ENGINEERING ANALYSIS

FACILITY HISTORY

Crosbys Creek Oil & Gas LLC (Crosbys Creek) operates the Sarah Middleton 34-11 and CCGU 34-14 wells accessible from Gunn Dees Road in Section 34, Township 8 North, Range 4 West, Washington County. Production equipment for both wells is located at the Sarah Middleton 34-11 well's surface location, including a flare permitted under Air Permit No. 108-0011-X001 in 1986. However, the production equipment at the 34-11 well site has been out of service, as observed in the Department's August 29, 2019 inspection of the site, and Crosbys Creek has sent the full well streams of these wells and their separately permitted Choctaw County wells (facility nos. 101-0019 & 101-0022) to the Chatom Gas Plant (facility no. 108-0009). The wells have been shut in since the Chatom Gas Plant's shut down in 2019.

The Department received the application to construct the Common Facility near the Sarah Middleton 34-11 well on May 12, 2020. The Department later received the application for use of the Sarah Middleton 34-11's flare on June 1, 2020.

PROJECT DESCRIPTION

Because the Chatom Gas Plant has been shut down, Crosbys Creek intends to convert the Sarah Middleton 34-11 well to a sour gas injection well for the gas produced by the CCGU 34-14 as well as their Gin Creek Field wells (101-0019) and Choctaw Lumber 14-11 well (101-0022) in Choctaw County. The full well stream from the CCGU 34-14 will be separated at the Sarah Middleton 34-11 site using existing equipment. Sarah Middleton 34-11 site's existing emergency flare will be fitted with a flow meter, and the site will be re-permitted as Synthetic Minor Operating Permit no. 108-0011-X001.

Crosbys Creek is constructing a new site, referred to as the Common Facility, roughly 100 yards west of the Sarah-Middleton 34-11 surface location. The Common Facility will accept the full well streams from the Choctaw County wells and the separated streams from the CCGU 34-14. At the Common Facility, the full well streams will be separated, the liquids will be stored in the tank battery, and gas will be routed over to the Sarah Middleton 34-11 well for injection via a compressor driven by an electric motor. The separation vessels include two heating elements: a 0.413 MMBtu/hr burner on the oil stabilizer, and a 0.5 MMBTU/hr burner on the heater treater. The Common Facility will have its own emergency flare. The oil and gas from these wells is sour (between 13.1% to 18% H_2S), which is why Crosbys Creek intends to inject the gas back into the ground.

EMISSIONS

The potential emissions for the facility are based on Crosbys Creek accepting a 95 TPY SO_2 limit on the entire facility. Flare emissions were evaluated using the combined gas stream composition provided in the application, with the H_2S composition conservatively increased from 15.82% to 18% by volume and the nitrogen composition decreased by an equal amount. Emissions from the heaters are calculated using AP-42 factors for burning propane.

	Pollutant	Heaters	Flares	Total Emissions
Criteria Pollutant Emissions (TPY)	PM	0.209	0.009	0.217
	SO_2	0.016	94.980	94.996
	NO_X	4.117	0.309	4.426
	CO	2.305	1.683	3.988
	VOC	0.151	0.493	0.644
	Total HAPs	0.052	0.014	0.066
GHG Emissions (TPY)	CO_2	3792.847	410.990	4,203.836
	N_2O	0.037	0.001	0.038
	CH_4	0.185	1.914	2.099
	Mass Sum	3793.069	412.905	4,205.973
	CO_{2e}	3808.509	459.135	4,267.645

Table 1 – Facility-wide Potential Emissions

At 380.67 scf/lb-mol (at industry standard conditions of 60 °F and 14.65 psia), a 1:1 stoichiometric conversion of H_2S to SO_2, and the 18% by volume high end of the range of H_2S in the incoming gas, Crosbys Creek would reach this 95 TPY SO_2 limit by flaring around 6,300 Mscf of gas per year. According to Alabama Oil & Gas Board production records, each of the five feeder wells produced an order of magnitude more than this amount in 2018 (before being shut in throughout much of 2019 due to issues downstream at the Chatom Gas Plant); in their application, Crosbys Creek stated that they expect the Common Facility to have a throughput of up to 2,000 Mscf/day. Therefore, Crosbys Creek will need to limit emergency flaring episodes in order to remain a Synthetic Minor source.

