

BUTTE COUNTY
AIR QUALITY MANAGEMENT DISTRICT
PRELIMINARY DETERMINATION EVALUATION
AUTHORITY TO CONSTRUCT
APPLICATIONS #11-04-05 through -07

1.0 Facility Name and Address

Wild Goose Storage, LLC
400, 607 8th Avenue SW
Calgary, Alberta, Canada T2P 0A7

Local Mailing:
P.O. Box 8
Gridley, CA 95948

Contact: Glen Thauberger, Manager, Engineering & Operations
Phone: (403) 544-5129

Consultant acting on behalf of the applicant: Chuck Solt
Phone: (916) 729-5004

2.0 Location of Equipment

Wild Goose Gas Storage, Inc.
Remote Facility Site
2780 West Liberty Road
Gridley, CA 95948

3.0 Project Description

Wild Goose Storage, LLC (WGS) operates a natural gas storage facility located west of Gridley, CA. The facility received pipeline quality natural gas, compresses it, and stores it underground in natural cavities. The facility has three "compression plants" currently on the site that consists of compressors powered by natural gas fired engines, dehydration units with contact towers, glycol reboilers, reboiler still vent with thermal oxidizer controls and associated piping and emergency relief vents. WGS has applied to install Plant 4 consisting of two more compressor and supporting power and dehydration units.

The proposed installation consists of two (2) compressors powered by two (2) 3,550 horsepower natural gas-fired engines with Selective Catalytic Reduction (SCR) for the control of Oxides of Nitrogen (NOx) and an Oxidation Catalyst to reduce the emissions of Carbon Monoxide (CO). A third dehydration unit consists of two (2) natural gas-fired glycol reboilers, one (1) reboiler still vent and one (1) emergency shutdown relief vent. The dehydration unit vents will be controlled by a thermal oxidizer. Both new engines will be used to drive compressors to increase their compression capacity.

4.0 Permits for Existing Equipment

Permit to Operate #	Equipment
WGS-98-01	Caterpillar Model G3612, 3,335 HP Natural Gas-Fired ICE
WGS-98-02	Caterpillar Model G3612, 3,335 HP Natural Gas-Fired ICE
WGS-02-03	Caterpillar Model G3612, 3,550 HP Natural Gas-Fired ICE
WGS-02-04	Caterpillar Model G3612, 3,550 HP Natural Gas-Fired ICE
WGS-02-07	Dehydration Unit #1
WGS-05-09	John Deere Model #4045TF150C Diesel Engine/Emer Genset
WGS-09-10	Caterpillar Model G3612, 3,550 HP Natural Gas-Fired ICE
WGS-09-11	Caterpillar Model G3612, 3,550 HP Natural Gas-Fired ICE
WGS-09-12	Dehydration Unit #2

The facility has three natural gas-fired emergency gensets and plans to add a fourth. These units are exempt from permit requirements under District Rule 401-*Permit Exemptions*.

5.0 Staff Summary

The Plant 4 Expansion project went through CEQA review in 2010. This review included a proposed Plant 5 as well. Plant 4 compressors and engines are identical to the Plant 3 project. The Dehydration Unit is slightly small.

6.0 Emissions Estimates

See attached Excel spreadsheet for Proposed equipment PTE and PTE based on operating limits. Staff developed a new spreadsheet to clarify the emissions from the facility. Due to several previous consultants and modification projects, the previous calculations were difficult to follow. A more concise spreadsheet with information consistent with earlier projects is attached for each plant.

7.0 Regulatory Compliance

Rule 200 Public Nuisance

This facility is located in a sparsely populated area. The potential for public nuisance is minimal. Compliance is expected.

Rule 201 Visible Emissions

The engines are subject to Rule 252 which has a visible emissions limit of Ringelmann 1/2 or 10% opacity; therefore, compliance is expected with controls as proposed.

Rule 202 Grain Loading

The equipment is not expected to result in a particulate emissions increase.

Compliance is expected with controls as proposed.

