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August 1, 2012

Ms. Aimee Wilson
U.S. EPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX, 75202-2733

**Re: Copano Processing
Houston Central Gas Plant
Greenhouse Gas PSD Permit Application
Response to Comments**

Dear Ms. Wilson:

This letter is in response to Mr. Carl Edlund's June 25, 2012 letter requesting additional information for the review of the above referenced PSD permit application. Your comments enclosed in Mr. Edlund's letter, with Copano's responses, are attached. Also attached are revisions to the emissions calculations in the permit application and additional supporting information as referenced in the responses.

If you have additional questions, please feel free to e-mail me at Rex.Prosser@Copano.com or call me at (713) 737-9048.

Sincerely

Rex J. Prosser
Senior Director, EH&S Corporate

Enclosures

cc: Steve Langevin, RPS

Greenhouse Gas Prevention of Significant Deterioration Permit Application for Houston Central Gas Plant Dated June 5, 2012

General

EPA Question:

1) The permit application does not propose any compliance monitoring for the combustion turbines, heaters, regenerative thermal oxidizer, and flare. EPA requests that Copano propose its preferred monitoring, recordkeeping, and reporting strategy to ensure enforceability of the BACT requirements pursuant to 40 CFR Section 52.21 (n). For the two combustion turbines, heaters and regenerative thermal oxidizer, we are currently assuming that Continuous Emission Monitoring System (CEMS) is the preferred method followed by parametric fuel monitoring with emission factors, etc.

Copano Response:

For the combustion turbines, as stated in Section 6.1.5 of our permit application, CO_2e emissions will be determined based on metered fuel consumption and standard emission factors and/or fuel composition and mass balance. The CO_2e emissions that are calculated from this monitoring data will be converted to 12-month rolling averages for comparison to the proposed annual emission limits. This is the same calculation method used in Table A-1 of the permit application and, although not stated in the calculations, is the Part 98 Equation 2a method. Calculation of emissions and subsequent compliance demonstration for the heaters will be the same as for the turbines.

For both the flash gas stream sent to the flare and the acid gas stream combusted in the proposed RTO, CO_2e emissions will be calculated from continuously monitored flow rates of each stream and the stream composition. Grab samples of each of these two gas streams will be taken and analyzed monthly for composition, and the composition data will be used to calculate the CO2 and CH4 emissions for that month using Equations W-19, W-20, W-21, and W-40 from Part 98. The emissions calculations for these two streams in Tables A-2 and A-3 of the permit application are simple mass balance calculations, as are the Part 98 equations, and although they are presented in a table format by compound, the calculation is essentially identical to Equations W-19, W-20, and W-21 for CO_2 and CH_4.

There is also a very small contribution to the RTO CO_2e emissions from the pilot gas burned in the RTO. These emissions will be calculated using Equation 2a as described above for the turbines and heaters.

BACT Analysis

EPA Question:

2) BACT limits for GHG emission units should be output based limits preferably associated with the efficiency of individual emission units. Please propose short-term emission limitations or efficiency based limits for emission sources in the application. For the emission sources where this is not feasible, please propose an operating work practice standard. Please provide detailed information that substantiates any reasons for infeasibility of an output based limit.

Copano Response:

The last bullet of the proposed BACT for the turbines in Section 6.1.5 of the permit application proposes an output based BACT standard of 1.16 tons of CO_2e/MMscf of residue gas compressed, on a 12-month rolling average basis. The format of this proposed standard is reflective of the efficiency of the turbines in compressing the residue gas. Copano notes that you refer to a "short-term" emission limitation or efficiency. As there is no scientific or regulatory basis for a short-term standard or limit associated with GHG emissions, Copano is not proposing short-term standards for the facilities to be included in this permit.