REGULATIONS

STATE REGULATIONS

ADEM Administrative Code Rule 335-3-4-.01(1)(a and b), "Visible Emission"

ADEM 335-3-4-.01(a) states that no person shall emit to the atmosphere particulate of an opacity of greater than twenty percent (20%) over a six (6) minute period. **ADEM 335-3-4-.01(b)** states that during one six minute period in any sixty minute period a person may discharge into the atmosphere from any source of emissions, particulate of an opacity not greater than that designated as forty percent (40%) opacity. Therefore, the flares and heaters will be subject to this regulation.

Crosbys Creek will be required to inspect the flare each day. If visible emissions are observed, the opacity should be determined using Method 9 of 40 CFR Part 60 Appendix A.

ADEM Administrative Code Rule 335-3-4-.03,"Fuel Burning Equipment"

This regulation covers particulate matter (PM) emissions from fuel burning equipment. The heaters will be subject to this regulation. Even though the heaters are located in a Class 2 County, their PM emissions cannot exceed the allowable for a Class 1 County since this unit is a new fuel-burning source emitting particulate matter [ADEM Admin. Code r. 335-3-4-.03(4)]. The PM emissions from the heaters shall not exceed 0.5 lb/MMBtu. The fuel type is propane, and based on AP-42 Table 1.4-2, the size of all particulates is expected to be <1 µm; therefore the value for PM_1 is equal to both $PM_{2.5}$ and PM_{10}. Based on the emissions from the heaters, this limit should not be exceeded for the well sites; therefore, no monitoring is required. However, if PM monitoring is needed Method 5 of 40 CFR Part 60, Appendix A or other approved methods should be used to determine PM emissions.

ADEM Administrative Code Rule 335-3-5-.01(b), "Fuel Combustion"

This regulation covers fuel combustion sulfur limitations for Category II counties, which includes Conecuh County. This regulation requires that fuel combustion source in Category II counties limit sulfur compounds to less than 4.0 lb/MMBtu. The existing and proposed fuel-burning units will burn purchased propane and will accordingly have negligible SO_2 emissions.

ADEM Administrative Code Rule 335-3-5-.03(1-3), "Control of Sulfur Emissions for Petroleum Production"

Under this regulation, hydrogen sulfide (H_2S) may not be emitted in a quantity greater than 0.10 grain per standard cubic foot (scf) (or 160 ppmv), unless it is properly burned to maintain a ground concentration of less than 20 ppbv beyond property limits, as averaged over a 30 minute period. The 95 TPY SMOP limit on emission of SO_2 will require Crosbys Creek to limit the duration flaring events. Flaring events lasting more than 30 minutes must be reported to the Department. Per Rule 335-3-5-.03(3), Crosbys Creek would be limited emission of 0.1 lbs SO_2 per lb of sulfur processed; however, the 95 TPY SO_2 limit is more stringent than this.

ADEM Administrative Code Rule 335-3-6-.03, "Loading and Storage of VOC"

This regulation applies to the loading and storage of volatile organic compounds (VOC). Per Rule 335-3-6-.03(4), this regulation does not apply to crude petroleum produced, separated, treated, or stored in the field. Since each oil tank will store crude petroleum at the production source in the field, this regulation does not apply.

ADEM Administrative Code Rule 335-3-6-.04, "Fixed-Roof Petroleum Liquid Storage Vessels"

This regulation applies to fixed roof petroleum liquid storage tanks. Per Rule 335-3-6-.03(3)(b), this regulation would not apply to storage tanks with a capacity less than 423,000 gallons, and used to store crude petroleum oil prior to custody transfer. Since the oil tanks would store crude prior to custody transfer and they would not meet the capacity requirement, this regulation would not apply.

ADEM Administrative Code Rule 335-3-14-.04*, *"Prevention of Significant Deterioration (PSD) Permitting"

Based on the emissions found in Table 1, the proposed wells and engines when aggregated with the existing sources would not be expected to exceed the 250 tons per year (TPY) major source threshold for criteria pollutants for this type of facility (oil and gas wells are not one of the 28 source categories listed in this regulation). Greenhouse Gas (GHG) Regulations require a facility that would be subject to PSD to address PSD regulations for Greenhouse Gases. Greenhouse Gases of concern for these sources would be CO_2, N_2O, and CH_4. Per Rule 335-3-14-.04(2)(a)1.(iii), no PSD review would be necessary for this project.