Rule 204 Process Weight Limitation

Not applicable.

Rule 205 Fugitive Dust Emissions

The proposed project is expected to comply with the fugitive dust requirements of Rule 205 with the controls as proposed. The new equipment is not expected to release significant quantities of dust or other particulate matter. Compliance is expected with controls as proposed.

Rule 261 Reduced Sulfur Emission Standards

By firing on pipeline quality natural gas, the engines emissions will not result in ground-level concentrations of Total Reduced Sulfur (TRS), expressed as hydrogen sulfide, in excess of 0.03 PPM for a period of sixty (60) minutes and the facility will be in compliance with the rule.

Rule 262 Sulfur Oxides Emission Standard

Emissions of sulfur oxides (calculated as SO₂) will be significantly less than 2,000 ppm. The project will be in compliance.

Rule 263 Circumvention

None of the equipment proposed for this project serves to circumvent any District Rule or Regulation, or a requirement of the California Health and Safety Code. In Compliance.

Rule 264 Separation of Emissions

No separation of emissions. In compliance.

Rule 265 Combination of Emissions

No combination of emissions. In compliance.

Rule 400 Permitting Requirements.

The applicant has applied for an Authority to Construct permit for each compressor unit and the dehydration unit. A permit is required prior to constructing the proposed equipment. Since the facility is over the 25TPY offset threshold, offsets will be required and the facility is currently acquiring them. Public notice will be published on June 2, 2011.

Rule 430 New Source Review

Section 5.1: Best Available Control Technology (BACT) - An applicant shall apply BACT to any new emissions unit or modification of an existing emissions unit which results in an emissions increase and the Potential to Emit (PTE) for the emissions unit exceeds the emissions limits specified in the rule. The facility has applied BACT to the proposed emissions units.

Section 5.2: Offset Requirements, General - An existing stationary source which has a potential to emit more than 25 tons per year as of January 12, 1993, of non-attainment pollutants or their precursors shall offset any increase above 25 tons per year. The Potential to Emit of facility wide operations of non-attainment pollutants or their precursors will exceed 25 tons. Therefore, offsets are required. The attached spreadsheet summarizes the emissions of the existing and new equipment and presents the offsets required. The PTE for the facility based on permitted equipment has been calculated and the offsets proposed to account for the new increases.

With this installation, offsets will be required for reactive Volatile Organic Compounds as well as Oxides of Nitrogen.

8.0 Conclusions

District requirements have been met and the Air Pollution Control Officer has made a preliminary determination to issue Authority to Construct Permits for the expansion of Wild Goose Storage, LLC. The proposed permits for Plant 4, Engine A, Engine B, and the Dehydration System have been attached.

9.0 Permit Conditions

See attached proposed Authority to Construct permit #'s:
WGS-11-13-AC: Plant 4 Engine A
WGS-11-14-AC: Plant 4 Engine B
WGS-11-15-AC: Plant 4 Dehydration System

10.0 References

1. Authority to Construct Application: #11-04-05, -06, and -07
2. Butte County Air Quality Management District Rules and Regulations.
3. Previous Permit Evaluations for Wild Goose Storage 1997-2009.
4. District and Consultant PTE Calculations (electronic)

BY:



Date:

5/31/11

BUTTE COUNTY AQMD

Source: Wild Goose Storage Inc.-Plant 3 Expansion Project
By: David Lusk
Date: 5/19/2011
Plant 1

