Appendix L

Continental Divide-Creston No Action Alternative Scenario Emissions Inventory

LIST OF ACRONYMS

B	Billion
BACT	Best Available Control Technology
bpd	Barrel Per Day
BSFC	Brake Specific Fuel Consumption
BTU	British Thermal Unit
CD-C	Continental Divide-Creston
CH_4	Methane
CO	Carbon Monoxide
CO_2	**Carbon Dioxide**
d	Day
EC	Elemental Carbon
EF	Emission Factor
G	Gram
HC	Hydrocarbons
HD	Heavy Duty
HHV	Higher Heating Value
HP	Horsepower
hp-hr	Horsepower-Hour
hr	Hour
ICE	Internal Combustion Engine
Lb	Pound
LD	Light Duty
M	Thousand
mi	Miles
MM	Million
mph	Miles Per Hour
N_2O	Nitrous Oxide
NG	Natural Gas
NMHC	Non-Methane Hydrocarbon
NOx	Oxides Of Nitrogen
PM	Particulate Matter
PM_cond	Condensable Particulate Matter
PM_filt	Filterable Particulate Matter
Scf	Standard Cubic Feet
SOA	Secondary Organic Aerosols
SO_2	Sulfur Dioxide
THC	Total Hydrocarbons
TOC	Total Organic Carbon
tpy	Tons Per Year
TSP	Total Suspended Particles
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds
Wt%	Weight Percentage
WtFraction	Weight Fraction
yr	Year

Note: Central Facility refers to gas plants and compressor stations.

Continental Divide-Creston No Action Project Emissions Inventory

In Appendix L, we present the detailed emissions calculations used to develop the CD-C Project Emission Inventory for the No Action Alternative.

Existing Wells Emissions Inventory

Table 1. Summary of Existing Wells Activity Data by Project Year.

Year	Project Yr	Well Pads Constructed	Spuds	Active Well Count	Annual Condensate Production (Mbbl/yr)	Annual Gas Production (MMSCF/yr)	Cumulative Well Pads Constructed	Cumulative Spuds	Cumulative Condensate Production (Mbbl)	Cumulative Gas Production (BSCF)
2008	1	462	462	2,850	2,726	193,570	462	462	2,726	194
2009	2	0	0	2,821	2,569	182,685	462	462	5,295	376
2010	3	0	0	2,792	2,211	157,216	462	462	7,507	533
2011	4	0	0	2,763	2,013	143,095	462	462	9,519	677
2012	5	0	0	2,736	1,976	140,480	462	462	11,495	817
2013	6	0	0	2,709	1,950	138,671	462	462	13,445	956
2014	7	0	0	2,682	1,851	131,597	462	462	15,296	1,087
2015	8	0	0	2,656	1,748	124,251	462	462	17,044	1,212
2016	9	0	0	2,629	1,657	117,844	462	462	18,701	1,329
2017	10	0	0	2,602	1,579	112,265	462	462	20,280	1,442
2018	11	0	0	2,575	1,510	107,356	462	462	21,790	1,549
2019	12	0	0	2,548	1,447	102,899	462	462	23,237	1,652
2020	13	0	0	2,524	1,389	98,793	462	462	24,627	1,751
2021	14	0	0	2,499	1,338	95,116	462	462	25,964	1,846
2022	15	0	0	2,475	1,267	90,091	462	462	27,232	1,936
2023	16	0	0	2,450	1,223	86,926	462	462	28,454	2,023
2024	17	0	0	2,426	1,181	83,975	462	462	29,635	2,107
2025	18	0	0	2,401	1,145	81,413	462	462	30,780	2,188
2026	19	0	0	2,376	1,110	78,899	462	462	31,890	2,267
2027	20	0	0	2,352	1,077	76,569	462	462	32,967	2,344
2028	21	0	0	2,305	1,047	74,456	462	462	34,014	2,418
2029	22	0	0	2,283	995	70,757	462	462	35,009	2,489
2030	23	0	0	2,260	968	68,803	462	462	35,977	2,558
2031	24	0	0	2,238	942	66,989	462	462	36,919	2,625
2032	25	0	0	2,216	917	65,232	462	462	37,836	2,690
2033	26	0	0	2,193	893	63,513	462	462	38,730	2,753
2034	27	0	0	2,171	871	61,923	462	462	39,601	2,815
2035	28	0	0	2,149	850	60,426	462	462	40,450	2,876
2036	29	0	0	2,126	831	59,091	462	462	41,282	2,935
2037	30	0	0	2,104	813	57,799	462	462	42,094	2,993
Total		**462**	**462**							

Table 2. Projection Parameters Used in Future Year Emission Inventory Development for Existing Wells by Source Category.

Source Category	Projection Parameter
Completion Equipment (diesel ICE)	totals for year with spuds
Condensate Tank Flashing Losses	annual condensate production
Dehydrator Venting - Well Site	active well counts
Heaters	active well counts
Initial Completion Venting	totals for year with spuds
Pneumatic Devices	active well counts
Pneumatic Pumps	active well counts
Tank Loadout (vapor losses)	annual condensate production
Well Stream Fugitive Devices	active well counts
Gas Stream Fugitive Devices	active well counts
Condensate Fugitive Devices	active well counts
Well Venting	active well counts
Condensate Tank Working Losses	total turnovers per year
Condensate Tank Breathing Losses	active well counts
Drilling Equip (diesel ICE)	totals for year with spuds
Drilling Traffic (LD)	total spuds
Drilling Traffic (HD)	total spuds
Completion Traffic (LD)	total spuds
Completion Traffic (HD)	total spuds
Well Pad Const Equip (diesel ICE)	new pads
Construction Dust, Fugitive	new pads
Construction Dust, Wind Erosion	new pads
Construction Traffic, Road and Well pad (LD)	new pads
Construction Traffic, Road and Well pad (HD)	new pads
Production Traffic (LD)	active well counts
Production Traffic (HD)	active well counts
Drilling Traffic (LD) Dust	total spuds
Drilling Traffic (HD) Dust	total spuds
Completion Traffic (LD) Dust	total spuds
Completion Traffic (HD) Dust	total spuds
Construction Traffic, Road and Well pad (LD) Dust	new pads
Construction Traffic, Road and Well pad (HD) Dust	new pads
Production Traffic (LD) Dust	active well counts
Production Traffic (HD) Dust	active well counts
Workover Equipment (diesel ICE)	active well counts
WorkoverTraffic (LD)	active well counts
WorkoverTraffic (HD)	active well counts
WorkoverTraffic (LD) Dust	active well counts
WorkoverTraffic (HD) Dust	active well counts

Source Category	Projection Parameter
Compressor Station (Reciprocating Engine Rich Burn)	totals for year with compressor station
Compressor Station (Reciprocating Engine Lean Burn)	totals for year with compressor station
Compressor Station (Turbine)	totals for year with compressor station
Compressor Station (Venting)	totals for year with compressor station
Compressor Station (External NG Combustion)	totals for year with compressor station
Compressor Station (Flashing)	totals for year with compressor station
Compressor Station (Working/Breathing)	totals for year with compressor station
Compressor Station (Flaring)	totals for year with compressor station
Gas Plant (Reciprocating Engine)	totals for year with gas plant
Gas Plant (Turbine)	totals for year with gas plant
Gas Plant (flaring)	totals for year with gas plant
Gas Plant (natural gas external combustion (boiler/heater))	totals for year with gas plant
Gas Plant (venting)	totals for year with gas plant
Condensate Tank Flashing Flaring	annual condensate production
Condensate Tank Working Flaring	total turnovers per year
Condensate Tank Breathing Flaring	active well counts
Production Traffic, Central Facility (HD)	None
Production Traffic, Central Facility (HD) Dust	None
Evaporation Ponds	active well counts

Table 3. Summary of Projection Factors Used in Future Year Emission Inventory Development for Existing Wells.

Projection	New pads per Year	Active Well Counts per Year	Total Spuds per Year	Annual Gas Production (MMSCF/yr)	Annual Condensate Production (bbl/yr)	Total Turnovers per Year	Totals for Year with Spuds	Totals for Year with Compressor Station	Totals for Year with Gas Plant	None
2008	462	2,850	462	193,570	2,726,059	2,850	1	1	1	1
2009	0	2,821	0	182,685	2,569,379	2,821	0	1	1	1
2010	0	2,792	0	157,216	2,211,169	2,792	0	1	1	1
2011	0	2,763	0	143,095	2,012,559	2,763	0	1	1	1
2012	0	2,736	0	140,480	1,975,782	2,736	0	1	1	1
2013	0	2,709	0	138,671	1,950,348	2,709	0	1	1	1
2014	0	2,682	0	131,597	1,850,855	2,682	0	1	1	1
2015	0	2,656	0	124,251	1,747,525	2,656	0	1	1	1
2016	0	2,629	0	117,844	1,657,424	2,629	0	1	1	1
2017	0	2,602	0	112,265	1,578,959	2,602	0	1	1	1
2018	0	2,575	0	107,356	1,509,910	2,575	0	1	1	1
2019	0	2,548	0	102,899	1,447,219	2,548	0	1	1	1
2020	0	2,524	0	98,793	1,389,480	2,524	0	1	1	1
2021	0	2,499	0	95,116	1,337,765	2,499	0	1	1	1
2022	0	2,475	0	90,091	1,267,081	2,475	0	1	1	1
2023	0	2,450	0	86,926	1,222,568	2,450	0	1	1	1
2024	0	2,426	0	83,975	1,181,063	2,426	0	1	1	1
2025	0	2,401	0	81,413	1,145,037	2,401	0	1	1	1
2026	0	2,376	0	78,899	1,109,676	2,376	0	1	1	1
2027	0	2,352	0	76,569	1,076,911	2,352	0	1	1	1
2028	0	2,305	0	74,456	1,047,183	2,305	0	1	1	1
2029	0	2,283	0	70,757	995,158	2,283	0	1	1	1
2030	0	2,260	0	68,803	967,685	2,260	0	1	1	1
2031	0	2,238	0	66,989	942,173	2,238	0	1	1	1
2032	0	2,216	0	65,232	917,459	2,216	0	1	1	1
2033	0	2,193	0	63,513	893,285	2,193	0	1	1	1
2034	0	2,171	0	61,923	870,920	2,171	0	1	1	1
2035	0	2,149	0	60,426	849,856	2,149	0	1	1	1
2036	0	2,126	0	59,091	831,090	2,126	0	1	1	1
2037	0	2,104	0	57,799	812,920	2,104	0	1	1	1

Gas Composition Analysis

Table 4. Summary of Gas Composition Analysis as Provided in Table 5 through Table 11.

Property	Sales/Produced Gas	Fugitive (Post-Flash)	Flashing	Produced Water	Condensate (Post-Flash)	Regenerator Overhead Vent Stream	Wet Gas
VOC Fraction (molar)	5.39%	49.52%	49.51%	55.26%	39.40%	15.07%	5.30%
VOC/TOC (weight)	15.59%	75.85%	75.78%	92.48%	66.34%	50.39%	15.22%
VOC MW	57.50	64.95	64.85	69.75	63.01	79.73	56.65
VOC Fraction (weight)	14.60%	73.55%	73.46%	69.58%	66.34%	40.07%	14.25%
CO2 Fraction (weight)	6.07%	3.02%	3.04%	24.76%	0.00%	8.81%	6.09%
CH4 Fraction (weight)	68.75%	13.57%	13.5%	3.9%	21.2%	32.6%	69.0%
H2S Fraction (weight)	0.00%	0.00%	0.0%	0.0%	0.0%	0.0%	0.0%
Heat Content (BTU/SCF)	1000	-	-	-	-	-	-
benzene/VOC (weight)	0.40%	0.83%	0.82%	0.56%	0.48%	9.63%	0.41%
toluene/VOC (weight)	0.56%	1.17%	1.17%	1.13%	0.63%	15.90%	0.57%
ethylbenzene/VOC (weight)	0.02%	0.02%	0.02%	0.05%	0.01%	0.59%	0.02%
xylenes/VOC (weight)	0.32%	0.63%	0.63%	0.43%	0.35%	5.86%	0.18%
n-hexane/VOC (weight)	4.74%	3.96%	3.93%	5.01%	3.40%	2.61%	1.98%
formaldehyde/VOC (weight)	0%	0%	0%	0%	0%	0%	0%

Assumptions

Data obtained from operators in blue text

Table 5. Sales Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	2.73%	2.73%	44.0	1.2	6.0666%	N		
Nitrogen	0.17%	0.17%	28.0	0.0	0.2420%	N		
Methane	84.99%	84.90%	16.0	13.6	68.7549%	N		
Ethane	6.81%	6.81%	30.1	2.0	10.3331%	N		
Propane	3.17%	3.17%	44.1	1.4	7.0516%	Y	48.29%	21.29
Isobutane	0.64%	0.64%	58.1	0.4	1.8647%	Y	12.77%	7.42
n-Butane	0.71%	0.71%	58.1	0.4	2.0830%	Y	14.26%	8.29
Isopentane	0.24%	0.24%	72.2	0.2	0.8812%	Y	6.03%	4.35
n-Pentane	0.20%	0.20%	72.2	0.1	0.7252%	Y	4.97%	3.58
Cyclopentane	0.00%	0.00%	70.1	0.0	0.0000%	Y	0.00%	0.00
n-Hexane	0.16%	0.16%	86.2	0.1	0.6928%	Y	4.74%	4.09
Cyclohexane	0.03%	0.03%	84.2	0.0	0.1349%	Y	0.92%	0.78
2,2-Dimethylbutane	0.00%	0.00%	86.2	0.0	0.0186%	Y	0.13%	0.11
2,3-Dimethylbutane	0.02%	0.02%	86.2	0.0	0.0712%	Y	0.49%	0.42
2-Methylpentane	0.05%	0.05%	86.2	0.0	0.2121%	Y	1.45%	1.25
3-Methylpentane	0.03%	0.03%	86.2	0.0	0.1091%	Y	0.75%	0.64
n-Heptane	0.06%	0.06%	100.2	0.1	0.2967%	Y	2.03%	2.04
Methylcyclohexane	0.03%	0.03%	98.2	0.0	0.1594%	Y	1.09%	1.07
2,2,4-Trimethylpentane	0.00%	0.00%	114.2	0.0	0.0218%	Y	0.15%	0.17
Benzene	0.01%	0.01%	78.1	0.0	0.0589%	Y	0.40%	0.31
Toluene	0.02%	0.02%	92.1	0.0	0.0811%	Y	0.56%	0.51
Ethylbenzene	0.00%	0.00%	106.2	0.0	0.0024%	Y	0.02%	0.02
m-Xylene	0.00%	0.00%	106.2	0.0	0.0250%	Y	0.17%	0.18
o-Xylene	0.00%	0.00%	106.2	0.0	0.0218%	Y	0.15%	0.16
n-Octane	0.00%	0.00%	114.2	0.0	0.0035%	Y	0.02%	0.03
n-Nonane	0.01%	0.01%	128.3	0.0	0.0886%	Y	0.61%	0.78
n-Decane	0.00%	0.00%	142.3	0.0	0.0000%	Y	0.00%	0.00
Total	**100.10%**	**100.00%**		**19.8**			**100.00%**	**57.5**

Table 6. Fugitive Post-Flash Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	2.79%	2.79%	44.0	1.2	3.0190%	N		
Nitrogen	0.02%	0.02%	28.0	0.0	0.0151%	N		
Methane	34.37%	34.37%	16.0	5.5	13.5728%	N		
Ethane	13.30%	13.30%	30.1	4.0	9.8429%	N		
Propane	17.80%	17.80%	44.1	7.9	19.3288%	Y	26.28%	11.59
Isobutane	6.84%	6.84%	58.1	4.0	9.7798%	Y	13.30%	7.73
n-Butane	9.37%	9.37%	58.1	5.4	13.4078%	Y	18.23%	10.60
Isopentane	4.55%	4.55%	72.2	3.3	8.0782%	Y	10.98%	7.92
n-Pentane	3.97%	3.97%	72.2	2.9	7.0578%	Y	9.60%	6.92
Cyclopentane	0.00%	0.00%	70.1	0.0	0.0000%	Y	0.00%	0.00
n-Hexane	1.37%	1.37%	86.2	1.2	2.9160%	Y	3.96%	3.42
Cyclohexane	0.30%	0.30%	84.2	0.3	0.6178%	Y	0.84%	0.71
2,2-Dimethylbutane	0.09%	0.09%	86.2	0.1	0.1907%	Y	0.26%	0.22
2,3-Dimethylbutane	0.35%	0.35%	86.2	0.3	0.7423%	Y	1.01%	0.87
2-Methylpentane	1.06%	1.06%	86.2	0.9	2.2383%	Y	3.04%	2.62
3-Methylpentane	0.54%	0.54%	86.2	0.5	1.1373%	Y	1.55%	1.33
n-Heptane	1.85%	1.85%	100.2	1.9	4.5651%	Y	6.21%	6.22
Methylcyclohexane	0.18%	0.18%	98.2	0.2	0.4350%	Y	0.59%	0.58
2,2,4-Trimethylpentane	0.07%	0.07%	114.2	0.1	0.1980%	Y	0.27%	0.31
Benzene	0.32%	0.32%	78.1	0.2	0.6104%	Y	0.83%	0.65
Toluene	0.38%	0.38%	92.1	0.3	0.8601%	Y	1.17%	1.08
Ethylbenzene	0.00%	0.00%	106.2	0.0	0.0114%	Y	0.02%	0.02
m-Xylene	0.16%	0.16%	106.2	0.2	0.4206%	Y	0.57%	0.61
o-Xylene	0.02%	0.02%	106.2	0.0	0.0399%	Y	0.05%	0.06
n-Octane	0.22%	0.22%	114.2	0.3	0.6172%	Y	0.84%	0.96
n-Nonane	0.05%	0.05%	128.3	0.1	0.1582%	Y	0.22%	0.28
n-Decane	0.04%	0.04%	142.3	0.1	0.1395%	Y	0.19%	0.27
Total	**100.00%**	**100.00%**		**40.6**			**100.00%**	**65.0**

Table 7. Flash Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	2.80%	2.80%	44.0	1.2	3.0392%	N		
Nitrogen	0.02%	0.02%	28.0	0.0	0.0149%	N		
Methane	34.25%	34.25%	16.0	5.5	13.5394%	N		
Ethane	13.42%	13.42%	30.1	4.0	9.9421%	N		
Propane	17.98%	17.98%	44.1	7.9	19.5446%	Y	26.60%	11.73
Isobutane	6.85%	6.85%	58.1	4.0	9.8099%	Y	13.35%	7.76
n-Butane	9.34%	9.34%	58.1	5.4	13.3756%	Y	18.21%	10.58
Isopentane	4.48%	4.48%	72.2	3.2	7.9707%	Y	10.85%	7.83
n-Pentane	3.91%	3.91%	72.2	2.8	6.9497%	Y	9.46%	6.83
Cyclopentane	0.00%	0.00%	70.1	0.0	0.0000%	Y	0.00%	0.00
n-Hexane	1.36%	1.36%	86.2	1.2	2.8850%	Y	3.93%	3.38
Cyclohexane	0.30%	0.30%	84.2	0.2	0.6125%	Y	0.83%	0.70
2,2-Dimethylbutane	0.09%	0.09%	86.2	0.1	0.1877%	Y	0.26%	0.22
2,3-Dimethylbutane	0.34%	0.34%	86.2	0.3	0.7319%	Y	1.00%	0.86
2-Methylpentane	1.04%	1.04%	86.2	0.9	2.2086%	Y	3.01%	2.59
3-Methylpentane	0.53%	0.53%	86.2	0.5	1.1231%	Y	1.53%	1.32
n-Heptane	1.85%	1.85%	100.2	1.9	4.5682%	Y	6.22%	6.23
Methylcyclohexane	0.18%	0.18%	98.2	0.2	0.4348%	Y	0.59%	0.58
2,2,4-Trimethylpentane	0.07%	0.07%	114.2	0.1	0.1981%	Y	0.27%	0.31
Benzene	0.31%	0.31%	78.1	0.2	0.6038%	Y	0.82%	0.64
Toluene	0.38%	0.38%	92.1	0.3	0.8615%	Y	1.17%	1.08
Ethylbenzene	0.00%	0.00%	106.2	0.0	0.0115%	Y	0.02%	0.02
m-Xylene	0.16%	0.16%	106.2	0.2	0.4243%	Y	0.58%	0.61
o-Xylene	0.02%	0.02%	106.2	0.0	0.0403%	Y	0.05%	0.06
n-Octane	0.22%	0.22%	114.2	0.3	0.6219%	Y	0.85%	0.97
n-Nonane	0.05%	0.05%	128.3	0.1	0.1598%	Y	0.22%	0.28
n-Decane	0.04%	0.04%	142.3	0.1	0.1410%	Y	0.19%	0.27
Total	**100.00%**	**100.00%**		**40.6**			**100.00%**	**64.9**

Table 8. Produced Water Working and Breathing Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	29.14%	29.14%	44.010	12.822	24.76%	N		
Nitrogen	0.00%	0.00%	28.010	0.000	0.00%	N		
Methane	12.59%	12.59%	16.040	2.019	3.90%	N		
Ethane	3.02%	3.02%	30.070	0.909	1.76%	N		
Propane	11.24%	11.24%	44.100	4.956	9.57%	Y	13.76%	6.066
Isobutane	8.05%	8.05%	58.120	4.679	9.04%	Y	12.99%	7.548
n-Butane	12.65%	12.65%	58.120	7.352	14.20%	Y	20.41%	11.861
Isopentane	6.97%	6.97%	72.150	5.031	9.72%	Y	13.96%	10.075
n-Pentane	5.97%	5.97%	72.150	4.308	8.32%	Y	11.96%	8.628
Cyclopentane	0.00%	0.00%	70.130	0.000	0.00%	Y	0.00%	0.000
n-Hexane	2.09%	2.09%	86.180	1.804	3.48%	Y	5.01%	4.316
Cyclohexane	3.09%	3.09%	84.160	2.600	5.02%	Y	7.22%	6.073
2,2-Dimethylbutane	0.00%	0.00%	86.177	0.000	0.00%	Y	0.00%	0.000
2,3-Dimethylbutane	0.00%	0.00%	86.177	0.000	0.00%	Y	0.00%	0.000
2-Methylpentane	0.00%	0.00%	86.177	0.000	0.00%	Y	0.00%	0.000
3-Methylpentane	0.00%	0.00%	86.177	0.000	0.00%	Y	0.00%	0.000
n-Heptane	3.55%	3.55%	100.202	3.558	6.87%	Y	9.88%	9.897
Methylcyclohexane	0.00%	0.00%	98.190	0.000	0.00%	Y	0.00%	0.000
2,2,4-Trimethylpentane	0.12%	0.12%	114.229	0.142	0.27%	Y	0.39%	0.451
Benzene	0.26%	0.26%	78.110	0.200	0.39%	Y	0.56%	0.434
Toluene	0.44%	0.44%	92.140	0.406	0.78%	Y	1.13%	1.038
Ethylbenzene	0.02%	0.02%	106.170	0.017	0.03%	Y	0.05%	0.051
m-Xylene	0.15%	0.15%	106.160	0.156	0.30%	Y	0.43%	0.458
o-Xylene	0.00%	0.00%	106.160	0.000	0.00%	Y	0.00%	0.000
n-Octane	0.36%	0.36%	114.229	0.415	0.80%	Y	1.15%	1.316
n-Nonane	0.12%	0.12%	128.255	0.149	0.29%	Y	0.41%	0.531
n-Decane	0.18%	0.18%	142.290	0.254	0.49%	Y	0.70%	1.003
Total	**100.00%**	**100.00%**		**51.777**			**100.00%**	**69.745**

Table 9. Condensate Tank Post-Flash Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	0.00%	0.00%	44.010	0.000	0.00%	N		
Nitrogen	0.00%	0.00%	28.010	0.000	0.00%	N		
Methane	46.18%	46.18%	16.040	7.407	21.23%	N		
Ethane	14.42%	14.42%	30.070	4.335	12.43%	N		
Propane	15.42%	15.42%	44.100	6.801	19.50%	Y	29.39%	12.960
Isobutane	5.69%	5.70%	58.120	3.310	9.49%	Y	14.30%	8.313
n-Butane	7.51%	7.51%	58.120	4.364	12.51%	Y	18.86%	10.961
Isopentane	3.54%	3.54%	72.150	2.557	7.33%	Y	11.05%	7.972
n-Pentane	2.87%	2.87%	72.150	2.070	5.93%	Y	8.94%	6.453
n-Hexane	0.91%	0.91%	86.180	0.786	2.25%	Y	3.40%	2.928
Cyclohexane	0.15%	0.15%	84.160	0.125	0.36%	Y	0.54%	0.454
2,2-Dimethylbutane	0.07%	0.07%	86.177	0.062	0.18%	Y	0.27%	0.233
2,3-Dimethylbutane	0.24%	0.24%	86.177	0.207	0.59%	Y	0.90%	0.771
2-Methylpentane	0.71%	0.71%	86.177	0.614	1.76%	Y	2.65%	2.287
3-Methylpentane	0.34%	0.34%	86.177	0.294	0.84%	Y	1.27%	1.093
n-Heptane	1.23%	1.23%	100.202	1.228	3.52%	Y	5.31%	5.319
Methylcyclohexane	0.10%	0.10%	98.190	0.098	0.28%	Y	0.42%	0.414
2,2,4-Trimethylpentane	0.04%	0.04%	114.229	0.049	0.14%	Y	0.21%	0.242
Benzene	0.14%	0.14%	78.110	0.111	0.32%	Y	0.48%	0.373
Toluene	0.16%	0.16%	92.140	0.145	0.42%	Y	0.63%	0.579
Ethylbenzene	0.00%	0.00%	106.170	0.002	0.01%	Y	0.01%	0.009
Xylenes	0.08%	0.08%	106.170	0.081	0.23%	Y	0.35%	0.370
n-Octane	0.11%	0.11%	114.229	0.131	0.37%	Y	0.56%	0.645
n-Nonane	0.04%	0.04%	128.255	0.046	0.13%	Y	0.20%	0.257
n-Decane	0.04%	0.04%	142.290	0.061	0.17%	Y	0.26%	0.374
Total	**100.00%**	**100.00%**	**0.000**	**34.884**	**100.00%**		**100.00%**	**63.007**

Table 10. Regenerated Overhead Vent Stream Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Water	17.54%	17.54%	18.010	3.159	11.56%	N		
Carbon Dioxide	5.47%	5.47%	44.010	2.407	8.81%	N		
Nitrogen	0.11%	0.11%	28.010	0.032	0.12%	N		
Methane	55.61%	55.61%	16.040	8.920	32.64%	N		
Ethane	6.19%	6.19%	30.070	1.861	6.81%	N		
Propane	3.98%	3.98%	44.100	1.755	6.42%	Y	16.03%	7.069
Isobutane	1.07%	1.07%	58.120	0.622	2.28%	Y	5.68%	3.301
n-Butane	1.49%	1.49%	58.120	0.866	3.17%	Y	7.91%	4.597
Isopentane	0.57%	0.57%	72.150	0.413	1.51%	Y	3.77%	2.719
n-Pentane	0.58%	0.58%	72.150	0.421	1.54%	Y	3.85%	2.776
n-Hexane	0.33%	0.33%	86.180	0.286	1.05%	Y	2.61%	2.252
Cyclohexane	0.62%	0.62%	84.160	0.523	1.92%	Y	4.78%	4.024
Other Hexanes	0.37%	0.37%	86.180	0.320	1.17%	Y	2.92%	2.517
n-Heptane	0.61%	0.61%	100.202	0.615	2.25%	Y	5.62%	5.630
Methylcyclohexane	0.79%	0.79%	98.190	0.775	2.83%	Y	7.08%	6.947
2,2,4-Trimethylpentane	0.02%	0.02%	114.229	0.022	0.08%	Y	0.20%	0.226
Benzene	1.35%	1.35%	78.110	1.055	3.86%	Y	9.63%	7.522
Toluene	1.89%	1.89%	92.140	1.741	6.37%	Y	15.90%	14.654
Ethylbenzene	0.06%	0.06%	106.170	0.065	0.24%	Y	0.59%	0.628
Xylenes	0.60%	0.60%	106.170	0.641	2.35%	Y	5.86%	6.218
n-Octane	0.73%	0.73%	114.229	0.829	3.03%	Y	7.57%	8.652
Total	**100.00%**	**100.00%**		**27.329**	**100.00%**		**100.00%**	**79.734**

Table 11. Wet Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	2.73%	2.73%	44.010	1.203	6.09%	N		
Nitrogen	0.17%	0.17%	28.010	0.048	0.24%	N		
Methane	84.98%	84.98%	16.040	13.631	69.04%	N		
Ethane	6.81%	6.81%	30.070	2.049	10.38%	N		
Propane	3.17%	3.17%	44.100	1.398	7.08%	Y	49.67%	21.906
Isobutane	0.64%	0.64%	58.120	0.370	1.87%	Y	13.14%	7.634
n-Butane	0.71%	0.71%	58.120	0.413	2.09%	Y	14.67%	8.528
Isopentane	0.24%	0.24%	72.150	0.175	0.88%	Y	6.21%	4.478
n-Pentane	0.20%	0.20%	72.150	0.144	0.73%	Y	5.11%	3.686
n-Hexane	0.06%	0.06%	86.180	0.056	0.28%	Y	1.98%	1.710
Cyclohexane	0.03%	0.03%	84.160	0.027	0.14%	Y	0.95%	0.800
2,2-Dimethylbutane	0.00%	0.00%	86.177	0.004	0.02%	Y	0.13%	0.113
2,3-Dimethylbutane	0.02%	0.02%	86.177	0.014	0.07%	Y	0.50%	0.433
2-Methylpentane	0.05%	0.05%	86.177	0.042	0.21%	Y	1.49%	1.288
3-Methylpentane	0.03%	0.03%	86.177	0.022	0.11%	Y	0.77%	0.662
n-Heptane	0.06%	0.06%	100.202	0.059	0.30%	Y	2.09%	2.094
Methylcyclohexane	0.03%	0.03%	98.190	0.032	0.16%	Y	1.12%	1.103
2,2,4-Trimethylpentane	0.00%	0.00%	114.229	0.004	0.02%	Y	0.15%	0.176
Benzene	0.01%	0.01%	78.110	0.012	0.06%	Y	0.41%	0.323
Toluene	0.02%	0.02%	92.140	0.016	0.08%	Y	0.57%	0.525
Ethylbenzene	0.00%	0.00%	106.170	0.001	0.00%	Y	0.02%	0.020
m&p-Xylene	0.00%	0.00%	106.160	0.004	0.02%	Y	0.15%	0.164
o-Xylene	0.00%	0.00%	106.160	0.001	0.00%	Y	0.02%	0.024
n-Octane	0.01%	0.01%	114.229	0.016	0.08%	Y	0.56%	0.635
n-Nonane	0.01%	0.01%	128.255	0.008	0.04%	Y	0.27%	0.345
n-Decane	0.00%	0.00%	142.290	0.000	0.00%	Y	0.00%	0.000
Total	**100.00%**	**100.00%**		**19.745**	**100.00%**		**100.00%**	**56.648**

Table 12. Toxic Speciation Profiles Used in Future Year Emission Inventory Development for Existing Wells.

