Impact Evaluations

Air Contaminant	Difference in Project Emissions (lb/hr)	(k)(3)(C) Demonstration Limit (lb/hr)	Difference in Project Emissions Less Than Limit?	Applicable Distance (ft)	Applicable Distance > 1 mile?	Further Compliance Demonstration Necessary?
Benzene	0.03	0.039	Yes	3,000	No	No
H_2S	0.26	0.025	No	50	No	**Yes**
SO_2	7.42	2.00	No	50	No	**Yes**
NOx	15.84	4.00	No	50	No	**Yes**

There are no receptors within a mile of the site; therefore, benzene impacts are not included. Impacts for NO2, SO2, and H2S are included.

H_2S Compliance Demonstration

Basis: This tab demonstrates compliance with the H_2S State Ambient Air Quality Standard (SAAQS) emission limitations in accordance with (k)(6)(A) & (B) of the non-rule Barnett Shale Standard Permit dated 11/08/2012.

Method Used	Emax
Short-term H_2S SAAQS ($\mu g/m^3$)	108
Background H_2S Concentration[1] ($\mu g/m^3$)	0

Impacts by Source:

									Emax Method Hourly SAAQS Demonstration[3]	
EPN	**FIN**	**Emission Source**	**Horsepower**	**Stack Height (ft)**	**Distance to Property Line (ft)**	**Modeling Value[2] ($\mu g/m^3$) / (lb/hr)**	**Modeling Table Category**	**Hourly H2S Emissions (lb/hr)**	**Wr (weighted ratio of emissions)**	**Maximum Allowable H2S Emissions (lb/hr)**
FUG	FUG	Fugitive Emissions: Equipment Leaks	--	3	50	**4375**	Fugitive	0.04	15.33%	0.00
TL1	TL1	Condensate Loading	--	10	50	**1232**	Loading	0.01	5.11%	0.00
TL2	TL2	Water Loading	--	10	50	**1232**	Loading	0.01	5.11%	0.00
Sweet Flare	FL-1, TK1, TK2, TK3, GB1	Sweet Flare	--	20	50	**58**	Flares and Thermal Destruction Devices	0.15	56.32%	1.05
Sour Flare	FL-2, TK4, TK5, PIG	Sour Flare	--	20	50	**58**	Flares and Thermal Destruction Devices	0.05	18.12%	0.34
							Totals	**0.26**	100.00%	**1.40**

[1]The background concentration of H_2S is expected to be negligible. In addition, there is no requirement to include background levels of H_2S in compliance demonstrations.
[2]Modeling values were chosen from the TCEQ Oil and Gas Emission Calculation Spreadsheet (Revised 10/2/2014), using the most conservative distance and applicable stack height (lowest value, highest impacts).
[3]H_2S is regulated by 30 TAC 112 on an hourly basis only (i.e., no annual compliance demonstration is required).

Equations used:

A. *For Emax Method, Per Source: (Weighted Ratio, %) = (Actual Emissions from Source, lb/hr or tpy) / (Sum of all Sources, lb/hr or tpy)*

B. *For Emax Method, Per Source: (Maximum Allowable Emissions, lb/hr) = (Weighted Ratio, %) x (Short-term H_2S SAAQS, $\mu g/m^3$) / (Modeling Value, $\mu g/m^3$ per lb/hr)*

C. *For Predicted Impact Method, Per Source: (Predicted Concentration, $\mu g/m^3$) = (H_2S emissions, lb/hr) x [Modeling Value, ($\mu g/m^3$)/(lb/hr)]*

Site-Wide Impacts:

Emax Method:	**Hourly Demonstration**
H_2S Emissions from All Sources (lb/hr)	0.26
Maximum Allowable H_2S Emissions (lb/hr)	1.40
Compliance Demonstrated? (Emissions < Allowable)	**Yes**

NO_2 Compliance Demonstration

Basis: This tab demonstrates compliance with the NO_2 National Ambient Air Quality Standard (NAAQS) emission limitations in accordance with (k)(6)(A) & (B) of the non-rule Barnett Shale Standard Permit dated 11/08/2012.