EMISSIONS OF CRITERIA POLLUTANTS FROM EXISTING EQUIPMENT

Plant 2

Plant 3

EQUIPMENT	Compressor Engine	Reboiler Burner	Still Vent & Thermal Oxidizer	Backup Generator	Compressor Engine	Reboiler Burner	Line Heater Burner	Still Vent & Thermal Oxidizer	Compressor Engine	Reboiler Burner	Line Heater Burner	Still Vent & Thermal Oxidizer
Make	Cat			Onan	Cat				Cat			
Model	G3612			65GGHB	G3612				G3612			
Rating (Units)	3,335		467	102	3,550			233	3,550			233
Fuel Rate (Units)	6,810	2.25	2.176	0.81	6,791	2.25	6.00	1.086	6,791	3.00	6.00	1,704
	Btu/bhp-hr	MMBtu/hr	MMBtu/hr	MMBtu/hr	Btu/bhp-hr	MMBtu/hr	MMBtu/hr	MMBtu/hr	Btu/bhp-hr	MMBtu/hr	MMBtu/hr	MMBtu/hr
CRITERIA EMISSIONS												
NOx												
Factor (Units)	0.5	0.1	0.098	1.9	0.5	0.1	0.09	0.098	0.5	0.109	0.09	0.1004
Source	g/hp-hr	lb/MMBtu	lb/MMBtu	g/hp-hr	g/hp-hr	lb/MMBtu	lb/MMBtu	lb/MMBtu	g/hp-hr	lb/MMBtu	lb/MMBtu	lb/MMBtu
Pounds/day/unit	Mfr.	Specification	C/D	Mfr.	Mfr.	Specification	Specification	C/D	Mfr.	Specification	Specification	C/D
Tons/year/unit	88.15	5.40	5.12	10.24	93.83	5.40	12.96	2.55	88.15	7.85	12.96	4.11
BACT Effectiveness	16.09	0.99	0.93	1.87	17.12	0.99	2.37	0.47	16.09	1.43	2.37	0.75
Tons/year/unit w/BACT	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.78	0.00	0.00	0.00
	16.09	0.99	0.93	1.87	4.11	0.99	2.37	0.47	3.59	1.43	2.37	0.75
CO												
Factor (Units)	2.75	0.075	0.082	5.5	2.75	0.075	0.08	0.082	2.75	0.0919	0.08	0.0378
Source	g/hp-hr	lb/MMBtu	lb/MMBtu	g/hp-hr	g/hp-hr	lb/MMBtu	lb/MMBtu	lb/MMBtu	g/hp-hr	lb/MMBtu	lb/MMBtu	lb/MMBtu
Pounds/day/unit	Mfr.	Specification	C/D	Mfr.	Mfr.	Specification	Specification	C/D	Mfr.	Specification	Specification	C/D
Tons/year/unit	484.82	4.05	4.28	29.66	516.08	4.05	11.52	2.14	484.82	6.62	11.52	1.55
BACT Effectiveness	88.48	0.74	0.78	5.41	94.18	0.74	2.10	0.39	88.48	1.21	2.10	0.28
Tons/year/unit w/BACT	0.80	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.89	0.00	0.00	0.00
	17.70	0.74	0.78	5.41	10.27	0.74	2.10	0.39	9.64	1.21	2.10	0.28
ROC (NMNEHC)												
Factor (Units)	0.25	0.006	0.0054	0.4	0.25	0.006	0.006	0.0054	0.25	0.006	0.006	0.0223
Source	g/hp-hr	lb/MMBtu	lb/MMBtu	g/hp-hr	g/hp-hr	lb/MMBtu	lb/MMBtu	lb/MMBtu	g/hp-hr	lb/MMBtu	lb/MMBtu	lb/MMBtu
Pounds/day/unit	F	C	C/D	Mfr.	F	C	C	C/D	F	C	C	C/D
Tons/year/unit	44.07	0.32	0.44	2.16	46.92	0.32	0.86	0.14	44.07	0.43	0.86	0.91
BACT Effectiveness	8.04	0.06	0.08	0.39	8.56	0.06	0.16	0.03	8.04	0.08	0.16	0.17
Tons/year/unit w/BACT	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.64	0.00	0.00	0.00
	8.04	0.06	0.08	0.39	3.08	0.06	0.16	0.03	2.90	0.08	0.16	0.17
SO2												
Factor (Units)	0.00313	0.00313	0.00313	0.00313	0.00313	0.00313	0.00313	0.00313	0.00313	0.00313	0.00313	0.00313
Source	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu
Pounds/day/unit	A	A	A/E	A	A	A	A	A/E	A	A	A	A/E
Tons/year/unit	1.71	0.17	0.09	0.06	1.81	0.17	0.45	0.00	1.71	0.23	0.45	0.00
	0.31	0.03	0.02	0.01	0.33	0.03	0.08	0.00	0.31	0.04	0.08	0.00
PM10												
Factor (Units)	0.0111	0.0083	0.0083	0.0111	0.0111	0.0083	0.0083	0.0083	0.0111	0.0083	0.0083	0.0083
Source	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu	lb/MMBtu
Pounds/day/unit	B	C	C/D	B	B	C	C	C/D	B	C	C	C/D
Tons/year/unit	6.05	0.45	0.43	0.22	6.42	0.45	1.20	0.22	6.05	0.60	1.20	0.34
	1.10	0.08	0.08	0.04	1.17	0.08	0.22	0.04	1.10	0.11	0.22	0.06