Source Type for lookup	VOC fractions						Source
	benzene	toluene	ethylbenzene	xylenes	n-hexane	formaldehyde	
venting other than well venting, initial completion and dehydrator	0.403%	0.555%	0.017%	0.320%	4.744%	0.000%	Wamsutter Produced Gas Composition
flashing loss	0.822%	1.173%	0.016%	0.632%	3.927%	0.000%	Flash speciation from Wamsutter HYSYS
Fugitive -working/breathing loss	0.830%	1.169%	0.016%	0.626%	3.965%	0.000%	Wamsutter Fugitive Composition (Post Flash)
diesel ICE	1.045%	1.518%	0.179%	1.205%	0.000%	8.510%	SPECIATE4, Profile 4674
HD traffic	1.132%	0.613%	0.152%	0.801%	0.129%	7.924%	From Catherine Yanca at EPA based on CRC E-55/E-59 Study
LD traffic	3.711%	10.147%	1.459%	5.744%	0.879%	2.456%	From David Brzezinski at EPA and MOVES
natural gas external combustion (boiler/heater)	4.000%	2.000%	0.000%	0.000%	0.000%	8.000%	SPECIATE4, Profile 0003
dust	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
compressor engine, lean burn	0.373%	0.346%	0.034%	0.156%	0.941%	44.746%	AP-42, CH 3.2
compressor engine, rich burn	5.338%	1.885%	0.084%	0.659%	0.000%	69.257%	AP-42, CH 3.2
natural gas drilling engine	0.373%	0.346%	0.034%	0.156%	0.941%	44.746%	AP-42, CH 3.2
flaring	0.000%	0.000%	0.000%	0.000%	0.000%	40.000%	SPECIATE4, Profile 1001
diesel external combustion boiler	0.000%	0.000%	0.000%	0.000%	10.800%	48.700%	SPECIATE4, Profile 0002
Reciprocating Engine	1.182%	0.430%	0.107%	0.430%	0.215%	8.700%	SPECIATE4, Profile 1001
Turbine	0.000%	0.000%	0.000%	0.000%	0.000%	100.000%	SPECIATE4, Profile 0007
produced water evaporation	13.858%	18.028%	1.529%	24.393%	0.147%	0.000%	EPA, Water 9 model Output. Based on data from evaporation facilities at Wamsutter Operations Center
Tank -working/breathing loss	0.478%	0.629%	0.009%	0.348%	3.398%	0.000%	Wamsutter Condensate Composition (Post Flash)
Dehydrator Venting	9.631%	15.905%	0.591%	5.857%	2.613%	0.000%	Wamsutter Regenerator Overhead Vent Stream Composition
venting -Well Venting and Initial completion	0.414%	0.570%	0.019%	0.177%	1.984%	0.000%	Wamsutter Wet Gas Composition

Table 13. List of Toxic Speciation Profiles Used in Emission Inventory Development for Existing Wells by Source Category.

Source Category	Speciation
Completion Equipment (diesel ICE)	diesel ICE
Completion Traffic (HD)	HD traffic
Completion Traffic (HD) Dust	dust
Completion Traffic (LD)	LD traffic
Completion Traffic (LD) Dust	dust
Compressor Station (External NG Combustion)	natural gas external combustion (boiler/heater)
Compressor Station (Flaring)	flaring
Compressor Station (Flashing)	flashing loss
Compressor Station (Turbine)	Turbine
Compressor Station (Venting)	venting other than well venting, initial completion and dehydrator
Compressor Station (Working/Breathing)	Tank -working/breathing loss
Compressor Station (Reciprocating Engine Lean Burn)	Reciprocating Engine
Compressor Station (Reciprocating Engine Rich Burn)	Reciprocating Engine
Condensate Fugitive Devices	Fugitive -working/breathing loss
Condensate Tank Breathing Flaring	flaring
Condensate Tank Breathing Losses	Tank -working/breathing loss
Condensate Tank Flashing Flaring	flaring
Condensate Tank Flashing Losses	flashing loss
Condensate Tank Working Flaring	flaring
Condensate Tank Working Losses	Tank -working/breathing loss
Construction Dust, Fugitive	dust
Construction Dust, Wind Erosion	dust
Construction Traffic, Road and Well pad (HD)	HD traffic
Construction Traffic, Road and Well pad (HD) Dust	dust
Construction Traffic, Road and Well pad (LD)	LD traffic
Construction Traffic, Road and Well pad (LD) Dust	dust
Dehydrator Venting - Well Site	Dehydrator Venting
Drilling Equip (diesel ICE)	diesel ICE
Drilling Traffic (HD)	HD traffic
Drilling Traffic (HD) Dust	dust
Drilling Traffic (LD)	LD traffic
Drilling Traffic (LD) Dust	dust
Evaporation Ponds	produced water evaporation
Gas Plant (flaring)	flaring
Gas Plant (natural gas external combustion (boiler/heater))	natural gas external combustion (boiler/heater)
Gas Plant (Reciprocating Engine)	Reciprocating Engine
Gas Plant (Turbine)	Turbine
Gas Plant (venting)	venting other than well venting, initial completion and dehydrator
Gas Stream Fugitive Devices	venting other than well venting, initial completion and dehydrator
Heaters	natural gas external combustion (boiler/heater)
Initial Completion Venting	venting -Well Venting and Initial completion
Pneumatic Devices	venting other than well venting, initial completion and dehydrator
Pneumatic Pumps	venting other than well venting, initial completion and dehydrator
Production Traffic (HD)	HD traffic
Production Traffic (HD) Dust	dust
Production Traffic (LD)	LD traffic
Production Traffic (LD) Dust	dust
Production Traffic, Central Facility (HD)	HD traffic
Production Traffic, Central Facility (HD) Dust	dust
Tank Loadout (vapor losses)	Tank -working/breathing loss
Well Pad Const Equip (diesel ICE)	diesel ICE
Well Stream Fugitive Devices	venting other than well venting, initial completion and dehydrator
Well Venting	venting -Well Venting and Initial completion
Workover Equipment (diesel ICE)	diesel ICE
WorkoverTraffic (HD)	HD traffic
WorkoverTraffic (HD) Dust	dust
WorkoverTraffic (LD)	LD traffic
WorkoverTraffic (LD) Dust	dust

2008 Well Pad Construction Equipment Emissions

ASSUMPTIONS

Activity data obtained from operator in blue text

Assumptions:

*	Emission factors from EPA Federal Diesel Engine Standards		http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
*	VOC/THC=	1.053	Conversion for HC->VOC for diesel engines (EPA, 2005; EPA420-R-05-0159, p. 5)
*	37% of fine particles assumed to be filterable and all filterable are assigned to EC (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)		
*	63% of fine particles assumed to be filterable and all filterable are assigned to SOA (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)		
	EPA NONROAD model Fully Deteriorated Tier Emission Factors		
	N2O Emission factors (g/gallons) from The Climate Registry, General Reporting Protocol v1.1, Table 13.6		

Equations:

$$\text{Emissions (tons/year-well)} = \frac{\text{Emission factor (g/hp-hr)} * \text{Horsepower} * \text{Time Used (hours)} * \text{Load}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

PM2.5/PM10 =	97%	EPA (2004) NONROAD
VOC/HC=	1.053	EPA NONROAD HC Conversions
NMHC/THC=	98.40%	EPA NONROAD HC Conversions

SO_2 Emission Factor Calculation Information

2008 Fuel Sulfur content			0.0355	sulfur fuel weight percent from EPA's NMIM County Database
soxcnv	Tiers I-III		0.02247	grams PM sulfur/grams fuel sulfur consumed
soxcnv	Tier IV		0.3	
grams PM sulfate/grams PM sulfur			7	
soxbas			0.33	
Density of Diesel Fuel	7.09	lb/gallons		
Molecular weight of S	32	g/mol		
Molecular weight of S02	64	g/mol		
	453.6	g/lb		

$$SO_2 = (BSFC * 453.6 * (1 - soxcnv) - HC) * 0.01 * soxdsl * 2$$

where

SO_2 is in g/hp-hr
BSFC is the in-use adjusted fuel consumption in lb/hp-hr
453.6 is the conversion factor from pounds to grams
soxcnv is the fraction of fuel sulfur converted to direct PM
HC is the in-use adjusted hydrocarbon emissions in g/hp-hr
0.01 is the conversion factor from weight percent to weight fraction
soxdsl is the episodic weight percent of sulfur in nonroad diesel fuel
2 is the grams of SO_2 formed from a gram of sulfur

$$CO_2 = (BSFC * 453.6 - HC) * 0.87 * (44/12)$$

Table 14. 2008 Well Pad Construction Equipment Emissions (lb/well pad) by Pollutants and by Equipment Type.

Equipment			Activity & Emission Factors	Emissions (lb/well pad)
Engine 1	Engine Function		Loader	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		200	
	Horsepower Range		175-300	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.433	
	Fuel Consumption		293	
	Emission Factors (g/bhp-hr)	NOx	6.860	72.60
		VOC	1.021	10.80
		CO	8.501	89.96
		PM10	0.403	4.26
		PM2.5	0.391	4.13
		SO2	0.136	1.44
		CO2	623	6597.37
		CH4	0.016	0.16
		PM_filt	0.145	1.53
		PM_cond	0.246	2.60
	(g/gal)	N2O	0.260	0.17
Engine 2	Engine Function		Dozer	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		500	
	Horsepower Range		300-600	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption		628	
	Emission Factors (g/bhp-hr)	NOx	6.860	181.49
		VOC	1.021	27.00
		CO	8.501	224.89
		PM10	0.403	10.65
		PM2.5	0.391	10.33
		SO2	0.116	3.07
		CO2	534	14120.07
		CH4	0.016	0.41
		PM_filt	0.145	3.82
		PM_cond	0.246	6.51
	(g/gal)	N2O	0.260	0.36
Engine 3	Engine Function		Scraper	
	Number of Engines		2	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		700	
	Horsepower Range		600-750	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption		1758	
	Emission Factors (g/bhp-hr)	NOx	6.860	508.18
		VOC	1.021	75.61
		CO	8.501	629.70
		PM10	0.403	29.83
		PM2.5	0.391	28.93
		SO2	0.116	8.60
		CO2	534	39536.20
		CH4	0.016	1.15
		PM_filt	0.145	10.71
		PM_cond	0.246	18.23
	(g/gal)	N2O	0.260	1.01

Equipment			Activity & Emission Factors	Emissions (lb/well pad)
Engine 4	Engine Function		Grader	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		350	
	Horsepower Range		300-600	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption		440	
	Emission Factors (g/bhp-hr)	NOx	6.860	127.05
		VOC	1.021	18.90
		CO	8.501	157.43
		PM10	0.403	7.46
		PM2.5	0.391	7.23
		SO2	0.116	2.15
		CO2	534	9884.05
		CH4	0.016	0.29
		PM_filt	0.145	2.68
		PM_cond	0.246	4.56
	(g/gal)	N2O	0.260	0.25
Engine 5	Engine Function		Backhoe	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		60	
	Horsepower Range		50-75	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.481	
	Fuel Consumption		98	
	Emission Factors (g/bhp-hr)	NOx	6.860	21.78
		VOC	1.314	4.17
		CO	6.425	20.40
		PM10	1.076	3.42
		PM2.5	1.044	3.31
		SO2	0.151	0.48
		CO2	692	2196.89
		CH4	0.020	0.06
		PM_filt	0.386	1.23
		PM_cond	0.658	2.09
	(g/gal)	N2O	0.260	0.06
Engine 6	Engine Function		Roller	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		200	
	Horsepower Range		175-300	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption		251	
	Emission Factors (g/bhp-hr)	NOx	6.860	72.60
		VOC	1.021	10.80
		CO	8.501	89.96
		PM10	0.403	4.26
		PM2.5	0.391	4.13
		SO2	0.116	1.23
		CO2	534	5648.03
		CH4	0.016	0.16
		PM_filt	0.145	1.53
		PM_cond	0.246	2.60
	(g/gal)	N2O	0.260	0.14

Equipment			Activity & Emission Factors	Emissions (lb/well pad)
Engine 7	Engine Function		Water Truck	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		210	
	Horsepower Range		175-300	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption		264	
	Emission Factors (g/bhp-hr)	NOx	6.860	76.23
		VOC	1.021	11.34
		CO	8.501	94.46
		PM10	0.403	4.47
		PM2.5	0.391	4.34
		SO2	0.116	1.29
		CO2	534	5930.43
		CH4	0.016	0.17
		PM_filt	0.145	1.61
		PM_cond	0.246	2.73
	(g/gal)	N2O	0.260	0.15
Engine 8	Engine Function		Dump Truck	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		330	
	Horsepower Range		300-600	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption		414	
	Emission Factors (g/bhp-hr)	NOx	6.860	119.79
		VOC	1.021	17.82
		CO	8.501	148.43
		PM10	0.403	7.03
		PM2.5	0.391	6.82
		SO2	0.116	2.03
		CO2	534	9319.25
		CH4	0.016	0.27
		PM_filt	0.145	2.52
		PM_cond	0.246	4.30
	(g/gal)	N2O	0.260	0.24
Engine 9	Engine Function		Trencher	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		250	
	Horsepower Range		175-300	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption		314	
	Emission Factors (g/bhp-hr)	NOx	6.860	90.75
		VOC	1.021	13.50
		CO	8.501	112.45
		PM10	0.403	5.33
		PM2.5	0.391	5.17
		SO2	0.116	1.54
		CO2	534	7060.04
		CH4	0.016	0.21
		PM_filt	0.145	1.91
		PM_cond	0.246	3.25
	(g/gal)	N2O	0.260	0.18

Table 15. Summary of 2008 Well Pad Construction Emissions (lb/well pad) by Pollutants for All Equipment.

Equipment Type	Pollutant	Emissions (lb/year-well pad)
Well Pad Construction Equipment	NOx	1,270
	VOC	190
	CO	1,568
	PM10	77
	PM2.5	74
	SO2	22
	CO2	100,292
	CH4	3
	PM_filt	28
	PM_cond	47
	N2O	3

Table 16. 2008 Well Pad Construction Equipment Emissions in tons per pad.

Description	Well Pad Construction Equipment Emissions (tons per pad)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Well Pad Const Equip (diesel ICE)	0.6352	0.0950	0.7838	0.0384	0.0372	0.0109	50.1462	0.0014	0.0138	0.0234	0.0013	new pads

Table 17. Percent Change in Emission from Base Year 2008 for Well Pad Construction (aggregate factors to apply to total emissions across all equipment types).

Technology Assumption	Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
Tier 1	2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2019	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2020	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2021	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2022	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2023	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2024	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2025	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2026	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2027	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2028	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2029	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2030	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2031	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2032	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2033	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2034	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2035	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2036	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2037	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Drilling and Completion Equipment Emissions

ASSUMPTIONS

Data provided by operators in blue text

Annual drill rig and well completion emissions (NO_x, CO, VOC, SO_2, and PM_{10}) were developed for all drill rig and completion events that were recorded in the CDC project area during 2008. Emissions were developed based on Wyoming Oil and Gas Conservation Commission (WOGCC) data and from data provided by the operators to the WDEQ-AQD as part of the 2008 minor source inventory submittals.

Well spud date and well depth data were obtained from the Wyoming Oil and Gas Commission (WOGCC) for all wells drilled in the project area beginning in November 2007 through December 2008. Well identification numbers were crossed checked between the WOGCC data and the WDEQ inventory files. Based on this comparison three data groups were established:

(1) Drilling and completion events that were included in the WDEQ data but not listed in the WOGCC database.

(2) Drilling and completion events common to both the WDEQ operator data and to WOGCC files.

(3) WOGCC well spud data information that was not included the WDEQ operator data.

The operator provided well completion data included in groups (1) and (2) were incorporated directly into the database.

For data group (3), where WOGCC spud information was available but no operator data were provided, average drilling rig emissions were developed from the operator data in group (2) and average completion emissions were developed from the operator data in groups (1) and (2). Specifically, average drill rig emissions and average well depth were determined for the wells in group (2). The drill rig emissions for wells in group (3) were determined by scaling the average emissions from the group (2) wells by the ratio of the average well depth of group (2) wells by the well depth of the group (3) well. [Note group (1) drilling data did not include WOGCC well depth so it was not used for the group (3) averages] Average completion emissions for the group (1) and (2) wells were applied for all group (3) wells. Where information was available that indicated that a drilling event had not completed during 2008 then completion emissions were not applied to these wells. For these drilling events, the drilling emissions were scaled based on the percent completed during 2008.

Diesel Exhuast HC conversions (source: EPA NONROAD model documentation)

VOC/THC	1.053
NMHC/THC	0.984
CH4/THC	0.016
CH4/VOC	0.015

Diesel Exhuast PM2.5 conversions (source: EPA NONROAD model documentation)

PM2.5/PM10	97%

Fuel Consumption	**Drilling**	**Completion**	
fuel sulfur	355	355	ppmw
fuel consumption	28,022,106	22,336,171	gallons
CO2/fuel consumption	10.21	10.21	kgCO2/gallon (source Climate Registry GHG Protocol)
diesel density	7.1	7.1	pounds/gallon
conversion	2.204	2.204	pounds/kilogram
CO2/fuel consumption	3.169	3.169	lbCO2/lbfuel
CO2 emissions	44,407	35,396	tons
N2O emission factor	0.260	0.260	grams/gallons
Molecular weight of S	32	32	g/mol
Molecular weight of S02	64	64	g/mol

Per NSPS Guidance, 37% of fine particles assumed to be filterable and all filterable are assigned to EC
Per NSPS Guidance, 63% of fine particles assumed to be filterable and all filterable are assigned toSOA

Venting GHG Conversions

VOC Fraction (weight)	15%
CO2 Fraction (weight)	6%
CH4 Fraction (weight)	69%
CH4/VOC	471%
CO2/VOC	42%

Table 18. Summary of 2008 Drilling and Completion Emissions (tons/year) by Pollutant.

Emissions (tons/year)	Drilling	Completion (diesel ICE)	Completion (venting)
NOx	1166.3	168.8	0.0
VOC	105.9	0.0	129.8
CO	503.8	131.7	0.0
PM10	55.8	12.4	0.0
PM2.5	54.1	12.0	0.0
SO2	70.6	56.3	0.0
CO2	44,406.8	35,396.3	53.9
CH4	1.6	0.0	611.0
PM_filt	20.0	4.4	0.0
PM_cond	34.1	7.6	0.0
N2O	8.0	6.4	0.0

assumed all VOC emissions from venting

Table 19. Total 2008 Drilling and Completion Equipment Emissions in tons per year.

Description	Drill Rig Emissions - total 2008 tons per year											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Drilling Equip (diesel ICE)	1,166.29	105.91	503.84	55.75	54.08	70.63	44,406.83	1.61	20.01	34.07	8.03	totals for year with spuds
Completion Equipment (diesel ICE)	168.79	0	131.70	12.37	11.99	56.30	35,396.29	0	4.44	7.56	6.40	totals for year with spuds
Initial Completion Venting	0	129.77	0	0	0	0	53.91	610.97	0	0	0	totals for year with spuds

Table 20. Percent Change in Emission from Base Year 2008 for Drilling and Completion (aggregate factors to apply to total emissions across all equipment types).

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%

unused values - no drilling activity post-2008

2008 Well Pad and Access Road Construction Traffic Emissions

ASSUMPTIONS

Data provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.
Data for Number of Days of Measurable (>0.01") Precipitation
Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE 2008 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH CONSTRUCTION TRAFFIC.

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} \cdot \frac{(365-P)}{365} \cdot (\text{Control Efficiency})$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 21. Summary of Traffic Activity Data Associated with Well Pad and Access Road Construction Phase.

Equipment Type	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Well
Light Truck	20	20	14
Heavy Truck	20	20	21

Table 22. 2008 Exhaust Emissions (lb/pad) Associated with Well Pad and Access Road Construction Traffic by Vehicle Type.

Vehicle Type	Pollutant	2008 Emission Factors (g/mile)	Base year Emissions (lb/well pad)
Light-Duty Truck	NOx	2.67	1.649
	SO2	0.02	0.015
	CO	19.44	12.002
	CO2	677.28	418
	VOC	1.57	0.968
	PM10	0.09	0.056
	PM2.5	0.09	0.053
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.057
	N2O	0.05	0.030
Heavy-Duty Truck	NOx	21.75	20.140
	SO2	0.08	0.076
	CO	15.96	14.782
	CO2	2612.85	2419.310
	VOC	1.93	1.789
	PM10	1.30	1.206
	PM2.5	1.26	1.169
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.084
	N2O	0.04	0.035

Table 23. Summary of 2008 Fugitive Dust Emissions (tons/well pad) Associated with Well Pad and Access Road Construction Traffic.

Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
								Em. Factor (lb/VMT)	Emissions (tpy/well)	Em. Factor (lb/VMT)	Emissions (tpy/well)
Travel to well	Light truck	7,000	20	14	14	20	280	0.20	0.03	0.02	0.00
Travel to well	Heavy Truck	70,000	20	21	21	20	420	0.20	0.04	0.02	0.00
							Total		**0.07**		**0.01**

Table 24. 2008 Exhaust and Fugitive Dust Emissions Associated with Well Pad and Access Road Construction Traffic in tons per well pad.

Description	Total Road and Well Pad Construction Traffic Emissions (tons per well pad)											Projection	Fugitive Road	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
Construction Traffic, Road and Well pad (LD)	0.0008	0.0005	0.0060	2.79E-05	2.65E-05	7.30E-06	0.2090	2.86E-05	0	0	1.50E-05	new pads	0.0277	0.0028
Construction Traffic, Road and Well pad (HD)	0.0101	0.0009	0.0074	0.0006	0.0006	3.80E-05	1.2097	4.18E-05	0	0	1.73E-05	new pads	0.0416	0.0041

Table 25. Percent Change in Emission from Base Year 2008 due to Fleet Turnover for Well Pad and Access Road Construction Traffic.

Year	Light-Duty Truck											Heavy-Duty Truck										
	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	-6%	-39%	-6%	0%	-6%	-4%	-4%	0%	0%	-8%	-6%	-7%	-2%	-6%	0%	-4%	-7%	-7%	0%	0%	0%	-5%
2010	-10%	-46%	-10%	-1%	-10%	-9%	-9%	0%	0%	-12%	-12%	-16%	-47%	-9%	0%	-6%	-14%	-14%	0%	0%	4%	-10%
2011	-15%	-50%	-13%	-2%	-15%	-16%	-16%	0%	0%	-15%	-19%	-25%	-75%	-14%	0%	-13%	-24%	-24%	0%	0%	13%	-16%
2012	-21%	-55%	-16%	-3%	-21%	-22%	-22%	0%	0%	-19%	-25%	-33%	-75%	-19%	0%	-21%	-33%	-33%	0%	0%	20%	-21%
2013	-26%	-56%	-20%	-4%	-26%	-27%	-28%	0%	0%	-22%	-32%	-41%	-76%	-24%	0%	-28%	-41%	-41%	0%	0%	24%	-27%
2014	-32%	-57%	-24%	-5%	-32%	-33%	-33%	0%	0%	-25%	-37%	-48%	-76%	-28%	0%	-34%	-49%	-49%	0%	0%	28%	-32%
2015	-37%	-57%	-27%	-7%	-36%	-38%	-38%	0%	0%	-28%	-42%	-54%	-76%	-32%	0%	-40%	-56%	-56%	0%	0%	30%	-36%
2016	-42%	-58%	-30%	-9%	-41%	-42%	-43%	0%	0%	-31%	-47%	-60%	-77%	-37%	0%	-46%	-63%	-63%	0%	0%	31%	-40%
2017	-46%	-59%	-33%	-10%	-45%	-46%	-47%	0%	0%	-34%	-51%	-65%	-77%	-40%	0%	-51%	-68%	-68%	0%	0%	32%	-44%
2018	-50%	-60%	-35%	-12%	-49%	-50%	-50%	0%	0%	-36%	-55%	-69%	-77%	-43%	0%	-56%	-73%	-73%	0%	0%	32%	-47%
2019	-53%	-60%	-37%	-13%	-52%	-53%	-53%	0%	0%	-38%	-58%	-73%	-77%	-45%	0%	-60%	-77%	-77%	0%	0%	33%	-50%
2020	-57%	-61%	-38%	-14%	-55%	-55%	-56%	0%	0%	-39%	-61%	-76%	-77%	-47%	0%	-64%	-81%	-81%	0%	0%	34%	-53%
2021	-59%	-62%	-40%	-16%	-58%	-57%	-58%	0%	0%	-41%	-64%	-78%	-77%	-49%	0%	-67%	-83%	-83%	0%	0%	34%	-55%
2022	-66%	-63%	-44%	-19%	-64%	-63%	-64%	0%	0%	-43%	-71%	-84%	-78%	-53%	0%	-74%	-90%	-90%	0%	0%	34%	-61%
2023	-62%	-62%	-41%	-17%	-60%	-59%	-60%	0%	0%	-42%	-67%	-81%	-78%	-51%	0%	-70%	-86%	-86%	0%	0%	34%	-58%
2024	-64%	-63%	-43%	-18%	-63%	-61%	-62%	0%	0%	-43%	-69%	-82%	-78%	-52%	0%	-72%	-88%	-88%	0%	0%	34%	-60%
2025	-68%	-64%	-45%	-19%	-67%	-64%	-65%	0%	0%	-44%	-72%	-85%	-78%	-54%	0%	-76%	-91%	-91%	0%	0%	34%	-63%
2026	-70%	-64%	-46%	-20%	-69%	-66%	-66%	0%	0%	-43%	-74%	-86%	-78%	-56%	0%	-79%	-92%	-92%	0%	0%	36%	-65%
2027	-71%	-64%	-47%	-21%	-71%	-67%	-68%	0%	0%	-43%	-75%	-87%	-78%	-56%	0%	-80%	-93%	-93%	0%	0%	36%	-66%
2028	-72%	-64%	-48%	-21%	-72%	-68%	-69%	0%	0%	-44%	-76%	-88%	-78%	-57%	0%	-81%	-94%	-94%	0%	0%	36%	-67%
2029	-73%	-65%	-48%	-22%	-73%	-69%	-70%	0%	0%	-45%	-78%	-88%	-78%	-58%	0%	-83%	-94%	-94%	0%	0%	35%	-68%
2030	-74%	-65%	-49%	-22%	-75%	-70%	-70%	0%	0%	-45%	-78%	-89%	-78%	-58%	0%	-84%	-95%	-95%	0%	0%	35%	-69%
2031	-75%	-65%	-50%	-23%	-76%	-70%	-71%	0%	0%	-47%	-79%	-89%	-78%	-59%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2032	-76%	-65%	-50%	-23%	-76%	-71%	-72%	0%	0%	-47%	-80%	-89%	-78%	-60%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2033	-77%	-66%	-51%	-24%	-77%	-72%	-72%	0%	0%	-48%	-80%	-89%	-78%	-61%	0%	-86%	-95%	-95%	0%	0%	33%	-71%
2034	-77%	-66%	-52%	-24%	-78%	-72%	-73%	0%	0%	-48%	-81%	-90%	-78%	-61%	0%	-86%	-96%	-96%	0%	0%	33%	-71%
2035	-78%	-66%	-52%	-24%	-78%	-73%	-73%	0%	0%	-48%	-81%	-90%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	33%	-72%
2036	-78%	-66%	-53%	-24%	-79%	-73%	-74%	0%	0%	-49%	-81%	-90%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	32%	-72%
2037	-78%	-66%	-53%	-25%	-79%	-73%	-74%	0%	0%	-49%	-81%	-90%	-78%	-63%	-1%	-87%	-96%	-96%	0%	0%	32%	-72%

2008 Drilling Construction Traffic Emissions

ASSUMPTIONS

Data Provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.
Data for Number of Days of Measurable (>0.01") Precipitation
Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE 2008 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH DRILLING TRAFFIC

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} \cdot \frac{(365-P)}{365} \cdot (\text{Control Efficiency})$$

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources* , Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 26. Summary of Traffic Activity Data Associated with Drilling Phase.

Equipment Type	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Well
Light Truck	20	20	98
Heavy Truck	20	20	224

Table 27. 2008 Exhaust Emissions (lb/spud) Associated with Drilling Traffic by Vehicle Type.

Vehicle Type	Pollutant	2008 Emission Factors (g/mile)	Base year Emissions (lb/spud)
Light-Duty Truck	NOx	2.67	11.546
	SO2	0.02	0.102
	CO	19.44	84.017
	CO2	677.28	2927
	VOC	1.57	6.777
	PM10	0.09	0.390
	PM2.5	0.09	0.370
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.401
	N2O	0.05	0.209
Heavy-Duty Truck	NOx	21.75	214.823
	SO2	0.08	0.810
	CO	15.96	157.678
	CO2	2612.85	25805.971
	VOC	1.93	19.086
	PM10	1.30	12.868
	PM2.5	1.26	12.474
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.893
	N2O	0.04	0.369

Table 28. Summary of 2008 Fugitive Dust Emissions (tons/spud) Associated with Drilling Traffic.

Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
							Em. Factor (lb/VMT)	Emissions (tpy/spudl)	Em. Factor (lb/VMT)	Emissions (tpy/spud)
Light truck	7,000	20	98	98	20	1960	0.20	0.1940	0.02	0.0193
Heavy Truck	70,000	20	224	224	20	4480	0.20	0.4435	0.02	0.0440
						Total	**0.40**	**0.64**	**0.04**	**0.06**

Table 29. 2008 Exhaust and Fugitive Dust Emissions Associated with Drilling Traffic in tons per spud.

Description	Total Drill Traffic Emissions (tons per spud)											Projection	Fugitive Road Dust	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
Drilling Traffic (LD)	0.0058	0.0034	0.0420	0.0002	0.0002	5.11E-05	1.4633	0.0002	0	0	0.0001	total spuds	0.1940	0.0193
Drilling Traffic (HD)	0.1074	0.0095	0.0788	0.0064	0.0062	0.0004	12.9030	0.0004	0	0	0.0002	total spuds	0.4435	0.0440

Table 30. Percent Change in Emission from Base Year 2008 Due to Fleet Turnover for Drilling Traffic.

