Ohio River Clean Fuels, LLC

Baard Energy, LLC

Michael E. Hopkins
Assistant Chief, Permitting
Division of Air Pollution Control, Permitting Section
Ohio EPA
50 West Town Street
Suite 700
Columbus, Ohio 43215

November 11, 2008

SUBJECT: Ohio EPA Permit to Install – Requested Information on Sulfuric Acid Emissions
Ohio River Clean Fuels, L.L.C.
Permit Number: 02-22896, Facility ID: 0215130393

Dear Mr. Hopkins:

Ohio EPA has requested that Ohio River Clean Fuels provide additional information to the PTI application detailing potential H_2SO_4 emissions, including a BACT analysis for Module 5, Syngas Cleanup, P011-P012 and Module 9, Combined Cycle Plant, B001, P018 and P019.

The following table reports a listing of all emissions units with the potential of emitting H_2SO_4:

Ohio River Clean Fuels, L.L.C.
Potential H_2SO_4 Mist Emissions

Description	Unit	H_2SO_4 Emissions, ton/year
High Pressure Flare	P020-P025	0.0024
Low Pressure Flare	P029	0.0002
CTG (1)	P018 & P019	8.6860
Phase I Boiler (1)	B001	0.7490
TTO (500^{0}F) (1)	P011 & P012	20.5420
Hot Gas Generators	P001-P010	0.0890
FT Heaters	B002-B006, P030	0.0042
Medium/Large Heaters	B005, B006	0.0310
Total(2)		**29.3548**

(1) BACT Analysis Provided.

(2) Excludes Phase I Boiler; CTGs are the largest contributor to H2SO4 potential.

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BACT ANALYSIS FOR H_2SO_4

MODULE 5, SYNGAS CLEANUP, P011-P012

Sulfuric Acid Emissions can be controlled by reducing the emissions of exhaust gases that contain SO_2. Two technically feasible control technologies are application of Flue Gas Desulfurization (FGD) control on the exhaust of the TTO and increased operating temperatures for the Tailgas Thermal Oxidizers (TTO). FGD has the potential to reduce H2SO4 emissions by 95% while increased operating temperatures may achieve 88% control.

Flue Gas Desulfurization (FGD)

The function of the FGD system is to scrub the TTO exhaust gases to reduce the SO_2 content prior to release to the environment. The best-case capital cost estimate was taken from DOE/FE-004, "Market-Based Advanced Coal Power Systems, Final Report; May 1999". The estimated capital cost for an appropriately sized FGD system is approximately $15 million. Applying a Capital Recovery Factor of 0.1424 as derived elsewhere in the application, the annualized capital cost for an appropriately-sized FGD system would be approximately $2.16 million.

Assuming 95% removal efficiency from the TTO exhaust (estimated H2SO4 emissions of 20.5 tpy), the cost to abate 19.5 tpy of H_2SO_4 is calculated to be $110,892 per ton abated (excluding O&M expenses). This control cost is not cost-effective; therefore the next feasible alternative has been evaluated.

Tailgas Thermal Oxidizer Temperature

Operating the Tailgas Thermal Oxidizers (TTO) at higher temperatures can increase control efficiency. By operating the TTO at 700 deg. F instead of 500 deg. F, the fuel factor (F1) will be reduced (0.0055 instead of 0.047) and the H_2SO_4 emissions from the TTOs will change in the following manner:

- 500 deg F: 3,063 x 0.047 x 285.48 = 41,098 lb/yr = 20.5 tons/yr H_2SO_4 released
- 700 deg. F: 3,063 x 0.0055 x 285.48 = 4,809 lb/yr = 2.4 tons/yr H_2SO_4 released

Operating at a higher temperature will increase the amount of fuel gas required. The difference in natural gas usage for operating the TTO at higher temperatures must be computed.

For this calculation, we assume a gas flow of 7,009.44 lbmol/hr that contains 126 ppmv H2S with the balance being air. For simplicity, we assume a natural gas composition of 95.4% methane and 4.6% nitrogen, which has a higher heating value of 950 Btu/scf. Adjusting the natural gas flow rate to achieve a burner temperature of 500 deg. F for the base case, the predicted natural gas usage is 1,005 lb/hr (23,336 scfh, 22.1 MMBtu/hr).