ADEM Admin. Rule 335-3-14-.06, "Determinations for Major Sources in Accordance with Clean Air Act Section 112(g)"

This regulation applies to major sources of hazardous air pollutants (HAPs) constructed after March 27, 1998. Since this facility is not a major source of HAPs, a 112(g) case by case MACT review would not be necessary.

ADEM Administrative Code, Rules 335-3-15, "Synthetic Minor Operating Permits (SMOPs)" and 335-3-16, "Major Source Operating Permits (MSOPs)"

The potential emissions from the facility would be expected to be greater than the 100 TPY major source threshold for SO_2; however, Crosbys Creek has accepted a 95 TPY limit on the facility, making them a synthetic minor source. Therefore, the facility would not be classified as a major source with respect to this regulation.

To show compliance with the 95 TPY SO2 limit, Crosbys Creek will be required to measure the volumetric flow rate of any gas flared and the chemical composition of gas flared, and each month they will calculate the monthly and rolling-12-month total SO_2 emissions.

Class I Area

The nearest Class I Area to this well site would be the Breton Wildlife Refuge; however, this site would be located more than 100 km from that area.

FEDERAL REGULATIONS

40 CFR 60 Subpart A, "General Provisions"

This subpart will be applicable provided that the facility is subject to one of the applicable subparts found under 40 CFR Part 60.

40 CFR 60 Subpart Kb "Standards of Performance for Volatile Organic Liquid Storage Vessels (including petroleum liquid storage vessels)"

This regulation applies to VOC tanks constructed after July 23, 1984. §60.110b(d)(4) states that vessels with a design storage capacity of less than, or equal to, 1590 m^3 (420,000 gallons) used for petroleum or condensate stored, treated, or processed prior to custody transfer are exempt from this regulation. Each of the tanks at this site has a volume of less than 420,000 gallons, and stores condensate prior to custody transfer. Therefore, the tanks are exempt from this regulation.

40 CFR 60 Subpart OOOOa, "Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution for which Construction, Modification, or Reconstruction Commenced after September 18, 2015"

This regulation was promulgated by EPA on June 3, 2016 and it contains SO_2 and VOC requirements for oil & gas production wells and natural gas processing plants constructed, reconstructed, or modified after September 18, 2015. The following table summarizes the portions of this regulation that apply specifically to this project:

AFFECTED SOURCES	APPLICABILITY
Reciprocating Compressor [§60.5365a(b)]	This applies to reciprocating compressors not located at well sites.
Pneumatic Controller [§60.5365a(d)(1)]	This applies to a single continuous-bleed natural-gas-driven pneumatic controllers with a bleed rate of > 6 scf/hr at an oil or natural gas production segment
Storage Vessels [§60.5365a(e)]	This applies to a single storage vessels located in the oil and natural gas production segment, natural gas processing segment or natural gas transmission and storage segment that has potential uncontrolled VOC emissions > 6 TPY
Collection of fugitive emission components (FEC) at a well site [§60.5365a(i)]	This applies to FEC (valves, flanges, PRVs, tank hatches, etc.) at well sites

Reciprocating Compressor

The gas-injection compressor is not subject to Subpart OOOOa, because reciprocating compressors located at well sites are exempt.

Pneumatic Controller

The pneumatic controllers at these wells are not continuous-bleed gas-driven controllers; therefore, there are no affected sources under this section of this subpart.

Storage Vessels

The storage vessels at the wells will be constructed after September 18, 2015. At the Common Facility, tank vapor is collected via a closed vent system and vapor recovery unit and injected down the 34-11 well with the produced gas. §60.5365a(e) only applies to tanks with an uncontrolled PTE of greater than 6 TPY of VOCs. Because the condensate or oil in the tanks will have had volatiles removed in the oil stabilizer and other separation units, VOC emissions from each tank are expected to be <6 TPY.