Sources:

- A. Based on maximum sulfur in fuel @ 1 grain/100 scf (PG&E Tariff GR-21); 914 Btu/scf
- B. EPA, AP-42, Sect. 3.2, 7/00, Table 3.2-2, Emission Factors for 4-Stroke Lean Burn Engines
- C. EPA, AP-42, Sect. 1.4, 7/98, Table 1.4-1&2, Emission Factors for ... From Nat. Gas Combustion
Note - AP-42 emission factors (B & C above) in lb/MMscf @ 1020 Btu/scf HHV converted to lb/MMBtu LHV @ 921 Btu/scf LHV = 1020 Btu/scf HHV.
- D. Emission factor applied to total fuel stream including still effluent and supplemental fuel from GLYCalc computer program output. ROC emissions include combustion products as well as ROC (VOC) emissions from still vent not destroyed by the thermal oxidizer, as calculated by the GLYCalc computer program.
Emission rate from thermal oxidizer is a function of the glycol regenerated in the reboiler, which in turn is a function of the volume of natural gas processed by dehydrator contactor towers..
The glycol from two existing 100 MMscf/day and one new 200 MMscf/day tower will be regenerated by the existing two reboilers. The combined still vent overheads streams will be sent to the existing thermal oxidizer. A second new 200 MMscf/day tower will be connected to a new reboiler and thermal oxidizer.
While the combined rated capacity of the existing and proposed dehydrator towers is 600 MMscf/day, based on operating experience they will be capable of achieving the full 700 MMscf/day project objective. The throughput rating reflects this
The rates below are per 100 MMscf/day dehydrator natural gas flow.
Still effluent = 0.221 MMBtu/hr
Supplemental fuel = 0.245 MMBtu/hr
ROC emissions = 0.0014 lb/hr
- E. Emission factor applied to supplemental fuel only.
- F. Source tests on existing engines typ. < 0.05 g/hp-hr; use 0.25 g/hp-hr (50% of mfr. guarantee).

Specification: Data provided by Washington Group International, engineering contractor.
Manufacturer's data for Caterpillar engines: letter from T.P. Fischbach, 8/12/97
Manufacturer's data for Backup Generator: Onan Corporation data sheet.
=This equipment was proposed but not installed.

Source: Wild Goose Storage Inc.-Plant 4 Expansion Project
 By: David Lusk
 Date: 5/19/2011