Method Used	Emax
Short-term NO_2 NAAQS ($\mu g/m^3$)	188

Impacts by Source:

								NO_2 Emissions			**Emax Method** Hourly NAAQS Demonstration[3]	
EPN	**FIN**	**Emission Source**	**Horsepower**	**Stack Height (ft)**	**Distance to Property Line (ft)**	**Modeling Value[1] ($\mu g/m^3$) / (lb/hr)**	**Modeling Table Category**	**Hourly NO_x Emissions (lb/hr)**	**Source NO_2:NO_x Ratio[2]**	**Hourly NO_2 Emissions (lb/hr)**	**Wr (weighted ratio of emissions)**	**Maximum Allowable NO_2 Emissions (lb/hr)**
COMP1	COMP1	Engine 1: CAT 3606 TALE	1,775	20	50	**7**	Eng. 1500 < hp ≤ 2000	2.74	0.2	0.55	20.91%	5.62
COMP2	COMP2	Engine 2: CAT 3606 TALE	1,775	20	50	**7**	Eng. 1500 < hp ≤ 2000	2.74	0.2	0.55	20.91%	6
COMP3	COMP3	Engine 3: CAT 3606 TALE	1,775	20	50	**7**	Eng. 1500 < hp ≤ 2000	2.74	0.2	0.55	20.91%	5.62
COMP4	COMP4	Engine 4: CAT 3606 TALE	1,775	20	50	**7**	Eng. 1500 < hp ≤ 2000	2.74	0.2	0.55	20.91%	5.62
COMP5	COMP5	Engine 5: CAT 3306TA	203	20	50	**71**	Engine ≤ 250 hp	0.45	0.2	0.09	3.42%	0.09
COMP6	COMP6	Engine 6: Cummins KTA19CGA	380	20	50	**34**	Eng. 250 < hp ≤ 500	0.42	0.2	0.08	3.20%	0.18
ENGMAINT	ENGMAINT	Engine Maintenance: All 1,775 hp engines	--	20	50	**N/A**	Eng. 1000 < hp ≤ 1500	0.00E+00	0	0.00E+00	0.00%	0.00E+00
FL-1	FL-1, TK1, TK2, TK3, GB1	Sweet Flare	--	20	50	**58**	Flares and Thermal Dest. Dev.	0.85	0.2	0.17	6.51%	0.21
FL-2	FL-2, TK4, TK5, PIG	Sour Flare	--	20	50	**58**	Flares and Thermal Dest. Dev.	0.42	0.2	0.08	3.22%	0.10
							Totals	13.10	--	**2.62**	100.00%	**23**

[1]Modeling values were interpolated by the TCEQ Oil and Gas Emission Calculation Spreadsheet (Revised 10/2/2014), unless otherwise noted.

[2]Per Barnett Shale PBR 106.352 and non-rule Barnett Shale Standard Permit (k)(4)(A), for all evaluations of NO_X to NO_2 a conversion factor of 0.20 for 4-stroke rich and lean burn engines, 0.50 for 2-stroke engines, and 0.5 for diesel engines are used. For other source types used conversion factor of 0.80 (EPA Memo "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the PSD Program" June 29, 2010).

[3]Annual ambient air standard compliance demonstration is not needed for NO_2. This is consistent with the table called "ESLs and AAQS needed for impacts review" on the "Is Full Impacts Review Required" tab in the TCEQ oil and gas calculation spreadsheet, dated 10/2/2014, which only lists the hourly NO_2 NAAQS. This is also consistent with the "NO_2 Full Impacts" tab of the TCEQ oil and gas calculation spreadsheet, dated 10/2/2014, which states at the top that a full impacts review needs to be done for NO_2 on an hourly basis. The reason for this is that the hourly NO_2 NAAQS is more stringent than the annual NAAQS, meaning that if the hourly NAAQS is met, even with the worst case hourly emissions occurring every hour of the year, the annual NAAQS would still be met. To illustrate this, if the hourly emissions are modeled to show a maximum off-property concentration of 188 micrograms per cubic meter, which is the same as the hourly NO_2 NAAQS, using the modeling factor of 0.08 to convert the concentration from an hourly basis to an annual basis, the result is 15.04 micrograms per cubic meter, which is less than the annual NO_2 NAAQS, 100 micrograms per cubic meter. The 0.08 factor is discussed in a cell comment on the "Is Full Impacts Review Required" tab in the TCEQ oil and gas calculation spreadsheet, dated 10/2/2014, which states "Note that an acceptable factor to go from 1-hr to annual concentration is 0.08, so the 1-hr concentration may be multiplied by 0.08 to get the annual concentration." Note: This is based on current, most stringent hourly and annual NO_2 ambient air quality standards as listed in the Technical Background Summary for the non-rule standard permit Effective February 2011 (P 57). If the standards are updated, this may change.