Collection of Fugitive Emission Components (FEC) at a well site

The surface location of the 34-11 and 34-14 wells and its respective collections of FEC is *existing* with regards to Subpart OOOOa. However, because the definition of well sites includes surface locations for both injection wells and for separate tank batteries or production sites, the collection of FEC at the Common Facility qualifies as *new* with respect to Subpart OOOOa. FEC are defined in §60.5430a as new pumps, pressure relief devices, valves, connectors, hatches on tanks not already subject to §60.5365a(e), and other required devices/systems (except compressors) capable of leaking methane or VOC. As outlined in §60.5397a(a), the aforementioned equipment are subject to the leak standards in §60.5397a(b)-(g), the reporting requirements of §60.5397a(j) and the recordkeeping requirements of §60.5397a(i).

RECOMMENDATIONS

This analysis indicates that the proposed emission sources could meet the requirements of all federal and state rules and regulations if flaring is restricted. Crosbys Creek must reduce SO_2 emissions below 95 TPY by constant operation of the gas injection compressor and minimal flaring. I recommend that Crosbys Creek Oil & Gas LLC be issued Synthetic Minor Operating Permits 108-0011-X001 and -X002 for the Sarah Middleton 34-11 injection well and the Common Facility respectively.

June 30, 2020
Date

R. Jackson Rogers, Jr.
Industrial Minerals Section
Energy Branch
Air Division
ADEM

ATTACHMENT A

TABLES

	Pollutant	Heaters	Flares	Total Emissions
Criteria Pollutant Emissions (TPY)	PM	0.209	0.009	0.217
	SO_2	0.016	94.980	94.996
	NO_X	4.117	0.309	4.426
	CO	2.305	1.683	3.988
	VOC	0.151	0.493	0.644
	Total HAPs	0.052	0.014	0.066
GHG Emissions (TPY)	CO_2	3792.847	410.990	4,203.836
	N_2O	0.037	0.001	0.038
	CH_4	0.185	1.914	2.099
	Mass Sum	3793.069	412.905	4,205.973
	CO_{2e}	3808.509	459.135	4,267.645

Table 1 – Facility-wide Potential Emissions

ATTACHMENT B

CALCULATIONS

Combined Flares Potential Emissions

Data	Total		Separator Gas			Pilot Gas		GWP (11/29/2013)		40 CFR Part 98 Sub C GHG Emission Factors (Table C-1)		
Volume	**785.833**	scf/hr (Ind.)	17.2	Mscf/day		1.7	Mscf/day	N_20=	298			
H_2S mol%	16.3966%	mol%	18.0%	mol%		0.0000%	mol%	CO_2=	1	N_20=	0.0001	kg/MMBtu
Heat Content	1321.61	Btu/scf (Ind)	1351.10	Btu/scf (Ind)		1020.00	Btu/scf (Ind)	CH_4=	25	AP 42 Emissions Factors[7]		
VOC MW	**2.73**	lb/lb-mol[2]	**2.98**	lb/lb-mol[2]		**0.15**	lb/lb-mol[2]			NO_X=	0.068	lb/MMBtu
CO_2	**1.74%**	mol%	**1.86%**	mol%		**0.50%**	mol%			CO=	0.37	lb/MMBtu
CH_4	**65.97%**	mol%	**63.13%**	mol%		**95.00%**	mol%			PM_1=	40	µg/L
C_6	**0.08**	lb/lb-mol[2]	**0.09**	lb/lb-mol[2]		**0.01**	lb/lb-mol[2]					
OP Hours	8760	Hrs						(Ind. STP)	scf/lbmol=	380.67	60 °F	14.65 psia
Destruction Eff	**98.00%**	DRE	Heat Input		**1.04** MMBtu/hr[1]			(EPA STP)	scf/lbmol=	385.5	68 °F	14.696 psia