Copano is also not proposing an output/efficiency based standard for the supplemental heaters or flare of the flash gas stream due to the negligible amount of CO_2e emissions from the facilities. Each facility contributes less than 0.5% to the total proposed CO_2e emissions from the project. The permit will have an annual mass emission limit for each of these facilities that Copano must demonstrate compliance with as described in response to Item 1 above. The very low emission gas flow rates to and/or operating hours of these facilities and the resulting emissions are reflective of proper and efficient operation of the proposed plant. Thus, compliance with the emission rates themselves requires and reflects efficient plant operation.

Section 6.4.5 of the permit application (flash gas flaring BACT) states that the heating value of the flared stream will be maintained at or above 300 Btu/scf, which ensures adequate destruction (99% for C_3 or less) of the GHGs (methane) in the stream. Section 6.2.5 of the permit application (heater BACT) states that manual air/fuel controls to maximize combustion efficiency of the heaters and that the heaters will be inspected and tuned per vendor recommendations. These are the proposed operating work practice for these emission sources.

The purpose of the RTO is to destroy VOC and H_2S in the acid gas stream. There is an insignificant fraction (0.04% by wt) of methane in the stream. The large majority of the CO_2e emissions from the RTO are from the CO_2 that passes through the RTO unchanged regardless of the RTO efficiency. The remainder is the CO_2 from destruction of the VOCs in the stream; therefore, efficient operation of the RTO insures that the small amount of VOC in the stream is converted to CO_2. As such, efficient operation of the RTO does nothing to decrease CO_2 emissions. Efficient operation of the RTO will minimize VOC emissions, and that requirement is under TCEQ's permitting authority and is not within the scope of the GHG permit. Use of an RTO eliminates the need for assist gas (methane), which would result in additional CO_2 emissions when oxidized. Thus, as explained in BACT analysis in Section 6.3.4 of the permit application, selection of the RTO itself for destruction of the VOCs and H_2S in the acid gas stream eliminates production of CO_2 from combustion, and there is no efficiency standard or operating practice that would further reduce CO_2 emissions.

EPA Question:

3) Copano provides a five-step BACT analysis for the turbines and heaters. Copano selected the use of high efficiency turbines and heaters as BACT. The application does not give the efficiency of the models of turbines and heaters selected. Please provide comparative benchmark data for the combustion turbines and heaters evaluated. In order to support the selection of the proposed combustion turbine and heater models, please supplement this comparative analysis with additional data that includes production output, gross heat rate, and percent efficiency of each existing or similarly designed combustion turbines evaluated as part of the BACT analysis.

Copano Response:

The rated efficiency of the proposed turbines is 34.4% per Solar specifications. This does not take into account the heat recovered by the waste heat recovery units (WHRUs). The attached Table 1 compares the estimated total annual fuel consumption for the project with the proposed turbines with that of an engine configuration option instead. The engines alone have a thermal efficiency of about 39%; however, the WHRU technology is not applicable to the engines. Therefore, continuous use hot oil heaters would be required if engines were used. As Table 1 shows, the total annual fuel consumption of the engines and heaters combined is estimated to be about 15% greater than what is required for the proposed turbines/WHRUs and limited use (600 hr/yr) heaters. Thus, the overall energy efficiency of the plant is higher with the turbine option.

Table 2 compares the proposed Solar turbines to comparable GE and Siemens turbines that could have been selected for the turbine/WHRU configuration. As can be seen, the GE turbines are slightly less efficient, and the Siemens turbines are slightly more efficient than the Solar turbines. NO_x emissions from each turbine are also shown in the table. The Solar turbines produce 40% less NO_x emissions (ppm basis, which is equivalent to fuel consumption basis) than the other models considered, while the slightly lower efficiency of the Solar turbines results in only about 5% more GHG emissions than the Siemens turbines. This reason alone is adequate justification for selection of the Solar turbines over the other models available. This and additional reasons for selecting the Solar turbines include:

- The Solar turbines produce 40% less NO_x emissions than the other models considered;
- Copano has two existing Solar Centaur 60 gas turbine packages;
- Copano has two existing Solar Mars 100 gas turbine packages identical to the ones that will be installed in this Cryo. There are capital/maintenance cost and operability advantages having the same exact equipment (i.e. safety, training, control system synergies, spare parts, etc.);
- Copano has an existing maintenance/service contract with Solar;
- Copano operations is familiar with the Solar gas turbine package, but has never used a Seimens package; and
- There is less risk using a US based company. Solar is a US based, while Seimens is German based.