For comparison to the BACT alternative, an identical case was evaluated by adjusting the natural gas flow to achieve a burner temperature of 700 deg. F. The predicted natural gas usage is 1,539 lb/hr (35,747 scfh, 33.9 MMBtu/hr). Therefore, the increase in gas usage equates to 537 lb/hr (12,411 scfh, 11.8 MMBtu/hr). If a market price for natural gas of $7.76/MMBtu is assumed, than the difference in cost is:

11.8 MMBtu/hr x $7.76/MMBtu x 8,760 hr/yr = $802,136/yr

Therefore, the estimated cost to abate 18.1 tpy H_2SO_4 is $44,317 per ton abated. This is not a cost-effective alternative even before the added impacts of additional NOx emissions produced by increase fuel combustion are considered.

ORCF therefore concludes that the TTO design as presented in the PTI application constitutes BACT. ORCF's proposed H_2SO_4 emission rate is 20.542 tons per year and an average hourly emission rate of 4.69 lb/hr. Maximum hourly emissions will be higher during the 12 hours per year of tailgas treatment unit startup or shutdown.

MODULE 9, COMBINED CYCLE PLANT, B001, P018 AND P019

Phase 1 Boiler-B001

Prior to the construction of the first combustion turbine, a 1,200 MMBtu/hr natural gas/tailgas-fired boiler will be installed to provide steam. The steam will be used to produce electricity for initial plant operations using a steam turbine generator.

The Phase 1 Boiler will use cleaned syngas or natural gas as a fuel to produce steam. The exhaust gas contains sulfur compounds, primarily sulfur dioxide (SO_2). There is a potential for a fraction of the SO_2 to form SO_3, which can combine with moisture in the exhaust to form sulfuric acid mist (H_2SO_4). Emissions for H_2SO_4 are controlled by limiting the fuel sulfur content or by removing SO_2 from the exhaust gas. Therefore, controlling H2S04 emissions is done by controlling the sulfur content or removing SO_2 from the exhaust gas.

As mentioned in the Application (Section 4.9, Page 9-34), the use of low sulfur fuels is the only technically feasible control technology identified and is therefore the proposed control for both SO_2 and H_2SO_4 emissions from the Phase 1 Boiler.

Combustion Turbines – B018 and B019

The combustion turbines oxidize sulfur compounds in fuel primarily into sulfur dioxide (SO_2). There is a potential for a fraction of the SO_2 to form SO_3, which can combine with moisture in the exhaust to form sulfuric acid mist (H_2SO_4). Emissions for H_2SO_4 are controlled by limiting the fuel sulfur content or by removing SO_2 from the exhaust gas.

As already provided in the Application (Section 4.5, Page 9-24), the pre-combustion system, Acid Gas Removal (Rectisol®), reduces tailgas sulfur concentrations by greater than 99% and produces a secondary gas stream that can be processed into potentially useful sulfur by-products. No post-combustion exhaust gas treatment systems were identified that would be technically feasible for the proposed combustion turbines. A RBLC database search performed on November 10, 2008 (see attached table) confirmed that post-combustion technologies have not been determined to constitute BACT for H_2SO_4 emissions from similarly-sized combustion turbines. The proposed BACT limits associated with a tailgas sulfur concentration is equivalent to an emission rate of 21.06 lb SO_2/hr or 0.0093 lb/MMBtu for each turbine.

Please let us know if there are any questions.

Regards,

Stephan M. Dopuch
Vice President, Business Development

Copy: K. Macoskey, Civil & Environmental Consultants, Inc
N. Petricoff, Baard Energy, L.L.C.

Attachment

November 10, 2008 EPA RBLC Search on large Gas-fired Combined Cycle Turbines

NOTE: Draft determinations are marked with a " * " beside the RBLC ID.