	Light-Duty Truck											Heavy-Duty Truck										
Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	-6%	-39%	-6%	0%	-6%	-4%	-4%	0%	0%	-8%	-6%	-7%	-2%	-6%	0%	-4%	-7%	-7%	0%	0%	0%	-5%
2010	-10%	-46%	-10%	-1%	-10%	-9%	-9%	0%	0%	-12%	-12%	-16%	-47%	-9%	0%	-6%	-14%	-14%	0%	0%	4%	-10%
2011	-15%	-50%	-13%	-2%	-15%	-16%	-16%	0%	0%	-15%	-19%	-25%	-75%	-14%	0%	-13%	-24%	-24%	0%	0%	13%	-16%
2012	-21%	-55%	-16%	-3%	-21%	-22%	-22%	0%	0%	-19%	-25%	-33%	-75%	-19%	0%	-21%	-33%	-33%	0%	0%	20%	-21%
2013	-26%	-56%	-20%	-4%	-26%	-27%	-28%	0%	0%	-22%	-32%	-41%	-76%	-24%	0%	-28%	-41%	-41%	0%	0%	24%	-27%
2014	-32%	-57%	-24%	-5%	-32%	-33%	-33%	0%	0%	-25%	-37%	-48%	-76%	-28%	0%	-34%	-49%	-49%	0%	0%	28%	-32%
2015	-37%	-57%	-27%	-7%	-36%	-38%	-38%	0%	0%	-28%	-42%	-54%	-76%	-32%	0%	-40%	-56%	-56%	0%	0%	30%	-36%
2016	-42%	-58%	-30%	-9%	-41%	-42%	-43%	0%	0%	-31%	-47%	-60%	-77%	-37%	0%	-46%	-63%	-63%	0%	0%	31%	-40%
2017	-46%	-59%	-33%	-10%	-45%	-46%	-47%	0%	0%	-34%	-51%	-65%	-77%	-40%	0%	-51%	-68%	-68%	0%	0%	32%	-44%
2018	-50%	-60%	-35%	-12%	-49%	-50%	-50%	0%	0%	-36%	-55%	-69%	-77%	-43%	0%	-56%	-73%	-73%	0%	0%	32%	-47%
2019	-53%	-60%	-37%	-13%	-52%	-53%	-53%	0%	0%	-38%	-58%	-73%	-77%	-45%	0%	-60%	-77%	-77%	0%	0%	33%	-50%
2020	-57%	-61%	-38%	-14%	-55%	-55%	-56%	0%	0%	-39%	-61%	-76%	-77%	-47%	0%	-64%	-81%	-81%	0%	0%	34%	-53%
2021	-59%	-62%	-40%	-16%	-58%	-57%	-58%	0%	0%	-41%	-64%	-78%	-77%	-49%	0%	-67%	-83%	-83%	0%	0%	34%	-55%
2022	-66%	-63%	-44%	-19%	-64%	-63%	-64%	0%	0%	-43%	-71%	-84%	-78%	-53%	0%	-74%	-90%	-90%	0%	0%	34%	-61%
2023	-62%	-62%	-41%	-17%	-60%	-59%	-60%	0%	0%	-42%	-67%	-81%	-78%	-51%	0%	-70%	-86%	-86%	0%	0%	34%	-58%
2024	-64%	-63%	-43%	-18%	-63%	-61%	-62%	0%	0%	-43%	-69%	-82%	-78%	-52%	0%	-72%	-88%	-88%	0%	0%	34%	-60%
2025	-68%	-64%	-45%	-19%	-67%	-64%	-65%	0%	0%	-44%	-72%	-85%	-78%	-54%	0%	-76%	-91%	-91%	0%	0%	34%	-63%
2026	-70%	-64%	-46%	-20%	-69%	-66%	-66%	0%	0%	-43%	-74%	-86%	-78%	-56%	0%	-79%	-92%	-92%	0%	0%	36%	-65%
2027	-71%	-64%	-47%	-21%	-71%	-67%	-68%	0%	0%	-43%	-75%	-87%	-78%	-56%	0%	-80%	-93%	-93%	0%	0%	36%	-66%
2028	-72%	-64%	-48%	-21%	-72%	-68%	-69%	0%	0%	-44%	-76%	-88%	-78%	-57%	0%	-81%	-94%	-94%	0%	0%	36%	-67%
2029	-73%	-65%	-48%	-22%	-73%	-69%	-70%	0%	0%	-45%	-78%	-88%	-78%	-58%	0%	-83%	-94%	-94%	0%	0%	35%	-68%
2030	-74%	-65%	-49%	-22%	-75%	-70%	-70%	0%	0%	-45%	-78%	-89%	-78%	-58%	0%	-84%	-95%	-95%	0%	0%	35%	-69%
2031	-75%	-65%	-50%	-23%	-76%	-70%	-71%	0%	0%	-47%	-79%	-89%	-78%	-59%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2032	-76%	-65%	-50%	-23%	-76%	-71%	-72%	0%	0%	-47%	-80%	-89%	-78%	-60%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2033	-77%	-66%	-51%	-24%	-77%	-72%	-72%	0%	0%	-48%	-80%	-89%	-78%	-61%	0%	-86%	-95%	-95%	0%	0%	33%	-71%
2034	-77%	-66%	-52%	-24%	-78%	-72%	-73%	0%	0%	-48%	-81%	-90%	-78%	-61%	0%	-86%	-96%	-96%	0%	0%	33%	-71%
2035	-78%	-66%	-52%	-24%	-78%	-73%	-73%	0%	0%	-48%	-81%	-90%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	33%	-72%
2036	-78%	-66%	-53%	-24%	-79%	-73%	-74%	0%	0%	-49%	-81%	-90%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	32%	-72%
2037	-78%	-66%	-53%	-25%	-79%	-73%	-74%	0%	0%	-49%	-81%	-90%	-78%	-63%	-1%	-87%	-96%	-96%	0%	0%	32%	-72%

2008 Well Completion Traffic Emissions

ASSUMPTIONS

Data Provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.

Data for Number of Days of Measurable (>0.01") Precipitation

Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE 2008 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH WELL COMPLETION TRAFFIC

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} * \frac{(365-P)}{365} * (\text{Control Efficiency})$$

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 31. Summary of Traffic Activity Data Associated with Well Completion Phase.

Equipment Type	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Well
Light Truck	20	20	66
Heavy Truck	20	20	138

Table 32. 2008 Exhaust Emissions (lb/spud) Associated with Completion Traffic by Vehicle Type.

Vehicle Type	Pollutant	2008 Emission Factors (g/mile)	Base year Emissions (lb/spud)
Light-Duty Truck	NOx	2.67	7.776
	SO2	0.02	0.069
	CO	19.44	56.583
	CO2	677.28	1971
	VOC	1.57	4.564
	PM10	0.09	0.263
	PM2.5	0.09	0.249
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.270
	N2O	0.05	0.141
Heavy-Duty Truck	NOx	21.75	132.347
	SO2	0.08	0.499
	CO	15.96	97.141
	CO2	2612.85	15898.322
	VOC	1.93	11.759
	PM10	1.30	7.927
	PM2.5	1.26	7.685
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.550
	N2O	0.04	0.227

Table 33. Summary of 2008 Fugitive Dust Emissions (tons/spud) Associated with Well Completion Traffic.

Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
								Em. Factor (lb/VMT)	Emissions (tpy/spud)	Em. Factor (lb/VMT)	Emissions (tpy/spud)
Travel to well	Light truck	7,000	20	66	66	20	1320	0.20	0.13	0.02	0.01
Travel to well	Heavy Truck	70,000	20	138	138	20	2760	0.20	0.27	0.02	0.03
							Total	**0.40**	**0.40**	**0.04**	**0.04**

Table 34. 2008 Exhaust and Fugitive Dust Emissions Associated with Well Completion Traffic in tons per spud.

Description	Total Completion Traffic Emissions (tons per spud)											Projection	Fugitive Road Dust	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
Completion Traffic (LD)	0.0039	0.0023	0.0283	0.0001	0.0001	3.44E-05	0.9855	0.0001	0	0	7.05E-05	total spuds	0.1307	0.0130
Completion Traffic (HD)	0.0662	0.0059	0.0486	0.0040	0.0038	0.0002	7.9492	0.0003	0	0	0.0001	total spuds	0.2732	0.0271

Table 35. Percent Change in Emission from Base Year 2008 Due to Fleet Turnover for Well Completion Traffic.

Year	Light-Duty Truck											Heavy-Duty Truck										
	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	-6%	-39%	-6%	0%	-6%	-4%	-4%	0%	0%	-8%	-6%	-7%	-2%	-6%	0%	-4%	-7%	-7%	0%	0%	0%	-5%
2010	-10%	-46%	-10%	-1%	-10%	-9%	-9%	0%	0%	-12%	-12%	-16%	-47%	-9%	0%	-6%	-14%	-14%	0%	0%	4%	-10%
2011	-15%	-50%	-13%	-2%	-15%	-16%	-16%	0%	0%	-15%	-19%	-25%	-75%	-14%	0%	-13%	-24%	-24%	0%	0%	13%	-16%
2012	-21%	-55%	-16%	-3%	-21%	-22%	-22%	0%	0%	-19%	-25%	-33%	-75%	-19%	0%	-21%	-33%	-33%	0%	0%	20%	-21%
2013	-26%	-56%	-20%	-4%	-26%	-27%	-28%	0%	0%	-22%	-32%	-41%	-76%	-24%	0%	-28%	-41%	-41%	0%	0%	24%	-27%
2014	-32%	-57%	-24%	-5%	-32%	-33%	-33%	0%	0%	-25%	-37%	-48%	-76%	-28%	0%	-34%	-49%	-49%	0%	0%	28%	-32%
2015	-37%	-57%	-27%	-7%	-36%	-38%	-38%	0%	0%	-28%	-42%	-54%	-76%	-32%	0%	-40%	-56%	-56%	0%	0%	30%	-36%
2016	-42%	-58%	-30%	-9%	-41%	-42%	-43%	0%	0%	-31%	-47%	-60%	-77%	-37%	0%	-46%	-63%	-63%	0%	0%	31%	-40%
2017	-46%	-59%	-33%	-10%	-45%	-46%	-47%	0%	0%	-34%	-51%	-65%	-77%	-40%	0%	-51%	-68%	-68%	0%	0%	32%	-44%
2018	-50%	-60%	-35%	-12%	-49%	-50%	-50%	0%	0%	-36%	-55%	-69%	-77%	-43%	0%	-56%	-73%	-73%	0%	0%	32%	-47%
2019	-53%	-60%	-37%	-13%	-52%	-53%	-53%	0%	0%	-38%	-58%	-73%	-77%	-45%	0%	-60%	-77%	-77%	0%	0%	33%	-50%
2020	-57%	-61%	-38%	-14%	-55%	-55%	-56%	0%	0%	-39%	-61%	-76%	-77%	-47%	0%	-64%	-81%	-81%	0%	0%	34%	-53%
2021	-59%	-62%	-40%	-16%	-58%	-57%	-58%	0%	0%	-41%	-64%	-78%	-77%	-49%	0%	-67%	-83%	-83%	0%	0%	34%	-55%
2022	-66%	-63%	-44%	-19%	-64%	-63%	-64%	0%	0%	-43%	-71%	-84%	-78%	-53%	0%	-74%	-90%	-90%	0%	0%	34%	-61%
2023	-62%	-62%	-41%	-17%	-60%	-59%	-60%	0%	0%	-42%	-67%	-81%	-78%	-51%	0%	-70%	-86%	-86%	0%	0%	34%	-58%
2024	-64%	-63%	-43%	-18%	-63%	-61%	-62%	0%	0%	-43%	-69%	-82%	-78%	-52%	0%	-72%	-88%	-88%	0%	0%	34%	-60%
2025	-68%	-64%	-45%	-19%	-67%	-64%	-65%	0%	0%	-44%	-72%	-85%	-78%	-54%	0%	-76%	-91%	-91%	0%	0%	34%	-63%
2026	-70%	-64%	-46%	-20%	-69%	-66%	-66%	0%	0%	-43%	-74%	-86%	-78%	-56%	0%	-79%	-92%	-92%	0%	0%	36%	-65%
2027	-71%	-64%	-47%	-21%	-71%	-67%	-68%	0%	0%	-43%	-75%	-87%	-78%	-56%	0%	-80%	-93%	-93%	0%	0%	36%	-66%
2028	-72%	-64%	-48%	-21%	-72%	-68%	-69%	0%	0%	-44%	-76%	-88%	-78%	-57%	0%	-81%	-94%	-94%	0%	0%	36%	-67%
2029	-73%	-65%	-48%	-22%	-73%	-69%	-70%	0%	0%	-45%	-78%	-88%	-78%	-58%	0%	-83%	-94%	-94%	0%	0%	35%	-68%
2030	-74%	-65%	-49%	-22%	-75%	-70%	-70%	0%	0%	-45%	-78%	-89%	-78%	-58%	0%	-84%	-95%	-95%	0%	0%	35%	-69%
2031	-75%	-65%	-50%	-23%	-76%	-70%	-71%	0%	0%	-47%	-79%	-89%	-78%	-59%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2032	-76%	-65%	-50%	-23%	-76%	-71%	-72%	0%	0%	-47%	-80%	-89%	-78%	-60%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2033	-77%	-66%	-51%	-24%	-77%	-72%	-72%	0%	0%	-48%	-80%	-89%	-78%	-61%	0%	-86%	-95%	-95%	0%	0%	33%	-71%
2034	-77%	-66%	-52%	-24%	-78%	-72%	-73%	0%	0%	-48%	-81%	-90%	-78%	-61%	0%	-86%	-96%	-96%	0%	0%	33%	-71%
2035	-78%	-66%	-52%	-24%	-78%	-73%	-73%	0%	0%	-48%	-81%	-90%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	33%	-72%
2036	-78%	-66%	-53%	-24%	-79%	-73%	-74%	0%	0%	-49%	-81%	-90%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	32%	-72%
2037	-78%	-66%	-53%	-25%	-79%	-73%	-74%	0%	0%	-49%	-81%	-90%	-78%	-63%	-1%	-87%	-96%	-96%	0%	0%	32%	-72%

2008 Construction Fugitive Dust Emissions

ASSUMPTIONS

Watering control efficiency assumed to be 50%

Information from operators:

Data Provided by operator in blue text

Equations

Emissions equations from AP-42 Table 11.9-1 for Bulldozing Overburden emissions, Western Surface Coal Mining

For total suspended particles (TSP) ≤ 30 microns:
Emissions (TSP lbs/hr) =[5.7 s^1.2 / M ^1.3] * Control Efficiency

For PM ≤ 15 microns:
Emissions (PM15 lbs/hr) =[1.0 s^1.5 / M ^1.4] * Control Efficiency

Emissions (PM10 lbs/hr) = PM15 * 0.75
Emissions (PM2.5 lbs/hr) = TSP * 0.105

See variables definition in following table:

Table 36. Parameters Used in Emission Equations.

Description	Parameter	Reference
Watering control efficiency	50%	Control of Open Fugitive Dust Sources, Section 5.3.1 Watering of Unpaved Surfaces (1988). EPA
M=soil moisture content	7.9	(AP-42 Table 11.9-3)
s=Soil silt content	6.9	(AP-42 Table 11.9-3)
PM10 multiplier	0.75	(AP-42 Table 11.9-1)
PM2.5 multiplier	0.105	(AP-42 Table 11.9-1)

Table 37. Summary of 2008 Well Pad and Pipeline Construction Equipment Utilization Data.

Phase	Equipment Tye	# Units	Time Used Per Pad (hours)
Well Pad-Access Road Construction	Loader	1	60
Well Pad-Access Road Construction	Dozer	1	60
Well Pad-Access Road Construction	Scraper	2	60
Well Pad-Access Road Construction	Grader	1	60
Well Pad-Access Road Construction	Backhoe	1	60
Well Pad-Access Road Construction	Roller	1	60
Well Pad-Access Road Construction	Water Truck	1	60
Well Pad-Access Road Construction	Dump Truck	1	60
Well Pad-Access Road Construction	Trencher	1	60

* assumed hours of use consistent with activity estimates used in equipment exhaust emission estimates

Table 38. Summary of 2008 Fugitive Dust Emissions (tons/well pad) from Well Pad and Access Road Construction Equipment.

Phase	Equipment Type	TSP	PM10	PM2.5	PM15
Well Pad-Access Road Construction	Loader	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Dozer	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Scraper	0.1182	0.0226	0.0124	0.0301
Well Pad-Access Road Construction	Grader	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Backhoe	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Roller	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Water Truck	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Dump Truck	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Trencher	0.0591	0.0113	0.0062	0.0151
	Total	**0.5911**	**0.1129**	**0.0621**	**0.1506**

Table 39. 2008 Construction Fugitive Dust Emissions in tons per well pad.

Description	Construction Fugitive Dust Emissions (tons per well pad)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Construction Dust, Fugitive	0	0	0	0.1129	0.0621	0	0	0	0	0	0	new pads

Table 40. Percent Change in Emission from Base Year 2008 for Construction Fugitive Dust.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Construction Wind Erosion Emissions

ASSUMPTIONS

Data obtained from operators in blue text

Disturbed Area Per Well:

Disturbed Ar 235224 ft^2 21853.05 m^2

1 Acre 43,560 square feet

* AP-42 methodology described to the right was implemented in a computer program with hourly wind speed data
* 2007, 2008, and 2009 Wind Speed data from the Wamsutter Station were used as inputs
* Of all years evaluated, 2007 showed the greatest per pad wind erosion emissions:

$$\text{Emissions}\left(\frac{\text{tons}}{\text{yr}}\right) = \frac{\text{k* Erosion Potential (g/m2/year) * Disturbed Area (m2) * (\#Disturbances/year)}}{\text{453.6 (g/lb) *2000 (lbs/ton)}}$$

Friction Velocity $U^* = 0.053\ U_{10}^*$ (AP-42 Section 13.2.5.3 Equation 4)

Erosion Potential P (g/m^2-time) = $58(U^*-U_t^*)^2 + 25(U^*-Ut^*)$ for $U^*>U_t^*$; P=0 otherwise (AP-42 Section 13.2.5.3 Equation 3)

k is a particle size multiplier that depends on the aerodynamic size of the particle (from AP-42 Section 13.2.5.3).
k = 0.5 for PM10
k = 0.075 for PM2.5

1.02 m/s = Threshold friction velocity for well pads (AP-42 Table 13.2.5-2 Overburden, Western Surface Coal Mine)
1.33 m/s = Threshold friction velocity for roads (AP-42 Table 13.2.5-2 Roadbed Material)
0.5 = Particle size multiplier for PM10
0.075 = Particle size multiplier for PM2.5
1 squ mile = 640 acres

Table 41. 2008 Construction Dust Wind Erosion Emissions in tons per well pad.

Description	Construction Dust Wind Erosion Emissions (tons/well pad)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Construction Dust, Wind Erosion	0	0	0	3.06E-01	4.59E-02	0	0	0	0	0	0	new pads

Table 42. Percent Change in Emission from Base Year 2008 for Construction Dust Wind Erosion.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Workover Equipment Emissions

ASSUMPTIONS

Activity data obtained from operators in blue text

Assumptions:

* Emission factors from EPA Federal Diesel Engine Standards http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
* Crankcase Emission factors are 2% of HC Exhaust Emission Factor for Tier II and earlier per
* EPA NONROAD Modeling Guidance p. 23 (EPA, 2004; EPA420-P-04-009).
* VOC/THC= 1.053 Conversion for HC->VOC for diesel engines (EPA, 2005; EPA420-R-05-0159, p. 5)
* 37% of fine particles assumed to be filterable and all filterable are assigned to EC (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)
* 63% of fine particles assumed to be filterable and all filterable are assigned to SOA (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)

EPA NONROAD model Fully Deteriorated Tier 0 Emission Factors

N2O Emission factors (g/gallons) from The Climate Registry, General Reporting Protocol v1.1, Table 13.6

Equations:

$$\text{Emissions (tons/year-well)} = \frac{\text{Emission factor (g/hp-hr)} * \text{Horsepower} * \text{Time Used (hours)} * \text{Load}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

PM2.5/PM10 =	97%	EPA (2004) NONROAD
VOC/HC	1.053	EPA NONROAD HC Conversions
NMHC/THC	98.40%	EPA NONROAD HC Conversions

SO2 Emission Factor Calculation Information

2008 Fuel Sulfur content		0.0355	sulfur fuel weight percent From NMIM
soxcnv	Tiers I-III	0.02247	grams PM sulfur/grams fuel sulfur consumed
soxcnv	Tier IV	0.3	
grams PM sulfate/grams PM sulfur		7	
soxbas		0.33	
Density of Diesel Fuel	7.09	lb/gallons	
Molecular weight of S	32	g/mol	
Molecular weight of S02	64	g/mol	
	453.6	g/lb	

The model does not require an SO_2 emission factors input file either. EPA will calculate SO_2 emission factors as shown in the equation below.

$$SO_2 = (BSFC * 453.6 * (1 - soxcnv) - HC) * 0.01 * soxdsl * 2 \qquad \text{[Equation 7]}$$

where

SO_2 is in g/hp-hr
BSFC is the in-use adjusted fuel consumption in lb/hp-hr
453.6 is the conversion factor from pounds to grams
soxcnv is the fraction of fuel sulfur converted to direct PM
HC is the in-use adjusted hydrocarbon emissions in g/hp-hr
0.01 is the conversion factor from weight percent to weight fraction
soxdsl is the episodic weight percent of sulfur in nonroad diesel fuel
2 is the grams of SO_2 formed from a gram of sulfur

$$CO_2 = (BSFC * 453.6 - HC) * 0.87 * (44/12)$$

Table 43. 2008 Workover Rig Equipment Emissions (lb/well) by Pollutants and by Equipment Type.

Equipment			Activity & Emission	Emissions (lb/well)
Engine 1	Engine Function		Rig	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 0	
	Rated horsepower		475	
	Horsepower Range		300-600	
	Time used (hrs)		36	
	Well workover frequency (events/yr)		0.07	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.367	
	Fuel Consumption (Gallons)		18	
	Emission Factors (g/bhp-hr)	NOx	8.581	6.47
		VOC	0.764	0.58
		CO	3.200	2.41
		PM10	0.512	0.39
		PM2.5	0.497	0.37
		SO2	0.115	0.09
		CO2	529	398.64
		CH4	0.012	0.01
		PM_filt	0.184	0.14
		PM_cond	0.313	0.24
		N2O	0.260	0.01
Engine 2	Engine Function		Snubbing unit	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 0	
	Rated horsepower		475	
	Horsepower Range		300-600	
	Time used (hrs)		36	
	Well workeover requirement (Yrs)		0.07	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.367	
	Fuel Consumption (Gallons)		18	
	Emission Factors (g/bhp-hr)	NOx	8.581	6.47
		VOC	0.764	0.58
		CO	3.200	2.41
		PM10	0.512	0.39
		PM2.5	0.497	0.37
		SO2	0.115	0.09
		CO2	529	398.64
		CH4	0.012	0.01
		PM_filt	0.184	0.14
		PM_cond	0.313	0.24
		N2O	0.260	0.01
Engine 3	Engine Function		Light plant	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 0	
	Rated horsepower		45	
	Horsepower Range		25-50	
	Well workeover requirement (Yrs)		0.07	
	Time used (hrs)		36	
	Load Factor		0.7	
	BSFC (lb/hp-hr)		0.408	
	Fuel Consumption (Gallons)		4	
	Emission Factors (g/bhp-hr)	NOx	7.066	1.18
		VOC	2.022	0.34
		CO	5.925	0.99
		PM10	1.093	0.18
		PM2.5	1.060	0.18
		SO2	0.127	0.02
		CO2	584	97.37
		CH4	0.031	0.01
		PM_filt	0.392	0.07
		PM_cond	0.668	0.11
		N2O	0.260	0.00

Table 44. Summary of 2008 Workover Rig Emissions (lb/well) by Pollutants for All Equipment.

Equipment Type	Pollutant	Emissions (lb/year-well)
Workover Rig Equipment	NOx	14
	VOC	1
	CO	6
	PM10	1
	PM2.5	1
	SO2	0
	CO2	895
	CH4	0
	PM_filt	0
	PM_cond	1
	N2O	0

Table 45. 2008 Workover Rig Equipment Emissions in tons per well.

Description	Workover Rig Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Workover Equipment (diesel ICE)	0.0071	0.0007	0.0029	0.0005	0.0005	9.73E-05	0.4473	1.13E-05	0.0002	0.0003	1.14E-05	active well counts

Table 46. Percent Change in Emission from Base Year 2008 for Workover Rig Equipment (aggregate factors to apply to total emissions across all equipment types).

Technology Assumption	Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
Tier 0	2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2019	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2020	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2021	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2022	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2023	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2024	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2025	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2026	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2027	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2028	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2029	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2030	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2031	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2032	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2033	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2034	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2035	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2036	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0	2037	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Workover Traffic Emissions

ASSUMPTIONS

Data Provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.
Data for Number of Days of Measurable (>0.01") Precipitation
Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE 2008 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH WORKOVER TRAFFIC.

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} \quad \frac{*(365-P)}{365} \quad *(\text{Control Efficiency})$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 47. Summary of Traffic Activity Data Associated with Well Workover Phase.

Equipment Type	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance	Number of Round Trips Per Well	Well workover frequency (events/yr)
Light Truck	20	20	6	0.07
Heavy Truck	20	20	8	0.07

Table 48. 2008 Exhaust Emissions (lb/well) Associated with Workover Traffic by Vehicle Type.

Vehicle Type	Pollutant	2008 Emission Factors (g/mile)	Base year Emissions (lb/well)
Light-Duty Truck	NOx	2.67	0.047
	SO2	0.02	0.000
	CO	19.44	0.343
	CO2	677.28	11.945
	VOC	1.57	0.028
	PM10	0.09	0.002
	PM2.5	0.09	0.002
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.002
	N2O	0.05	0.001
Heavy-Duty Truck	NOx	21.75	0.511
	SO2	0.08	0.002
	CO	15.96	0.375
	CO2	2612.85	61.443
	VOC	1.93	0.045
	PM10	1.30	0.031
	PM2.5	1.26	0.030
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.002
	N2O	0.04	0.001

Table 49. Summary of 2008 Fugitive Dust Emissions (tons/well) Associated with Workover Traffic.

Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
								Em. Factor (lb/VMT)	Emissions (tpy/well)	Em. Factor (lb/VMT)	Emissions (tpy/well)
Travel to well	Light truck	7,000	20	6	0.4	20	8	0.20	0.00	0.02	0.00
Travel to well	Heavy Truck	70,000	20	8	1	20	10.67	0.20	0.00	0.02	0.00
							Total	**0.40**	**0.00**	**0.04**	**0.00**

Table 50. 2008 Exhaust and Fugitive Dust Emissions Associated with Workover Rigs Traffic in tons per well.

Description	Total Workover Traffic Emissions (tons per well)											Projection	Fugitive Road	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
WorkoverTraffic (LD)	2.36E-05	1.38E-05	0.0002	7.96E-07	7.56E-07	2.09E-07	0.0060	8.18E-07	0	0	4.28E-07	active well counts	0.0008	0.0001
WorkoverTraffic (HD)	0.0003	2.27E-05	0.0002	1.53E-05	1.49E-05	9.65E-07	0.0307	1.06E-06	0	0	4.39E-07	active well counts	0.0011	0.0001

Table 51. Percent Change in Emission from Base Year 2008 Due to Fleet Turnover for Workover Rigs Traffic.

	Light-Duty Truck											Heavy-Duty Truck										
Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	N2O	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	-6%	-39%	-6%	0%	-6%	-4%	-4%	0%	0%	-8%	-6%	-5%	-2%	-6%	0%	-4%	-7%	-7%	0%	0%	0%	-5%
2010	-10%	-46%	-10%	-1%	-10%	-9%	-9%	0%	0%	-12%	-12%	-10%	-47%	-9%	0%	-6%	-14%	-14%	0%	0%	4%	-10%
2011	-15%	-50%	-13%	-2%	-15%	-16%	-16%	0%	0%	-15%	-19%	-16%	-75%	-14%	0%	-13%	-24%	-24%	0%	0%	13%	-16%
2012	-21%	-55%	-16%	-3%	-21%	-22%	-22%	0%	0%	-19%	-25%	-21%	-75%	-19%	0%	-21%	-33%	-33%	0%	0%	20%	-21%
2013	-26%	-56%	-20%	-4%	-26%	-27%	-28%	0%	0%	-22%	-32%	-27%	-76%	-24%	0%	-28%	-41%	-41%	0%	0%	24%	-27%
2014	-32%	-57%	-24%	-5%	-32%	-33%	-33%	0%	0%	-25%	-37%	-32%	-76%	-28%	0%	-34%	-49%	-49%	0%	0%	28%	-32%
2015	-37%	-57%	-27%	-7%	-36%	-38%	-38%	0%	0%	-28%	-42%	-36%	-76%	-32%	0%	-40%	-56%	-56%	0%	0%	30%	-36%
2016	-42%	-58%	-30%	-9%	-41%	-42%	-43%	0%	0%	-31%	-47%	-40%	-77%	-37%	0%	-46%	-63%	-63%	0%	0%	31%	-40%
2017	-46%	-59%	-33%	-10%	-45%	-46%	-47%	0%	0%	-34%	-51%	-44%	-77%	-40%	0%	-51%	-68%	-68%	0%	0%	32%	-44%
2018	-50%	-60%	-35%	-12%	-49%	-50%	-50%	0%	0%	-36%	-55%	-47%	-77%	-43%	0%	-56%	-73%	-73%	0%	0%	32%	-47%
2019	-53%	-60%	-37%	-13%	-52%	-53%	-53%	0%	0%	-38%	-58%	-50%	-77%	-45%	0%	-60%	-77%	-77%	0%	0%	33%	-50%
2020	-57%	-61%	-38%	-14%	-55%	-55%	-56%	0%	0%	-39%	-61%	-53%	-77%	-47%	0%	-64%	-81%	-81%	0%	0%	34%	-53%
2021	-59%	-62%	-40%	-16%	-58%	-57%	-58%	0%	0%	-41%	-64%	-55%	-77%	-49%	0%	-67%	-83%	-83%	0%	0%	34%	-55%
2022	-66%	-63%	-44%	-19%	-64%	-63%	-64%	0%	0%	-43%	-71%	-61%	-78%	-53%	0%	-74%	-90%	-90%	0%	0%	34%	-61%
2023	-62%	-62%	-41%	-17%	-60%	-59%	-60%	0%	0%	-42%	-67%	-58%	-78%	-51%	0%	-70%	-86%	-86%	0%	0%	34%	-58%
2024	-64%	-63%	-43%	-18%	-63%	-61%	-62%	0%	0%	-43%	-69%	-60%	-78%	-52%	0%	-72%	-88%	-88%	0%	0%	34%	-60%
2025	-68%	-64%	-45%	-19%	-67%	-64%	-65%	0%	0%	-44%	-72%	-63%	-78%	-54%	0%	-76%	-91%	-91%	0%	0%	34%	-63%
2026	-70%	-64%	-46%	-20%	-69%	-66%	-66%	0%	0%	-43%	-74%	-65%	-78%	-56%	0%	-79%	-92%	-92%	0%	0%	36%	-65%
2027	-71%	-64%	-47%	-21%	-71%	-67%	-68%	0%	0%	-43%	-75%	-66%	-78%	-56%	0%	-80%	-93%	-93%	0%	0%	36%	-66%
2028	-72%	-64%	-48%	-21%	-72%	-68%	-69%	0%	0%	-44%	-76%	-67%	-78%	-57%	0%	-81%	-94%	-94%	0%	0%	36%	-67%
2029	-73%	-65%	-48%	-22%	-73%	-69%	-70%	0%	0%	-45%	-78%	-68%	-78%	-58%	0%	-83%	-94%	-94%	0%	0%	35%	-68%
2030	-74%	-65%	-49%	-22%	-75%	-70%	-70%	0%	0%	-45%	-78%	-69%	-78%	-58%	0%	-84%	-95%	-95%	0%	0%	35%	-69%
2031	-75%	-65%	-50%	-23%	-76%	-70%	-71%	0%	0%	-47%	-79%	-70%	-78%	-59%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2032	-76%	-65%	-50%	-23%	-76%	-71%	-72%	0%	0%	-47%	-80%	-70%	-78%	-60%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2033	-77%	-66%	-51%	-24%	-77%	-72%	-72%	0%	0%	-48%	-80%	-71%	-78%	-61%	0%	-86%	-95%	-95%	0%	0%	33%	-71%
2034	-77%	-66%	-52%	-24%	-78%	-72%	-73%	0%	0%	-48%	-81%	-71%	-78%	-61%	0%	-86%	-96%	-96%	0%	0%	33%	-71%
2035	-78%	-66%	-52%	-24%	-78%	-73%	-73%	0%	0%	-48%	-81%	-72%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	33%	-72%
2036	-78%	-66%	-53%	-24%	-79%	-73%	-74%	0%	0%	-49%	-81%	-72%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	32%	-72%
2037	-78%	-66%	-53%	-25%	-79%	-73%	-74%	0%	0%	-49%	-81%	-72%	-78%	-63%	-1%	-87%	-96%	-96%	0%	0%	32%	-72%

2008 Heaters Emissions

ASSUMPTIONS

Data Provided by operator in blue text

Assumptions

Assume no controls on the heater

Assume 10 percent of all wells have tank heaters

Equations

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (lbs/MMscf)} * \text{Heater Size (Btu/hr)} * \text{Time On (Hours/Year)}}{\text{Fuel Heat Value (Btu/scf)} * 1\text{x}10^6 \text{ (scf/MMscf)} * 2000 \text{ (lbs/ton)}}$$

Table 52. Natural Gas Fired Heaters Emission Factors (lb/MMscf).

