79	3.03	1.37	0.53	0.42	2.26	2.20	2.25	2.30		
Sodium Oxide (Na2O) - %	0.96	0.91	1.37	0.23	0.25	0.19	0.17	1.53	1.21	1.65	1.00	0.59	0.55	0.50		
Phosphorous Pentoxide (P2O5) - %	0.47	0.38	0.11	0.23	0.18	0.04	0.11	0.19	0.87	1.00	0.12	0.28	0.09	0.20		
Sulfur Trioxide (SO3) - %	4.53	3.53	2.65	0.76	0.53	0.2	0.34	5.07	13.58	10.49	2.43	1.70	2.54	2.10		
Ash Fusion Temperature																
ID @ Oxidizing - F	2,409	2,349	2,293	2700	2,700	2,800	2,700	2,647	2,173	2,135	2,410	1,990	2,345	2,430		
Softening @ Oxidizing - F	2,461	2,409	2,381	2700	2,700	2,800	2,700	2,702	2,188	2,188	2,510	2,040	2,440	2,470		
Hemispherical @ Oxidizing - F	2,480	2,499	2,447	2700	2,700	2,800	2,700	2,732	2,198	2,205	2,540	2,110	2,490	2,500		
Fluid @ Oxidizing - F	2,531	2,543	2,547	2700	2,700	2,800	2,700	2,761	2,265	2,261	2,560	2,350	2,525	2,530		
ID @ Reducing - F	2,017	2,067	1,984	2689	2,700	2,800	2,700	2,516	2,077	2,080	2,020	1,980	1,995	2,040		
Softening @ Reducing - F	2,148	2,145	2,097	2700	2,700	2,800	2,700	2,578	2,140	2,105	2,070	2,040	2,035	2,130		
Hemispherical @ Reducing - F	2,179	2,281	2,178	2700	2,700	2,800	2,700	2,655	2,150	2,113	2,190	2,320	2,105	2,220		
Fluid @ Reducing - F	2,352	2,344	2,309	2700	2,700	2,800	2,700	2,704	2,173	2,152	2,420	2,390	2,345	2,290		
Miscellaneous:																
Grind (HGI)	56	55	52	39	41	42	42	45	51	52	56	54	50	57		
Equilibrium Moisture (%)											7.50	5.30	4.52	3.50		
Free Swelling Index	8.5	7	3.00	3.80	4.30	2.50	1.50	1.50	0.10	0.10	5.50	6.00	6.00	7.00		
Calculated Hg (lbm/Tbtu)	5.75	7.66	4.71	10.28	13.84	9.50	6.68	3.02	6.58	4.12	7.47	5.94	8.15	5.12		
Trace Metals - dry whole coal basis																
Chlor_Ppm	921	500	1316	1040	1152	503	563	183.4	100	100	3100	1400	1800	3209		
Fluorine_Ppm	80	132.5	92	94	75	159	177	29.6	64	107			54.5	72		
Mercury_Ppm	0.08	0.1	0.06	0.13	0.18	0.1	0.07	0.04	0.08	0.05	0.1	0.08	0.11	0.07		

ATTACHMENT 3

POWER
ENVIRONMENTAL CONTROL SYSTEMS
North America

1409 Centerpoint Blvd.
Knoxville, Tennessee 37932 USA
Phone: +1 865 693 7550
Fax: +1 865 694 5203
www.environment.power.alstom.com

ALSTOM

October 14, 2008

Subject: Cliffside 6 Acid Gas Removal

Duke Energy
526 South Church Street
Charlotte, NC 28202

Attn:
Sam Alexander
General Manager
Cliffside Modernization Project

Dear Sam,

In response to your inquiry concerning the expected emissions of hydrogen chloride (HCl) and hydrogen fluoride (HF) from Cliffside Unit 6, Alstom offers the following:

Performance predictions for HCl and HF emissions at Cliffside Unit 6 were originally based on the assumption that these species are removed in the same percentage as SO_2. Thus, if the SO_2 removal efficiency is 99%, it is assumed that HCl and HF removal efficiencies are also 99%. The above assumption is known to be conservative as both HCl and HF are stronger acids and more reactive than SO_2, which would tend to produce higher removal efficiencies than SO_2, all other parameters being equal.