RBLCID	FACILITYN	CORPORATEO	SIC	NAICS	PROCESSNAME	PROCTYP	THRUPUT	THRUPUT	POLLUTANT	CONTROL	CTRLDESC	EMISLIMIT	EMISLIMIT	PCTEFFIC
LA-0224	ARSENAL	SOUTHWEST E	4911	221112	TWO COMBINED CYCLE GAS TURBINES	15.21	2110	MMBTU/H	Particulate Matter (F	N	GOOD COMBUSTION DESIGN/ PROPER OPERATING PRACTICES/ PIPELINE QUALITY NATURAL GAS AS FUEL	24.23	LB/H	
PA-0189	CONECTI\	CONECTIV BET	4911	221112	TURBINE, COMBINED CYCLE, (6)	15.21	122	MW	Sulfuric Acid (mist, \	P	BACT FOR H2SO4 IS GOOD COMBUSTION AND LOW SULFUR FUELS	0.0002	PPM	
NV-0035	TRACY SL	SIERRA PACIFI	4911	221112	TURBINE, COMBINED CYCLE COMBUSTION #1 WITH HRSG AND DUCT BURNER.	15.21	306	MW	Sulfuric Acid (mist, \	P	BEST COMBUSTION PRACTICES.	1	LB/H	
NV-0035	TRACY SL	SIERRA PACIFI	4911	221112	TURBINE, COMBINED CYCLE COMBUSTION #2 WITH HRSG AND DUCT BURNER.	15.21	306	MW	Sulfuric Acid (mist, \	P	BEST COMBUSTION PRACTICES.	1	LB/H	
MI-0363	BLUEWAT	BLUEWATER E	4911	221112	TURBINE, COMBINED CYCLE, (3)	15.21	180	MW	Sulfuric Acid (mist, \	P	EXCLUSIVE USE OF NATURAL GAS.	8.2	LB/H	
TX-0262	ARCHER (	ARCHER POWI	4911	221112	GAS TURBINES (4) WITH HRSG (4) (COMBINED FIRING)	15.21	173	MW EACH	Sulfuric Acid (mist, \	P	EXCLUSIVE USE OF PIPELINE QUALITY LOW-SULFUR CONTENT NATURAL GAS.	0.32	LB/H	
WA-0302	GOLDENC	GOLDENDALE	4911	221112	COMBINED CYCLE UNIT (TURBINE/HRSG)	15.21	248.7	MW	Sulfuric Acid (mist, \	P	EXCLUSIVE USE OF PIPELINE QUALITY NATURAL GAS AND GOOD COMBUSTION PRACTICES.	0.207	LB/H	
TX-0344	DEER PAF	DEER PARK EN	4911	221112	(4) CTG1-4 & HRSG1-4, ST-1 THRU -4	15.21	180	MW, EA	Sulfuric Acid (mist, \	P	FIRING LOW-S FUELS	4.89	LB/H	
TX-0294	GATEWAY	GATEWAY POV	4911	221112	(3) COMBUSTION TURBINES & DUCTBURNERS, CTG-1,-2,-3	15.21	170	MW, EACH	Sulfuric Acid (mist, \	P	FIRING NAT GAS	5.2	LB/H	
TX-0352	BRAZOS \	BRAZOS VALLE	4911	221112	(2) HRSG/TURBINES, HRSG-001 & -002	15.21	175	MW, EA	Sulfuric Acid (mist, \	P	FIRING PIPELINE QUALITY NATURAL GAS	1.3	LB/H	
FL-0252	FORT PIEI	FORT PIERCE I	4911	221112	TURBINE, COMBINED CYCLE, NATURAL GAS	15.21	180	MW	Sulfuric Acid (mist, \	P	FUEL SPECIFICATION: : NATURAL GAS WITH A MAXIMUM OF 2.0 GRAINS OF SULFUR PER 100 SCF			
AR-0057	TENASKA	TENASKA ARK/	4911	221112	TURBINE, COMBINED CYCLE, NATURAL GAS	15.21	185	MW	Sulfuric Acid (mist, \	P	FUEL SPECIFICATION: LOW SULFUR FUEL	0.0038	PPMVD @	