Heaters (lb/MMscf) (from AP-42 Tables 1.4-1 and 1.4-2)										
NOx	SO2	CO	VOC	PM10	PM2.5	PM_filt	PM_cond	CO2	CH4	N2O
100	0.6	84	5.5	7.6	7.6	1.9	5.7	120,000	2.3	2.2

Table 53. Summary of Heaters Operational Data.

Equipment Type	Heat Input (btu/hr)	Local Heating Value (Btu/scf)	# Units/well	Time Used Per Unit (hours)	Cycle Fraction	Actual Firing hours
Dehydrator Heater	500,000	1000	1	8760	0.5	4380
Separator Heater	500,000	1000	1	6552	0.5	3276
Tank Heater	500,000	1000	0.1	6750	0.5	3375

Table 54. Summary of 2008 Well-site Heater/Reboiler Emissions (lbs/well).

Equipment Type	NOx	SO2	CO	VOC	PM10	PM2.5	PM_filt	PM_cond	CO_2	CH_4	N_2O
Dehydrator Heater	219	0	184	12	17	17	4	12	262,800	5	5
Separator Heater	164	0	138	9	12	12	3	9	196,560	4	4
Tank Heater	17	0	14	0.93	1.28	1.28	0.32	0.96	20,250	0.39	0.37

Table 55. 2008 Heater/Reboiler Emissions in tons per well.

Description	Heater/Reboiler Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Heaters	0.1998	0.0110	0.1679	0.0152	0.0152	0	239.8050	0.0046	0.0038	0.0114	0.0044	active well counts

Table 56. Percent Change in Emission from Base Year 2008 for Heaters/Reboilers.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Fugitive Devices Emissions

ASSUMPTIONS

Activity data provided by operators in blue text

Hours of operation was assumed to be year round 24-7

Equation

$$E_{fugitive} = EF_i \times N \times t_{annual} \times Y$$

where:

$E_{fugitive}$ is the fugitive VOC emissions per well [ton-VOC/yr]

EF_i is the emission factor of TOC [kg/hr/source]

N is the total number of devices

Y is the ratio of VOC to TOC in the vented gas

t_{annual} is total annual hours of operation

CH_4 and CO_2 emissions

Emissions.CH_4 = Emission.VOC * WeightFraction.CH_4 / WeightFraction.CO_2

Emissions.CO_2 = Emission.VOC * WeightFraction.CO_2 / WeightFraction.VOC

Table 57. Total Organic Compound (TOC) Emission Factor (kg/hr/component).

Well Equipment Component	Gas	Light Oil >20° API	Heavy Oil <20° API	Water/Oil
valves	4.50E-03	2.50E-03	8.40E-06	9.80E-05
pump seals	2.40E-03	1.30E-02	3.20E-05	2.40E-05
others	8.80E-03	7.50E-03	3.20E-05	1.40E-02
connectors	2.00E-04	2.10E-04	7.50E-06	1.10E-04
flanges	3.90E-04	1.10E-04	3.90E-07	2.90E-06
open-ended lines	2.00E-03	1.40E-03	1.40E-04	2.50E-04

Emission Factors are from EPA, 1995 -AP-42 Table 2-4. "Oil and Gas Production Operations Average Emission Factors"

Do not calculate fugitives from pipelines containing only water

"Other" category includes compressor seals, pressure relief valves, diaphragms, drains, dump arms, hatches, instruments, meters, polished rods and vents

Pump seals Heavy Oil EF uses other Heavy Oil EF

Table 58. VOC, CO_2 and CH_4 Sales Gas and Condensate Gas Weight Fractions.

Component	Sales Gas	Fugitive
VOC Fraction (weight)	14.60%	73.55%
CO2 Fraction (weight)	6.07%	3.02%
CH4 Fraction (weight)	68.75%	13.57%

Table 59. 2008 TOC and VOC Emissions (lbs/well) by Media and Equipment Type.

Media	Type	Well Equipment Component			TOC Emission Factor (kg / hr / component)	TOC Emissions (lbs/yr)			VOC Emissions (lbs/yr)		
		Well Stream	Gas	Condensate		Well Stream	Gas	Condensate	Well Stream	Gas	Condensate
Gas	valves	10	10	-	4.50E-03	869	869	0	135.48	135.48	0.00
	pump seals	1	0	-	2.40E-03	46	0	0	7.23	0.00	0.00
	others	0	0	-	8.80E-03	0	0	0	0.00	0.00	0.00
	connectors	150	50	-	2.00E-04	579	193	0	90.32	30.11	0.00
	flanges	15	15	-	3.90E-04	113	113	0	17.61	17.61	0.00
	open-ended lines	0	0	-	2.00E-03	0	0	0	0.00	0.00	0.00
Light Oil >20º API	valves	-	-	20	2.50E-03	0	0	966	0.00	0.00	732.57
	pump seals	-	-	0	1.30E-02	0	0	0	0.00	0.00	0.00
	others	-	-	0	7.50E-03	0	0	0	0.00	0.00	0.00
	connectors	-	-	50	2.10E-04	0	0	203	0.00	0.00	153.84
	flanges	-	-	10	1.10E-04	0	0	21	0.00	0.00	16.12
	open-ended lines	-	-	0	1.40E-03	0	0	0	0.00	0.00	0.00
Heavy Oil <20º API	valves	-	-	-	8.40E-06	0	0	0	0.00	0.00	0.00
	pump seals	-	-	-	3.20E-05	0	0	0	0.00	0.00	0.00
	others	-	-	-	3.20E-05	0	0	0	0.00	0.00	0.00
	connectors	-	-	-	7.50E-06	0	0	0	0.00	0.00	0.00
	flanges	-	-	-	3.90E-07	0	0	0	0.00	0.00	0.00
	open-ended lines	-	-	-	1.40E-04	0	0	0	0.00	0.00	0.00
Water/Oil	valves	-	-	-	9.80E-05	0	0	0	0.00	0.00	0.00
	pump seals	-	-	-	2.40E-05	0	0	0	0.00	0.00	0.00
	others	-	-	-	1.40E-02	0	0	0	0.00	0.00	0.00
	connectors	-	-	-	1.10E-04	0	0	0	0.00	0.00	0.00
	flanges	-	-	-	2.90E-06	0	0	0	0.00	0.00	0.00
	open-ended lines	-	-	-	2.50E-04	0	0	0	0.00	0.00	0.00

Table 60. 2008 Fugitive Device Emissions in tons per well.

Description	Fugitive Device Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Well Stream Fugitive Devices	0	0.1253	0	0	0	0	0.0521	0.5900	0	0	0	active well counts
Gas Stream Fugitive Devices	0	0.0916	0	0	0	0	0.0381	0.4313	0	0	0	active well counts
Condensate Fugitive	0	0.4513	0	0	0	0	0.0185	0.0833	0	0	0	active well counts

Table 61. Percent Change in Emission from Base Year 2008 for Fugitive Devices.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Pneumatic Devices Emissions

ASSUMPTIONS

As per operator's input no bleed devices are used exclusively, hence zero emissions from this category

Table 62. 2008 Pneumatic Devices Emissions in tons per well.

Description	Pneumatic Devices Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CH4	CO2	PM_filt	PM_cond	N2O	
Pneumatic Devices	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	active well counts

Table 63. Percent Change in Emission from Base Year 2008 for Pneumatic Devices.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Tank Loadout (vapor losses) Emissions

ASSUMPTIONS

Data Provided by operator in blue text
Method from Wyoming Permitting Guidance for Oil and Gas Production Facilities
Wyoming DEQ, March, 2010, Chapter 6, Section 2, p.65 for Crude Oil, RVP 5
After AP-42, Section 5.2.1

$$\text{Emissions VOC (tpy)} = \frac{\text{Loading Loss (lbs/1000 gal)} * \text{truck load rate (bbl/year)} * 42\ \text{(gal/bbl)} * \text{VOC mass fraction}}{2000\ \text{(lbs/ton)}}$$

Loading losses determined using AP-42 Section 5.2.2.1.1 Equation 1

LL =12.46 x S x P x M/T

LL=Loading Loss in (lbs/1000gallons)

S= Saturation Factor
P = true vapor pressure of liquid loaded (psia)
M = molecular weight of tank vapors (lb/(lb-mol))
T = temperature of bulk liquid loaded (R=F+460)

Table 64. VOC, CO_2 and CH_4 Condensate Post-Flash Gas Weight Fractions.

Compound	Weight (%)
Methane (weight)	21.23%
VOC Fraction (weight)	66.34%
CO2 Fraction (weight)	0.00%

Table 65. Summary of Truck Load Activity Data.

Type of Petroleum Liquid Loaded	Saturation Factor	True Vapor Pressure of Liquid Loaded (psia)	Molecular Weight of Vapors (lb/lb-mole)	Temperature of Bulk Liquid (°R)	Mode of Operation	Loading Losses (lb/1000 gallons)	Capacity of Truck
Condensate RVP 8	0.6	7.2	50	520	Submerged loading: dedicated normal service	5.18	80 bbl

Table 66. 2008 Well Site Condensate Tank Loadout Emissions in tons per barrel.

Description	Base Year Well Site Condensate Tank Loadout Emissions (tons per barrel)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Tank Loadout (vapor losses)	0	7.21E-05	0	0	0	0	0	2.31E-05	0	0	0	annual condensate production

Table 67. Percent Change in Emission from Base Year 2008 for Condensate Tank Loadout.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Well Venting Emissions

ASSUMPTIONS

Data provided by operator in blue text
Well venting includes all emissions from venting categories other than fugitive devices, pneumatic devices, chemical injection pumps, tank load out, condensate tanks, completion and dehydrator venting.

Table 68. Well Venting VOC, CH_4 and CO_2 Emission Factors (tons/well).

	Weight (%) : Well Stream Gas	(t/yr/well)
Venting VOC Emission Factor		0.75
Methane	69.04%	3.624
Carbon Dioxide	6.09%	0.320
VOC Fraction (weight)	14.25%	

Table 69. 2008 Well Venting Emissions in tons per well.

Description	Base Year Well Venting Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Well Venting	0	0.7483	0	0	0	0	0.3198	3.6240	0	0	0	active well counts

Table 70. Percent Change in Emission from Base Year 2008 for Well Venting.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Condensate Tank Flashing/Working/Breathing Emissions

ASSUMPTIONS

Data provided by operator in blue text

Assume one tank per well

$$E_{condensate,tanks} = \frac{P_{condensate\ tanks} \times EF_{condensate,\ tanks}}{2000} \times (1 - \mathrm{CF})$$

where:

$E_{condensate,tanks}$ is the per well emissions from condensate tanks [tons/yr-well]

$EF_{condensate,tank}$ is the derived VOC emissions factor for condensate tanks [lb-VOC/bbl]

$P_{condensatetanks}$ is the condensate production per gas wells throughput [bbl/well]

CF = *Percentage of Volume Controlled*

CO2 emissions

Emissions.CO2 = Emission.VOC * WtFraction.CO2 / WtFraction.VOC

where WtFraction = weight fraction of the pollutant

68% percentage of condensate volume controlled

	Flash Wt %	Post-Flash Wt %
Carbon Dioxide	3.04%	0.00%
VOC Fraction (weight)	73.46%	66.34%

Table 71: Flash speciation from Wamsutter HYSYS.

Chemical	Mole %[1]	Molecular Weight (lb/lb-mol)[2]	Pounds per Bbl @ 365 psig
Carbon Dioxide	2.80%	44.01	1.24
Nitrogen	0.02%	28.01	0.01
Methane	34.25%	16.04	5.52
Ethane	13.42%	30.07	4.05
Propane	17.98%	44.10	7.96
Isobutane	6.85%	58.12	4.00
n-Butane	9.34%	58.12	5.45
Isopentane	4.48%	72.15	3.25
n-Pentane	3.91%	72.15	2.83
Cyclopentane	0.00%	72.15	0.00
n-Hexane	1.36%	86.18	1.18
Cyclohexane	0.30%	84.16	0.25
2,2-Dimethylbutane	0.09%	86.18	0.08
2,3-Dimethylbutane	0.34%	86.18	0.30
2-Methylpentane	1.04%	86.18	0.90
3-Methylpentane	0.53%	86.18	0.46
n-Heptane	1.85%	100.20	1.86
Methylcylcohexane	0.18%	98.19	0.18
2,2,4 Trimethylpentane	0.07%	114.23	0.08
Benzene	0.31%	78.11	0.25
Toluene	0.38%	92.14	0.35
Ethylbenzene	0.00%	106.17	0.00
m-Xylene	0.16%	106.17	0.17
o-Xylene	0.02%	106.17	0.02
n-Octane	0.22%	114.23	0.25
n-Nonane	0.05%	128.26	0.07
n-Decane	0.04%	142.28	0.06
Total	**100.00%**	**40.58**	**40.75**
Total VOC	**49.51%**		**29.93**

[1] The flash gas composition is based on the 2008 HYSYS model for

[2] The molecular weights and the higher heating values are from the "GSPA Engineering Data Book", Twelfth Edition, Section 23 Physical Properties, 2004.

Assumptions	**365**	PSIG Separator Pressure
	75	Degrees F Temperature (Tank)
	379.48	SCF/Mole
Total Flash @ 365 psig	**381.05**	SCF/Bbl Produced (From Wamsutter SCC Heat Input File)

From EPA's TANKS 4.09 Output based on the condensate composition from 2007 Wamsutter HYSYS model.

Net Throughput(gal/yr):	47,632	bbls/yr:	1510
Turnovers:	2.93		

Table 72: Working and Breathing Loss Calculations.

Components	Working Loss (lbs/yr)	Working Loss (lb/turnover)	Breathing Loss (lbs/yr)	Total Emissions (lbs/yr)
Condensate	368.64	125.82	3,232.66	3,601.30
Methane	78.28	26.72	686.48	764.76
Ethane	45.81	15.63	401.75	447.57
Propane	71.86	24.53	630.14	702
Isobutane	34.98	11.94	306.72	341.7
n-Butane	46.12	15.74	404.46	450.58
Isopentane	27.02	9.22	236.95	263.97
n-Pentane	21.87	7.46	191.8	213.68
n-Hexane	8.31	2.84	72.84	81.15
Cyclohexene	1.32	0.45	11.54	12.86
2,2-Dimethylbutane	0.66	0.23	5.79	6.45
2,3-Dimethylbutane	2.19	0.75	19.19	21.37
2-Methylpentane	6.49	2.22	56.93	63.42
3-Methylpentane	3.1	1.06	27.22	30.32
n-Heptane	12.98	4.43	113.84	126.82
Methylcyclohexane	1.03	0.35	9.06	10.09
2,2,4-Trimethylpentane	0.52	0.18	4.54	5.06
Benzene	1.17	0.40	10.23	11.4
Toluene	1.54	0.53	13.46	15
Ethylbenzene	0.02	0.01	0.19	0.21
Xylenes	0.85	0.29	7.48	8.34
n-Octane	1.38	0.47	12.1	13.49
n-Nonane	0.49	0.17	4.3	4.79
n-Decane	0.64	0.22	5.65	6.3
THC	**368.63**	**125.81**	**3,232.66**	**3,601.33**
VOC	**244.54**	**83.46**	**2,144.43**	**2,389.00**

Table 73: TANKS 4.0.9d Emissions Report. Tank Identification and Physical Characteristics

Identification		
User Identification:	400 BBL Condensate Tank	
City:	Wamsutter	
State:	Wyoming	
Company:	BP America Production Company	
Type of Tank:	Vertical Fixed Roof Tank	
Description:		
Tank Dimensions		
Shell Height (ft):		20.00
Diameter (ft):		12.00
Liquid Height (ft) :		18.00
Avg. Liquid Height (ft):		16.00
Volume (gallons):		15,228.53
Turnovers:		2.93
Net Throughput(gal/yr):		47,632.33
Is Tank Heated (y/n):	N	
Paint Characteristics		
Shell Color/Shade:	Gray/Light	
Shell Condition	Good	
Roof Color/Shade:	Gray/Light	
Roof Condition:	Good	
Roof Characteristics		
Type:	Cone	
Height (ft)		0.00
Slope (ft/ft) (Cone Roof)		0.06
Breather Vent Settings		
Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Cheyenne, Wyoming (Avg Atmospheric Pressure = 11.76 psia)

Table 74: TANKS 4.0.9d Emissions Report. Liquid Contents of Storage Tank

400 BBL Condensate Tank - Vertical Fixed Roof Tank
Wamsutter, Wyoming

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Condensate	All	52.84	43.08	62.60	47.84	9.3180	8.2489	10.5047	34.8841			101.69	
2,2,4-Trimethylpentane (isooctane)						0.4829	0.3585	0.6417	114.2300	0.0093	0.0014	114.23	Option 2: A=6.8118, B=1257.84, C=220.74
2,2-Dimethylbutane						3.5768	2.8194	4.4903	86.1766	0.0016	0.0018	86.18	Option 2: A=6.75483, B=1081.176, C=229.343
2,3-Dimethylbutane						2.5637	1.9986	3.2526	86.1800	0.0074	0.0059	86.18	Option 2: A=6.8098, B=1127.187, C=228.9
2-Methylpentane						2.2792	1.7648	2.9102	86.1800	0.0247	0.0176	86.18	Option 2: A=6.8391, B=1135.41, C=226.57
3-Methylpentane						1.8953	1.4637	2.4260	86.1766	0.0142	0.0084	86.18	Option 2: A=6.81887, B=1152.368, C=227.129
Benzene						0.9542	0.7163	1.2545	78.1100	0.0106	0.0032	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Butane (-n)						22.7236	18.7796	27.2745	58.1230	0.0176	0.1251	58.12	Option 2: A=6.80896, B=935.86, C=238.73
Cyclohexane						0.8986	0.6771	1.1774	82.1500	0.0127	0.0036	82.15	Option 2: A=6.8861, B=1229.973, C=224.1
Decane (-n)						0.0283	0.0227	0.0354	142.2900	0.1973	0.0017	142.29	Option 1: VP50 = .026411 VP60 = .033211
Ethane						441.4026	392.3831	494.2334	30.0694	0.0009	0.1243	30.07	Option 2: A=6.83452, B=663.7, C=256.47
Ethylbenzene						0.0842	0.0587	0.1187	106.1700	0.0022	0.0001	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Heptane (-n)						0.4920	0.3622	0.6607	100.2000	0.2288	0.0352	100.20	Option 3: A=37358, B=8.2585
Hexane (-n)						1.5831	1.2100	2.0463	86.1700	0.0455	0.0225	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Isobutane						34.0780	28.4370	40.5351	58.1230	0.0089	0.0949	58.12	Option 2: A=6.91048, B=946.35, C=246.68
Isopentane						8.4891	6.4965	10.6607	72.1500	0.0276	0.0733	72.15	Option 1: VP50 = 7.889 VP60 = 10.005
Methane						3,393.9992	3,176.7515	3,616.9806	16.0426	0.0002	0.2124	16.04	Option 2: A=6.69561, B=405.42, C=267.777
Methylcyclohexane						0.4522	0.3353	0.6017	98.1800	0.0198	0.0026	98.18	Option 2: A=6.823, B=1270.763, C=221.42
Nonane (-n)						0.0553	0.0437	0.0699	128.2600	0.0769	0.0013	128.26	Option 1: VP50 = .051285 VP60 = .065278
Octane (-n)						0.1218	0.0947	0.1566	114.2300	0.0983	0.0037	114.23	Option 1: VP50 = .112388 VP60 = .145444
Pentane (-n)						5.8178	4.6359	7.2392	72.1500	0.0326	0.0593	72.15	Option 3: A=27691, B=7.558
Propane						95.8603	82.2333	111.0438	44.0962	0.0065	0.1949	44.10	Option 2: A=6.80398, B=803.81, C=246.99
Toluene						0.2631	0.1907	0.3578	92.1300	0.0506	0.0042	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Xylenes (mixed isomers)						0.0699	0.0486	0.0990	106.1700	0.1058	0.0023	106.17	Option 2: A=7.009, B=1462.266, C=215.11

Table 75: TANKS 4.0.9d Emissions Report. Detail Calculations.

400 BBL Condensate Tank - Vertical Fixed Roof Tank
Wamsutter, Wyoming

Annual Emission Calcaulations	
Standing Losses (lb):	3,232.6611
Vapor Space Volume (cu ft):	466.5265
Vapor Density (lb/cu ft):	0.0591
Vapor Space Expansion Factor:	0.9755
Vented Vapor Saturation Factor:	0.3293
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	466.5265
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	4.1250
Tank Shell Height (ft):	20.0000
Average Liquid Height (ft):	16.0000
Roof Outage (ft):	0.1250
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.1250
Roof Height (ft):	0.0000
Roof Slope (ft/ft):	0.0625
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0591
Vapor Molecular Weight (lb/lb-mole):	34.8841
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	9.3180
Daily Avg. Liquid Surface Temp. (deg. R):	512.5062
Daily Average Ambient Temp. (deg. F):	45.5958
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	507.5058
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,403.1795
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.9755
Daily Vapor Temperature Range (deg. R):	39.0421
Daily Vapor Pressure Range (psia):	2.2558
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	9.3180
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	8.2489
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	10.5047
Daily Avg. Liquid Surface Temp. (deg R):	512.5062
Daily Min. Liquid Surface Temp. (deg R):	502.7457
Daily Max. Liquid Surface Temp. (deg R):	522.2667
Daily Ambient Temp. Range (deg. R):	24.7583
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.3293
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	9.3180
Vapor Space Outage (ft):	4.1250
Working Losses (lb):	368.6395
Vapor Molecular Weight (lb/lb-mole):	34.8841
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	9.3180
Annual Net Throughput (gal/yr.):	47,632.3290
Annual Turnovers:	2.9290
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	15,228.5332
Maximum Liquid Height (ft):	18.0000
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	3,601.3007

Table 76: TANKS 4.0.9d Emissions Report. Individual Tank Emissions Total (lbs).

Emissions Report for: Annual

400 BBL Condensate Tank - Vertical Fixed Roof Tank
Wamsutter, Wyoming

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Condensate	368.64	3,232.66	3,601.30
Propane	71.86	630.14	702.00
Isobutane	34.98	306.72	341.70
Butane (-n)	46.12	404.46	450.58
Isopentane	27.02	236.95	263.97
Pentane (-n)	21.87	191.80	213.68
Hexane (-n)	8.31	72.84	81.15
Heptane (-n)	12.98	113.84	126.82
Octane (-n)	1.38	12.10	13.49
Nonane (-n)	0.49	4.30	4.79
Decane (-n)	0.64	5.65	6.30
Benzene	1.17	10.23	11.40
Toluene	1.54	13.46	15.00
Ethylbenzene	0.02	0.19	0.21
Xylenes (mixed isomers)	0.85	7.48	8.34
2,2,4-Trimethylpentane (isooctane)	0.52	4.54	5.06
2-Methylpentane	6.49	56.93	63.42
Methane	78.28	686.48	764.76
Ethane	45.81	401.75	447.57
Cyclohexene	1.32	11.54	12.86
2,2-Dimethylbutane	0.66	5.79	6.45
2,3-Dimethylbutane	2.19	19.19	21.37
3-Methylpentane	3.10	27.22	30.32
Methylcyclohexane	1.03	9.06	10.09

Table 77. VOC and CH_4 Flashing, Working and Breathing Emission Factors (lb/activity).

Source	Uncontrolled VOC Emission Factors			Uncontrolled CH4 Emission Factors		
	Flashing (lb per barrel)	Working (lb per turnover per well)	Breathing Losses (lb per well)	Flashing (lb per barrel)	Working (lb per turnover per well)	Breathing Losses (lb per well)
Condensate tank losses	29.93	83.46	2144.43	5.52	26.72	686.48

Table 78. 2008 Uncontrolled Condensate Tank Emissions in tons per activity.

Description	Condensate Tank Venting Emissions- Uncontrolled Volume (tons per barrel or tons per turnover per well or tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Condensate Tank Flashing Losses	0.0000	0.0048	0.0000	0.0000	0.0000	0.0000	0.0002	0.0009	0.0000	0.0000	0.0000	annual condensate production
Condensate Tank Working Losses	0.0000	0.0134	0.0000	0.0000	0.0000	0.0000	0.0000	0.0043	0.0000	0.0000	0.0000	total turnovers per year
Condensate Tank Breathing Losses	0.0000	0.3431	0.0000	0.0000	0.0000	0.0000	0.0000	0.1098	0.0000	0.0000	0.0000	active well counts

Table 79. Percent Change in Emission from Base Year 2008 for Condensate Tank Losses.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Condensate Tank Flaring Emissions

ASSUMPTIONS

Data provided by operator in blue text

Condensate	2246.45	Btu/scf
Total Flash @	381.05	SCF/Bbl Produced

[1] 2008 HYSYS model runs for the Wamsutter Operations Center at 365 psig.

68% percentage of condensate volume controlled

NOx, VOC, CH_4, N_2O and CO Emissions Calculation

$$E_{flare} = EF_i \times Q \times HV$$

where:

E_{flare} is the flaring emissions per well [lb/yr]

EF_i is the emissions factor for pollutant i [lb/MMBtu]

Q is the volume of gas flared supplied by operator [MMscf/yr]

HV is the heating value of the gas as provided by the operators [MMBtu/MMscf]

CO_2 Emissions ($tons\ per\ activity$) = (Total CO_2 Emission Potential of the Entire Gas – THC Component to CO_2 Emission Potential – CO Component to CO_2 Emission Potential) x Percentage of Production Controlled

$$THC\ \text{Component } CO_2 \text{ Emissions Potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \sum \frac{\left(\frac{\text{lb emissions emitted}}{\text{activity}}\right)_i \times \frac{No.\ of\ Moles\ of\ C\ in\ compound}{No.\ of\ Moles\ of\ C\ in\ CO2} \times \text{Molecular Weight of } CO_2 \text{ (lb/lb-mol)}}{\text{Molecular weight of Compound C (lb/lb-mol)} \times 2000}$$

$$\text{CO component } CO_2 \text{ emissions potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \frac{\text{CO emissions from flaring}\left(\frac{\text{lb}}{\text{activity}}\right) \times \frac{\text{No.of Moles of C in compound}}{\text{No.of Moles of C in CO2}} \times \text{Molecular Weight of CO2 (lb/lb-mol)}}{\text{Molecular weight of CO } \left(\frac{\text{lb}}{\text{lb-mol}}\right) \times 2000}$$

.

Where,

$_i$= each compound identified in flaring gas speciation profile

(lb emissions emitted/activity)$_i$ = Total TOG Emissions (lb/activity) from flaring X Weight Fraction of the Compound

Table 80. Flaring Emission Factors

Flaring Emission Factor (lb/MMBtu)*			Fraction of THC as CH4	N2O (lb/MMSCF)[b]	VOC/THC[c]
NOx	CO	THC			
0.068	0.37	0.14	25%	1.44	63%

*Emission Factors are from AP-42

b Emission Factor from API Compendium of greenhouse gas emissions methodologies for the oil and natural gas industry,2009 Table 4-11, GHG Emission Factors for Gas Flares in Developed Countries - Footnote C

[c]EPA SPECIATE Profile 0051

Table 81. 2008 CO_2 Emissions (tons/bbl) Potential for All Gas Sample Species from Flashing Loss.