EMISSIONS OF CRITERIA POLLUTANTS FROM PROPOSED EQUIPMENT

EQUIPMENT	Compressor Engine	Reboiler Burner	Still Vent & Thermal Oxidizer
Make	Cat		
Model	G3612		
Rating (Units)	3,550 hp		233 MMscf/d
Fuel Rate (Units)	6,791 Btu/bhp-hr	2.75 MMBtu/hr	1.200 MMBtu/hr
CRITERIA EMISSIONS			
NOx			
Factor (Units)	0.5 g/hp-hr	0.053 lb/MMBtu	0.23 lb/MMBtu
Source	Mfr.	Specification	C/D
Pounds/day/unit	93.83	3.50	6.62
Tons/year/unit	17.12	0.64	1.21
BACT Effectiveness	0.78	0.00	0.00
Tons/year/unit w/BACT	3.82	0.64	1.21
CO			
Factor (Units)	2.75 g/hp-hr	0.0919 lb/MMBtu	0.0378 lb/MMBtu
Source	Mfr.	Specification	C/D
Pounds/day/unit	516.08	6.07	1.09
Tons/year/unit	94.18	1.11	0.20
BACT Effectiveness	0.89	0.00	0.00
Tons/year/unit w/BACT	10.27	1.11	0.20
ROC (NMNEHC)			
Factor (Units)	0.09 g/hp-hr	0.006 lb/MMBtu	0.0223 lb/MMBtu
Source	F	C	C/D
Pounds/day/unit	16.89	0.40	0.64
Tons/year/unit	3.08	0.07	0.12
BACT Effectiveness	0.64	0.00	0.00
Tons/year/unit w/BACT	1.11	0.07	0.12
SO2			
Factor (Units)	0.00313 lb/MMBtu	0.00313 lb/MMBtu	0.00313 lb/MMBtu
Source	A	A	A/E
Pounds/day/unit	1.81	0.21	0.09
Tons/year/unit	0.33	0.04	0.02
PM10			
Factor (Units)	0.0111 lb/MMBtu	0.0083 lb/MMBtu	0.0083 lb/MMBtu
Source	B	C	C/D
Pounds/day/unit	6.42	0.55	0.24
Tons/year/unit	1.17	0.10	0.04

Sources:

- A. Based on maximum sulfur in fuel @ 1 grain/100 scf (PG&E Tariff GR-21); 914 Btu/scf
- B. EPA, AP-42, Sect. 3.2, 7/00, Table 3.2-2, Emission Factors for 4-Stroke Lean Burn Engines
- C. EPA, AP-42, Sect. 1.4, 7/98, Table 1.4-1&2, Emission Factors for ... From Nat. Gas Combustion
 Note - AP-42 emission factors (B & C above) in lb/MMscf @ 1020 Btu/scf HHV converted to lb/MMBtu LHV @ 921 Btu/scf LHV = 1020 Btu/scf HHV.
- E. Emission factor applied to supplemental fuel only.
- F. Per 2006 permit amendment for CAT 3612 engines.

Specification: Data provided by Washington Group International, engineering contractor.
 Manufacturer's data for Caterpillar engines: letter from Kenneth Hall, 3/5/02.