FL-0223	LAKE WOI	LAKE WORTH (	4911	221112	TURBINE, COMBINED CYCLE, NATURAL GAS	15.21	186	MW	Sulfuric Acid (mist, \	P	FUEL SPECIFICATION: USE OF NATURAL GAS, 1 GR/100 SCF OF GAS			
SC-0061	COLUMBI/	COLUMBIA ENE	4911	221111	TURBINES, COMBINED CYCLE, NATURAL GAS (2)	15.21	170	MW (EACH	Sulfuric Acid (mist, \	P	GOOD COMBUSTION PRACTICES, CLEAN BURNING LOW SULFUR FUELS	0.9	LB/H	
AL-0132	TENASKA	TENASKA ALAE	4911	221111	TURBINE & DUCT BURNER, NAT GAS, (3)	15.21	170	MW	Sulfuric Acid (mist, \	P	INHERENTLY LIMITED BY LOW SULFUR IN FUEL	0.0011	LB/MMBTU	
*WA-0328	BP CHERF	BP WEST COA!	4911	221112	GE 7FA COMBUSTION TURBINE & HEAT RECOVERY STEAM GENERATOR	15.21	174	MW	Sulfuric Acid (mist, \	P	LIMIT FUEL TYPE TO NATURAL GAS			
TX-0374	CHOCOLA	BP AMOCO CH	2869	325110	(2) COGENERATION TRAINS 2 & 3, GT-2 & 3	15.21	70	MW, TOTA	Sulfuric Acid (mist, \	P	LOW SULFUR FUEL	1.94	LB/H	
FL-0245	FPL MANA	FLORIDA POWI	4911	221112	TURBINE, COMBINED CYCLE, NATURAL GAS (4)	15.21	170	MW	Sulfuric Acid (mist, \	P	LOW SULFUR FUEL	2	GR/100 SC	
OK-0044	SMITH PO	SMITH COGENI	4911	221111	TURBINES, COMBINED CYCLE, NATURAL GAS, (4)	15.21	171.5	MW	Sulfuric Acid (mist, \	P	LOW SULFUR FUEL	4.8	LB/H	
TX-0411	AMELIA EI	CALPINE CONS	4911	221112	TURBINE, COMBINED CYCLE, & DUCT BURNER (3)	15.21	180	MW	Sulfuric Acid (mist, \	P	LOW SULFUR FUEL	2.08	LB/H	
TX-0265	LOST PINI	GENTEX POWE	4911	221112	COMBINED CYCLE TURBINE, (2)	15.21	183	MW	Sulfuric Acid (mist, \	P	LOW SULFUR FUEL	4.4	LB/H	
WA-0299	SUMAS EI	SUMAS ENERG	4911	221112	TURBINES, COMBINED CYCLE, (2)	15.21	334.5	MW	Sulfuric Acid (mist, \	P	LOW SULFUR FUEL -- NATURAL GAS ONLY	0.0008	LB/MMBTU	
NH-0012	NEWINGT	NEWINGTON E	4911	221111	TURBINES, COMBINED CYCLE, NATURAL GAS	15.21	160	MW	Sulfuric Acid (mist, \	P	LOW SULFUR FUELS	22.35	LB/H	
SC-0060	RAINEY G	SANTEE COOP	4911	221111	TURBINES, COMBINED CYCLE, NATURAL GAS (2)	15.21	170	MW (EACH	Sulfuric Acid (mist, \	P	LOW SULFUR FUELS	0.24	LB/H	
SC-0066	SANTEE C	SANTEE COOP	4911	221112	TURBINES, COMBINED CYCLE, NATURAL GAS, (2)	15.21	170	MW	Sulfuric Acid (mist, \	P	LOW SULFUR FUELS	0.24	LB/H	
TX-0383	FORNEY F	COBISA-FORNI	4911	221112	(6) COMBINED TURBINE & DUCT BURNER	15.21	169.8	MW	Sulfuric Acid (mist, \	P	LOW SULFUR PIPELINE NAT GAS	44.36	T/YR	
TX-0428	HOUSTON	OXY VINYLS LF	4911	221112	TURBINE, COMBINED CYCLE & DUCT BURNER	15.21	87	mw	Sulfuric Acid (mist, \	P	LOW SULFUR PIPELINE NATURAL GAS AND PLANT FUEL GAS			