There is now reason to believe that the actual performance at Cliffside 6 will be significantly better than originally predicted as demonstrated by data from recent testing of WFGD systems.

	Duke Energy Marshall Unit 4	Plant A
SO_2 Removal (%)	95-96	95-96
HCl Inlet (lb/MMBtu)	0.096	0.087
HCl Emissions (lb/MMBtu)	Avg. 0.000128	Avg. 0.000214
HCl Removal (%)	99.7-99.9 (Avg. 99.87)	99.7-99.8 (Avg. 99.75)
HF Inlet (lb/MMBtu)	Avg. 0.0070	Avg. 0.0093
HF Emissions (lb/MMBtu)	Avg. 0.0000125	Avg. 0.0000463
HF Removal (%)	99.8-99.9	99.7-99.8

It is evident from the data that (1) the HCl and HF removal efficiencies are higher than SO_2 in all cases and (2) very high removal efficiencies/low emissions are achievable.

Marshall Unit 4 incorporates Alstom's most current design features – dual orifice nozzles and performance enhancement plates (wall rings). Dual orifice nozzles provide extremely good contact between the flue gas and scrubbing slurry, and increase liquid residence time in the absorber. Performance enhancement plates ensure that no unscrubbed flue gas

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bypasses the spray zone along the vessel walls. These two features are responsible for the extremely low emissions at Marshall.

Plant A is a utility grade coal fired plant with two large scale units firing bituminous coal. The Alstom WFGD system, put in service in the mid-1990's, is of similar design, but lacks performance enhancement plates and has been only partially retrofitted with dual orifice nozzles.

The advanced Integrated Air Quality Control System planned for Cliffside Unit 6 further enhances the potential for extremely low acid gas emissions. In this process, a high-efficiency WFGD system is preceded by DFGD system comprised of a Spray Dryer Absorber (SDA) and Pulse Jet Fabric Filter (PJFF). Lime slurry is injected in the SDA primarily for acid mist (H_2SO_4) control. Pilot testing at Cliffside Unit 5 has indicated that 50-70% of the HCl is collected in the SDA; HF was not measured.

The high efficiency Cliffside WFGD is an advanced version of the Marshall WFGD with an additional spray level and design SO_2 removal efficiency of 99% compared with the Marshall design efficiency of 95%. With two stages (i.e. DFGD and WFGD) of acid gas control, HCl and HF removal performance at Cliffside Unit 6 is expected to be better than the single stage scrubber (i.e. WFGD) systems at Marshall.

This information is provided for information purposes only and reflects what Alstom reasonably expects the emissions to be based on the data above and the particular equipment to be provided at Cliffside Unit 6, but it does not constitute a specific performance guarantee or warranty by Alstom for HCl or HF removal.

Sincerely,

Phil Rader
Business Sales Manager

cc: Eileen Windham, Alstom
Dave Borsare, Alstom

ATTACHMENT 4

FORM A1

FACILITY (General Information)

REVISED 11/01/02 — NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate — **A1**

NOTE- APPLICATION WILL NOT BE PROCESSED WITHOUT THE FOLLOWING:

☐ Local Zoning Consistency Determination (if required) ☐ Facility Reduction & Recycling Survey Form (Form A4) ☐ Application Fee
☑ Responsible Official/Authorized Contact Signature ☑ Appropriate Number of Copies of Application ☐ P.E. Seal (if required)

GENERAL INFORMATION

Legal Corporate/Owner Name:	Duke Energy Carolinas
Site Name:	*Cliffside Steam Station*
Site Address (911 Address) Line 1:	573 Duke Power Road
Site Address Line 2:	
City: Cliffside	State: NC
Zip Code: 28024	County: Rutherford