4. Engine Maintenance emissions for NOx are equal to normal operating emissions, and would not sum into maximum hourly totals.

Equations used:

A. *For Predicted Impact Method, Per Source: (Predicted Concentration, $\mu g/m^3$) = (NO_2 emissions, lb/hr) x [Modeling Value, ($\mu g/m^3$)/(lb/hr)]*

B. *For Emax Method, Per Source: (Weighted Ratio, %) = (Actual Emissions from Source, lb/hr or tpy) / (Sum of all Sources, lb/hr or tpy)*

C. *For Emax Method, Per Source: (Maximum Allowable Emissions, lb/hr) = (Weighted Ratio, %) x (Short-term NO_2 NAAQS, $\mu g/m^3$) / (Modeling Value, $\mu g/m^3$ per lb/hr)*

Site-Wide Impacts:

Emax Method:	**Hourly Demonstration**
NO_2 Emissions from All Sources (lb/hr)	2.62
Maximum Allowable NO_2 Emissions (lb/hr)	23
Compliance Demonstrated? (Emissions < Allowable)	**Yes**

SO_2 Compliance Demonstration

Basis: This tab demonstrates compliance with the SO_2 National Ambient Air Quality Standard (NAAQS) emission limitations in accordance with (k)(6)(A) & (B) of the non-rule Barnett Shale Standard Permit dated 11/08/2012.

Method Used	Emax
Short-term SO_2 NAAQS ($\mu g/m^3$)	196

Impacts by Source:

								SO_2 Emissions	Emax Method Hourly NAAQS Demonstration[2]	
EPN	**FIN**	**Emission Source**	**Horsepower**	**Stack Height (ft)**	**Distance to Property Line (ft)**	**Modeling Value[1] ($\mu g/m^3$) / (lb/hr)**	**Modeling Table Category**	**Hourly SO_2 Emissions (lb/hr)**	**Wr (weighted ratio of emissions)**	**Maximum Allowable SO_2 Emissions (lb/hr)**
COMP1	COMP1	Engine 1: CAT 3606 TALE	1,775	20	50	7	Eng. 1500 < hp ≤ 2000	0.01	0.10%	0.03
COMP2	COMP2	Engine 2: CAT 3606 TALE	1,775	20	50	7	Eng. 1500 < hp ≤ 2000	0.01	0.10%	0.03
COMP3	COMP3	Engine 3: CAT 3606 TALE	1,775	20	50	7	Eng. 1500 < hp ≤ 2000	0.01	0.10%	0.03
COMP4	COMP4	Engine 4: CAT 3606 TALE	1,775	20	50	7	Eng. 1500 < hp ≤ 2000	0.01	0.10%	0.03
COMP5	COMP5	Engine 5: CAT 3306TA	203	20	50	71	Engine ≤ 250 hp	9.63E-04	0.01%	3.59E-04
COMP6	COMP6	Engine 6: Cummins KTA19CGA	380	20	50	34	Eng. 250 < hp ≤ 500	1.78E-03	0.02%	1.38E-03
ENGMAINT	ENGMAINT	Engine Maintenance: All 1,775 hp engines	--	20	50	N/A	Eng. 1000 < hp ≤ 1500	0.00E+00	0.00%	0.00E+00
FL-1	FL-1, TK1, TK2, TK3, GB1	Sweet Flare	--	20	50	5.66	Flares and Thermal Dest. Dev.	5.58	75.34%	26.10
FL-2	FL-2, TK4, TK5, PIG	Sour Flare	--	20	50	58	Flares and Thermal Dest. Dev.	1.80	24.24%	0.82
							Totals	**7.41**	100.00%	**27.03**

[1]Modeling values were interpolated by the TCEQ Oil and Gas Emission Calculation Spreadsheet (Revised 10/2/2014), unless otherwise noted.