AL-0180	DUKE ENE	DUKE ENERGY	4911	221111	2 GE 7FA GAS FIRED COMB. CYCLE W/568 MMBTU DUCT B	15.21	170	MW EACH	Sulfuric Acid (mist, \	P	NATURAL GAS AS EXCLUSIVE FUEL.	0.0007	LB/MMBTU	
AL-0185	BARTON S	BARTON SHOA	4911	221111	FOUR (4) COMBINED CYCLE COMBUSTION TURBINE UNITS	15.21	173	MW	Sulfuric Acid (mist, \	P	NATURAL GAS ONLY	0.0011	LB/MMBTU	
AL-0141	GPC - GO/	GEORGIA POW	4911	221111	SIX (6) COMBINED CYCLE ELECTRIC GENERATING UNITS	15.21	173	MW	Sulfuric Acid (mist, \	P	NATURAL GAS ONLY	0.009	LB/MMBTU	
TX-0350	ENNIS TR	ENNIS-TRACTE	4911	221112	COMBUSTION TURBINE W/HEAT RECOVERY STEAM GENERATOR	15.21	350	MW	Sulfuric Acid (mist, \	N	NONE INDICATED	2.37	LB/H	
AL-0179	TENASKA	TENASKA ALAE	4911	221111	COMBINED CYCLE COMB. TURB. UNITS W/ DUCT FIRING (6	15.21	170	MW	Sulfuric Acid (mist, \	P	PIPELINE QUALITY NATURAL GAS	0.0017	LB/MMBTU	
TX-0352	BRAZOS \	BRAZOS VALLE	4911	221112	(2) HRSG/TURBINES, HRSG-003 & -004	15.21	175	MW	Sulfuric Acid (mist, \	P	PIPELINE QUALITY NATURAL GAS	1.3	LB/H	
TX-0497	INEOS CH	INEOS USA LLC	282	325110	COGENERATION TRAIN 2 AND 3 (TURBINE AND DUCT BURNER EMISSIONS)	15.21	35	MW	Sulfuric Acid (mist, \	P	THE TURBINES WILL FIRE NATURAL GAS AND THE DUCT BURNERS WILL FIRE NATURAL GAS AND COMPLEX GAS WITH A SULFUR CONTENT LESS THAN FIVE GRAINS PER 100 STANDARD CUBIC FEET ON AN HOURLY BASIS	1.94	LB/H	
OK-0050	ONETA GE	CALPINE CORF	4911	221111	COMBUSTION TURBINES, COMBINED CYCLE (4)	15.21	170	MW	Sulfuric Acid (mist, \	P	USE OF LOW SULFUR NATURAL GAS FUEL	0.29	LB/H	
WV-0014	PANDA CL	PANDA CULLOI	4911	221111	COMBUSTION TURBINE, 300 MW	15.21	300	MW	Sulfuric Acid (mist, \	P	USE OF LOW-SULFUR FUEL - NATURAL GAS	0.62	LB/H	
TX-0255	PASADEN	CALPINE CORF	4911	221112	TURBINE/HRSG (CG-3)	15.21	160	MW	Sulfuric Acid (mist, \	P	USE OF NATURAL GAS WITH A TOTAL SULFUR CONTENT LESS THAN 5 GR/100 SCF. USE OF PROPER COMBUSTION CONTROLS.	1.36	LB/H	
TX-0255	PASADEN	CALPINE CORF	4911	221112	TURBINE/HRSG (CG-2)	15.21	160	MW	Sulfuric Acid (mist, \	P	USE OF PROPER COMBUSTION CONTROL AND FIRING ONLY LOW SULFUR CONTENT FUELS.	1.36	LB/H	
TX-0437	HARTBUR	HARTBURG PC	4911	221112	TURBINE, COMBINED CYCLE & DUCT BURNER	15.21	277	mw	Sulfuric Acid (mist, \	P	USE OF PROPER COMBUSTION CONTROL AND LOW SULFUR FUEL: < 5 GR S/100 SCF HOURLY BASIS, < .25 GR S/100 SCF ANNUAL BASIS.			