Wild Goose Storage LLC
Plant 4 Expansion Calculations
Plant 2

5/31/2011

Plant 2 Emission based on Current Permit limits 5/16/11									
				Emissions (lbs)					
Engine A	Rating	Emission Factor	Units	Quarters				Total	
	3550	HP		1	2	3	4		
	Fuel Usage	24.11	MMBtu/hr	56.97	57.61	58.28	58.28	231.14	MMscf
									Tons
	NOx	9	ppm	1897.3	1918.6	1940.9	1940.9	7697.8	7697.8 3.849
	ROC	0.09	g/bhp-hr	1519.9	1537.0	1554.8	1554.8	6166.5	6166.5 3.083
	CO	0.3	g/bhp-hr	5066.3	5123.2	5182.8	5182.8	20555.0	20555.0 10.278
	SOx	0.00313	lb/MMBtu	163.0	164.8	166.7	166.7	661.2	661.2 0.331
	PM	0.0111	lb/MMBtu	578.0	584.5	591.3	591.3	2345.0	2345.0 1.173
Engine B									
	Rating	3550	HP						Verification
	Fuel Usage	24.11	MMBtu/hr	56.97	57.61	58.28	58.28	231.14	MMscf
								Total	Tons
	NOx	9	ppm	1897.3	1918.6	1940.9	1940.9	7697.8	7697.8 3.849
	ROC	0.09	g/bhp-hr	1519.9	1537.0	1554.8	1554.8	6166.5	6166.5 3.083
	CO	0.3	g/bhp-hr	5066.3	5123.2	5182.8	5182.8	20555.0	20555.0 10.278
	SOx	0.00313	lb/MMBtu	163.0	164.8	166.7	166.7	661.2	661.2 0.331
	PM	0.0111	lb/MMBtu	578.0	584.5	591.3	591.3	2345.0	2345.0 1.173
Reboiler Burners									
	Fuel Usage	2.25	MMBtu/hr						
			day/qtr	90	91	92	92	365.0	
	NOx	0.1	lb/MMBtu						
	ROC	0.006	lb/MMBtu	NOT INSTALLED					
	CO	0.075	lb/MMBtu						
	SOx	0.00313	lb/MMBtu						
	PM	0.083	lb/MMBtu						
Still Vents/Thermal Oxidizer									
	Fuel Usage	2.174	MMBtu/hr						
			day/qtr						
	NOx	0.098	lb/MMBtu	NOT INSTALLED					
	ROC	0.082	lb/MMBtu						
	CO	0.054	lb/MMBtu						
	SOx	0.00313	lb/MMBtu						
	PM	0.083	lb/MMBtu						
Diesel Back up Generator									
	Rating	0	HP						
	(Genset is not at compression site.)		hours	12.5	12.5	12.5	12.5	50.0	
	NOx	6.2	g/bhp-hr	0.0	0.0	0.0	0.0	0.0	0.000
	ROC	0.4	g/bhp-hr	0.0	0.0	0.0	0.0	0.0	0.000
	CO	0.6	g/bhp-hr	0.0	0.0	0.0	0.0	0.0	0.000
	SOx	0.0015	g/bhp-hr	0.0	0.0	0.0	0.0	0.0	0.000
	PM	0.15	g/bhp-hr	0.0	0.0	0.0	0.0	0.0	0.000
Blowdowns									
	ROC	1004	lbs	247.5	250.2	253.2	253.2	1004.0	1004.0 0.502
Plant 2 Totals									
	NOx			3794.6	3837.2	3881.9	3881.9	15395.6	15395.6 7.698
	ROC			3287.2	3324.2	3362.8	3362.8	13337.0	13337.0 6.669
	CO			10132.6	10246.4	10365.5	10365.5	41110.0	41110.0 20.555
	SOx			326.0	329.6	333.5	333.5	1322.5	1322.5 0.661
	PM			1156.0	1169.0	1182.5	1182.5	4690.0	4690.0 2.345
Check Row for past permits									
	NOx	Tons		1.90	1.92	1.94	1.94		7.70
Constants:									
	Gas heat value	914	BTU/scf						
	PPM to lb NOx	247	lb NOx/MMBTU						