Potential Flare Emission Calculations

Pollutants																				
PM_1	40	µg	785.8	scf (Ind.)	2.2E-9	lb	8,760	Hr	1	Ton	28.31685	L	1.01	scf(EPA)	=	**0.009**	**Tons**
	L		Hr		µg		Year		2,000	Lb	scf (EPA)		1	scf(Ind.)		**Year**	
SO_2	168.3	Lb SO_2[4]	0.786	MScf (Ind.)	16.397%	H_2S Mol%	8,760	Hr	1	Ton					=	**94.980**	**Tons**
	MScf (Ind.)		Hr				Year		2,000	Lb						**Year**	
NO_X	0.068	lb	1.039	MMBtu	8,760	Hr	1 Ton								=	**0.309**	**Tons**
	MMBtu		Hr		Year		2,000 Lb									**Year**	
CO	0.37	lb	1.039	MMBtu	8,760	Hr	1 Ton								=	**1.683**	**Tons**
	MMBtu		Hr		Year		2,000 Lb									**Year**	
VOC[5]	785.8	Scf (Ind.)	1	lb-mol	2.73	Lb VOC	8,760	Hr	1 Ton		2.00%	Inv. DRE			=	**0.493**	**Tons**
	Hr		380.67	scf (Ind.)	Lb-Mole		Year		2,000	Lb						**Year**	
HAPs[8]	785.8	Scf (Ind.)	1	lb-mol	0.08	Lb C_6	8,760	Hr	1 Ton		2.00%	Inv. DRE			=	**0.014**	**Tons**
	Hr		380.67	scf (Ind.)	Lb-Mole		Year		2,000	Lb						**Year**	
CO_2[5,6] of Combustion	98.00%	DRE	6.88E+06	Scf (Ind.)	1.04	lb-mol CO_2 (stoich.)	1	lb-mol gas	44.01	lb CO_2	1 Ton				=	**404.07**	**Tons**
			Yr		1	lb-mol gas (stoich.)	380.67	scf (Ind.)	lb-mole CO_2		2,000 Lb					**Year**	
CO_2 of Fuel	6.88E+06	Scf (Ind.)	1.74%	mol% CO_2	1	lb-mol	44.01	Lb CO2	1 Ton						=	**6.92**	**Tons**
	Yr				380.67	scf (Ind.)	Lb-mole		2,000	Lb						**Year**	
N_2O	0.001	M Ton	0.001322	MMBtu	785.8	Scf (Ind.)	0.0001	kg	8,760	Hr	1.1023	Tons			=	**0.0010**	**Tons**
	kg		Scf (Ind.)		Hr		MMBtu		Year		1 Metric Ton					**Year**	
CH_4 Uncombusted	6.88E+06	Scf (Ind.)	2.00%	Inv. DRE	65.97%	mol% CH_4	1	lb-mol	16.043	Lb CH4	1 Ton				=	**1.91**	**Tons**
	Yr						380.675	scf (Ind.)	Lb-mole		2,000 Lb					**Year**	
Mass Sum	410.99	Tons		+	0.0010	Tons		+	1.91	Tons					=	**412.90**	**Tons**
	Year				Year				Year							**Year**	
	CO2				N2O				CH4								
CO_2e	410.99	TPY	X 1		0.0010	TPY	X 298		1.91	TP	X 25				=	**459.14**	**Tons**
	410.99			+	0.30			+	47.85							**Year**	
	CO2				N2O				CH4								

[1] Rated Heat Capacity (MMBtu/Hr) = Flowrate (Scf/Hr) * Heat Content (Btu/Scf) * (MMBtu/10^6 Btu)

[2] VOC (Lb/Lb-mole) = Σ(Mole% of Each Compound)* (1%/100)*MW of Each Compound) -See Flare GHG Spreed Sheet for gas analysis

[3] Has to be maintained <500 lb/hr or 20 ppbv offsite concentration could potentially be exceeded

H_2S (Lb/hr) = Volume (Scf/hr) * (1 lb-mol/380.67) *(H_2S mol%) * (34.08 Lb H_2S/Lb-mol)

[4] SO_2 Conversion Factor 168.3 Lb SO_2/MScf of Gas

=(1,000 Scf/MScf) *(1Lb-Mole/380.67 Scf)* (64.066 Lb SO_2/Lb-Mole)

[5] Assuming the flare is 98% efficient

[6] Calculated using the gas analysis:

$\Sigma Y_j * R_j$ where, Y_j= mole fraction of gas hydrocarbon constituents' j (such as methane, ethane, propane, carbon dioxide, etc.) and R_j= number of carbon atoms in gas hydrocarbon constituent j: 1 for methane and carbon dioxide, 2 for ethane, 3 for propane, etc.