CONTACT INFORMATION

Permit/Technical Contact:	***Facility/Inspection Contact:***
Name/Title: Kris Knudsen / Senior Technical Consultant	Name/Title: Steve Hodges / Environmental Coordinator
Mailing Address Line 1: 526 South Church St.	Mailing Address Line 1: 573 Duke Power Road
Mailing Address Line 2: Mail Code EC13K	Mailing Address Line 2:
City: Charlotte State: NC Zip Code: 28202	City: Mooresboro State: NC Zip Code: 28114
Phone No. (area code) (980) 373-32 Fax No. (area code) (704) 382-0249	Phone No. (area code) (828) 657-23 Fax No. (area code) (828) 657-2060
Email Address: kwknudsen@duke-energy.com	Email Address: sdhodges@duke-energy.com
Responsible Official/Authorized Contac	***Invoice Contact:***
Name/Title: Rick R. Roper / Manager Cliffside Steam Station	Name/Title: William Horton, Senior Environmental Specialist
Mailing Address Line 1: 573 Duke Power Road	Mailing Address Line 1: 526 South Church St.
Mailing Address Line 2:	Mailing Address Line 2: Mail Code EC13K
City: Mooresboro State: NC Zip Code: 28114	City: Charlotte State: NC Zip Code: 28202
Phone No. (area code) (828) 657-2001 Fax No. (area code) (828) 657-2060	Phone No. (area code) (980) 373-3226 Fax No. (area code) (704) 382-0249
Email Address: rroper@duke-energy.com	Email Address: wthorton@duke-energy.com

APPLICATION IS BEING MADE FOR

☐ New Non-permitted Facility/Greenfield ☑ Modification of Facility (permitted) * ☐ Renewal with Modification
☐ Renewal (TV Only) * Revised emission estimates for HAPS and criteria pollutants for new Unit 6 under construction.

FACILITY CLASSIFICATION AFTER APPLICATION (Check Only One)

☐ General ☐ Small ☐ phibitory Small ☐ Synthetic Minor ☑ Title V

FACILITY (Plant Site) INFORMATION

Describe nature of (plant site) operation(s):
Generation of electricity for sale

Primary SIC/NAICS Code: 4911	Current/Previous Air Permit No. 04044T28 Expiration 10/31/2008
Facility Coordinates: Latitude: 35° 12' 55"	Longitude: 81° 45' 46"
Does this application contain confidential data? ☐ YES	☑ NO

PERSON OR FIRM THAT PREPARED APPLICATION

Person Name: Kris Knudsen / Dan Markley	Firm Name: Duke Energy
Mailing Address Line 1: 526 South Church St.	Mailing Address Line 2: Mail Code EC13K
City: Charlotte State: NC	Zip Code: 28202 County: Mecklenburg
Phone No. (980) 373-3225 Fax No. (704) 382-0249	Email Address: kwknudsen@duke-energy.com

SIGNATURE OF RESPONSIBLE OFFICIAL/AUTHORIZED CONTACT

Name (typed): Rick R. Roper (by James L. Turner, President and Chief Operating Officer)	Title: Manager Cliffside Steam Station
X Signature(Blue Ink): Rick R. Roper (by James L. Turner)	Date:

Attach Additional Sheets As Necessary

FORM B

SPECIFIC EMISSIONS SOURCE INFORMATION (REQUIRED FOR ALL SOURCES)

REVISED 12/01/01 — NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate — **B**

EMISSION SOURCE DESCRIPTION: Unit 6 Boiler	EMISSION SOURCE ID NO: U6
	CONTROL DEVICE ID NO(S): CD 19-22
OPERATING SCENARIO 1 OF 1	EMISSION POINT (STACK) ID NO(S): EP-U6

DESCRIBE IN DETAILTHE EMISSION SOURCE PROCESS (ATTACH FLOW DIAGRAM):
Nominal 800 MW pulverized coal (PC) boiler fired with bituminous coal or a blend of bituminous and sub-bituminous coals. The boiler will be equipped with the following control devices to reduce air emissions during normal operations: low NOx burners, SCR, SDA, baghouse, and Wet FGD.