365.00 PSIG Separator Pressure
75.00 Degrees F Temperature (Tank)
379.48 SCF/lb-mole

Chemical	Mole %[1]	Molecular Weight (lb/lb-mol)[2]	Pounds per Bbl @ 365 psig	lb/ MMscf	lb CO_2/ MMscf	HHV (Btu/scf)[2]	2008 CO2 emission potential of the entire gas (tons/bbl)
Carbon Dioxide	2.80%	44.01	1.24	3,250	3,250	0	6.E-04
Nitrogen	0.02%	28.01	0.01	16		0	0.E+00
Methane	34.25%	16.04	5.52	14,478	39,725	1010	8.E-03
Ethane	13.42%	30.07	4.05	10,631	31,120	1770	6.E-03
Propane	17.98%	44.10	7.96	20,900	62,571	2516	1.E-02
Isobutane	6.85%	58.12	4.00	10,490	31,773	3252	6.E-03
n-Butane	9.34%	58.12	5.45	14,303	43,322	3262	8.E-03
Isopentane	4.48%	72.15	3.25	8,523	25,995	4001	5.E-03
n-Pentane	3.91%	72.15	2.83	7,432	22,665	4009	4.E-03
n-Hexane	1.36%	86.18	1.18	3,085	9,453	4756	2.E-03
Cyclohexane	0.30%	84.16	0.25	655	2,055	4482	4.E-04
2,2-Dimethylbutane	0.09%	86.18	0.08	201	615	4736	1.E-04
2,3-Dimethylbutane	0.34%	86.18	0.30	783	2,398	4745	5.E-04
2-Methylpentane	1.04%	86.18	0.90	2,362	7,237	4747	1.E-03
3-Methylpentane	0.53%	86.18	0.46	1,201	3,680	4750	7.E-04
n-Heptane	1.85%	100.20	1.86	4,885	15,019	5503	3.E-03
Methylcyclohexane	0.18%	98.19	0.18	465	1,667	5216	3.E-04
2,2,4-Trimethylpentane	0.07%	114.23	0.08	212	653	6249	1.E-04
Benzene	0.31%	78.11	0.25	646	2,183	3742	4.E-04
Toluene	0.38%	92.14	0.35	921	3,080	4475	6.E-04
Ethylbenzene	0.00%	106.17	0.00	12	41	5222	8.E-06
m-Xylene	0.16%	106.16	0.17	454	1,505	5208	3.E-04
o-Xylene	0.02%	106.16	0.02	43	143	5210	3.E-05
n-Octane	0.22%	114.23	0.25	665	2,050	6249	4.E-04
n-Nonane	0.05%	128.26	0.07	171	528	6996	1.E-04
n-Decane	0.04%	142.29	0.06	151	466	7743	9.E-05
VOC	**100.00%**	**40.58**	**40.75**	**106,934**	**309,944**	**2246**	**0.059**
Total VOC	**49.51%**		**29.93**	**78,558**			

[1] The flash gas composition is based on the 2008 HYSYS model for Wamsutter at 365 psig.
[2] The molecular weights and the higher heating values are from the "GSPA Engineering Data Book", Twelfth Edition,

Table 82. 2008 CO_2 Emissions (tons/turnover) Potential for All Gas Sample Species from Working Loss.

From EPA's TANKS 4.09 Output based on the condensate composition from 2007 Wamsutter HYSYS model.

Throughput 1509.94 bbls/yr
Turnovers: 2.93
Vapor Density 0.06 lb/ft^3

Components	Working Loss (lbs/yr)	Working Loss (lb/ turnover well)	Weight %	Molecular Weight (lb/lb-mol)[1]	Mole %	HHV (Btu/scf)[1]	lb/ MMscf	lb CO_2/ MMscf	2008 CO2 emission potential of the entire gas (Tons/turnover)
Methane	78.28	26.72	21.23%	16.04	46.18%	1010	19,519	53,555	0.0121
Ethane	45.81	15.63	12.43%	30.07	14.42%	1770	11,425	33,442	0.0044
Propane	71.86	24.53	19.50%	44.10	15.42%	2516	17,921	53,654	0.0111
Isobutane	34.98	11.94	9.49%	58.12	5.70%	3252	8,722	26,419	0.0027
n-Butane	46.12	15.74	12.51%	58.12	7.51%	3262	11,501	34,835	0.0046
Isopentane	27.02	9.22	7.33%	72.15	3.54%	4001	6,738	20,551	0.0016
n-Pentane	21.87	7.46	5.93%	72.15	2.87%	4009	5,454	16,634	0.0011
n-Hexane	8.31	2.84	2.25%	86.18	0.91%	4756	2,072	6,349	0.0002
Cyclohexane	1.32	0.45	0.36%	84.16	0.15%	4482	329	1,031	0.0000
2,2-Dimethylbuta	0.66	0.23	0.18%	86.18	0.07%	4736	165	504	0.0000
2,3-Dimethylbuta	2.19	0.75	0.59%	86.18	0.24%	4745	546	1,673	0.0000
2-Methylpentane	6.49	2.22	1.76%	86.18	0.71%	4747	1,619	4,960	0.0001
3-Methylpentane	3.10	1.06	0.84%	86.18	0.34%	4750	774	2,370	0.0000
n-Heptane	12.98	4.43	3.52%	100.20	1.23%	5503	3,237	9,952	0.0004
Methylcyclohexa	1.03	0.35	0.28%	98.19	0.10%	5216	257	922	0.0000
2,2,4-Trimethylpe	0.52	0.18	0.14%	114.23	0.04%	6249	129	399	0.0000
Benzene	1.17	0.40	0.32%	78.11	0.14%	3742	291	985	0.0000
Toluene	1.54	0.53	0.42%	92.14	0.16%	4475	383	1,282	0.0000
Ethylbenzene	0.02	0.01	0.01%	106.17	0.00%	5222	5	17	0.0000
Xylenes	0.85	0.29	0.23%	106.17	0.08%	5208	212	704	0.0000
n-Octane	1.38	0.47	0.37%	114.23	0.11%	6249	344	1,061	0.0000
n-Nonane	0.49	0.17	0.13%	128.26	0.04%	6996	122	378	0.0000
n-Decane	0.64	0.22	0.17%	142.29	0.04%	7743	160	495	0.0000
THC	**368.63**	**125.81**	**100.00%**	**34.88**	**100.00%**	**2016**	**91,926**	**272,174**	**0.04**
VOC	**244.54**	**83.46**	**66.34%**		**39.40%**		**60,983**		

[1] The molecular weights and the higher heating values are from the "GSPA Engineering Data Book", Twelfth Edition, Section 23 Physical

Table 83. 2008 CO_2 Emissions (tons/well) Potential for All Gas Sample Species from Breathing Loss.

From EPA's TANKS 4.09 Output based on the condensate composition from 2007 Wamsutter HYSYS model.

Throughput 1509.94 bbls/yr
Turnovers: 2.93
Vapor Density 0.06 lb/ft^3

Components	Breathing Loss (lbs/well)	Weight %	Molecular Weight (lb/lb-mol)[1]	Mole %	HHV (Btu/scf)[1]	lb/ MMscf	lb CO_2/ MMscf	2008 CO2 emission potential of the entire gas (tons/well)
Methane	686.48	21.23%	16.04	46.18%	1010	19,519	53,555	0.31
Ethane	401.75	12.43%	30.07	14.42%	1770	11,425	33,442	0.11
Propane	630.14	19.50%	44.10	15.42%	2516	17,921	53,654	0.29
Isobutane	306.72	9.49%	58.12	5.70%	3252	8,722	26,419	0.07
n-Butane	404.46	12.51%	58.12	7.51%	3262	11,501	34,835	0.12
Isopentane	236.95	7.33%	72.15	3.54%	4001	6,738	20,551	0.04
n-Pentane	191.8	5.93%	72.15	2.87%	4009	5,454	16,634	0.03
n-Hexane	72.84	2.25%	86.18	0.91%	4756	2,072	6,349	0.00
Cyclohexane	11.54	0.36%	84.16	0.15%	4482	329	1,031	0.00
2,2-Dimethylbu	5.79	0.18%	86.18	0.07%	4736	165	504	0.00
2,3-Dimethylbu	19.19	0.59%	86.18	0.24%	4745	546	1,673	0.00
2-Methylpentar	56.93	1.76%	86.18	0.71%	4747	1,619	4,960	0.00
3-Methylpentar	27.22	0.84%	86.18	0.34%	4750	774	2,370	0.00
n-Heptane	113.84	3.52%	100.20	1.23%	5503	3,237	9,952	0.01
Methylcyclohex	9.06	0.28%	98.19	0.10%	5216	257	922	0.00
2,2,4-Trimethyl	4.54	0.14%	114.23	0.04%	6249	129	399	0.00
Benzene	10.23	0.32%	78.11	0.14%	3742	291	985	0.00
Toluene	13.46	0.42%	92.14	0.16%	4475	383	1,282	0.00
Ethylbenzene	0.19	0.01%	106.17	0.00%	5222	5	17	0.00
Xylenes	7.48	0.23%	106.17	0.08%	5208	212	704	0.00
n-Octane	12.1	0.37%	114.23	0.11%	6249	344	1,061	0.00
n-Nonane	4.3	0.13%	128.26	0.04%	6996	122	378	0.00
n-Decane	5.65	0.17%	142.29	0.04%	7743	160	495	0.00
THC	**3232.66**	**100.00%**	**34.88**	**100.00%**	**2016**	**91,926**	**272,174**	**0.98**
VOC	**2144.43**	**66.34%**		**39.40%**		**60,983**		

[1] The molecular weights and the higher heating values are from the "GSPA Engineering Data Book", Twelfth Edition, Section 23 Physical Properties, 2004.

Table 84. Summary of THC and CO Component to CO_2 Emissions Potentials (tons/activity) for 2008.

Compound	MW (lb/lb-mol)	Flashing Emissions (lb/bbl)	Working Emissions (lb/turnover)	Breathing Emissions (lb/well)
TOG	31.47	0.15	0.75	19.30
CO	28.01	0.32	1.59	40.80

Name	HC?	VOC?	WEIGHT_PER (Flaring Speciation Profile (EPA SPECIATE 0051))	Molecular Weight (lb/lb-mol)[2]	Flashing 2008 CO2 emissions				Working 2008 CO2 emissions				Breathing 2008 CO2 emissions			
					THC component CO2 emissions			CO component CO2 emissions potentials (tons/bbl)	THC component CO2 emissions			CO component CO2 emissions potentials (tons/well)	THC component CO2 emissions			CO component CO2 emissions potentials (tons/well)
					lb emitted/well	Moles C in compound/ Moles C in CO2	CO2 Emissions (tons/bbl)		lb emitted/turnover	Moles C in compound /Moles C in CO2	CO2 Emissions (Tons/turnover)		lb emitted/well	Moles C in compound/Moles C in CO2	CO2 Emissions (tons/well)	
Ethane	Y	N	30	30.07	0.04	2	0.0001	0.0002	0.23	2	0.0003	0.0012	5.79	2	0.0085	0.0321
Formaldehyde	N	Y	20	30.03	0.03	1	0.0000		0.15	1	0.0001		3.86	1	0.0028	
Methane	Y	N	20	16.04	0.03	1	0.0000		0.15	1	0.0002		3.86	1	0.0053	
Propane	Y	Y	30	44.10	0.04	3	0.0001		0.23	3	0.0003		5.79	3	0.0087	
			100		**0.15**		**0.0002**	**0.0002**	**0.75**		**0.0010**	**0.0012**	**19.30**		**0.0253**	**0.0321**

Table 85. 2008 Condensate Tank Flaring Emissions per activity metric of each Category.

Description	Condensate Tank Flaring Emissions (tons per activity metric)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Condensate Tank Flashing Flaring	1.98E-05	2.55E-05	0.0001	0	0	0	0.0399	1.02E-05	0	0	1.86E-07	annual condensate production
Condensate Tank Working Flaring	9.92E-05	0.0001	0.0005	0	0	0	0.0245	5.11E-05	0	0	1.04E-06	total turnovers per year
Condensate Tank Breathing Flaring	0.0025	0.0033	0.0139	0	0	0	0.6302	0.0013	0	0	2.67E-05	active well counts

Table 86. Percent Change in Emission from Base Year 2008 for Condensate Tank Flaring.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Dehydrator Venting Emissions

ASSUMPTIONS

Data Provided by operator in blue text
Assume no change in pressure (365 psi)
Dehydrator VOC Emissions (t/yr)=2.0254*ln(flow (MMscf/yr))+0.9636
Dehydrator CH4 Emissions (t/yr)=0.0543*ln(flow (MMscf/yr))+7.3694
Assume one dehydrator per well
Total Waste Gas Stream (MMscf/yr/ well) =0.0013*flow(MMscf/yr)+0.5094
assumed no wells subject of control based on estimated uncontrolled VOC emissions below 15tpy VOC threshold

$$CO_2 \text{ Emissions (tons/well/yr)} = \frac{((\text{lb } CO_2/\text{MMscf})* \text{ Total Waste Gas Stream (MMscf/well/yr))}}{2000}$$

Table 87. Dehydrator Uncontrolled and Controlled VOC and CH_4 Emissions (tons per well).

Year	Average production per year per well (MMscf/yr/well)	Uncontrolled VOC Emissions (tons per well)	Controlled VOC Emissions (tons per well)	Uncontrolled CH4 Emissions (tons per well)	Controlled CH4 Emissions* (tons per well)	Uncontrolled C2H6 Emissions (tons per well)	Total Waste Gas Stream (MMscf/yr/ well)	CO2 Emissions (tons per well)
2008	67.92	9.51	9.51	7.60	7.60	2	0.598	1.8358
2009	64.76	9.41	9.41	7.60	7.60	2	0.594	1.8232
2010	56.31	9.13	9.13	7.59	7.59	2	0.583	1.7895
2011	51.79	8.96	8.96	7.58	7.58	2	0.577	1.7714
2012	51.34	8.94	8.94	7.58	7.58	2	0.576	1.7696
2013	51.18	8.93	8.93	7.58	7.58	2	0.576	1.7690
2014	49.06	8.85	8.85	7.58	7.58	2	0.573	1.7605
2015	46.79	8.75	8.75	7.58	7.58	2	0.570	1.7514
2016	44.83	8.67	8.67	7.58	7.58	2	0.568	1.7436
2017	43.14	8.59	8.59	7.57	7.57	2	0.565	1.7369
2018	41.69	8.52	8.52	7.57	7.57	2	0.564	1.7311
2019	40.38	8.45	8.45	7.57	7.57	2	0.562	1.7258
2020	39.14	8.39	8.39	7.57	7.57	2	0.560	1.7209
2021	38.06	8.33	8.33	7.57	7.57	2	0.559	1.7166
2022	36.40	8.24	8.24	7.56	7.56	2	0.557	1.7100
2023	35.48	8.19	8.19	7.56	7.56	2	0.556	1.7063
2024	34.62	8.14	8.14	7.56	7.56	2	0.554	1.7028
2025	33.91	8.10	8.10	7.56	7.56	2	0.553	1.7000
2026	33.20	8.06	8.06	7.56	7.56	2	0.553	1.6972
2027	32.56	8.02	8.02	7.56	7.56	2	0.552	1.6946
2028	32.30	8.00	8.00	7.56	7.56	2	0.551	1.6936
2029	31.00	7.92	7.92	7.56	7.56	2	0.550	1.6884
2030	30.44	7.88	7.88	7.55	7.55	2	0.549	1.6861
2031	29.93	7.85	7.85	7.55	7.55	2	0.548	1.6841
2032	29.44	7.81	7.81	7.55	7.55	2	0.548	1.6822
2033	28.96	7.78	7.78	7.55	7.55	2	0.547	1.6802
2034	28.52	7.75	7.75	7.55	7.55	2	0.546	1.6785
2035	28.12	7.72	7.72	7.55	7.55	2	0.546	1.6769
2036	27.79	7.70	7.70	7.55	7.55	2	0.546	1.6756
2037	27.47	7.67	7.67	7.55	7.55	2	0.545	1.6743

* assumed CH4 control would be analagous to VOC control

Table 88. Summary of lb CO_2 per MMSCF Estimation.

Chemical	Mole %[1]	Molecular Weight (lb/lb-mol)[2]	lb/ MMscf	lb CO_2/ MMscf	HHV (Btu/scf)[2]
Water	17.54%	18.01	8060.8		0.0
Carbon Dioxide	5.47%	44.01	6142.9	6142.9	0
Nitrogen	0.11%	28.01	80.8		0
Methane	55.61%	16.04	22761.2		1010
Ethane	6.19%	30.07	4749.6		1770
Propane	3.98%	44.10	4478.8		2516
Isobutane	1.07%	58.12	1586.9		3252
n-Butane	1.49%	58.12	2209.8		3262
Isopentane	0.57%	72.15	1053.1		4001
n-Pentane	0.58%	72.15	1075.2		4009
n-Hexane	0.33%	86.18	730.1		4756
Cyclohexane	0.62%	84.16	1335.8		4482
Other Hexanes	0.37%	86.18	815.9		4745
n-Heptane	0.61%	100.20	1569.9		5503
Methylcyclohexane	0.79%	98.19	1976.9		5216
2,2,4-Trimethylpentane	0.02%	114.23	55.4		6249
Benzene	1.35%	78.11	2690.8		3742
Toluene	1.89%	92.14	4443.7		4475
Ethylbenzene	0.06%	106.17	165.3		5222
Xylenes	0.60%	106.17	1636.3		5208
n-Octane	0.73%	114.23	2116.2		6249
Total	**100.00%**	**27.33**	**69735.3**	**6142.9**	**1254**
Total VOC	**15.07%**		**27940.0**		

[1] Mole percent is based on the GLYCalc run at 0.25 MMscf/day for Wamsutter.

[2] The molecular weights and the higher heating values are from GSPA Engineering Data Book, 12th Edition.

Assumptions

0.0821	L-atm/K-mol		
298.15	^{o}K		
1		1	atm
1 ft3		28.31685	L
453.59237	mol/lb-mol		
391.90	scf/lbmol		

Table 89. Summary of Well Site Dehydrator Emissions in tons per well by Project Year.

Description	Year	Dehydrator Emissions - Weighted Average (tons per well)											Projection
		NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Dehydrator Venting - Well Site	2008	0	9.5074	0	0	0	0	1.8358	7.5985	0	0	0	active well counts
Dehydrator Venting - Well Site	2009	0	9.4109	0	0	0	0	1.8232	7.5959	0	0	0	active well counts
Dehydrator Venting - Well Site	2010	0	9.1278	0	0	0	0	1.7895	7.5883	0	0	0	active well counts
Dehydrator Venting - Well Site	2011	0	8.9583	0	0	0	0	1.7714	7.5837	0	0	0	active well counts
Dehydrator Venting - Well Site	2012	0	8.9407	0	0	0	0	1.7696	7.5833	0	0	0	active well counts
Dehydrator Venting - Well Site	2013	0	8.9344	0	0	0	0	1.7690	7.5831	0	0	0	active well counts
Dehydrator Venting - Well Site	2014	0	8.8485	0	0	0	0	1.7605	7.5808	0	0	0	active well counts
Dehydrator Venting - Well Site	2015	0	8.7525	0	0	0	0	1.7514	7.5782	0	0	0	active well counts
Dehydrator Venting - Well Site	2016	0	8.6658	0	0	0	0	1.7436	7.5759	0	0	0	active well counts
Dehydrator Venting - Well Site	2017	0	8.5883	0	0	0	0	1.7369	7.5738	0	0	0	active well counts
Dehydrator Venting - Well Site	2018	0	8.5187	0	0	0	0	1.7311	7.5719	0	0	0	active well counts
Dehydrator Venting - Well Site	2019	0	8.4540	0	0	0	0	1.7258	7.5702	0	0	0	active well counts
Dehydrator Venting - Well Site	2020	0	8.3912	0	0	0	0	1.7209	7.5685	0	0	0	active well counts
Dehydrator Venting - Well Site	2021	0	8.3342	0	0	0	0	1.7166	7.5670	0	0	0	active well counts
Dehydrator Venting - Well Site	2022	0	8.2442	0	0	0	0	1.7100	7.5646	0	0	0	active well counts
Dehydrator Venting - Well Site	2023	0	8.1920	0	0	0	0	1.7063	7.5632	0	0	0	active well counts
Dehydrator Venting - Well Site	2024	0	8.1425	0	0	0	0	1.7028	7.5619	0	0	0	active well counts
Dehydrator Venting - Well Site	2025	0	8.1004	0	0	0	0	1.7000	7.5607	0	0	0	active well counts
Dehydrator Venting - Well Site	2026	0	8.0577	0	0	0	0	1.6972	7.5596	0	0	0	active well counts
Dehydrator Venting - Well Site	2027	0	8.0180	0	0	0	0	1.6946	7.5585	0	0	0	active well counts
Dehydrator Venting - Well Site	2028	0	8.0021	0	0	0	0	1.6936	7.5581	0	0	0	active well counts
Dehydrator Venting - Well Site	2029	0	7.9186	0	0	0	0	1.6884	7.5559	0	0	0	active well counts
Dehydrator Venting - Well Site	2030	0	7.8818	0	0	0	0	1.6861	7.5549	0	0	0	active well counts
Dehydrator Venting - Well Site	2031	0	7.8478	0	0	0	0	1.6841	7.5540	0	0	0	active well counts
Dehydrator Venting - Well Site	2032	0	7.8143	0	0	0	0	1.6822	7.5531	0	0	0	active well counts
Dehydrator Venting - Well Site	2033	0	7.7807	0	0	0	0	1.6802	7.5522	0	0	0	active well counts
Dehydrator Venting - Well Site	2034	0	7.7501	0	0	0	0	1.6785	7.5513	0	0	0	active well counts
Dehydrator Venting - Well Site	2035	0	7.7215	0	0	0	0	1.6769	7.5506	0	0	0	active well counts
Dehydrator Venting - Well Site	2036	0	7.6974	0	0	0	0	1.6756	7.5499	0	0	0	active well counts
Dehydrator Venting - Well Site	2037	0	7.6740	0	0	0	0	1.6743	7.5493	0	0	0	active well counts

Table 90. Percent Change in Emission from Base Year 2008 for Dehydrators.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Production Traffic Emissions

ASSUMPTIONS

Data Provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.

Data for Number of Days of Measurable (>0.01") Precipitation

Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH PRODUCTION TRAFFIC.

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} * \frac{(365-P)}{365} * (\text{Control Efficiency})$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 91. Summary of Traffic Activity Data Associated with Production Traffic.

Equipment Type	Field		
	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Well (annual)
Light Truck	20	20	52
Heavy Truck	20	20	14
Heavy Trucks - Central Facility	0	0	0

Production traffic assumes that vehicles end up at the central facility

Table 92. 2008 Exhaust Emissions (lb/well) Associated with Production Traffic by Vehicle Type.

Vehicle Type	Pollutant	2008 Emission Factors (g/mile)	Base year Emissions (lb/well)
Light-Duty Truck	NOx	2.67	6.127
	SO2	0.02	0.054
	CO	19.44	44.580
	CO2	677.28	1553
	VOC	1.57	3.596
	PM10	0.09	0.207
	PM2.5	0.09	0.197
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.213
	N2O	0.05	0.111
Heavy-Duty Truck	NOx	21.75	13.426
	SO2	0.08	0.051
	CO	15.96	9.855
	CO2	2612.85	1612.873
	VOC	1.93	1.193
	PM10	1.30	0.804
	PM2.5	1.26	0.780
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.056
	N2O	0.04	0.023
Heavy-Duty Diesel Truck Travel to Central Facility	NOx	21.75	0.000
	SO2	0.08	0.000
	CO	15.96	0.000
	CO2	2612.85	0.000
	VOC	1.93	0.000
	PM10	1.30	0.000
	PM2.5	1.26	0.000
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.000
	N2O	0.04	0.000

Table 93. Summary of 2008 Fugitive Dust Emissions (tons/well) Associated with Production Traffic.

Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
								Em. Factor (lb/VMT)	Emissions (tpy/well)	Em. Factor (lb/VMT)	Emissions (tpy/well)
Travel to well	Light truck	7,000	20	52	52	20	1040	0.20	0.10	0.02	0.01
Travel to well	Heavy Truck	70,000	20	14	14	20	280	0.20	0.03	0.02	0.00
Travel to Central Facility	Heavy Truck	70,000	0	0	0	0	0	0.00	0.00	0.02	0.00
							Total		**0.13**		**0.01**

Table 94. 2008 Exhaust and Fugitive Dust Emissions Associated with Production Traffic.

Description	Total Production Traffic Emissions (tons per well)											Projection	Fugitive Road	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
Production Traffic (LD)	0.0031	0.0018	0.0223	0.0001	9.83E-05	2.71E-05	0.7764	0.0001	0	0	5.56E-05	active well counts	0.1030	0.0102
Production Traffic (HD)	0.0067	0.0006	0.0049	0.0004	0.0004	2.53E-05	0.8064	2.79E-05	0	0	1.15E-05	active well counts	0.0277	0.0028
Production Traffic, Central Facility (HD)	0	0	0	0	0	0	0	0	0	0	0	None	0.0000	0.0000

Table 95. Percent Change in Emission from Base Year 2009 due to Fleet Turnover for Production Traffic.

	Light-Duty Truck (%)											Heavy-Duty Truck (%)										
Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	-6%	-39%	-6%	0%	-6%	-4%	-4%	0%	0%	-8%	-6%	-7%	-2%	-6%	0%	-4%	-7%	-7%	0%	0%	0%	-5%
2010	-10%	-46%	-10%	-1%	-10%	-9%	-9%	0%	0%	-12%	-12%	-16%	-47%	-9%	0%	-6%	-14%	-14%	0%	0%	4%	-10%
2011	-15%	-50%	-13%	-2%	-15%	-16%	-16%	0%	0%	-15%	-19%	-25%	-75%	-14%	0%	-13%	-24%	-24%	0%	0%	13%	-16%
2012	-21%	-55%	-16%	-3%	-21%	-22%	-22%	0%	0%	-19%	-25%	-33%	-75%	-19%	0%	-21%	-33%	-33%	0%	0%	20%	-21%
2013	-26%	-56%	-20%	-4%	-26%	-27%	-28%	0%	0%	-22%	-32%	-41%	-76%	-24%	0%	-28%	-41%	-41%	0%	0%	24%	-27%
2014	-32%	-57%	-24%	-5%	-32%	-33%	-33%	0%	0%	-25%	-37%	-48%	-76%	-28%	0%	-34%	-49%	-49%	0%	0%	28%	-32%
2015	-37%	-57%	-27%	-7%	-36%	-38%	-38%	0%	0%	-28%	-42%	-54%	-76%	-32%	0%	-40%	-56%	-56%	0%	0%	30%	-36%
2016	-42%	-58%	-30%	-9%	-41%	-42%	-43%	0%	0%	-31%	-47%	-60%	-77%	-37%	0%	-46%	-63%	-63%	0%	0%	31%	-40%
2017	-46%	-59%	-33%	-10%	-45%	-46%	-47%	0%	0%	-34%	-51%	-65%	-77%	-40%	0%	-51%	-68%	-68%	0%	0%	32%	-44%
2018	-50%	-60%	-35%	-12%	-49%	-50%	-50%	0%	0%	-36%	-55%	-69%	-77%	-43%	0%	-56%	-73%	-73%	0%	0%	32%	-47%
2019	-53%	-60%	-37%	-13%	-52%	-53%	-53%	0%	0%	-38%	-58%	-73%	-77%	-45%	0%	-60%	-77%	-77%	0%	0%	33%	-50%
2020	-57%	-61%	-38%	-14%	-55%	-55%	-56%	0%	0%	-39%	-61%	-76%	-77%	-47%	0%	-64%	-81%	-81%	0%	0%	34%	-53%
2021	-59%	-62%	-40%	-16%	-58%	-57%	-58%	0%	0%	-41%	-64%	-78%	-77%	-49%	0%	-67%	-83%	-83%	0%	0%	34%	-55%
2022	-66%	-63%	-44%	-19%	-64%	-63%	-64%	0%	0%	-43%	-71%	-84%	-78%	-53%	0%	-74%	-90%	-90%	0%	0%	34%	-61%
2023	-62%	-62%	-41%	-17%	-60%	-59%	-60%	0%	0%	-42%	-67%	-81%	-78%	-51%	0%	-70%	-86%	-86%	0%	0%	34%	-58%
2024	-64%	-63%	-43%	-18%	-63%	-61%	-62%	0%	0%	-43%	-69%	-82%	-78%	-52%	0%	-72%	-88%	-88%	0%	0%	34%	-60%
2025	-68%	-64%	-45%	-19%	-67%	-64%	-65%	0%	0%	-44%	-72%	-85%	-78%	-54%	0%	-76%	-91%	-91%	0%	0%	34%	-63%
2026	-70%	-64%	-46%	-20%	-69%	-66%	-66%	0%	0%	-43%	-74%	-86%	-78%	-56%	0%	-79%	-92%	-92%	0%	0%	36%	-65%
2027	-71%	-64%	-47%	-21%	-71%	-67%	-68%	0%	0%	-43%	-75%	-87%	-78%	-56%	0%	-80%	-93%	-93%	0%	0%	36%	-66%
2028	-72%	-64%	-48%	-21%	-72%	-68%	-69%	0%	0%	-44%	-76%	-88%	-78%	-57%	0%	-81%	-94%	-94%	0%	0%	36%	-67%
2029	-73%	-65%	-48%	-22%	-73%	-69%	-70%	0%	0%	-45%	-78%	-88%	-78%	-58%	0%	-83%	-94%	-94%	0%	0%	35%	-68%
2030	-74%	-65%	-49%	-22%	-75%	-70%	-70%	0%	0%	-45%	-78%	-89%	-78%	-58%	0%	-84%	-95%	-95%	0%	0%	35%	-69%
2031	-75%	-65%	-50%	-23%	-76%	-70%	-71%	0%	0%	-47%	-79%	-89%	-78%	-59%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2032	-76%	-65%	-50%	-23%	-76%	-71%	-72%	0%	0%	-47%	-80%	-89%	-78%	-60%	0%	-85%	-95%	-95%	0%	0%	34%	-70%
2033	-77%	-66%	-51%	-24%	-77%	-72%	-72%	0%	0%	-48%	-80%	-89%	-78%	-61%	0%	-86%	-95%	-95%	0%	0%	33%	-71%
2034	-77%	-66%	-52%	-24%	-78%	-72%	-73%	0%	0%	-48%	-81%	-90%	-78%	-61%	0%	-86%	-96%	-96%	0%	0%	33%	-71%
2035	-78%	-66%	-52%	-24%	-78%	-73%	-73%	0%	0%	-48%	-81%	-90%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	33%	-72%
2036	-78%	-66%	-53%	-24%	-79%	-73%	-74%	0%	0%	-49%	-81%	-90%	-78%	-62%	0%	-87%	-96%	-96%	0%	0%	32%	-72%
2037	-78%	-66%	-53%	-25%	-79%	-73%	-74%	0%	0%	-49%	-81%	-90%	-78%	-63%	-1%	-87%	-96%	-96%	0%	0%	32%	-72%

2008 Chemical Injection Pump Emissions

ASSUMPTIONS

Data provided by operators in blue text
No statewide requirement for Pneumatic Pumps (Ref: OIL AND GAS PRODUCTION FACILITIES CHAPTER 6, SECTION 2 PERMITTING GUIDANCE, August 2007)

VOC and CH4 Emissions (tons/well) = (lb/MMscf)c* Volume of Gas Vented per well
(lb/MMscf)c = Mole %(c)*(Weight (lb/lb-mol))(c)*sfc/mol
CO_2 Emissions (tons/well) = (lb CO2/MMscf)* Volume of Gas Vented per well
where,
(lb/MMscf)c= lb emissions per MMscf for a particular compound
c = compound identified in Sales Gas Composition
Mole% = Mole percentage of compound
Weight (lb/lb-mol)(c) = Molecular weight of a compound

Calculation Inputs

VOC Fraction (molar)	5.39%	
VOC molecular weight	57.50	
R	0.08206	L atm / K-mol
standard temp	298.15	K
standard press	1	atm
MCF to 1000 liter conversion	28.317	1000L/MCF
L/mol	24.47	L/mol
	28.32	L/SCF
	453.59237	mol/lb-mol
	391.90	scf/lbmol

Table 96. Summary of Chemical Injection Pump Data.