Wild Goose Storage LLC
Plant 4 Expansion Calculations
Plant 4

5/31/2011

Proposed Plant 4 Emission based on Plant 3 Permit limits 5/16/11										
				Emissions (lbs)						
Engine A	Emission Factor	Units	Quarters	1	2	3	4	Total		
Rating	3550	HP								
Fuel Usage	24.1	MMBtu/hr		34.82	50.83	46.42	34.82	166.89	MMscf	
									Tons	
NOx	9	ppm		1159.6	1692.8	1546.0	1159.6	5558.0	5558.0	2.779
ROC	0.09	g/bhp-hr		929.3	1356.6	1238.9	929.3	4454.2	4454.2	2.227
CO	0.3	g/bhp-hr		3097.8	4522.1	4129.8	3097.8	14847.5	14847.5	7.424
SOx	0.00151	lb/MMBtu		47.9	70.0	63.9	47.9	229.7	229.7	0.115
PM	0.0111	lb/MMBtu		353.3	515.7	470.9	353.3	1693.2	1693.2	0.847
Engine B	Emission Factor	Units	Quarters	1	2	3	4	Total		
Rating	3550	HP							Verification	
Fuel Usage	24.1	MMBtu/hr		34.82	50.83	46.42	34.82	166.89	MMscf	
									Tons	
NOx	9	ppm		1159.6	1692.8	1546.0	1159.6	5558.0	5558.0	2.779
ROC	0.09	g/bhp-hr		929.3	1356.6	1238.9	929.3	4454.2	4454.2	2.227
CO	0.3	g/bhp-hr		3097.8	4522.1	4129.8	3097.8	14847.5	14847.5	7.424
SOx	0.00151	lb/MMBtu		47.9	70.0	63.9	47.9	229.7	229.7	0.115
PM	0.0111	lb/MMBtu		353.3	515.7	470.9	353.3	1693.2	1693.2	0.847
Reboiler Burners	Emission Factor	Units	Quarters	1	2	3	4	Total		
Fuel Usage	2.75	MMBtu/hr								
		day/qtr		90	91	92	92	365.0		
		hrs/qtr		2160	1500	1500	1500	6660.0		
NOx	0.053	lb/MMBtu		314.8	218.6	218.6	218.6	970.7	970.7	0.485
ROC	0.006	lb/MMBtu		35.6	24.8	24.8	24.8	109.9	109.9	0.055
CO	0.0919	lb/MMBtu		545.9	379.1	379.1	379.1	1683.1	1683.1	0.842
SOx	0.00151	lb/MMBtu		8.9	6.2	6.2	6.2	27.6	27.6	0.014
PM	0.083	lb/MMBtu		493.0	342.4	342.4	342.4	1520.1	1520.1	0.760
Still Vents/Thermal Oxidizer	Emission Factor	Units	Quarters	1	2	3	4	Total		
Fuel Usage	1.2	MMBtu/hr								
		day/qtr		90	91	92	92	365.0		
		hrs/qtr		2160	1500	1500	1500	6660.0		
NOx	0.23	lb/MMBtu		596.2	414.0	414.0	414.0	1838.2	1838.2	0.919
ROC	0.0223	lb/MMBtu		57.8	40.1	40.1	40.1	178.2	178.2	0.089
CO	0.0378	lb/MMBtu		98.0	68.0	68.0	68.0	302.1	302.1	0.151
SOx	0.00151	lb/MMBtu		3.9	2.7	2.7	2.7	12.0	12.0	0.006
PM	0.083	lb/MMBtu		215.1	149.4	149.4	149.4	663.3	663.3	0.332
Blowdowns	ROC	1004	lbs	209.5	305.8	279.3	209.5	1004.0	1004.0	0.502
Plant 4 Totals										
	NOx			3230.2	4018.3	3724.5	2951.9	13924.9	13924.9	6.962
	ROC			2161.6	3084.0	2822.0	2133.0	10200.6	10200.6	5.100
	CO			6839.4	9491.4	8706.7	6642.7	31680.2	31680.2	15.840
	SOx			108.7	148.8	136.7	104.8	499.0	499.0	0.249
	PM			1414.7	1523.2	1433.7	1198.3	5569.8	5569.8	2.785
Check Row for past permits	NOx	Tons		1.62	2.01	1.86	1.48			6.96
Constants:										
Gas heat value	914	BTU/scf								
PPM to lb NOx	247	lb NOx/MMBTU								
Blowdown ROC distribution based on gas used ratio/qtr										
Data from Emission Summary spreadsheet										

Wild Goose Storage LLC
Plant 4 Expansion Calculations

5/31/2011

Wild Goose Storage Summary Page

Offsets

		Quarters					
		1	2	3	4	Sum	
Fuel Use	MMscf	151.84	208.11	200.5	153.73	714.2	
		Emissions (lbs)					
		Quarters					
Plant 1 thru 4 Emission Totals:		1	2	3	4	Sum	Tons/yr
	NOx	19311.3	27875.6	27508.4	18994.7	93690.0	46.845
	ROC	11876.3	17305.7	16906.7	11983.4	58072.1	29.036
	CO	33089.8	46168.9	44905.2	33112.0	157275.9	78.638
	SOx	735.3	954.1	937.2	738.5	3365.0	1.682
	PM	5829.0	6510.0	6368.8	5419.8	24127.6	12.064