The supplemental heaters will be approximately 80% efficient under steady state, full load conditions, which is typical for heaters of this size and application. It should be noted however that since these are essentially emergency use heaters (no more than 600 hour per year of equivalent full load operation); it is not feasible to achieve high actual operating efficiencies regardless of the design efficiency of the heater selected. Also, due to the minimal use, fuel consumption and resulting GHG emissions are insignificant (<0.5% each) compared to the project totals. Therefore, minor differences in efficiency between different heaters would correspond to a negligible difference in total project GHG emissions.

EPA Question:

4) Does the waste gas going to the regenerative thermal oxidizer (RTO) contain methane? If yes, what is the destruction removal efficiency (DRE) of the RTO for methane? Will the waste gases have a gas composition analyzer? Also, the applicant should provide comparative benchmark data to indicate other similar industry operating or designed units and compare the DRE of the process to other similar or equivalent process to supplement the BACT analysis.

Copano Response:

The composition of the acid gas stream going to the RTO is shown in Table A-2 of the permit application. As shown in the table, it is expected to have an average methane concentration of 0.04% by weight. There will not be a continuous composition analyzer; however, as described in the response to Item 1, a gram sample will be taken monthly and analyzed for composition. The DRE of the RTO for methane will be at least 99%. Thus, methane emissions will be negligible and were not represented in the application. Based on the composition and minimum DRE, 0.30 tpy of methane would be emitted from the RTO. For completeness these emissions have been added to the calculations, which are enclosed with these responses. As explained in the response to Item 2, the RTO is not a control device for GHG emissions, and other than the negligible amount of methane in the acid gas stream, any improved DRE of the hydrocarbons in the stream will increase, rather than decrease, GHG emissions. Over 99% of the CO_2 emissions from the RTO are simply "pass through" emissions, which are unaffected by the DRE of the device. Because a higher DRE will neither increase nor decrease GHG emissions, a comparative analysis of DRE with other available units is not applicable to GHG emissions for this device.

EPA Question:

5) Please provide efficiency or output based benchmarking information related to the flare. Does the LL Treater flash gas combusted by the flare contain methane? If yes, what is the DRE of the flare for methane? Is the flare air assisted, steam assisted, or unassisted?

Copano Response:

The composition of the flash gas stream going to the flare is shown in Table A-3 of the permit application. As shown in the table, it is expected to have an average methane concentration of about 25% by weight. There will not be a continuous composition analyzer; however, as described in the response to Item 1, a grab sample will be taken monthly and analyzed for composition. The flare is air assisted and has a DRE of 99% for methane. Thus, methane emissions will be negligible and were not represented in the application. Based on the composition and minimum DRE, 0.74 tpy of methane would be emitted from the flare due to this stream. For completeness these emissions have been added to the calculations, which are enclosed with these responses. The flash gas stream is a low flow rate stream, and a new separate flare is not warranted or proposed; therefore, as described in the permit application, the stream will be routed to a previously permitted flare. Even if a device with a DRE of 100% was feasible, it would result in only a 0.74 tpy additional reduction in methane emissions. This small potential emissions decrease does not warrant consideration of other devices when an already permitted device is available.