Type	Gallons Used	Gallons/well	SCF/Gallon	Number of Pump	Days Used in Quarter	SCF/Pump/Minute	Vented Volume (MCF/year)	Vented Volume (MMSCF/year)
Methanol	1,381,989	1,368	47	1	-	-	64.31	0.06
Glycol Heat Medium Pumps	-	-	-	1	273	2.84	1,116.73	1.12
Total	-	-	-	-	-	-	1181.04	1.18

Table 97. Uncontrolled 2008 Emissions (tons/well) Estimation by Compound.

Component	Mole %[1]	Molecular Weight (lb/lb-mol)[2]	Weight %	lb/ MMscf	lb CO_2/ MMscf	HHV (Btu/scf)[2]	Uncontrolled Emissions (TPY/well)
Carbon Dioxide	2.73%	44.01	6.07%	3066.1	3066.1	0	1.8106
Nitrogen	0.17%	28.01	0.24%	122.3		0	0.0722
Methane	84.90%	16.04	68.75%	34749.6		1010	20.5203
Ethane	6.81%	30.07	10.33%	5222.5		1770	3.0840
Propane	3.17%	44.10	7.05%	3564.0		2516	2.1046
Isobutane	0.64%	58.12	1.86%	942.4		3252	0.5565
n-Butane	0.71%	58.12	2.08%	1052.8		3262	0.6217
Isopentane	0.24%	72.15	0.88%	445.4		4001	0.2630
n-Pentane	0.20%	72.15	0.73%	366.5		4009	0.2164
n-Hexane	0.16%	86.18	0.69%	350.1		4756	0.2068
Cyclohexane	0.03%	84.16	0.13%	68.2		4482	0.0403
2,2-Dimethylbutane	0.00%	86.18	0.02%	9.4		4736	0.0055
2,3-Dimethylbutane	0.02%	86.18	0.07%	36.0		4745	0.0213
2-Methylpentane	0.05%	86.18	0.21%	107.2		4747	0.0633
3-Methylpentane	0.03%	86.18	0.11%	55.1		4750	0.0325
n-Heptane	0.06%	100.20	0.30%	149.9		5503	0.0885
Methylcyclohexane	0.03%	98.19	0.16%	80.6		5216	0.0476
2,2,4-Trimethylpentane	0.00%	114.23	0.02%	11.0		6249	0.0065
Benzene	0.01%	78.11	0.06%	29.8		3742	0.0176
Toluene	0.02%	92.14	0.08%	41.0		4475	0.0242
Ethylbenzene	0.00%	106.17	0.00%	1.2		5222	0.0007
m-Xylene	0.00%	106.16	0.03%	12.6		5208	0.0075
o-Xylene	0.00%	106.16	0.02%	11.0		5210	0.0065
n-Octane	0.00%	114.23	0.00%	1.8		6249	0.0010
n-Nonane	0.01%	128.26	0.09%	44.8		6996	0.0264
n-Decane	0.00%	142.29	0.00%	0.0		7743	0.0000
Total	**100.00%**	**19.81**	**100.00%**	**50541.4**	**3066.1**	**1140.5767**	**29.8457**
Total VOC	**5.39%**		**14.60%**	**7380.8**			**4.3585**

1 Mole percentage of the sales gas

2 The molecular weights and the higher heating values are from GSPA Engineering Data Book, 12th Edition.

Table 98. 2008 Chemical Injection Pump Emissions in tons per well.

Description	Chemical Injection Pump Emissions -Weighted Average(tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Pneumatic Pumps	0	4.3585	0	0	0	0	1.8106	20.5203	0	0	0	active well counts

Table 99. Percent Change in Emission from Base Year 2008 for Chemical Injection Pump.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2008 Compressor Emissions

ASSUMPTIONS

Data provided by operators in blue text

Operator provided NOx, VOC and CO emissions for each compressor station. For remaining pollutants the unknown pollutant to NOx emission factor was multiplied by NOx emissions to get unknown pollutant emissions except for CH_4 and CO_2 either speciation profile or CO_2/VOC and CH_4/VOC weight ratio was multiplied to VOC emissions.

Table 100. Speciation Profiles used to Calculate CH_4 and CO_2 Emissions.

Turbine CH4/VOC	2.33	SPECIATE PROFILE
4-Stroke Rich Burn CH4/VOC	8.24	SPECIATE PROFILE
Venting CH4/VOC	4.71	Sales/Produced Gas Composition
Venting CO2/VOC	0.42	Sales/Produced Gas Composition
4-Stroke Lean Burn CH4/VOC	8.24	SPECIATE PROFILE

Table 101. Compressor Engine Emission Factors (turbine and rich burn SI).

	Emission Factors			
	Turbine		Reciprocating	
Pollutant	EF (g/hp-hr)	source	EF (g/hp-hr)	source
PM10	0.0240	EPA,AP-42 Turbine EFs	0.0704	EPA,AP-42, 4-Stroke Rich Burn Engine Efs
PM2.5	0.0240	EPA,AP-42 Turbine EFs	0.0704	EPA,AP-42, 4-Stroke Rich Burn Engine Efs
SO2	0.0000		0.0000	
CO2	399.1680	EPA,AP-42 Turbine EFs	399.1680	EPA,AP-42, 4-Stroke Rich Burn Engine Efs
CH4	0.0210	SPECIATE Profile	0.7669	SPECIATE Profile
PM_cond	0.0171	EPA,AP-42 Turbine EFs	0.0360	EPA,AP-42, 4-Stroke Rich Burn Engine Efs
PM_filt	0.0069	EPA,AP-42 Turbine EFs	0.0345	EPA,AP-42, 4-Stroke Rich Burn Engine Efs
N2O	0.0109	EPA,AP-42 Turbine EFs	0.00076	API Compendium

source: API Compendium Table 4-5. CH4 and N2O Combustion Emission Factors (Fuel Basis) for Common Industry Fuel Types - Natural Gas (tonnes/MMBtu)

Table 102. EPA AP-42 Compressor Engine Emission Factors (lean burn SI).

Pollutant	Emission Factor (lb/MMBTU)	Emission Factor (g/hp-hr)
PM_filt	7.71E-05	2.80E-04
PM_cond	9.91E-03	3.60E-02
PM10	9.99E-03	3.62E-02
PM2.5	9.99E-03	3.62E-02
CH4	1.25E+00	4.54E+00
CO2	1.10E+02	3.99E+02
N2O		0.00076

Assumed 8000 Btu/hp-hr heat input
Source: API Compendium Table 4-5. CH4 and N2O Combustion Emission Factors (Fuel Basis) for Common Industry Fuel Types - Natural Gas (tonnes/MMBtu)

Table 103. 2008 Actual Emissions (tons/year) by Facility and Process.

Station (Process)	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O
Wamsutter Compressor Station (Colorado Interstate Gas) (Reciprocating Engine	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Colorado Interstate Gas) (Reciprocating Engine	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Colorado Interstate Gas) (Turbine)	155.9	22.8	109.0	7.0	7.0	2.0	291,586.4	53.2	2.0	5.0	8.0
Wamsutter Compressor Station (Colorado Interstate Gas) (Venting)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Colorado Interstate Gas) (External NG	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Colorado Interstate Gas) (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Colorado Interstate Gas) (working and breathing)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Colorado Interstate Gas) (Flaring)	-	-	-	-	-	-	-	-	-	-	-
Table Rock (Reciprocating Engine Rich Burn)	130.4	4.9	86.9	13.1	13.1	-	74,359.3	40.4	6.4	6.7	0.1
Table Rock (Reciprocating Engine Lean Burn)	-	-	-	-	-	-	-	-	-	-	-
Table Rock (Turbine)	-	-	-	-	-	-	-	-	-	-	-
Table Rock (Venting)	-	-	-	-	-	-	-	-	-	-	-
Table Rock (External NG Combustion)	-	-	-	-	-	-	-	-	-	-	-
Table Rock (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Table Rock (working and breathing)	-	-	-	-	-	-	-	-	-	-	-
Table Rock (Flaring)	-	-	-	-	-	-	-	-	-	-	-
Creston 221 (Reciprocating Engine Rich Burn)	-	-	-	-	-	-	-	-	-	-	-
Creston 221 (Reciprocating Engine Lean Burn)	37.7	6.7	37.9	0.91	0.91	-	10,026.30	54.83	0.01	0.90	0.02
Creston 221 (Turbine)	-	-	-	-	-	-	-	-	-	-	-
Creston 221 (Venting)	0.0	2.7	-	-	-	-	1.12	12.72	-	-	-
Creston 221 (External NG Combustion)	2.1	0.0	1.8	0.16	0.16	0.01	2,542.57	0.05	0.04	0.12	0.05
Creston 221 (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Creston 221 (working and breathing)	-	-	-	-	-	-	-	-	-	-	-
Creston 221 (Flaring)	-	-	-	-	-	-	-	-	-	-	-
Fillmore Compressor Station (Reciprocating Engine Rich Burn)	-	-	-	-	-	-	-	-	-	-	-
Fillmore Compressor Station (Reciprocating Engine Lean Burn)	6.6	14.8	12.6	0.16	0.16	-	1,764.00	121.62	0.00	0.16	0.00
Fillmore Compressor Station (Turbine)	-	-	-	-	-	-	-	-	-	-	-
Fillmore Compressor Station (Venting)	-	7.3	-	-	-	-	3.04	34.46	-	-	-
Fillmore Compressor Station (External NG Combustion)	0.5	0.1	0.5	0.04	0.04	0.00	565.45	0.01	0.01	0.03	0.01
Fillmore Compressor Station (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Fillmore Compressor Station (working and breathing)	-	-	-	-	-	-	-	-	-	-	-
Fillmore Compressor Station (Flaring)	-	-	-	-	-	-	-	-	-	-	-
Frewen Lake Compressor Station (Reciprocating Engine Rich Burn)	-	-	-	-	-	-	-	-	-	-	-
Frewen Lake Compressor Station (Reciprocating Engine Lean Burn)	53.8	10.0	85.5	1.30	1.30	-	14,307.43	82.56	0.01	1.29	0.03
Frewen Lake Compressor Station (Turbine)	91.9	30.2	19.1	10.32	10.32	-	########	70.46	2.97	7.35	4.7
Frewen Lake Compressor Station (Venting)	-	17.2	-	-	-	-	7.14	80.89	-	-	-
Frewen Lake Compressor Station (External NG Combustion)	-	-	-	-	-	-	-	-	-	-	-
Frewen Lake Compressor Station (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Frewen Lake Compressor Station (working and breathing)	-	-	-	-	-	-	-	-	-	-	-
Frewen Lake Compressor Station (Flaring)	-	-	-	-	-	-	-	-	-	-	-
Siberia Ridge Compressor Station (Reciprocating Engine Rich Burn)	-	-	-	-	-	-	-	-	-	-	-
Siberia Ridge Compressor Station (Reciprocating Engine Lean Burn)	1.4	0.1	1.5	0.03	0.03	-	383.07	0.91	0.00	0.03	0.00
Siberia Ridge Compressor Station (Turbine)	-	-	-	-	-	-	-	-	-	-	-
Siberia Ridge Compressor Station (Venting)	-	1.1	-	-	-	-	0.45	5.11	-	-	-
Siberia Ridge Compressor Station (External NG Combustion)	1.1	0.0	1.0	0.08	0.08	0.01	1,272.59	0.02	0.02	0.06	0.02
Siberia Ridge Compressor Station (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Siberia Ridge Compressor Station (working and breathing)	-	-	-	-	-	-	-	-	-	-	-
Siberia Ridge Compressor Station (Flaring)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Rockies Express Pipeline) (Reciprocating Engine	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Rockies Express Pipeline) (Reciprocating Engine	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Rockies Express Pipeline) (Turbine)	84.3	49.1	71.5	9.5	9.5	-	157,669.9	114.6	2.7	6.7	4.3
Wamsutter Compressor Station (Rockies Express Pipeline) (Venting)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Rockies Express Pipeline) (External NG	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Rockies Express Pipeline) (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Rockies Express Pipeline) (working and	-	-	-	-	-	-	-	-	-	-	-
Wamsutter Compressor Station (Rockies Express Pipeline) (Flaring)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter A-6 Compressor Station (Marathon Oil) (Reciprocating Engine Rich	-	-	-	-	-	-	-	-	-	-	-
Wamsutter A-6 Compressor Station (Marathon Oil) (Reciprocating Engine Lean	-	-	-	-	-	-	-	-	-	-	-
Wamsutter A-6 Compressor Station (Marathon Oil) (Turbine)	40.0	42.2	13.6	4.5	4.5	-	74,813.7	98.5	1.3	3.2	2.0
Wamsutter A-6 Compressor Station (Marathon Oil) (Venting)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter A-6 Compressor Station (Marathon Oil)) (External NG Combustion)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter A-6 Compressor Station (Marathon Oil) (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter A-6 Compressor Station (Marathon Oil) (working and breathing)	-	-	-	-	-	-	-	-	-	-	-
Wamsutter A-6 Compressor Station (Marathon Oil) (Flaring)	-	-	-	-	-	-	-	-	-	-	-
Table Rock Compressor Station (Chevron) (Reciprocating Engine Rich Burn)	14.8	11.6	8.1	1.5	1.5	-	8,439.6	95.6	0.7	0.8	0.0
Table Rock Compressor Station (Chevron) (Reciprocating Engine Lean Burn)	-	-	-	-	-	-	-	-	-	-	-
Table Rock Compressor Station (Chevron) (Turbine)	-	-	-	-	-	-	-	-	-	-	-
Table Rock Compressor Station (Chevron) (Venting)	-	-	-	-	-	-	-	-	-	-	-
Table Rock Compressor Station (Chevron)k (External NG Combustion)	-	-	-	-	-	-	-	-	-	-	-
Table Rock Compressor Station (Chevron) (Flashing)	-	-	-	-	-	-	-	-	-	-	-
Table Rock Compressor Station (Chevron) (working and breathing)	-	-	-	-	-	-	-	-	-	-	-
Table Rock Compressor Station (Chevron) (Flaring)	-	-	-	-	-	-	-	-	-	-	-

Wamsutter A-6 Compressor Station (Marathon Oil) and Wamsutter Compressor Station (Rockies Express Pipeline) emissions assumed to be entirely from compressor engines. Assumed a turbine natural gas emission factor of 0.2134197530864 2 g/hp-hr NOx to estimate CO2 and N2O emissions

Table Rock Compressor Station (Chevron) emissions assumed to be entirely from compressor engines. Assumed a spark ignition natural gas emission factor of 0.7 g/hp-hr NOx to estimate CO2 , N2O and PM emissions

Table 104. Compressor Engine Emissions in tons per activity.

Description	Compressor Engine Emissions (tons total)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Compressor Station (Reciprocating Engine Rich Burn)	145.20	16.50	95.00	14.61	14.61	0	82798.85	135.92	7.15	7.46	0.1576	totals for year with compressor station
Compressor Station (Reciprocating Engine Lean Burn)	99.51	31.55	137.47	2.40	2.40	0	26480.80	259.91	0.0186	2.39	0.0504	totals for year with compressor station
Compressor Station (Turbine)	372.14	144.30	213.20	31.27	31.27	2.00	696020.41	336.69	9.00	22.27	18.98	totals for year with compressor station
Compressor Station (Venting)	0.0042	28.29	0	0	0	0	11.75	133.18	0	0	0	totals for year with compressor station
Compressor Station (External NG Combustion)	3.65	0.1631	3.33	0.2774	0.2774	0.0219	4380.61	0.0840	0.0694	0.2081	0.0803	totals for year with compressor station
Compressor Station (Flashing)	0	0	0	0	0	0	0	0	0	0	0	totals for year with compressor station
Compressor Station (Working/Breathing)	0	0	0	0	0	0	0	0	0	0	0	totals for year with compressor station
Compressor Station (Flaring)	0	0	0	0	0	0	0	0	0	0	0	totals for year with compressor station

2008 Gas Plants Emissions

ASSUMPTIONS

Data provided by operators in blue text.

Operator provided the total facility NOx, VOC and CO actual emissions and permitted Nox,VOC and CO emissions by source for the Echo Spring Gas Plant. NOx, VOC and CO actual emissions by sources were then calculated by multiplying total facility actual emissions with the ratio of the gas plant permitted emissions by-source over total gas plant permitted emissions. For remaining pollutants, the unknown pollutant emission factor to NOx emission factor was multiplied by NOx emissions to get unknown pollutant emissions except for CH_4 and CO_2. Emissions for these pollutants were estimated either using speciation profiles or CO_2/VOC and CH_4/VOC weight ratio to VOC emissions.

Table 105. Emission rates (lb/MMBTU or g/hp-hr) for estimating PM and GHG emissions.

Process	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O
(Reciprocating Engine)	1.56	-	-	0.04	0.04	0.00	399.17	4.54	0.00	0.04	0.00076
(Turbine)	0.35	-	-	0.02	0.02	0.00	399.17	0.02	0.01	0.02	0.01089
(flaring)	0.068	-	-	0	0	0	113	0.035	0	0	0.00131
(natural gas external combustion (boiler/heater))	100	-	-	7.6	7.6	0	120,000	2	1.9	5.7	2.2
(venting)	-	14.60%	-	-	-	-	6.07%	68.75%	-	-	-
gas fractions (wt)											

Table 106: 2008 Actual Total Facility Emissions (tons/yr) for the Echo Springs Gas Plant

Pollutant	Echo Springs Gas Plant Emissions (tons/yr)
NOx	568.1
CO	740.6
VOC	198.4
PM10	-
SO2	-
Reference Permits	0
Permit No.	MD-10112
Permit date	40395

Table 107. Summary of Gas Plants Emissions in tons per year.

Description	Gas Plant Emissions (tons total)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Gas Plant (Reciprocating Engine)	99.48	59.65	142.53	2.32	2.32	0	25510.69	289.89	0.0179	2.30	0.0486	totals for year with gas plant
Gas Plant (Turbine)	339.13	61.71	435.78	22.94	22.94	0	382382.05	20.12	6.60	16.34	10.43	totals for year with gas plant
Gas Plant (flaring)	40.70	38.57	110.89	0	0	0	67603.22	20.95	0	0	0.7812	totals for year with gas plant
Gas Plant (natural gas external combustion (boiler/heater))	88.80	34.44	51.40	6.75	6.75	0	106558.39	2.04	1.69	5.06	1.95	totals for year with gas plant
Gas Plant (venting)	0	4.02	0	0	0	0	1.67	18.93	0	0	0	totals for year with gas plant

2008 Evaporative Pond Emissions

Table 108. 2008 Emissions (tons/year) from Wamsutter North and South Evaporation Ponds.

Parameter		Wamsutter North Pond	Wamsutter South Pond
VOC Emissions (tpy)		4.67	5.85
Emissions (tpy) based on Water 9 model Output*	Benzene	0.62	0.84
	Ethylbenzene	0.07	0.09
	Hexane (-n)	0.01	0.01
	Methanol	2.09	2.31
	Toluene	0.80	1.11
	Xylene	0.92	1.25
	Xylene (-o)	0.17	0.24

**based on data from evaporation facilities at Wamsutter Operations Center*

Table 109. 2008 Average VOC emissions per well.

Average VOC emissions per evaporation basin (tpy)	5.26
Average Evaporation Facilities per well [a]	0.133%
Average VOC emissions per well (tpy)	0.01

a *Based on two existing evaporation facilities for existing 1500 CDC wells*

Table 110. VOC, CO_2 and CH_4 Weight Fractions (Produced Water Composition).

Component	% Wt	Average per Well Emissions
Methane	3.90%	0.0004
Carbon Dioxide	24.76%	0.0025
VOC Fraction (weight)	69.58%	

Table 111. 2008 Evaporation Pond Emissions in tons per well.

Description	Evaporation Pond Emissions -Weighted Average(tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Evaporation Ponds	0	0.0070	0	0	0	0	0.0025	0.0004	0	0	0	active well counts

Table 112. Percent Change in Emission from Base Year 2008 for Evaporation Ponds.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2008	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 113. Existing Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
NOx [tpy]	2008	0	293	5	1,166	52	169	32	0	0	0	570	0	0	29	0	62	20	0	568	621	0	0	3,587
	2009	0	0	0	0	0	0	0	0	0	0	564	0	0	28	0	58	20	0	568	621	0	0	1,859
	2010	0	0	0	0	0	0	0	0	0	0	558	0	0	28	0	51	20	0	568	621	0	0	1,845
	2011	0	0	0	0	0	0	0	0	0	0	552	0	0	28	0	47	20	0	568	621	0	0	1,835
	2012	0	0	0	0	0	0	0	0	0	0	547	0	0	27	0	46	19	0	568	621	0	0	1,828
	2013	0	0	0	0	0	0	0	0	0	0	541	0	0	27	0	46	19	0	568	621	0	0	1,822
	2014	0	0	0	0	0	0	0	0	0	0	536	0	0	27	0	44	19	0	568	621	0	0	1,814
	2015	0	0	0	0	0	0	0	0	0	0	531	0	0	26	0	42	19	0	568	621	0	0	1,806
	2016	0	0	0	0	0	0	0	0	0	0	525	0	0	26	0	40	19	0	568	621	0	0	1,798
	2017	0	0	0	0	0	0	0	0	0	0	520	0	0	26	0	38	18	0	568	621	0	0	1,791
	2018	0	0	0	0	0	0	0	0	0	0	515	0	0	26	0	37	18	0	568	621	0	0	1,784
	2019	0	0	0	0	0	0	0	0	0	0	509	0	0	25	0	35	18	0	568	621	0	0	1,777
	2020	0	0	0	0	0	0	0	0	0	0	504	0	0	25	0	34	18	0	568	621	0	0	1,770
	2021	0	0	0	0	0	0	0	0	0	0	499	0	0	25	0	33	18	0	568	621	0	0	1,764
	2022	0	0	0	0	0	0	0	0	0	0	495	0	0	24	0	32	17	0	568	621	0	0	1,757
	2023	0	0	0	0	0	0	0	0	0	0	490	0	0	24	0	31	17	0	568	621	0	0	1,750
	2024	0	0	0	0	0	0	0	0	0	0	485	0	0	24	0	30	17	0	568	621	0	0	1,744
	2025	0	0	0	0	0	0	0	0	0	0	480	0	0	24	0	29	17	0	568	621	0	0	1,738
	2026	0	0	0	0	0	0	0	0	0	0	475	0	0	23	0	28	17	0	568	621	0	0	1,732
	2027	0	0	0	0	0	0	0	0	0	0	470	0	0	23	0	28	17	0	568	621	0	0	1,726
	2028	0	0	0	0	0	0	0	0	0	0	461	0	0	23	0	27	16	0	568	621	0	0	1,715
	2029	0	0	0	0	0	0	0	0	0	0	456	0	0	23	0	26	16	0	568	621	0	0	1,709
	2030	0	0	0	0	0	0	0	0	0	0	452	0	0	22	0	25	16	0	568	621	0	0	1,704
	2031	0	0	0	0	0	0	0	0	0	0	447	0	0	22	0	25	16	0	568	621	0	0	1,698
	2032	0	0	0	0	0	0	0	0	0	0	443	0	0	22	0	24	16	0	568	621	0	0	1,693
	2033	0	0	0	0	0	0	0	0	0	0	438	0	0	22	0	23	15	0	568	621	0	0	1,688
	2034	0	0	0	0	0	0	0	0	0	0	434	0	0	21	0	23	15	0	568	621	0	0	1,682
	2035	0	0	0	0	0	0	0	0	0	0	429	0	0	21	0	23	15	0	568	621	0	0	1,677
	2036	0	0	0	0	0	0	0	0	0	0	425	0	0	21	0	22	15	0	568	621	0	0	1,672
	2037	0	0	0	0	0	0	0	0	0	0	420	0	0	21	0	22	15	0	568	621	0	0	1,666
	TOTAL	0	293	5	1,166	52	169	32	0	0	0	14,770	0	0	733	0	1,029	522	0	17,043	18,615	0	0	54,431

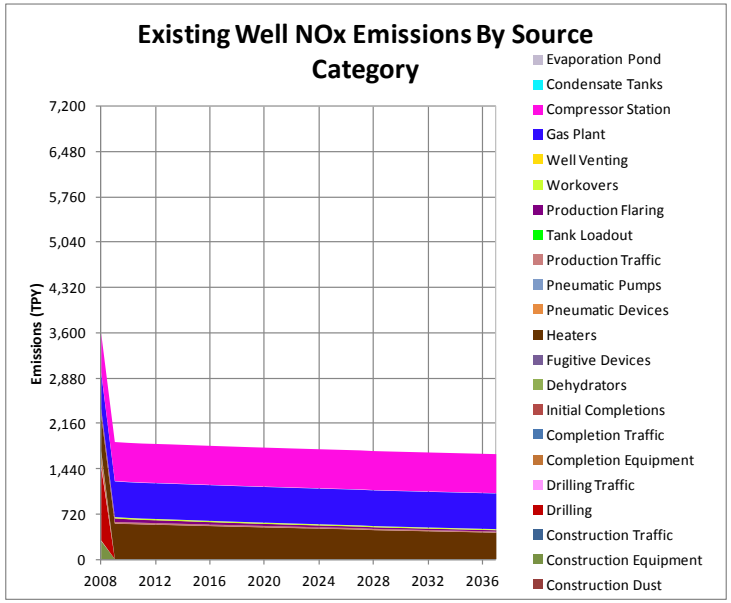

Figure 1. Existing Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year

Table 114. Existing Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
VOC [tpy]	2008	0	44	1	106	6	0	4	130	27,096	1,904	31	0	12,422	7	197	79	2	2,133	198	221	14,072	20	58,672
	2009	0	0	0	0	0	0	0	0	26,548	1,885	31	0	12,295	7	185	75	2	2,111	198	221	13,311	20	56,889
	2010	0	0	0	0	0	0	0	0	25,484	1,866	31	0	12,169	7	159	66	2	2,089	198	221	11,585	20	53,896
	2011	0	0	0	0	0	0	0	0	24,751	1,846	30	0	12,042	7	145	61	2	2,067	198	221	10,624	19	52,014
	2012	0	0	0	0	0	0	0	0	24,463	1,828	30	0	11,925	7	142	60	2	2,047	198	221	10,438	19	51,381
	2013	0	0	0	0	0	0	0	0	24,206	1,810	30	0	11,808	7	141	59	2	2,027	198	221	10,307	19	50,835
	2014	0	0	0	0	0	0	0	0	23,736	1,792	29	0	11,692	6	133	56	2	2,007	198	221	9,821	19	49,714
	2015	0	0	0	0	0	0	0	0	23,244	1,774	29	0	11,575	6	126	54	2	1,987	198	221	9,316	19	48,551
	2016	0	0	0	0	0	0	0	0	22,781	1,757	29	0	11,458	6	120	51	2	1,967	198	221	8,875	18	47,484
	2017	0	0	0	0	0	0	0	0	22,347	1,739	29	0	11,341	6	114	49	2	1,947	198	221	8,490	18	46,501
	2018	0	0	0	0	0	0	0	0	21,938	1,721	28	0	11,224	6	109	47	2	1,927	198	221	8,150	18	45,590
	2019	0	0	0	0	0	0	0	0	21,545	1,703	28	0	11,108	6	104	46	2	1,907	198	221	7,840	18	44,725
	2020	0	0	0	0	0	0	0	0	21,179	1,686	28	0	11,000	6	100	44	2	1,889	198	221	7,555	18	43,925
	2021	0	0	0	0	0	0	0	0	20,830	1,670	27	0	10,893	6	96	43	2	1,870	198	221	7,298	18	43,173
	2022	0	0	0	0	0	0	0	0	20,403	1,654	27	0	10,786	6	91	41	2	1,852	198	221	6,951	17	42,249
	2023	0	0	0	0	0	0	0	0	20,072	1,637	27	0	10,679	6	88	39	2	1,833	198	221	6,729	17	41,549
	2024	0	0	0	0	0	0	0	0	19,751	1,621	27	0	10,572	6	85	38	2	1,815	198	221	6,521	17	40,874
	2025	0	0	0	0	0	0	0	0	19,449	1,604	26	0	10,465	6	83	37	2	1,797	198	221	6,340	17	40,245
	2026	0	0	0	0	0	0	0	0	19,149	1,588	26	0	10,358	6	80	36	2	1,778	198	221	6,162	17	39,621
	2027	0	0	0	0	0	0	0	0	18,858	1,572	26	0	10,251	6	78	35	2	1,760	198	221	5,996	16	39,018
	2028	0	0	0	0	0	0	0	0	18,445	1,540	25	0	10,046	6	76	35	2	1,725	198	221	5,837	16	38,171
	2029	0	0	0	0	0	0	0	0	18,076	1,525	25	0	9,949	5	72	33	2	1,708	198	221	5,580	16	37,410
	2030	0	0	0	0	0	0	0	0	17,816	1,510	25	0	9,852	5	70	32	2	1,691	198	221	5,440	16	36,879
	2031	0	0	0	0	0	0	0	0	17,564	1,495	25	0	9,754	5	68	32	2	1,675	198	221	5,310	16	36,364
	2032	0	0	0	0	0	0	0	0	17,314	1,480	24	0	9,657	5	66	31	2	1,658	198	221	5,184	16	35,856
	2033	0	0	0	0	0	0	0	0	17,066	1,466	24	0	9,560	5	64	30	2	1,641	198	221	5,060	15	35,353
	2034	0	0	0	0	0	0	0	0	16,826	1,451	24	0	9,462	5	63	30	2	1,624	198	221	4,945	15	34,866
	2035	0	0	0	0	0	0	0	0	16,591	1,436	24	0	9,365	5	61	29	2	1,608	198	221	4,836	15	34,390
	2036	0	0	0	0	0	0	0	0	16,367	1,421	23	0	9,268	5	60	28	2	1,591	198	221	4,738	15	33,938
	2037	0	0	0	0	0	0	0	0	16,146	1,406	23	0	9,170	5	59	28	2	1,574	198	221	4,643	15	33,490
	TOTAL	0	44	1	106	6	0	4	130	620,038	49,387	812	0	322,148	178	3,035	1,324	55	55,305	5,952	6,624	227,956	518	1,293,623