NOx Offsets:		Quarters					
		1	2	3	4	Sum	Tons/yr
Total Facility NOx	lbs	19311.3	27875.6	27508.4	18994.7	93690.0	46.845
Plant 1 Limits for 25TPY	lbs	8891.3	15887.4	16062.9	9094.6	49936.2	24.968
25 TPY difference	lbs	16.0	16.0	16.0	16.0		
NOx amount subject to Offsets		10404.0	11972.3	11429.5	9884.2	43690.0	21.845
Offset Ratio 1:1.2		12484.8	14366.8	13715.4	11861.0	52428.0	26.214

Offset previously surrendered					
11/3/2003	lbs	2575	2575	2575	2575
7/10/2006	lbs	2472	2472	2472	2472
7/8/2009	lbs	3883	4803	4505	3602
Total		8930	9850	9552	8649

Offsets needed		3554.8	4516.8	4163.4	3212.0	15447.0	7.724
Certificate 07-09-60 Available		2838.0	1918.0	2216.0	3119.0	10091.0	5.046
Balance of Credits needed:		716.8	2598.8	1947.4	93.0	5356.0	2.678

ROC Offsets		Quarters					
		1	2	3	4		
Total Facility ROC (lbs)	lbs	11876.3	17305.7	16906.7	11983.4	58072.1	29.036
25 TPY Threshold	lbs/qtr	10630.4	14569.9	14037.1	10762.7	50000.0	25.000
(ration based on gas use)							
ROC amount subject to Offsets	lbs	1245.9	2735.9	2869.6	1220.7	8072.1	4.036
Offset Ratio 1:1.2	lbs	1495.1	3283.1	3443.5	1464.9	9686.6	4.843

DERIVATION OF CONVERSION CONSTANT FOR LB. PER MILLION Btu to PPMV

Fuel Composition			Combustion Data			Combustion Products (per cubic foot of fuel excluding water)		Fuel Lower Heating Value	
Symbol	Component	Fraction	Carbon Atoms	Hydrogen Atoms	O2 Required (per mole) (1)	N2 (cu. ft.) (2)	CO2 (cu. ft.) (3)	LHV (Btu/SCF)	LHV x Fraction
C1	Methane	0.9530	1	4	2	7.2142	0.9530	909.1	866.4
C2	Ethane	0.0180	2	6	3.5	0.2385	0.0360	1618	29.12
C3	Propane	0.0040	3	8	5	0.0757	0.0120	2316	9.264
C4	Butane	0.0030	4	10	6.5	0.0738	0.0120	3010	9.031
C5	Pentane	0.0000	5	12	8	0.0000	0.0000	3708	0.000
N2	Nitrogen	0.0110				0.0110	0.0000	0	0.000
CO2	Carbon Dioxide	0.0110	1			0.0000	0.0110	0	0.000
	Total	1.0000				7.6132	1.0240	BTU/SCF	913.8

- (1) = Carbon Atoms + Hydrogen Atoms/4
- (2) = Oxygen Molecules x 79.1/20.9 x Fraction
- (3) = Carbon Atoms x Fraction

One cubic foot of fuel yields 8.64 cubic feet of dry combustion products at 0% O2
[7.61 + 1.02]

One cubic foot of fuel yields 30.60 cubic feet of dry combustion products at 15% O2
[8.64 x 20.9/(20.9-15)]

The fuel contains 914 Btu/scf, so one million Btu is 1094 scf
- or - 33483 cubic feet of combustion products.

Molecular weight of NO2 is 46, so there are 46 lb. NO2 per lb. mole NO2.
- and one pound of NO2 is 0.0217 lb. Moles

Ideal gas volume is 379.86 cu. ft. per pound mole
so one pound of NOx occupies 8.258 cu. ft.

Therefore, one pound of NOx per million Btu is: 8.258 / 33483 = 0.000247
or 247 ppmv