EPA Question:

6) For the process fugitives BACT, on page 6-15, it is stated that the applicant will implement the TCEQ 28M Leak Detection and Repair (LDAR) program. Will an enhanced 28M program which would include instrumented monitoring for methane (CH_4) be utilized? Also, it does not appear that Copano considered the TCEQ 28LAER program as an available control option for reducing fugitive

emissions and leaks as part of its BACT analysis. Did the BACT analysis consider 28LAER as the highest available control option? If not, why? Please further refine the BACT analysis for fugitive emissions.

Copano Response:

The fugitive emissions calculations have been revised to include additional flanges not originally included in the component counts. A cost analysis is included in Table 3 that demonstrates that even the least stringent LDAR program has a cost effectiveness of $161/ton of CO_2e, which is not cost effective for GHGs. Although not shown, a more stringent LDAR program, such as 28LAER, would have an even higher cost effectiveness value. Therefore, as stated in the permit application, BACT for GHGs is "no control" for process fugitives. The 28M LDAR program will be implemented for VOC control, and since there is a collateral benefit of reducing GHG emissions; the reduction efficiencies are used in the GHG calculations. This in no way is intended to suggest that BACT for GHG process fugitives in LDAR of any level.

Emission Calculations

EPA Question:

7) In Appendix A, the table A-2 titled "Regenerative Thermal Oxidizer Emissions" please provide an explanation of the calculations used to determine the annual GHG emissions. Were equations W-39a, W-39B, and W-40 from 40 CFR Part 98 Subpart W used? If not, please provide detailed emission calculations and justification. Are metered fuel flow measurements available for these units?

Copano Response:

As explained above in the response to Item 1, the calculations in Table A-2 of the permit application are mass balance calculations that are equivalent to the Part 98 Subpart W calculations. The calculations consist of multiplying the volume % of each carbon compound by the gas volume, converting that to equivalent volume of CO_2 and converting CO_2 volume to mass. To be conservative, 100% conversion of carbon to CO_2 is assumed. An example calculation has been added below the Table A-2. There is no fuel flow other than pilot gas to the RTO; however, the acid gas flow rate will be monitored continuously.

EPA Question:

8) In Appendix A, the tables A-3 titled "LL Treater Flash Gas Flaring," please provide an explanation of the calculations used to determine the annual GHG emissions. Were emissions calculated using 40 CFR Part 98 Subpart W §98.233 (n), using equations W-19, W-20, W-21, and W-40? If not, please provide

detailed emission calculations and justification. Are metered fuel flow measurements available for this unit?

Copano Response:

As explained above in the response to Item 1, the calculations in Table A-3 of the permit application are mass balance calculations that are equivalent to the Part 98 Subpart W calculations. The calculations consist of multiplying the volume % of each carbon compound by the gas volume, converting that to equivalent volume of CO_2 and converting CO_2 volume to mass. To be conservative, 100% conversion of carbon to CO_2 is assumed. An example calculation has been added below the Table A-3. The flash gas flow rate will be monitored continuously.

Additional Impacts Analysis

EPA Question:

9) 40 C.F.R. Part 52.21 (o), Additional Impact Analyses, requires and applicant to provide an analysis of the impairment to the soils and vegetation that would occur as a result of the modification that include all regulated pollutants and not just GHG. Please provide an assessment to support this requirement.

Copano Response:

The Additional Impacts Analysis is included as Section 7 of the permit application. The level of analysis included in the application is consistent with the guidance provided by Brian Tomasovic and Alfred Dumaual of EPA in a May 15, 2012 teleconference with Steve Langevin and Joe Kupper of RPS for projects that had insignificant emission increases for all pollutants other than GHGs.