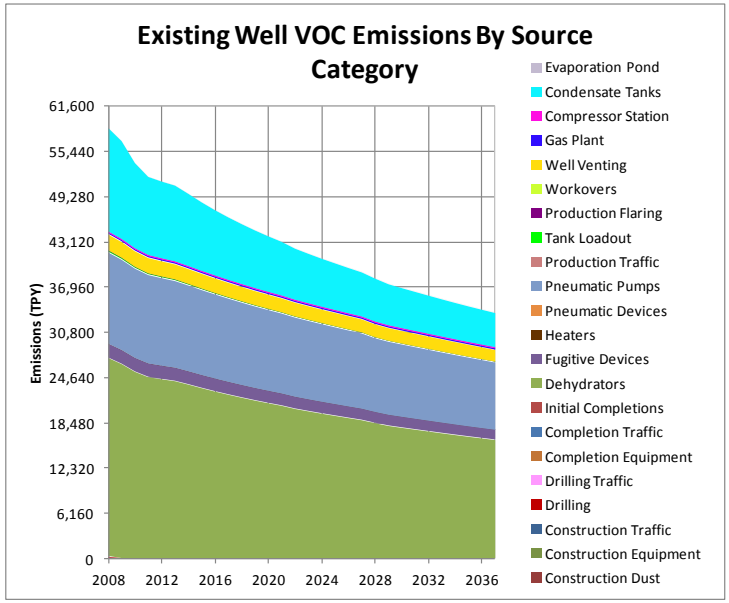

Figure 2. Existing Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 115. Existing Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
SO2 [tpy]	2008	0	5	0	71	0	56	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	135
	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
	TOTAL	0	5	0	71	0	56	0	0	0	0	0	0	0	4	0	0	1	0	0	61	0	0	198

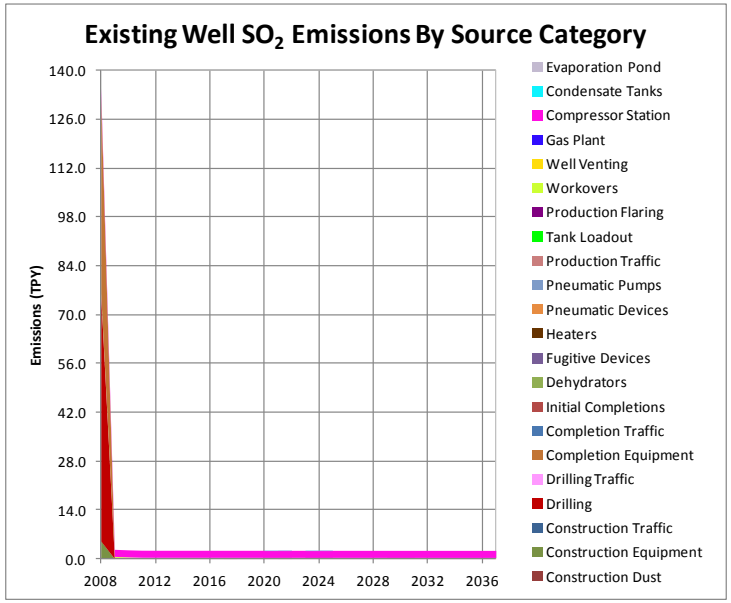

Figure 3. Existing Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 116. Existing Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
PM10 [tpy]	2008	194	18	32	56	298	12	188	0	0	0	43	0	0	379	0	0	1	0	32	49	0	0	1,302
	2009	0	0	0	0	0	0	0	0	0	0	43	0	0	375	0	0	1	0	32	49	0	0	500
	2010	0	0	0	0	0	0	0	0	0	0	42	0	0	371	0	0	1	0	32	49	0	0	496
	2011	0	0	0	0	0	0	0	0	0	0	42	0	0	368	0	0	1	0	32	49	0	0	491
	2012	0	0	0	0	0	0	0	0	0	0	42	0	0	364	0	0	1	0	32	49	0	0	487
	2013	0	0	0	0	0	0	0	0	0	0	41	0	0	360	0	0	1	0	32	49	0	0	483
	2014	0	0	0	0	0	0	0	0	0	0	41	0	0	357	0	0	1	0	32	49	0	0	479
	2015	0	0	0	0	0	0	0	0	0	0	40	0	0	353	0	0	1	0	32	49	0	0	475
	2016	0	0	0	0	0	0	0	0	0	0	40	0	0	350	0	0	1	0	32	49	0	0	471
	2017	0	0	0	0	0	0	0	0	0	0	40	0	0	346	0	0	1	0	32	49	0	0	467
	2018	0	0	0	0	0	0	0	0	0	0	39	0	0	343	0	0	1	0	32	49	0	0	464
	2019	0	0	0	0	0	0	0	0	0	0	39	0	0	339	0	0	1	0	32	49	0	0	460
	2020	0	0	0	0	0	0	0	0	0	0	38	0	0	336	0	0	1	0	32	49	0	0	456
	2021	0	0	0	0	0	0	0	0	0	0	38	0	0	332	0	0	1	0	32	49	0	0	452
	2022	0	0	0	0	0	0	0	0	0	0	38	0	0	329	0	0	1	0	32	49	0	0	449
	2023	0	0	0	0	0	0	0	0	0	0	37	0	0	326	0	0	1	0	32	49	0	0	445
	2024	0	0	0	0	0	0	0	0	0	0	37	0	0	323	0	0	1	0	32	49	0	0	441
	2025	0	0	0	0	0	0	0	0	0	0	36	0	0	319	0	0	1	0	32	49	0	0	438
	2026	0	0	0	0	0	0	0	0	0	0	36	0	0	316	0	0	1	0	32	49	0	0	434
	2027	0	0	0	0	0	0	0	0	0	0	36	0	0	313	0	0	1	0	32	49	0	0	430
	2028	0	0	0	0	0	0	0	0	0	0	35	0	0	307	0	0	1	0	32	49	0	0	423
	2029	0	0	0	0	0	0	0	0	0	0	35	0	0	304	0	0	1	0	32	49	0	0	420
	2030	0	0	0	0	0	0	0	0	0	0	34	0	0	301	0	0	1	0	32	49	0	0	417
	2031	0	0	0	0	0	0	0	0	0	0	34	0	0	298	0	0	1	0	32	49	0	0	413
	2032	0	0	0	0	0	0	0	0	0	0	34	0	0	295	0	0	1	0	32	49	0	0	410
	2033	0	0	0	0	0	0	0	0	0	0	33	0	0	292	0	0	1	0	32	49	0	0	407
	2034	0	0	0	0	0	0	0	0	0	0	33	0	0	289	0	0	1	0	32	49	0	0	403
	2035	0	0	0	0	0	0	0	0	0	0	33	0	0	286	0	0	1	0	32	49	0	0	400
	2036	0	0	0	0	0	0	0	0	0	0	32	0	0	283	0	0	1	0	32	49	0	0	397
	2037	0	0	0	0	0	0	0	0	0	0	32	0	0	280	0	0	1	0	32	49	0	0	393
	TOTAL	194	18	32	56	298	12	188	0	0	0	1,123	0	0	9,833	0	0	35	0	960	1,457	0	0	14,206

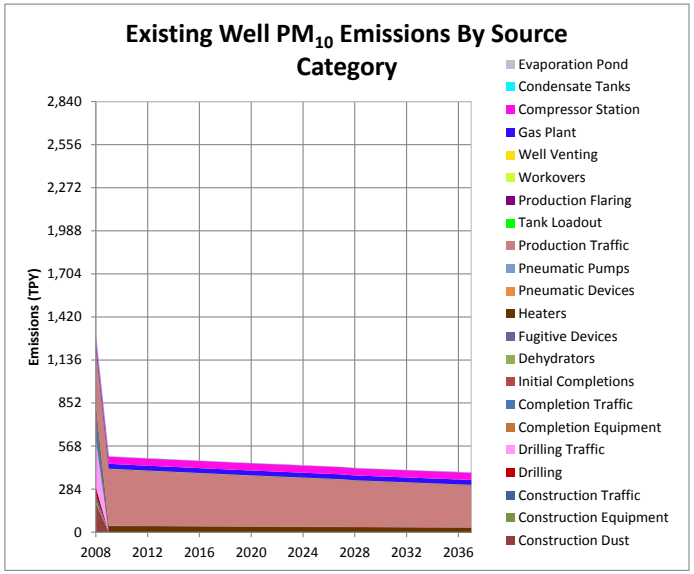

Figure 4. Existing Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 117. Existing Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
PM2.5 [tpy]	2008	50	17	3	54	32	12	20	0	0	0	43	0	0	39	0	0	1	0	32	49	0	0	353
	2009	0	0	0	0	0	0	0	0	0	0	43	0	0	39	0	0	1	0	32	49	0	0	163
	2010	0	0	0	0	0	0	0	0	0	0	42	0	0	38	0	0	1	0	32	49	0	0	162
	2011	0	0	0	0	0	0	0	0	0	0	42	0	0	38	0	0	1	0	32	49	0	0	162
	2012	0	0	0	0	0	0	0	0	0	0	42	0	0	37	0	0	1	0	32	49	0	0	161
	2013	0	0	0	0	0	0	0	0	0	0	41	0	0	37	0	0	1	0	32	49	0	0	160
	2014	0	0	0	0	0	0	0	0	0	0	41	0	0	37	0	0	1	0	32	49	0	0	159
	2015	0	0	0	0	0	0	0	0	0	0	40	0	0	36	0	0	1	0	32	49	0	0	158
	2016	0	0	0	0	0	0	0	0	0	0	40	0	0	36	0	0	1	0	32	49	0	0	158
	2017	0	0	0	0	0	0	0	0	0	0	40	0	0	36	0	0	1	0	32	49	0	0	157
	2018	0	0	0	0	0	0	0	0	0	0	39	0	0	35	0	0	1	0	32	49	0	0	156
	2019	0	0	0	0	0	0	0	0	0	0	39	0	0	35	0	0	1	0	32	49	0	0	155
	2020	0	0	0	0	0	0	0	0	0	0	38	0	0	34	0	0	1	0	32	49	0	0	155
	2021	0	0	0	0	0	0	0	0	0	0	38	0	0	34	0	0	1	0	32	49	0	0	154
	2022	0	0	0	0	0	0	0	0	0	0	38	0	0	34	0	0	1	0	32	49	0	0	153
	2023	0	0	0	0	0	0	0	0	0	0	37	0	0	33	0	0	1	0	32	49	0	0	152
	2024	0	0	0	0	0	0	0	0	0	0	37	0	0	33	0	0	1	0	32	49	0	0	152
	2025	0	0	0	0	0	0	0	0	0	0	36	0	0	33	0	0	1	0	32	49	0	0	151
	2026	0	0	0	0	0	0	0	0	0	0	36	0	0	32	0	0	1	0	32	49	0	0	150
	2027	0	0	0	0	0	0	0	0	0	0	36	0	0	32	0	0	1	0	32	49	0	0	149
	2028	0	0	0	0	0	0	0	0	0	0	35	0	0	31	0	0	1	0	32	49	0	0	148
	2029	0	0	0	0	0	0	0	0	0	0	35	0	0	31	0	0	1	0	32	49	0	0	147
	2030	0	0	0	0	0	0	0	0	0	0	34	0	0	31	0	0	1	0	32	49	0	0	147
	2031	0	0	0	0	0	0	0	0	0	0	34	0	0	31	0	0	1	0	32	49	0	0	146
	2032	0	0	0	0	0	0	0	0	0	0	34	0	0	30	0	0	1	0	32	49	0	0	145
	2033	0	0	0	0	0	0	0	0	0	0	33	0	0	30	0	0	1	0	32	49	0	0	145
	2034	0	0	0	0	0	0	0	0	0	0	33	0	0	30	0	0	1	0	32	49	0	0	144
	2035	0	0	0	0	0	0	0	0	0	0	33	0	0	29	0	0	1	0	32	49	0	0	144
	2036	0	0	0	0	0	0	0	0	0	0	32	0	0	29	0	0	1	0	32	49	0	0	143
	2037	0	0	0	0	0	0	0	0	0	0	32	0	0	29	0	0	1	0	32	49	0	0	142
	TOTAL	50	17	3	54	32	12	20	0	0	0	1,123	0	0	1,009	0	0	34	0	960	1,457	0	0	4,772

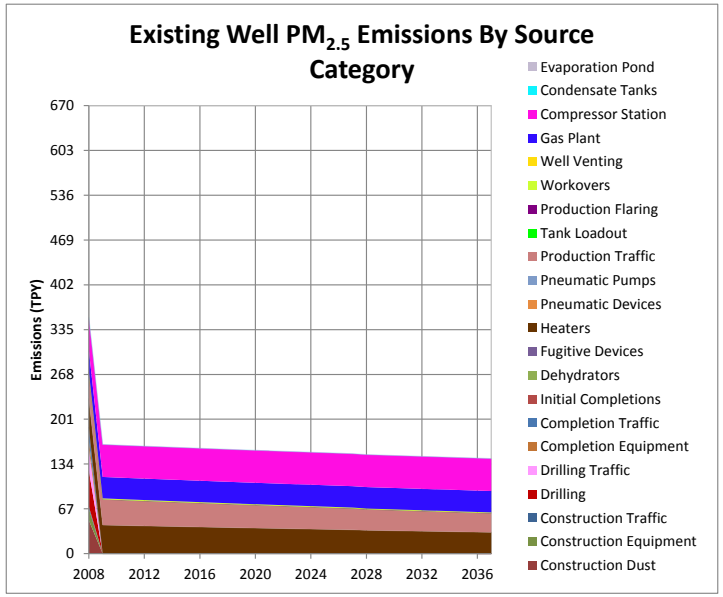

Figure 5. Existing Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 118. Existing Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO [tpy]	2008	0	362	6	504	56	132	36	0	0	0	478	0	0	79	0	335	8	0	741	449	0	0	3,185
	2009	0	0	0	0	0	0	0	0	0	0	474	0	0	78	0	317	8	0	741	449	0	0	2,066
	2010	0	0	0	0	0	0	0	0	0	0	469	0	0	77	0	278	8	0	741	449	0	0	2,022
	2011	0	0	0	0	0	0	0	0	0	0	464	0	0	76	0	257	8	0	741	449	0	0	1,994
	2012	0	0	0	0	0	0	0	0	0	0	459	0	0	75	0	252	8	0	741	449	0	0	1,984
	2013	0	0	0	0	0	0	0	0	0	0	455	0	0	74	0	249	8	0	741	449	0	0	1,976
	2014	0	0	0	0	0	0	0	0	0	0	450	0	0	74	0	238	8	0	741	449	0	0	1,959
	2015	0	0	0	0	0	0	0	0	0	0	446	0	0	73	0	226	8	0	741	449	0	0	1,943
	2016	0	0	0	0	0	0	0	0	0	0	441	0	0	72	0	216	8	0	741	449	0	0	1,927
	2017	0	0	0	0	0	0	0	0	0	0	437	0	0	71	0	208	8	0	741	449	0	0	1,913
	2018	0	0	0	0	0	0	0	0	0	0	432	0	0	71	0	200	7	0	741	449	0	0	1,900
	2019	0	0	0	0	0	0	0	0	0	0	428	0	0	70	0	193	7	0	741	449	0	0	1,887
	2020	0	0	0	0	0	0	0	0	0	0	424	0	0	69	0	186	7	0	741	449	0	0	1,876
	2021	0	0	0	0	0	0	0	0	0	0	420	0	0	69	0	180	7	0	741	449	0	0	1,865
	2022	0	0	0	0	0	0	0	0	0	0	415	0	0	68	0	172	7	0	741	449	0	0	1,852
	2023	0	0	0	0	0	0	0	0	0	0	411	0	0	67	0	167	7	0	741	449	0	0	1,842
	2024	0	0	0	0	0	0	0	0	0	0	407	0	0	66	0	162	7	0	741	449	0	0	1,832
	2025	0	0	0	0	0	0	0	0	0	0	403	0	0	66	0	158	7	0	741	449	0	0	1,823
	2026	0	0	0	0	0	0	0	0	0	0	399	0	0	65	0	154	7	0	741	449	0	0	1,814
	2027	0	0	0	0	0	0	0	0	0	0	395	0	0	64	0	150	7	0	741	449	0	0	1,806
	2028	0	0	0	0	0	0	0	0	0	0	387	0	0	63	0	146	7	0	741	449	0	0	1,792
	2029	0	0	0	0	0	0	0	0	0	0	383	0	0	63	0	140	7	0	741	449	0	0	1,782
	2030	0	0	0	0	0	0	0	0	0	0	379	0	0	62	0	137	7	0	741	449	0	0	1,774
	2031	0	0	0	0	0	0	0	0	0	0	376	0	0	61	0	134	7	0	741	449	0	0	1,767
	2032	0	0	0	0	0	0	0	0	0	0	372	0	0	61	0	131	6	0	741	449	0	0	1,759
	2033	0	0	0	0	0	0	0	0	0	0	368	0	0	60	0	128	6	0	741	449	0	0	1,752
	2034	0	0	0	0	0	0	0	0	0	0	364	0	0	59	0	125	6	0	741	449	0	0	1,745
	2035	0	0	0	0	0	0	0	0	0	0	361	0	0	59	0	122	6	0	741	449	0	0	1,738
	2036	0	0	0	0	0	0	0	0	0	0	357	0	0	58	0	120	6	0	741	449	0	0	1,731
	2037	0	0	0	0	0	0	0	0	0	0	353	0	0	58	0	118	6	0	741	449	0	0	1,724
	TOTAL	0	362	6	504	56	132	36	0	0	0	12,407	0	0	2,028	0	5,598	215	0	22,218	13,470	0	0	57,031

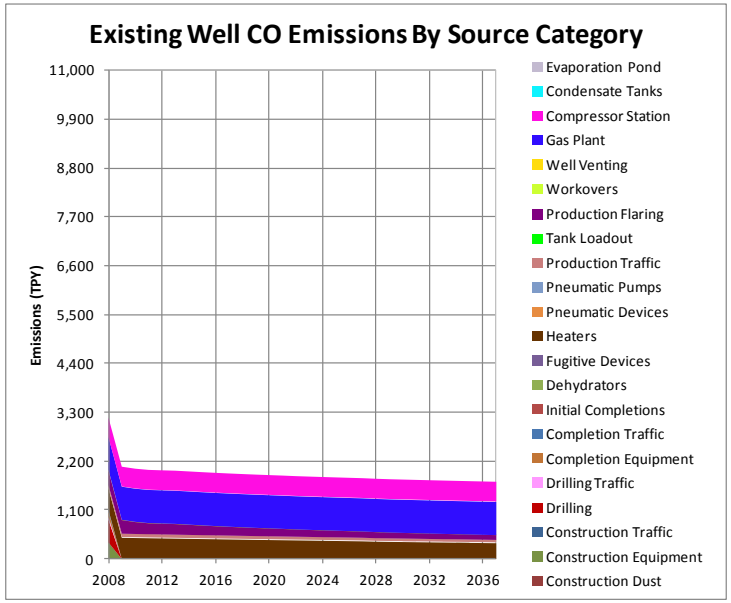

Figure 6. Existing Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 119. Existing Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
formaldehyde [tpy]	2008	0	4	0	9	0	0	0	0	0	0	3	0	0	0	0	32	0	0	85	148	0	0	282
	2009	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	30	0	0	85	148	0	0	267
	2010	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	26	0	0	85	148	0	0	263
	2011	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	24	0	0	85	148	0	0	261
	2012	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	24	0	0	85	148	0	0	260
	2013	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	24	0	0	85	148	0	0	260
	2014	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	23	0	0	85	148	0	0	259
	2015	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	21	0	0	85	148	0	0	258
	2016	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	20	0	0	85	148	0	0	257
	2017	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	20	0	0	85	148	0	0	256
	2018	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	19	0	0	85	148	0	0	255
	2019	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	18	0	0	85	148	0	0	254
	2020	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	18	0	0	85	148	0	0	254
	2021	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	17	0	0	85	148	0	0	253
	2022	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	16	0	0	85	148	0	0	252
	2023	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	16	0	0	85	148	0	0	252
	2024	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	15	0	0	85	148	0	0	251
	2025	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	15	0	0	85	148	0	0	251
	2026	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	15	0	0	85	148	0	0	251
	2027	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	14	0	0	85	148	0	0	250
	2028	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	14	0	0	85	148	0	0	250
	2029	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	13	0	0	85	148	0	0	249
	2030	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	13	0	0	85	148	0	0	249
	2031	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	13	0	0	85	148	0	0	249
	2032	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	12	0	0	85	148	0	0	248
	2033	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	12	0	0	85	148	0	0	248
	2034	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	12	0	0	85	148	0	0	248
	2035	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	12	0	0	85	148	0	0	247
	2036	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	11	0	0	85	148	0	0	247
	2037	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	11	0	0	85	148	0	0	247
	TOTAL	0	4	0	9	0	0	0	0	0	0	65	0	0	7	0	530	5	0	2,553	4,455	0	0	7,627

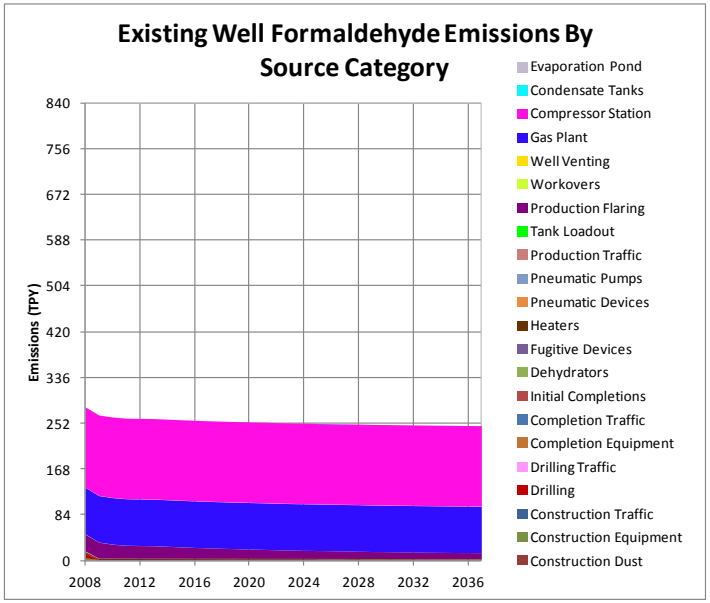

Figure 7. Existing Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 120. Existing Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production															Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
n-hexane [tpy]	2008	0	0	0	0	0	0	0	3	708	80	0	0	589	0	7	0	0	42	0	1	547	0	1,978
	2009	0	0	0	0	0	0	0	0	694	79	0	0	583	0	6	0	0	42	0	1	517	0	1,924
	2010	0	0	0	0	0	0	0	0	666	79	0	0	577	0	5	0	0	41	0	1	450	0	1,820
	2011	0	0	0	0	0	0	0	0	647	78	0	0	571	0	5	0	0	41	0	1	412	0	1,756
	2012	0	0	0	0	0	0	0	0	639	77	0	0	566	0	5	0	0	41	0	1	405	0	1,734
	2013	0	0	0	0	0	0	0	0	633	76	0	0	560	0	5	0	0	40	0	1	400	0	1,716
	2014	0	0	0	0	0	0	0	0	620	76	0	0	555	0	5	0	0	40	0	1	381	0	1,677
	2015	0	0	0	0	0	0	0	0	607	75	0	0	549	0	4	0	0	39	0	1	361	0	1,638
	2016	0	0	0	0	0	0	0	0	595	74	0	0	544	0	4	0	0	39	0	1	344	0	1,601
	2017	0	0	0	0	0	0	0	0	584	73	0	0	538	0	4	0	0	39	0	1	328	0	1,568
	2018	0	0	0	0	0	0	0	0	573	73	0	0	532	0	4	0	0	38	0	1	315	0	1,537
	2019	0	0	0	0	0	0	0	0	563	72	0	0	527	0	4	0	0	38	0	1	303	0	1,508
	2020	0	0	0	0	0	0	0	0	553	71	0	0	522	0	3	0	0	37	0	1	292	0	1,481
	2021	0	0	0	0	0	0	0	0	544	70	0	0	517	0	3	0	0	37	0	1	282	0	1,456
	2022	0	0	0	0	0	0	0	0	533	70	0	0	512	0	3	0	0	37	0	1	268	0	1,425
	2023	0	0	0	0	0	0	0	0	525	69	0	0	507	0	3	0	0	36	0	1	260	0	1,401
	2024	0	0	0	0	0	0	0	0	516	68	0	0	502	0	3	0	0	36	0	1	252	0	1,378
	2025	0	0	0	0	0	0	0	0	508	68	0	0	496	0	3	0	0	36	0	1	244	0	1,357
	2026	0	0	0	0	0	0	0	0	500	67	0	0	491	0	3	0	0	35	0	1	237	0	1,336
	2027	0	0	0	0	0	0	0	0	493	66	0	0	486	0	3	0	0	35	0	1	231	0	1,316
	2028	0	0	0	0	0	0	0	0	482	65	0	0	477	0	3	0	0	34	0	1	225	0	1,287
	2029	0	0	0	0	0	0	0	0	472	64	0	0	472	0	2	0	0	34	0	1	215	0	1,262
	2030	0	0	0	0	0	0	0	0	466	64	0	0	467	0	2	0	0	34	0	1	209	0	1,244
	2031	0	0	0	0	0	0	0	0	459	63	0	0	463	0	2	0	0	33	0	1	204	0	1,226
	2032	0	0	0	0	0	0	0	0	452	62	0	0	458	0	2	0	0	33	0	1	199	0	1,209
	2033	0	0	0	0	0	0	0	0	446	62	0	0	453	0	2	0	0	33	0	1	195	0	1,192
	2034	0	0	0	0	0	0	0	0	440	61	0	0	449	0	2	0	0	32	0	1	190	0	1,176
	2035	0	0	0	0	0	0	0	0	434	61	0	0	444	0	2	0	0	32	0	1	186	0	1,160
	2036	0	0	0	0	0	0	0	0	428	60	0	0	440	0	2	0	0	32	0	1	182	0	1,145
	2037	0	0	0	0	0	0	0	0	422	59	0	0	435	0	2	0	0	31	0	1	178	0	1,130
	TOTAL	0	0	0	0	0	0	0	3	16,202	2,083	0	0	15,282	1	103	0	0	1,097	10	43	8,812	1	43,638

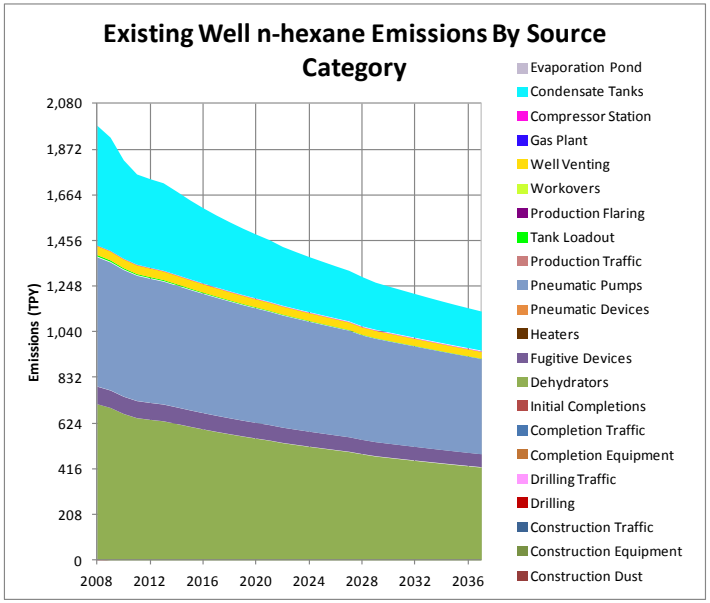

Figure 8. Existing Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 121. Existing Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production															Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
benzene [tpy]	2008	0	0	0	1	0	0	0	1	2,610	13	1	0	50	0	1	0	0	9	2	1	112	3	2,804
	2009	0	0	0	0	0	0	0	0	2,557	13	1	0	50	0	1	0	0	9	2	1	106	3	2,742
	2010	0	0	0	0	0	0	0	0	2,454	13	1	0	49	0	1	0	0	9	2	1	92	3	2,624
	2011	0	0	0	0	0	0	0	0	2,384	13	1	0	49	0	1	0	0	9	2	1	84	3	2,545
	2012	0	0	0	0	0	0	0	0	2,356	13	1	0	48	0	1	0	0	8	2	1	82	3	2,515
	2013	0	0	0	0	0	0	0	0	2,331	13	1	0	48	0	1	0	0	8	2	1	81	3	2,489
	2014	0	0	0	0	0	0	0	0	2,286	12	1	0	47	0	1	0	0	8	2	1	77	3	2,439
	2015	0	0	0	0	0	0	0	0	2,239	12	1	0	47	0	1	0	0	8	2	1	73	3	2,386
	2016	0	0	0	0	0	0	0	0	2,194	12	1	0	46	0	1	0	0	8	2	1	70	3	2,337
	2017	0	0	0	0	0	0	0	0	2,152	12	1	0	46	0	1	0	0	8	2	1	67	3	2,292
	2018	0	0	0	0	0	0	0	0	2,113	12	1	0	45	0	1	0	0	8	2	1	64	3	2,249
	2019	0	0	0	0	0	0	0	0	2,075	12	1	0	45	0	0	0	0	8	2	1	61	2	2,208
	2020	0	0	0	0	0	0	0	0	2,040	12	1	0	44	0	0	0	0	8	2	1	59	2	2,169
	2021	0	0	0	0	0	0	0	0	2,006	12	1	0	44	0	0	0	0	8	2	1	57	2	2,133
	2022	0	0	0	0	0	0	0	0	1,965	11	1	0	43	0	0	0	0	8	2	1	54	2	2,088
	2023	0	0	0	0	0	0	0	0	1,933	11	1	0	43	0	0	0	0	8	2	1	52	2	2,054
	2024	0	0	0	0	0	0	0	0	1,902	11	1	0	43	0	0	0	0	8	2	1	51	2	2,021
	2025	0	0	0	0	0	0	0	0	1,873	11	1	0	42	0	0	0	0	7	2	1	49	2	1,990
	2026	0	0	0	0	0	0	0	0	1,844	11	1	0	42	0	0	0	0	7	2	1	48	2	1,959
	2027	0	0	0	0	0	0	0	0	1,816	11	1	0	41	0	0	0	0	7	2	1	46	2	1,929
	2028	0	0	0	0	0	0	0	0	1,776	11	1	0	40	0	0	0	0	7	2	1	45	2	1,886
	2029	0	0	0	0	0	0	0	0	1,741	11	1	0	40	0	0	0	0	7	2	1	43	2	1,848
	2030	0	0	0	0	0	0	0	0	1,716	10	1	0	40	0	0	0	0	7	2	1	42	2	1,821
	2031	0	0	0	0	0	0	0	0	1,691	10	1	0	39	0	0	0	0	7	2	1	41	2	1,795
	2032	0	0	0	0	0	0	0	0	1,667	10	1	0	39	0	0	0	0	7	2	1	40	2	1,770
	2033	0	0	0	0	0	0	0	0	1,644	10	1	0	39	0	0	0	0	7	2	1	39	2	1,744
	2034	0	0	0	0	0	0	0	0	1,620	10	1	0	38	0	0	0	0	7	2	1	38	2	1,720
	2035	0	0	0	0	0	0	0	0	1,598	10	1	0	38	0	0	0	0	7	2	1	37	2	1,696
	2036	0	0	0	0	0	0	0	0	1,576	10	1	0	37	0	0	0	0	7	2	1	36	2	1,673
	2037	0	0	0	0	0	0	0	0	1,555	10	1	0	37	0	0	0	0	7	2	1	36	2	1,650
	TOTAL	0	0	0	1	0	0	0	1	59,713	341	32	0	1,299	5	14	0	1	229	63	21	1,783	72	63,576