[2]Annual ambient air standard compliance demonstration is not needed for SO_2. This is consistent with the table called "ESLs and AAQS needed for impacts review" on the "Is Full Impacts Review Required" tab in the TCEQ oil and gas calculation spreadsheet, dated 10/2/2014, which only lists the hourly SO_2 NAAQS. This is also consistent with the "SO_2 Full Impacts" tab of the TCEQ oil and gas calculation spreadsheet, dated 10/2/2014, which states at the top that a full impacts review needs to be done for SO_2 on an hourly basis. The reason for this is that the hourly SO_2 NAAQS is more stringent than the annual NAAQS, meaning that if the hourly NAAQS is met, even with the worst case hourly emissions occurring every hour of the year, the annual NAAQS would still be met. To illustrate this, if the hourly emissions are modeled to show a maximum off-property concentration of 196 micrograms per cubic meter, which is the same as the hourly SO_2 NAAQS, using the modeling factor of 0.08 to convert the concentration from an hourly basis to an annual basis, the result is 15.68 micrograms per cubic meter, which is less than the annual SO_2 NAAQS, 80 micrograms per cubic meter. The 0.08 factor is discussed in a cell comment on the "Is Full Impacts Review Required" tab in the TCEQ oil and gas calculation spreadsheet, dated 10/2/2014, which states "Note that an acceptable factor to go from 1-hr to annual concentration is 0.08, so the 1-hr concentration may be multiplied by 0.08 to get the annual concentration." Note: This is based on current, most stringent hourly and annual SO_2 ambient air quality standards as listed in the Technical Background Summary for the non-rule standard permit Effective February 2011 (P 57). If the standards are updated, this may change.

4. Engine Maintenance emissions for SO2 are equal to normal operating emissions, and would not sum into maximum hourly totals.

Equations used:

A. *For Predicted Impact Method, Per Source: (Predicted Concentration, $\mu g/m^3$) = (SO_2 emissions, lb/hr) x [Modeling Value, ($\mu g/m^3$)/(lb/hr)]*

B. *For Emax Method, Per Source: (Weighted Ratio, %) = (Actual Emissions from Source, lb/hr or tpy) / (Sum of all Sources, lb/hr or tpy)*

C. *For Emax Method, Per Source: (Maximum Allowable Emissions, lb/hr) = (Weighted Ratio, %) x (Short-term SO_2 NAAQS, $\mu g/m^3$) / (Modeling Value, $\mu g/m^3$ per lb/hr)*

Site-Wide Impacts:

Emax Method:	**Hourly Demonstration**
SO_2 Emissions from All Sources (lb/hr)	7.41
Maximum Allowable SO_2 Emissions (lb/hr)	27.03
Compliance Demonstrated? (Emissions < Allowable)	**Yes**