Table 1 Comparative Analysis of Efficiency of Turbines and Engines

EPN	Description	Firing Rate (mmbtu/hr)	Firing Rate (mmbtu/yr)	Notes
OPTION 1 - Solar Mars 100 Turbines				
HTR No. 1	Supplemental Gas Heater	25.00	15,000.0	Only needed in emergency conditions. Permitted for 600 hrs/yr
HTR No. 2	Supplemental Gas Heater	25.00	15,000.0	Only needed in emergency conditions. Permitted for 600 hrs/yr
Turbine No. 1	Solar Mars 100 w/ WHRU	114.59	1,003,808.4	WHRU removes need for gas heater.
Turbine No. 2	Solar Mars 100 w/ WHRU	114.59	1,003,808.4	WHRU removes need for gas heater.
Total			**2,037,616.8**	
OPTION 2 - CAT 3616LE Reciprocating Engine				
HTR No. 1	Supplemental Gas Heater	25.00	219,000.0	Required full time with out WHRU's.
HTR No. 2	Supplemental Gas Heater	25.00	219,000.0	Required full time with out WHRU's.
CAT 3616 No. 1	CAT 3616 Engine	31.14	272,786.4	4,735 HP at 6,576 btu/hp-hr
CAT 3616 No. 2	CAT 3616 Engine	31.14	272,786.4	4,735 HP at 6,576 btu/hp-hr
CAT 3616 No. 3	CAT 3616 Engine	31.14	272,786.4	4,735 HP at 6,576 btu/hp-hr
CAT 3616 No. 4	CAT 3616 Engine	31.14	272,786.4	4,735 HP at 6,576 btu/hp-hr
CAT 3616 No. 5	CAT 3616 Engine	31.14	272,786.4	4,735 HP at 6,576 btu/hp-hr
CAT 3616 No. 6	CAT 3616 Engine	31.14	272,786.4	4,735 HP at 6,576 btu/hp-hr
CAT 3616 No. 7	CAT 3616 Engine	31.14	272,786.4	4,735 HP at 6,576 btu/hp-hr
Total			**2,347,504.8**	

Gas Turbine Oper Schedule:	8760 hrs/yr	
CAT Engine Oper Schedule:	8760 hrs/yr	
Heater Operating Schedule:	600 hrs/yr	For Gas Turbine Option
Heater Operating Schedule:	8760 hrs/yr	For CAT 3616 Option

Table 2 Comparative Analysis of Efficiency of Combustion Turbines

Turbine Description	Output (HP)	NOx Emissions (ppm)	Turbine Efficiency	Heat Rate at ISO Conditions
Solar Mars 100 w/ WHRU	15,900	9.0	34.4%	7,395 btu/hp-hr
GE 10-2 w/ WHRU	16,068	15.0	33.3%	7,651 btu/hp-hr
SGT-400 w/ WHRU	17,969	15.0	36.2%	7,028 btu/hp-hr

Table 3 Cost Effectiveness of 28M LDAR Program for Copano Cryo 3 Process Fugitives

Monitoring Cost:	$1.45	per component per quarter
Number of Valves:	1,720	monitored
Number of Flanges:	4,300	not monitored
Number of PRVs:	24	monitored
Number of Pumps:	8	monitored
Number of Comps:	14	monitored
Total Number Monitored:	1,766	monitored
Total Cost of Monitoring:	$10,243	per year
Number of Repairs:	848	per year (12% of monitored components per quarter)
Cost of Repairs:	$144,106	per year @ $200 per component (85% of leaking components; remaining 15% only require minor repair)
Cost to re-monitor repairs:	$1,229	per year
Total Cost of LDAR:	$155,578	per year (montoring + repair + re-monitor)
Emission Reduction:	45.98	tpy of methane (based on 28M reduction credits)
Emission Reduction:	965.66	tpy of CO_2e
Cost Effectiveness:	$3,383	per ton of CH_4
Cost Effectiveness:	**$161**	per ton of CO_2e

Table A-1
Greenhouse Gas (GHG) Emissions from New Cryogenic Plant
Copano Gas Processing, LP, Houston Central Gas Plant
Colorado County, Texas