TYPE OF EMISSION SOURCE (CHECK AND COMPLETE APPROPRIATE FORM B1-B9 ON THE FOLLOWING PAGES):

X Coal,wood,oil, gas, other burner (Form B1) ☐ Woodworking (Form B4) ☐ Manufact. of chemicals/coatings/inks (Form B7)
☐ Int.combustion engine/generator (Form B2) ☐ Coating/finishing/printing (Form B5) ☐ Incineration (Form B8)
☐ Liquid storage tanks (Form B3) ☐ Storage silos/bins (Form B6) ☐ Other (Form B9)

START CONSTRUCTION DATE: June 2007	OPERATION DATE: 2011	DATE MANUFACTURED:	2007
MANUFACTURER / MODEL NO.: TBD		EXPECTED OP. SCHEDULE: 24 HR/DAY 7 DAY/WK 52 WK/YR	
IS THIS SOURCE SUBJECT TO? NSPS (SUBPART?): Da, HHHH	NESHAP (SUBPART?):	MACT (SUBPART?):	
PERCENTAGE ANNUAL THROUGHPUT (%): DEC-FEB 25	MAR-MAY 25	JUN-AUG 25	SEP-NOV 25
EXPECTED ANNUAL HOURS OF OPERATION: 8760	VISIBLE STACK EMISSIONS UNDER NORMAL OPERATION: <20 % OPACITY		

CRITERIA AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

AIR POLLUTANT EMITTED	SOURCE OF EMISSION FACTOR	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS) lb/hr	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS) tons/yr	POTENTIAL EMSSIONS (BEFORE CONTROLS / LIMITS) lb/hr	POTENTIAL EMSSIONS (BEFORE CONTROLS / LIMITS) tons/yr	POTENTIAL EMSSIONS (AFTER CONTROLS / LIMITS) lb/hr	POTENTIAL EMSSIONS (AFTER CONTROLS / LIMITS) tons/yr
PARTICULATE MATTER (PM)	BACT	94.2	412.6			94.2	412.6
PARTICULATE MATTER<10 MICRONS (PM_{10})	BACT	141.3	618.9			141.3	618.9
PARTICULATE MATTER<2.5 MICRONS ($PM_{2.5}$)		NA	NA			NA	NA
SULFUR DIOXIDE (SO2)	Permit Limit	942	4126			942	4126
NITROGEN OXIDES (NOx)	Regulatory	549.5	2406.81			549.5	2406.81
CARBON MONOXIDE (CO)	BACT	1177.5	5157.5			1177.5	5157.5
VOLATILE ORGANIC COMPOUNDS (VOC)	BACT	23.6	103.1			23.6	103.1
LEAD	BACT	0.2	0.8			0.2	0.8
OTHER							