03/14/25
15:55:18

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 13043 ***

C:\Users\Kat Galloway\OneDrive - brightskyenv.com\Client Files\Hilcorp\King Com

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	FLARE
EMISSION RATE (G/S)	=	0.125998
FLARE STACK HEIGHT (M)	=	6.0960
TOT HEAT RLS (CAL/S)	=	432693.
RECEPTOR HEIGHT (M)	=	0.0000
URBAN/RURAL OPTION	=	RURAL
EFF RELEASE HEIGHT (M)	=	8.3505
BUILDING HEIGHT (M)	=	0.0000
MIN HORIZ BLDG DIM (M)	=	0.0000
MAX HORIZ BLDG DIM (M)	=	0.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 7.174 M**4/S**3; MOM. FLUX = 4.375 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
15.	0.000	1	1.0	1.0	320.0	102.27	7.32	5.91	NO
100.	2.874	3	10.0	10.0	3200.0	17.74	12.61	7.68	NO
200.	5.523	3	8.0	8.0	2560.0	20.09	23.86	14.42	NO
300.	5.098	4	10.0	10.0	3200.0	17.74	22.77	12.39	NO
400.	4.737	4	8.0	8.0	2560.0	20.09	29.64	15.63	NO
500.	4.182	4	5.0	5.0	1600.0	27.13	36.54	19.07	NO
600.	3.947	4	5.0	5.0	1600.0	27.13	43.05	21.88	NO
700.	3.621	4	4.5	4.5	1440.0	29.22	49.55	24.76	NO
800.	3.338	4	4.0	4.0	1280.0	31.83	55.98	27.61	NO
900.	3.096	4	3.5	3.5	1120.0	35.18	62.36	30.45	NO
1000.	2.876	4	3.0	3.0	960.0	39.66	68.71	33.32	NO
1100.	2.692	4	3.0	3.0	960.0	39.66	74.85	35.28	NO
1200.	2.515	4	3.0	3.0	960.0	39.66	80.94	37.18	NO
1300.	2.370	4	2.5	2.5	800.0	45.92	87.18	39.49	NO
1400.	2.247	4	2.5	2.5	800.0	45.92	93.17	41.28	NO
1500.	2.128	4	2.5	2.5	800.0	45.92	99.13	43.03	NO
1600.	2.173	5	1.0	1.0	10000.0	65.68	79.85	33.39	NO
1700.	2.235	5	1.0	1.0	10000.0	65.68	84.18	34.38	NO
1800.	2.283	5	1.0	1.0	10000.0	65.68	88.50	35.36	NO
1900.	2.321	5	1.0	1.0	10000.0	65.68	92.80	36.32	NO
2000.	2.348	5	1.0	1.0	10000.0	65.68	97.09	37.28	NO
2100.	2.355	5	1.0	1.0	10000.0	65.68	101.36	38.13	NO
2200.	2.355	5	1.0	1.0	10000.0	65.68	105.61	38.97	NO
2300.	2.367	6	1.0	1.0	10000.0	55.92	73.54	27.01	NO
2400.	2.412	6	1.0	1.0	10000.0	55.92	76.34	27.48	NO
2500.	2.451	6	1.0	1.0	10000.0	55.92	79.12	27.95	NO
2600.	2.485	6	1.0	1.0	10000.0	55.92	81.90	28.41	NO
2700.	2.514	6	1.0	1.0	10000.0	55.92	84.67	28.87	NO

2800.	2.538	6	1.0	1.0	10000.0	55.92	87.43	29.32	NO
2900.	2.559	6	1.0	1.0	10000.0	55.92	90.18	29.77	NO
3000.	2.575	6	1.0	1.0	10000.0	55.92	92.92	30.21	NO
3500.	2.557	6	1.0	1.0	10000.0	55.92	106.52	32.01	NO
4000.	2.504	6	1.0	1.0	10000.0	55.92	119.94	33.70	NO
4500.	2.432	6	1.0	1.0	10000.0	55.92	133.20	35.29	NO
5000.	2.349	6	1.0	1.0	10000.0	55.92	146.30	36.81	NO
5500.	2.261	6	1.0	1.0	10000.0	55.92	159.27	38.25	NO
6000.	2.173	6	1.0	1.0	10000.0	55.92	172.12	39.64	NO
6500.	2.086	6	1.0	1.0	10000.0	55.92	184.84	40.97	NO
7000.	2.002	6	1.0	1.0	10000.0	55.92	197.46	42.25	NO
7500.	1.917	6	1.0	1.0	10000.0	55.92	209.98	43.35	NO
8000.	1.838	6	1.0	1.0	10000.0	55.92	222.40	44.41	NO
8500.	1.763	6	1.0	1.0	10000.0	55.92	234.73	45.44	NO
9000.	1.693	6	1.0	1.0	10000.0	55.92	246.98	46.43	NO
9500.	1.628	6	1.0	1.0	10000.0	55.92	259.15	47.40	NO
10000.	1.567	6	1.0	1.0	10000.0	55.92	271.24	48.33	NO
15000.	1.119	6	1.0	1.0	10000.0	55.92	388.67	56.54	NO
20000.	0.8599	6	1.0	1.0	10000.0	55.92	501.13	61.81	NO
25000.	0.6951	6	1.0	1.0	10000.0	55.92	609.90	66.26	NO
30000.	0.5813	6	1.0	1.0	10000.0	55.92	715.72	70.16	NO
40000.	0.4382	6	1.0	1.0	10000.0	55.92	920.32	75.72	NO
50000.	0.3506	6	1.0	1.0	10000.0	55.92	1117.51	80.35	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 15. M:

171.	5.658	3	10.0	10.0	3200.0	17.74	20.73	12.51	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

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*** SUMMARY OF SCREEN MODEL RESULTS ***
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CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	5.658	171.	0.

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** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
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