EPN	Description	Firing Rate (mmbtu/hr)	Firing Rate (mmbtu/yr)	CO2 (tpy*)	CH4 (tpy*)	N2O (tpy*)	Total CO2 Equivalent (tpy*)
HTR-3	Supplemental Gas Heater	25.00	15,000.0	875.9	0.02	0.002	876.7
HTR-4	Supplemental Gas Heater	25.00	15,000.0	875.9	0.02	0.002	876.7
RTO-3	RTO - Natural Gas Combustion	2.50	8,760.0	511.5	0.01	0.001	512.0
	RTO - Waste Gas Combustion			68,940.5	0.3		68,946.7
TURB-5	Solar Mars 100	114.59	1,003,808.4	58,614.5	1.1	0.1	58,671.9
TURB-6	Solar Mars 100	114.59	1,003,808.4	58,614.5	1.1	0.1	58,671.9
CRYO3 FUG	Fugitives	NA	NA	0.0	22.1	0.0	465.0
FLARE	LL Treater Flash Gas to Flare			835.5	0.7		851.1
Total				**189,268.1**	**25.4**	**0.2**	**189,872.1**
Contemporaneous Changes							
TURB-3	Solar Mars 100			58,819.1	1.1	0.1	58,876.7
TURB-4	Solar Mars 100			58,819.1	1.1	0.1	58,876.7
HTR-1	Supplement Gas Heater			875.9	0.0	0.0	876.7
HTR-2	Supplement Gas Heater			875.9	0.0	0.0	876.7
RTO-2	Regenerative Termal Oxidizer			58,005.3	0.2	0.002	58,009.5
STKBLR3	Steam Boiler No. 3			110,487.1	2.1	0.2	110,595.5
CRYO2 FUG	Fugitives			0.0	22.1	0.0	465.0

* Note all emission rates are in units of short tons.

** These two turbines will have a combined operating rate equal to one turbine operating at capacity year round.

Turbine Operating Schedule: 8760 hrs/yr
Heater Operating Schedule: 600 hrs/yr

Emission Rate (tpy) = Emission Factor (lb/mmbtu) x Firing Rate (mmbtu/yr) / 2000 lb/ton

Emission Factors:

Emission Factors from Tables C-1 & C-2 of Appendix A to 40 CFR Part 98 Subpart C

Pollutant	kg/mmBtu	lb/mmbtu
CO2	53.02	116.78
CH4	0.001	0.0022
N2O	0.0001	0.00022

Factors are for natural gas

CO2 Equivalents (ton/ton):

CO2	1.0
CH4	21.0
N2O	310.0

Table A-2
Regenerative Thermal Oxidizer Emissions
Copano Gas Processing, LP, Houston Central Gas Plant
Colorado County, Texas

Emission Source Type:	Regenerative Thermal Oxidizer
EPN:	RTO-3
Firing Rate (MMBtu/hr):	2.5
Operating Hours (hrs/yr):	8760
Waste Gas Flow from Cryo Unit 3 (scf/hr):	149,275
scf/mole:	387

Pilot Gas Emissions

Short term Rate

Firing Rate (MMBtu/hr)	Fuel Heating Value (Btu/scf)	Hours of Operation (hrs/year)
2.5	1020	8760

Annual Rate

Firing Rate (MMBtu/hr)	Fuel Heating Value (Btu/scf)	Hours of Operation (hrs/year)
1	1020	8760