HAZARDOUS AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

HAZARDOUS AIR POLLUTANT AND CAS NO.	SOURCE OF EMISSION FACTOR	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS) lb/hr	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS) tons/yr	POTENTIAL EMSSIONS (BEFORE CONTROLS / LIMITS) lb/hr	POTENTIAL EMSSIONS (BEFORE CONTROLS / LIMITS) tons/yr	POTENTIAL EMSSIONS (AFTER CONTROLS / LIMITS) lb/hr	POTENTIAL EMSSIONS (AFTER CONTROLS / LIMITS) tons/yr
Hydrogen Chloride	Mass Balance	2.03E+00	8.88E+00	-	-	2.03E+00	8.88
Hydrogen Fluoride	Mass Balance	1.14E-01	5.01E-01	-	-	1.14E-01	0.50
Antimony	AP-42	1.32E-04	5.77E-04	-	-	1.32E-04	0.00
Arsenic	AP-42	2.03E-03	8.91E-03	-	-	2.03E-03	0.01
Beryllium	AP-42	1.82E-04	7.98E-04	-	-	1.82E-04	0.00
Cadmium	AP-42	3.44E-04	1.50E-03	-	-	3.44E-04	0.00
Chromium	AP-42	4.49E-03	1.96E-02	-	-	4.49E-03	0.02
Cobalt	AP-42	1.13E-03	4.96E-03	-	-	1.13E-03	0.00
Lead	AP-42	2.48E-03	1.08E-02	-	-	2.48E-03	0.01
Manganese	AP-42	5.41E-03	2.37E-02	-	-	5.41E-03	0.02
Mercury[1]	NC BACT	1.90E-02	8.32E-02	-	-	1.90E-02	0.08
Nickel	AP-42	4.25E-03	1.86E-02	-	-	4.25E-03	0.02
Selenium	AP-42	3.00E-01	1.31E+00	-	-	3.00E-01	1.31
Acetaldehyde	EPRI	2.51E-02	1.10E-01	-	-	2.51E-02	0.11
Acetophenone	EPRI	9.42E-03	4.13E-02	-	-	9.42E-03	0.04
Acrolein	EPRI	1.49E-02	6.53E-02	-	-	1.49E-02	0.07
Anthracene	AP-42	6.45E-05	2.83E-04	-	-	6.45E-05	0.00
Benzene	EPRI	3.06E-02	1.34E-01	-	-	3.06E-02	0.13
Benzo(g,h,i)perylene	EPRI	1.18E-05	5.16E-05	-	-	1.18E-05	0.00
Benzyl Chloride	EPRI	2.20E-03	9.63E-03	-	-	2.20E-03	0.01
Biphenyl	EPRI	1.26E-03	5.50E-03	-	-	1.26E-03	0.01
Bis(2-ethylhexyl)phthalate	EPRI	2.83E-02	1.24E-01	-	-	2.83E-02	0.12
Bromoform	EPRI	0.00E+00	0.00E+00	-	-	0.00E+00	0.00
Carbon Disulfide	EPRI	8.64E-03	3.78E-02	-	-	8.64E-03	0.04
2-Chloroacetophenone	AP-42	2.15E-03	9.42E-03	-	-	2.15E-03	0.01
Chlorobenzene	EPRI	1.26E-03	5.50E-03	-	-	1.26E-03	0.01
Chloroform	EPRI	6.28E-03	2.75E-02	-	-	6.28E-03	0.03
Cumene	AP-42	1.63E-03	7.13E-03	-	-	1.63E-03	0.01
Cyanide	AP-42	7.68E-01	3.36E+00	-	-	7.68E-01	3.36
2,4-Dinitrotoluene	EPRI	1.57E-03	6.88E-03	-	-	1.57E-03	0.01
Dimethyl Sulfate	AP-42	1.47E-02	6.46E-02	-	-	1.47E-02	0.06