[7] Flare assumed to be "lightly smoking" in AP-42 table 13.5-1

[8] n-Hexane, Benzene, Toluene, etc are HAPs, but i-Hexanes, n-Heptane, n-Octane, etc are not. Assume by mass 50% Hexanes and 10% Heptanes+ are HAPS

Combined Heaters Potential Emissions

Data:					AP-42 EF (Propane)			Based on NG with Btu/Content of 1020				
H_2S mol%	0.00%	mol%			PM=	7.6	Lb/MMScf		GWP*			*Revised 11/29/2013
Op Hours	8760	Hrs			NO_X=	150	Lb/MMScf		N_2O=	298		
Heat Content	2,500	Btu/scf (Ind.)			CO=	84	Lb/MMScf		CO_2=	1		
Flowrate	**0.365**	MScf/Hr (Ind.)			VOC=	5.5	Lb/MMScf		CH_4=	25		
Heat Input	913,000	Btu/hr			HAP=	1.89	Lb/MMScf					
Use btu/scf (EPA) for PM, NOx, CO, VOC. Factors for EPA STP (also ADEM STP). SO2 factor already for Industry STP (from Al. Oil & Gas Board)					SO_2=	0.60	Lb/MMScf					
					(Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for C_3			(Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for C_1				
Ind. STP:	60	°F	14.65	psia	N_20=	0.0006	kg/MMBtu	N_20=	0.0001	kg/MMBtu		
EPA STP:	68	°F	14.696	psia	CO_2=	61.46	kg/MMBtu	CO_2=	53.06	kg/MMBtu		
Heat Content	2,470	Btu/scf (EPA)			CH_4=	0.003	kg/MMBtu	CH_4=	0.001	kg/MMBtu		
Fuel HHV Correction Factor	**2.421**											

Heater Emission Calculations

Pollutants														
PM	7.6	Lb	0.913	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	2.421		=	**0.030**	**Tons**
	MMScf (EPA)		Hr		2,470	Btu	Year	2,000 Lb				**Year**	
SO_2	0.60	Lb	0.913	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	2.421		=	**0.002**	**Tons**
	MMScf (EPA)		Hr		2,470	Btu	Year	2,000 Lb				**Year**	
NO_X	150	Lb	0.913	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	2.421		=	**0.588**	**Tons**
	MMScf (EPA)		Hr		2,470	Btu	Year	2,000 Lb				**Year**	
CO	84	Lb	0.913	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	2.421		=	**0.329**	**Tons**
	MMScf (EPA)		Hr		2,470	Btu	Year	2,000 Lb				**Year**	
VOC	5.5	Lb	0.913	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	2.421		=	**0.022**	**Tons**
	MMScf (EPA)		Hr		2,470	Btu	Year	2,000 Lb				**Year**	
HAP	1.89	Lb	0.913	MMBtu	Scf (EPA)	8,760	Hr	1 Ton	2.421		=	**0.007**	**Tons**
	MMScf (EPA)		Hr		2,470	Btu	Year	2,000 Lb				**Year**	
CO_2	0.913	MMBtu	61.46	kg	0.001 Metric Ton	8,760	Hr	1.1023 Tons			=	**541.84**	**Tons**
	Hr		MMBtu		kg	Year		1 Metric Ton				**Year**	
N_2O	0.913	MMBtu	0.0006	kg	0.001 Metric Ton	8,760	Hr	1.1023 Tons			=	**0.00529**	**Tons**
	Hr		MMBtu		kg	Year		1 Metric Ton				**Year**	
CH_4	0.913	MMBtu	0.003	kg	0.001 Metric Ton	8,760	Hr	1.1023 Tons			=	**0.02645**	**Tons**
	Hr		MMBtu		kg	Year		1 Metric Ton				**Year**	
Mass Sum	541.84	Tons		+	0.0053	Tons	+	0.0264	Tons		=	**541.87**	**Tons**
	Year				Year			Year				**Year**	
	CO_2				**N_2O**			**CH_4**					
CO_2e	541.84	TPY	X 1		0.0053	TPY	X 298	0.0264	TPY	X 25	=	**544.07**	**Tons**
	541.84			+	1.58		+	0.66				**Year**	
	CO_2				**N_2O**			**CH_4**					

[1] AP-42 emission factors taken from Chapter 1.4. Based on natural gas with 1020 btu/scf, and corrected in calculations. From Chapter 1.5, propane emission factors are equivalent on a heat basis to methane factors, except the NO_X factor is 1.5x higher.