Cryo Unit #3 (NEW) - Amine Still Flux Accumulator Acid Gas Analysis

Component	Waste Stream							
	Inlet Flow to RTO						Outlet CO_2 to Atmos.	
	MW	Wt %	Mol%	Vol%	tpy	MMscf/yr	Carbon #	tpy
Methane	16.04	0.04%	0.1090%	0.1090%	29.54	1.4	1	81.0
Ethane	30.07	0.03%	0.0462%	0.0462%	23.45	0.6	2	68.7
Isobutane	58.12	0.00%	0.0000%	0.0000%	-	0.0	4	0.0
n-Butane	58.12	0.05%	0.0378%	0.0378%	37.11	0.5	4	112.4
Isopentane	72.15	0.00%	0.0000%	0.0000%	-	0.0	5	0.0
n-Pentane	72.15	0.02%	0.0118%	0.0118%	14.36	0.2	5	43.8
Carbon Dioxide	44.01	96.41%	91.9500%	91.9500%	68,388	1,202.4	1	68,388.1
Nitrogen	28.01	0.00%	0.0000%	0.0000%	-	0.0	0	0.0
H2S	34.08	0.00%	0.0001%	0.0001%	0.06	0.0	0	0.0
Propane	44.10	0.05%	0.0502%	0.0502%	37.39	0.7	3	111.9
C6+	86.18	0.06%	0.0302%	0.0302%	43.91	0.4	6	134.5
Water	18.00	3.33%	7.7688%	7.7688%	2,363.22	101.6	0	0.0
TOTAL		100.00%	100.00%	100.00%	70,937	1,308	NA	68,940

Example Calculations:

Methane (MMscf/yr) = 0.109% vol x 149,275 scf/hr x 8760 hr/yr / 1,000,000 scf/MMscf = 1.4 MMscf/yr

CO2 (tpy) = 1.4 MMscf/yr x 1 Carbon per mole x 44.01 lb/mole x 1 mole/387 scf x 1,000,000 scf/MMscf x 1 ton/2000 lb = 81.0 tpy

Methane Emissions (from undestructed methane in acid gas):

Component	Inlet Flow to RTO						Outlet CH_4 to Atmos.	
	MW	Wt %	Mol%	Vol%	tpy		DRE	tpy
Methane	16.04	0.04%	0.1090%	0.1090%	29.54		99%	0.3

Note: Gas flow rate and composition used for GHG emissions differs from the worst case used for other compounds in the TCEQ permit, as the above scenario results in higher GHG emissions.

Table A-3
LL Treater Flash Gas Flaring
Copano Gas Processing, LP, Houston Central Gas Plant
Colorado County, Texas

Emission Source Type: Elevated Flare
EPN: FLARE
Flare Type: Air or Unassisted >1000
Operating Hours (hrs/yr): 8760
Flash Gas Flow Rate (scf/hr): 830 (Basis: Process flow data)
scf/mole: 387

Cryo Unit #3 (NEW) - Amine Still Flux Accumulator Acid Gas Analysis

Waste Stream								
Component	Inlet Flow to RTO						Outlet CO_2 to Atmos.	
	MW	Wt %	Mol%	Vol%	tpy	MMscf/yr	Carbon #	tpy
Methane	16.04	25.06%	49.37%	49.3700%	74.39	3.6	1	204.1
Ethane	30.07	14.49%	15.23%	15.2300%	43.01	1.1	2	125.9
Isobutane	58.12	0.00%	0.00%	0.0000%	-	0.0	4	0.0
n-Butane	58.12	14.92%	8.12%	8.1155%	44.30	0.6	4	134.2
Isopentane	72.15	0.00%	0.00%	0.0000%	-	0.0	5	0.0
n-Pentane	72.15	8.33%	3.65%	3.6502%	24.74	0.3	5	75.4
Carbon Dioxide	44.01	4.77%	3.43%	3.4250%	14	0.2	1	14.2
Nitrogen	28.01	0.00%	0.0000%	0.0000%	-	0.0	0	0.0
H2S	34.08	0.00%	0.0001%	0.0001%	0.00	0.0	0	0.0
Propane	44.10	19.71%	14.13%	14.1300%	58.53	1.0	3	175.2
C6+	86.18	11.70%	4.29%	4.2927%	34.75	0.3	6	106.5
Water	18.00	1.02%	1.78%	1.7826%	3.01	0.1	0	0.0
TOTAL		100.00%	100.00%	100.00%	297	7	NA	835