Ethyl benzene	EPRI	6.28E-03	2.75E-02	-	-	6.28E-03	0.03
Ethyl Chloride (Chloroethane)	EPRI	4.16E-03	1.82E-02	-	-	4.16E-03	0.02
Ethylene Dichloride	AP-42	1.23E-02	5.38E-02	-	-	1.23E-02	0.05
Ethylene Dibromide	AP-42	3.69E-04	1.61E-03	-	-	3.69E-04	0.00
Formaldehyde	EPRI	2.04E-02	8.94E-02	-	-	2.04E-02	0.09
Hexane	AP-42	2.06E-02	9.01E-02	-	-	2.06E-02	0.09
Isophorone	EPRI	9.42E-03	4.13E-02	-	-	9.42E-03	0.04
Methyl Bromide (Bromomethane)	EPRI	6.99E-03	3.06E-02	-	-	6.99E-03	0.03
Methyl Chloride (Chloromethane)	EPRI	8.64E-03	3.78E-02	-	-	8.64E-03	0.04
Methyl Ethyl Ketone	AP-42	1.20E-01	5.25E-01	-	-	1.20E-01	0.52
Methyl Hydrazine	AP-42	5.22E-02	2.29E-01	-	-	5.22E-02	0.23
Methyl Methacrylate	EPRI	8.64E-03	3.78E-02	-	-	8.64E-03	0.04
Methyl tert-butyl ether	AP-42	1.08E-02	4.71E-02	-	-	1.08E-02	0.05
Methylene Chloride	EPRI	2.83E-02	1.24E-01	-	-	2.83E-02	0.12
Naphthalene	EPRI	4.87E-03	2.13E-02	-	-	4.87E-03	0.02
Phenanthrene	EPRI	3.30E-03	1.44E-02	-	-	3.30E-03	0.01
Phenol	EPRI	2.59E-02	1.13E-01	-	-	2.59E-02	0.11
Propionaldehyde	EPRI	1.49E-02	6.53E-02	-	-	1.49E-02	0.07
Styrene	EPRI	5.50E-03	2.41E-02	-	-	5.50E-03	0.02
Tetrachloroethylene	EPRI	3.30E-03	1.44E-02	-	-	3.30E-03	0.01
Toluene	EPRI	1.33E-02	5.85E-02	-	-	1.33E-02	0.06
1,1,1-Trichloroethane	AP-42	6.14E-03	2.69E-02	-	-	6.14E-03	0.03
Vinyl Acetate	EPRI	2.43E-03	1.07E-02	-	-	2.43E-03	0.01
Xylene	EPRI	3.45E-03	1.51E-02	-	-	3.45E-03	0.02
Total PCDD/PCDF	AP-42	5.41E-07	2.37E-06	-	-	5.41E-07	0.00
Total HAPS							**16.60**

TOXIC AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

INDICATE EXPECTED ACTUAL EMISSIONS AFTER CONTROLS / LIMITATIONS

TOXIC AIR POLLUTANT AND CAS NO.	EF SOURCE	lb/hr	lb/day	lb/yr
Hydrogen Chloride	Mass Balance	2.03	48.65	17757.39
Hydrogen Fluoride	Mass Balance	0.11	2.75	1002.75
Arsenic	AP-42	0.00	0.05	17.82
Beryllium	AP-42	0.00	0.00	1.60
Cadmium	AP-42	0.00	0.01	3.01
Chromium	AP-42	0.00	0.11	39.29
Manganese	AP-42	0.01	0.13	47.41
Mercury	NC BACT	0.02	0.46	166.44
Nickel	AP-42	0.00	0.10	37.24
Acetaldehyde	EPRI	0.03	0.60	220.05
Acrolein	EPRI	0.01	0.36	130.66
Benzene	EPRI	0.03	0.73	268.19
Benzyl Chloride	EPRI	0.00	0.05	19.25
Carbon Disulfide	EPRI	0.01	0.21	75.64
Chlorobenzene	EPRI	0.00	0.03	11.00
Chloroform	EPRI	0.01	0.15	55.01
Ethylene Dichloride	EPRI	0.01	0.29	107.64
Ethylene Dibromide	AP-42	0.00	0.01	3.23
Formaldehyde	AP-42	0.02	0.49	178.79
Hexane	AP-42	0.02	0.49	180.30
Methyl Ethyl Ketone	AP-42	0.12	2.88	1049.49
Methylene Chloride	EPRI	0.01	0.21	75.64
Phenol	EPRI	0.03	0.62	226.93
Styrene	EPRI	0.01	0.13	48.14
Toluene	EPRI	0.01	0.32	116.90
Xylene	EPRI	0.00	0.08	30.26
Sulfuric Acid	BACT	47.10	1130.40	412596.00
Ammonia	Vendor	31.40	753.60	275064.00

Attachments: (1) emissions calculations and supporting documentation; (2) indicate all requested state and federal enforceable permit limits (e.g. hours of operation, emission rates) and describe how these are monitored and with what frequency; and (3) describe any monitoring devices, gauges, or test ports for this source.

[1] Calculated based on NC BACT limit of 0.019 lb/GWH as set in the Cliffside 6 construction permit, January 28, 2008