Example Calculations:
Methane (MMscf/yr) = 49.37% vol x 830 scf/hr x 8760 hr/yr / 1,000,000 scf/MMscf = 3.6 MMscf/yr
CO2 (tpy) = 3.6 MMscf/yr x 1 Carbon per mole x 44.01 lb/mole x 1 mole/387 scf x 1,000,000 scf/MMscf x 1 ton/2000 lb = 204.1 tpy

Methane Emissions (from undestructed methane in flash gas):

Component	Inlet Flow to RTO						Outlet CH_4 to Atmos.	
	MW	Wt %	Mol%	Vol%	tpy		DRE	tpy
Methane	16.04	25.06%	49.37%	49.3700%	74.39		99%	0.74

Table A-4
Cryogenic Plant Equipment Leak Fugitives (EPN: CRYO3 FUG)
Copano Gas Processing, LP, Houston Central Gas Plant
Colorado County, Texas

Monitored Component Type	Service	[1]Oil & Gas Production Operations Fugitive Emission Factors	Total Component Count	28M Control Efficiencies (%)	Uncontrolled Emissions (lb/hr)	Uncontrolled Emissions (TPY)	Controlled Emissions (lb/hr)	Controlled Emissions, all compounds (TPY)
Valves	Gas/Vapor	0.00992	1600	75%	15.87	69.52	3.97	17.38
	Light Liquid	0.0055	120	75%	0.66	2.89	0.17	0.72
	Heavy Liquid	0.0000185		0%				
Pumps	Gas Vapor	0.00529						
	Light Liquid	0.02866	14	75%	0.40	1.76	0.10	0.44
	Heavy Liquid	0.00113		0%				
Flanges	Gas/Vapor	0.00086	4000	30%	3.44	15.07	2.41	10.55
	Light Liquid	0.000243	300	30%	0.07	0.32	0.05	0.22
	Heavy Liquid	0.00000086		30%				
Compressors	Gas/Vapor	0.0194	8	75%	0.16	0.68	0.04	0.17
Relief Valves	Gas/Vapor	0.0194	24	75%	0.47	2.04	0.12	0.51
		Total:	*6066*		*21.07*	*92.27*	*6.85*	*29.99*

1) Emission factors are from TCEQ Air Permit Technical Guidance for Chemical Sources: Equipment Leak Fugitives October 2000 which refers to Oil and Gas Production Operations extracted from Table 2-4 of EPA-453/R-95-017

2) For Oil and Gas Production Operations, "Other" includes diaphragms, dump arms, hatches, instruments, meters, polished rods, and vents.

Sample Calculations:
Non-Monitored Component Count Emissions (lb/hr)=Emission Factor (lb/hr) * Non-Monitored Component Count

Speciated Emissions for Methane Calculation:

Inlet Gas Analysis					Component Emissions	
Compound	Dry Basis Mole %	MW	lb/mol	Dry Basis Weight %	lb/hr	TPY
Methane	87.40	16.043	1402.21	73.83%	5.06	22.14
Ethane	6.40	30.070	192.39	10.13%	0.69	3.04
Propane	2.54	44.097	111.79	5.89%	0.40	1.77
i-butane	0.497	58.124	28.89	1.52%	0.10	0.46
n-butane	0.66	58.124	38.25	2.01%	0.14	0.60
i-pentane	0.22	72.151	15.51	0.82%	0.06	0.24
n-pentane	0.15	72.151	10.82	0.57%	0.04	0.17
$C6^+$	0.17	86.117	14.64	0.77%	0.05	0.23
CO_2	1.84	44.010	80.85	4.26%		
N_2	0.14	28.013	3.84	0.20%		
H_2S	0.00	34.076	0.00	0.00%	0.00	0.00
Total:	100.00		1899.17	100.0%		
			Methane Total:	73.83%	5.06	22.14

**Use of inlet gas analysis is conservative as the compressors will be compressing residue gas.*