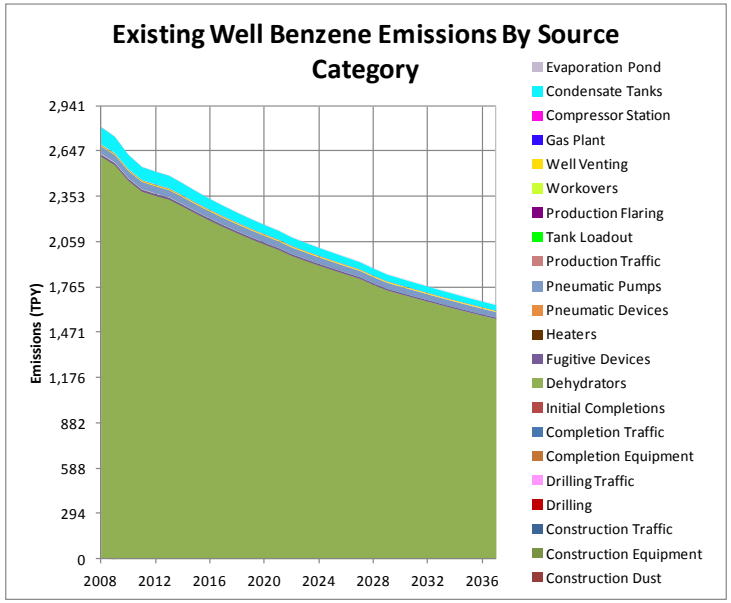

Figure 9. Existing Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 122. Existing Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production															Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
ethylbenzene [tpy]	2008	0	0	0	0	0	0	0	0	160	0	0	0	2	0	0	0	0	0	0	0	2	0	166
	2009	0	0	0	0	0	0	0	0	157	0	0	0	2	0	0	0	0	0	0	0	2	0	162
	2010	0	0	0	0	0	0	0	0	151	0	0	0	2	0	0	0	0	0	0	0	2	0	156
	2011	0	0	0	0	0	0	0	0	146	0	0	0	2	0	0	0	0	0	0	0	2	0	151
	2012	0	0	0	0	0	0	0	0	145	0	0	0	2	0	0	0	0	0	0	0	2	0	149
	2013	0	0	0	0	0	0	0	0	143	0	0	0	2	0	0	0	0	0	0	0	2	0	148
	2014	0	0	0	0	0	0	0	0	140	0	0	0	2	0	0	0	0	0	0	0	1	0	145
	2015	0	0	0	0	0	0	0	0	137	0	0	0	2	0	0	0	0	0	0	0	1	0	142
	2016	0	0	0	0	0	0	0	0	135	0	0	0	2	0	0	0	0	0	0	0	1	0	139
	2017	0	0	0	0	0	0	0	0	132	0	0	0	2	0	0	0	0	0	0	0	1	0	136
	2018	0	0	0	0	0	0	0	0	130	0	0	0	2	0	0	0	0	0	0	0	1	0	134
	2019	0	0	0	0	0	0	0	0	127	0	0	0	2	0	0	0	0	0	0	0	1	0	132
	2020	0	0	0	0	0	0	0	0	125	0	0	0	2	0	0	0	0	0	0	0	1	0	129
	2021	0	0	0	0	0	0	0	0	123	0	0	0	2	0	0	0	0	0	0	0	1	0	127
	2022	0	0	0	0	0	0	0	0	121	0	0	0	2	0	0	0	0	0	0	0	1	0	125
	2023	0	0	0	0	0	0	0	0	119	0	0	0	2	0	0	0	0	0	0	0	1	0	123
	2024	0	0	0	0	0	0	0	0	117	0	0	0	2	0	0	0	0	0	0	0	1	0	121
	2025	0	0	0	0	0	0	0	0	115	0	0	0	2	0	0	0	0	0	0	0	1	0	119
	2026	0	0	0	0	0	0	0	0	113	0	0	0	2	0	0	0	0	0	0	0	1	0	117
	2027	0	0	0	0	0	0	0	0	112	0	0	0	2	0	0	0	0	0	0	0	1	0	115
	2028	0	0	0	0	0	0	0	0	109	0	0	0	2	0	0	0	0	0	0	0	1	0	113
	2029	0	0	0	0	0	0	0	0	107	0	0	0	2	0	0	0	0	0	0	0	1	0	110
	2030	0	0	0	0	0	0	0	0	105	0	0	0	2	0	0	0	0	0	0	0	1	0	109
	2031	0	0	0	0	0	0	0	0	104	0	0	0	2	0	0	0	0	0	0	0	1	0	107
	2032	0	0	0	0	0	0	0	0	102	0	0	0	2	0	0	0	0	0	0	0	1	0	106
	2033	0	0	0	0	0	0	0	0	101	0	0	0	2	0	0	0	0	0	0	0	1	0	104
	2034	0	0	0	0	0	0	0	0	100	0	0	0	2	0	0	0	0	0	0	0	1	0	103
	2035	0	0	0	0	0	0	0	0	98	0	0	0	2	0	0	0	0	0	0	0	1	0	101
	2036	0	0	0	0	0	0	0	0	97	0	0	0	2	0	0	0	0	0	0	0	1	0	100
	2037	0	0	0	0	0	0	0	0	96	0	0	0	2	0	0	0	0	0	0	0	1	0	99
	TOTAL	0	0	0	0	0	0	0	0	3,667	8	0	0	54	2	0	0	0	10	2	2	34	8	3,788

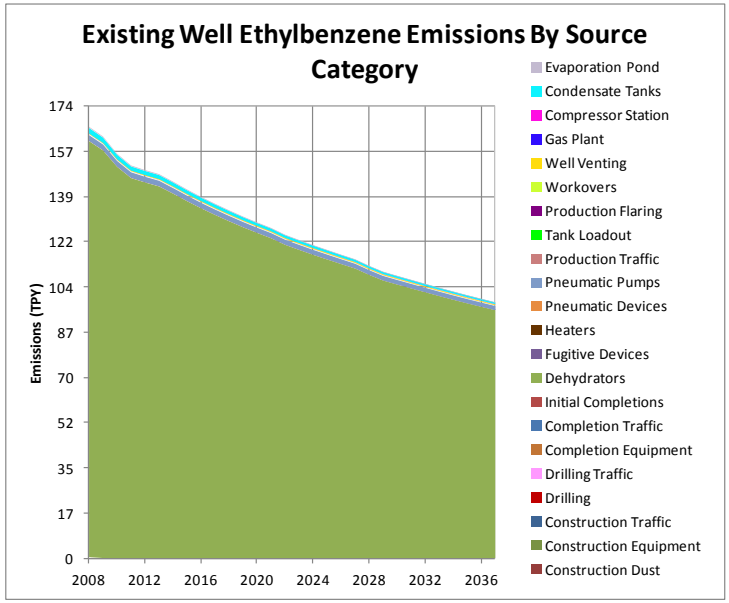

Figure 10. Existing Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 123. Existing Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production															Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
toluene [tpy]	2008	0	1	0	2	0	0	0	1	4,310	18	1	0	69	1	1	0	0	12	1	0	159	4	4,579
	2009	0	0	0	0	0	0	0	0	4,222	18	1	0	68	1	1	0	0	12	1	0	151	4	4,479
	2010	0	0	0	0	0	0	0	0	4,053	18	1	0	68	1	1	0	0	12	1	0	130	4	4,288
	2011	0	0	0	0	0	0	0	0	3,937	18	1	0	67	1	1	0	0	12	1	0	119	3	4,159
	2012	0	0	0	0	0	0	0	0	3,891	18	1	0	66	1	1	0	0	12	1	0	117	3	4,110
	2013	0	0	0	0	0	0	0	0	3,850	18	1	0	66	1	1	0	0	12	1	0	116	3	4,067
	2014	0	0	0	0	0	0	0	0	3,775	17	1	0	65	1	1	0	0	11	1	0	110	3	3,985
	2015	0	0	0	0	0	0	0	0	3,697	17	1	0	64	0	1	0	0	11	1	0	104	3	3,900
	2016	0	0	0	0	0	0	0	0	3,623	17	1	0	64	0	1	0	0	11	1	0	99	3	3,821
	2017	0	0	0	0	0	0	0	0	3,554	17	1	0	63	0	1	0	0	11	1	0	95	3	3,746
	2018	0	0	0	0	0	0	0	0	3,489	17	1	0	62	0	1	0	0	11	1	0	91	3	3,676
	2019	0	0	0	0	0	0	0	0	3,427	17	1	0	62	0	1	0	0	11	1	0	87	3	3,609
	2020	0	0	0	0	0	0	0	0	3,368	16	1	0	61	0	1	0	0	11	1	0	84	3	3,546
	2021	0	0	0	0	0	0	0	0	3,313	16	1	0	60	0	1	0	0	11	1	0	81	3	3,487
	2022	0	0	0	0	0	0	0	0	3,245	16	1	0	60	0	1	0	0	11	1	0	77	3	3,414
	2023	0	0	0	0	0	0	0	0	3,192	16	1	0	59	0	1	0	0	10	1	0	74	3	3,358
	2024	0	0	0	0	0	0	0	0	3,141	16	1	0	59	0	1	0	0	10	1	0	72	3	3,304
	2025	0	0	0	0	0	0	0	0	3,093	16	1	0	58	0	1	0	0	10	1	0	70	3	3,253
	2026	0	0	0	0	0	0	0	0	3,046	15	1	0	58	0	1	0	0	10	1	0	68	3	3,202
	2027	0	0	0	0	0	0	0	0	2,999	15	1	0	57	0	0	0	0	10	1	0	66	3	3,153
	2028	0	0	0	0	0	0	0	0	2,934	15	1	0	56	0	0	0	0	10	1	0	64	3	3,084
	2029	0	0	0	0	0	0	0	0	2,875	15	1	0	55	0	0	0	0	10	1	0	61	3	3,021
	2030	0	0	0	0	0	0	0	0	2,833	15	0	0	55	0	0	0	0	10	1	0	59	3	2,977
	2031	0	0	0	0	0	0	0	0	2,793	15	0	0	54	0	0	0	0	10	1	0	58	3	2,935
	2032	0	0	0	0	0	0	0	0	2,754	14	0	0	54	0	0	0	0	9	1	0	56	3	2,893
	2033	0	0	0	0	0	0	0	0	2,714	14	0	0	53	0	0	0	0	9	1	0	55	3	2,851
	2034	0	0	0	0	0	0	0	0	2,676	14	0	0	53	0	0	0	0	9	1	0	54	3	2,811
	2035	0	0	0	0	0	0	0	0	2,639	14	0	0	52	0	0	0	0	9	1	0	53	3	2,772
	2036	0	0	0	0	0	0	0	0	2,603	14	0	0	51	0	0	0	0	9	1	0	51	3	2,734
	2037	0	0	0	0	0	0	0	0	2,568	14	0	0	51	0	0	0	0	9	1	0	50	3	2,697
	TOTAL	0	1	0	2	0	0	0	1	98,614	479	16	0	1,789	14	19	0	1	315	29	11	2,530	93	103,914

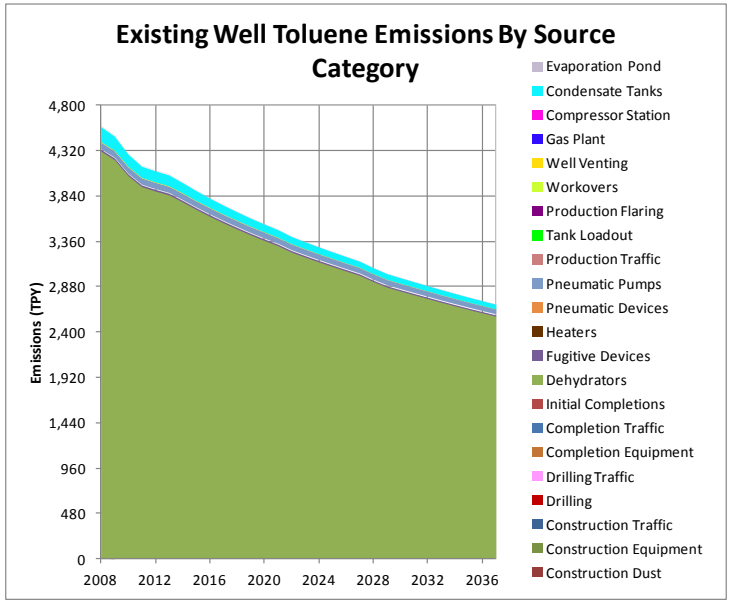

Figure 11. Existing Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 124. Existing Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production															Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
xylenes [tpy]	2008	0	1	0	1	0	0	0	0	1,587	10	0	0	40	0	1	0	0	4	0	0	86	5	1,735
	2009	0	0	0	0	0	0	0	0	1,555	10	0	0	39	0	1	0	0	4	0	0	81	5	1,696
	2010	0	0	0	0	0	0	0	0	1,493	10	0	0	39	0	1	0	0	4	0	0	70	5	1,622
	2011	0	0	0	0	0	0	0	0	1,450	10	0	0	39	0	1	0	0	4	0	0	64	5	1,572
	2012	0	0	0	0	0	0	0	0	1,433	10	0	0	38	0	0	0	0	4	0	0	63	5	1,553
	2013	0	0	0	0	0	0	0	0	1,418	10	0	0	38	0	0	0	0	4	0	0	62	5	1,537
	2014	0	0	0	0	0	0	0	0	1,390	9	0	0	37	0	0	0	0	4	0	0	59	5	1,506
	2015	0	0	0	0	0	0	0	0	1,361	9	0	0	37	0	0	0	0	4	0	0	56	5	1,473
	2016	0	0	0	0	0	0	0	0	1,334	9	0	0	37	0	0	0	0	3	0	0	53	4	1,443
	2017	0	0	0	0	0	0	0	0	1,309	9	0	0	36	0	0	0	0	3	0	0	51	4	1,415
	2018	0	0	0	0	0	0	0	0	1,285	9	0	0	36	0	0	0	0	3	0	0	49	4	1,388
	2019	0	0	0	0	0	0	0	0	1,262	9	0	0	36	0	0	0	0	3	0	0	47	4	1,362
	2020	0	0	0	0	0	0	0	0	1,240	9	0	0	35	0	0	0	0	3	0	0	45	4	1,339
	2021	0	0	0	0	0	0	0	0	1,220	9	0	0	35	0	0	0	0	3	0	0	44	4	1,316
	2022	0	0	0	0	0	0	0	0	1,195	9	0	0	35	0	0	0	0	3	0	0	41	4	1,288
	2023	0	0	0	0	0	0	0	0	1,176	9	0	0	34	0	0	0	0	3	0	0	40	4	1,267
	2024	0	0	0	0	0	0	0	0	1,157	9	0	0	34	0	0	0	0	3	0	0	39	4	1,246
	2025	0	0	0	0	0	0	0	0	1,139	8	0	0	34	0	0	0	0	3	0	0	38	4	1,227
	2026	0	0	0	0	0	0	0	0	1,121	8	0	0	33	0	0	0	0	3	0	0	37	4	1,208
	2027	0	0	0	0	0	0	0	0	1,104	8	0	0	33	0	0	0	0	3	0	0	36	4	1,189
	2028	0	0	0	0	0	0	0	0	1,080	8	0	0	32	0	0	0	0	3	0	0	35	4	1,163
	2029	0	0	0	0	0	0	0	0	1,059	8	0	0	32	0	0	0	0	3	0	0	33	4	1,140
	2030	0	0	0	0	0	0	0	0	1,043	8	0	0	32	0	0	0	0	3	0	0	32	4	1,123
	2031	0	0	0	0	0	0	0	0	1,029	8	0	0	31	0	0	0	0	3	0	0	31	4	1,107
	2032	0	0	0	0	0	0	0	0	1,014	8	0	0	31	0	0	0	0	3	0	0	31	4	1,091
	2033	0	0	0	0	0	0	0	0	999	8	0	0	31	0	0	0	0	3	0	0	30	4	1,075
	2034	0	0	0	0	0	0	0	0	985	8	0	0	30	0	0	0	0	3	0	0	29	4	1,060
	2035	0	0	0	0	0	0	0	0	972	8	0	0	30	0	0	0	0	3	0	0	28	4	1,045
	2036	0	0	0	0	0	0	0	0	959	7	0	0	30	0	0	0	0	3	0	0	28	4	1,031
	2037	0	0	0	0	0	0	0	0	946	7	0	0	29	0	0	0	0	3	0	0	27	4	1,017
	TOTAL	0	1	0	1	0	0	0	0	36,314	260	0	0	1,032	8	11	0	1	98	8	9	1,367	126	39,235

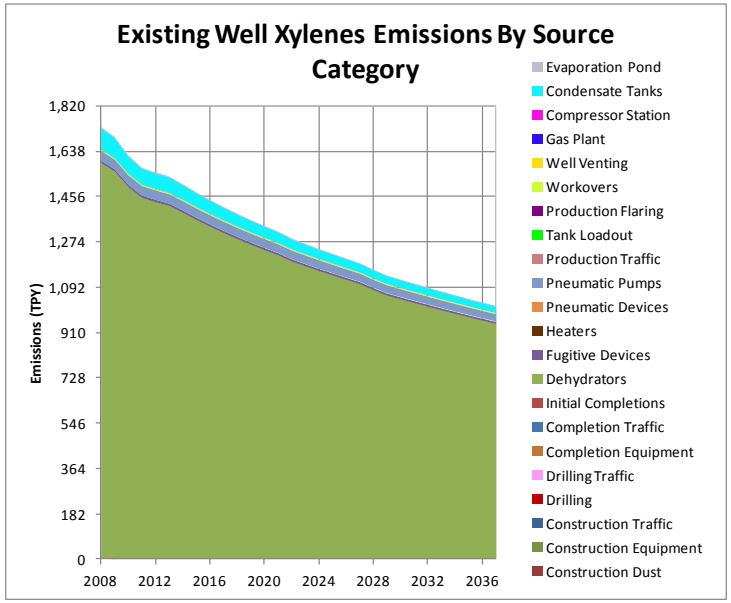

Figure 12. Existing Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 125. Existing Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction +
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	Drilling + Completion + Production)
CO2 [tpy]	2008	0	23,168	655	44,407	6,637	35,396	4,128	54	5,232	310	683,444	0	5,160	4,616	0	110,507	1,275	911	582,056	809,692	540	7	2,318,196
	2009	0	0	0	0	0	0	0	0	5,143	306	676,481	0	5,108	4,569	0	104,244	1,262	902	582,056	809,692	509	7	2,190,280
	2010	0	0	0	0	0	0	0	0	4,996	303	669,518	0	5,055	4,522	0	89,949	1,249	893	582,056	809,692	438	7	2,168,679
	2011	0	0	0	0	0	0	0	0	4,894	300	662,555	0	5,003	4,474	0	82,015	1,236	883	582,056	809,692	399	7	2,153,515
	2012	0	0	0	0	0	0	0	0	4,842	297	656,128	0	4,954	4,431	0	80,532	1,224	875	582,056	809,692	391	7	2,145,429
	2013	0	0	0	0	0	0	0	0	4,793	294	649,701	0	4,905	4,387	0	79,501	1,212	866	582,056	809,692	386	7	2,137,801
	2014	0	0	0	0	0	0	0	0	4,722	291	643,273	0	4,857	4,343	0	75,518	1,200	858	582,056	809,692	367	7	2,127,185
	2015	0	0	0	0	0	0	0	0	4,651	289	636,846	0	4,808	4,300	0	71,383	1,188	849	582,056	809,692	346	7	2,116,415
	2016	0	0	0	0	0	0	0	0	4,584	286	630,418	0	4,760	4,256	0	67,774	1,176	841	582,056	809,692	328	7	2,106,178
	2017	0	0	0	0	0	0	0	0	4,519	283	623,991	0	4,711	4,212	0	64,630	1,164	832	582,056	809,692	313	6	2,096,410
	2018	0	0	0	0	0	0	0	0	4,458	280	617,564	0	4,663	4,169	0	61,860	1,152	823	582,056	809,692	299	6	2,087,023
	2019	0	0	0	0	0	0	0	0	4,398	277	611,136	0	4,614	4,125	0	59,344	1,140	815	582,056	809,692	287	6	2,077,892
	2020	0	0	0	0	0	0	0	0	4,343	274	605,245	0	4,570	4,085	0	57,027	1,129	807	582,056	809,692	275	6	2,069,510
	2021	0	0	0	0	0	0	0	0	4,290	272	599,353	0	4,525	4,045	0	54,950	1,118	799	582,056	809,692	265	6	2,061,372
	2022	0	0	0	0	0	0	0	0	4,232	269	593,461	0	4,481	4,005	0	52,117	1,107	791	582,056	809,692	251	6	2,052,469
	2023	0	0	0	0	0	0	0	0	4,181	266	587,569	0	4,436	3,966	0	50,327	1,096	783	582,056	809,692	242	6	2,044,621
	2024	0	0	0	0	0	0	0	0	4,130	264	581,677	0	4,392	3,926	0	48,657	1,085	776	582,056	809,692	234	6	2,036,895
	2025	0	0	0	0	0	0	0	0	4,082	261	575,786	0	4,347	3,886	0	47,205	1,074	768	582,056	809,692	227	6	2,029,389
	2026	0	0	0	0	0	0	0	0	4,033	258	569,894	0	4,303	3,846	0	45,780	1,063	760	582,056	809,692	220	6	2,021,911
	2027	0	0	0	0	0	0	0	0	3,986	256	564,002	0	4,258	3,806	0	44,458	1,052	752	582,056	809,692	213	6	2,014,537
	2028	0	0	0	0	0	0	0	0	3,904	250	552,754	0	4,173	3,730	0	43,242	1,031	737	582,056	809,692	207	6	2,001,784
	2029	0	0	0	0	0	0	0	0	3,854	248	547,398	0	4,133	3,694	0	41,154	1,021	730	582,056	809,692	197	6	1,994,184
	2030	0	0	0	0	0	0	0	0	3,811	246	542,042	0	4,093	3,657	0	40,045	1,011	723	582,056	809,692	192	6	1,987,573
	2031	0	0	0	0	0	0	0	0	3,769	243	536,686	0	4,052	3,621	0	39,014	1,001	716	582,056	809,692	187	6	1,981,042
	2032	0	0	0	0	0	0	0	0	3,727	241	531,330	0	4,012	3,585	0	38,014	991	708	582,056	809,692	182	6	1,974,544
	2033	0	0	0	0	0	0	0	0	3,685	238	525,974	0	3,971	3,549	0	37,036	981	701	582,056	809,692	177	5	1,968,067
	2034	0	0	0	0	0	0	0	0	3,644	236	520,617	0	3,931	3,513	0	36,130	971	694	582,056	809,692	173	5	1,961,663
	2035	0	0	0	0	0	0	0	0	3,603	233	515,261	0	3,890	3,476	0	35,276	961	687	582,056	809,692	168	5	1,955,311
	2036	0	0	0	0	0	0	0	0	3,563	231	509,905	0	3,850	3,440	0	34,513	951	680	582,056	809,692	165	5	1,949,052
	2037	0	0	0	0	0	0	0	0	3,523	229	504,549	0	3,810	3,404	0	33,775	941	673	582,056	809,692	161	5	1,942,817
	TOTAL	0	23,168	655	44,407	6,637	35,396	4,128	54	127,593	8,030	17,724,559	0	133,827	119,638	0	1,725,977	33,063	23,634	17,461,681	24,290,773	8,340	184	61,771,744

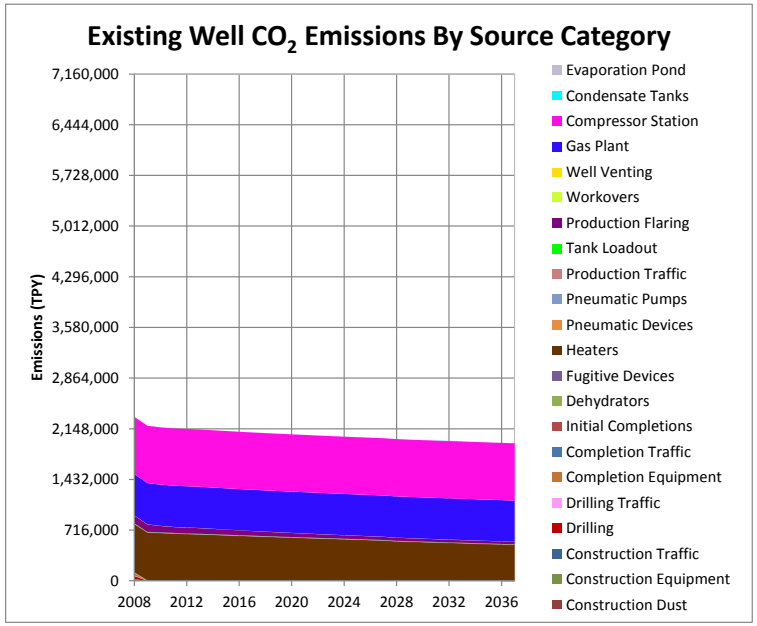

Figure 13. Existing Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 126. Existing Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production															Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-from CH4 [tpy]	2008	0	14	1	34	6	0	4	12,830	454,768	66,108	275	0	1,228,142	8	1,321	665	1	216,897	7,391	18,182	57,368	24	2,064,038
	2009	0	0	0	0	0	0	0	0	449,981	65,435	272	0	1,215,630	8	1,245	630	1	214,687	7,391	18,182	54,394	23	2,027,879
	2010	0	0	0	0	0	0	0	0	444,904	64,761	269	0	1,203,117	8	1,072	553	1	212,477	7,391	18,182	47,684	23	2,000,442
	2011	0	0	0	0	0	0	0	0	440,014	64,088	267	0	1,190,605	8	975	510	1	210,267	7,391	18,182	43,932	23	1,976,261
	2012	0	0	0	0	0	0	0	0	435,718	63,466	264	0	1,179,055	8	958	501	1	208,228	7,391	18,182	43,186	23	1,956,978
	2013	0	0	0	0	0	0	0	0	431,440	62,844	262	0	1,167,505	8	945	495	1	206,188	7,391	18,182	42,650	22	1,937,932
	2014	0	0	0	0	0	0	0	0	427,042	62,223	259	0	1,155,955	8	897	473	1	204,148	7,391	18,182	40,741	22	1,917,341
	2015	0	0	0	0	0	0	0	0	422,632	61,601	256	0	1,144,405	8	847	450	1	202,108	7,391	18,182	38,762	22	1,896,663
	2016	0	0	0	0	0	0	0	0	418,238	60,979	254	0	1,132,855	8	803	430	1	200,068	7,391	18,182	37,027	22	1,876,257
	2017	0	0	0	0	0	0	0	0	413,861	60,358	251	0	1,121,305	7	765	412	1	198,029	7,391	18,182	35,508	21	1,856,090
	2018	0	0	0	0	0	0	0	0	409,497	59,736	249	0	1,109,756	7	732	397	1	195,989	7,391	18,182	34,164	21	1,836,119
	2019	0	0	0	0	0	0	0	0	405,142	59,114	246	0	1,098,206	7	701	383	1	193,949	7,391	18,182	32,937	21	1,816,279
	2020	0	0	0	0	0	0	0	0	401,147	58,544	244	0	1,087,618	7	673	369	1	192,079	7,391	18,182	31,808	21	1,798,084
	2021	0	0	0	0	0	0	0	0	397,162	57,974	241	0	1,077,031	7	648	358	1	190,209	7,391	18,182	30,790	21	1,780,014
	2022	0	0	0	0	0	0	0	0	393,132	57,404	239	0	1,066,443	7	614	342	1	188,340	7,391	18,182	29,421	20	1,761,536
	2023	0	0	0	0	0	0	0	0	389,157	56,835	236	0	1,055,856	7	593	332	1	186,470	7,391	18,182	28,537	20	1,743,615
	2024	0	0	0	0	0	0	0	0	385,187	56,265	234	0	1,045,268	7	572	322	1	184,600	7,391	18,182	27,709	20	1,725,757
	2025	0	0	0	0	0	0	0	0	381,229	55,695	232	0	1,034,681	7	555	314	1	182,730	7,391	18,182	26,982	20	1,708,016
	2026	0	0	0	0	0	0	0	0	377,271	55,125	229	0	1,024,094	7	538	305	1	180,860	7,391	18,182	26,267	20	1,690,289
	2027	0	0	0	0	0	0	0	0	373,318	54,555	227	0	1,013,506	7	522	298	1	178,991	7,391	18,182	25,601	19	1,672,616
	2028	0	0	0	0	0	0	0	0	365,852	53,467	222	0	993,294	7	508	290	1	175,421	7,391	18,182	24,937	19	1,639,590
	2029	0	0	0	0	0	0	0	0	362,200	52,949	220	0	983,669	7	482	278	1	173,721	7,391	18,182	23,919	19	1,623,037
	2030	0	0	0	0	0	0	0	0	358,609	52,431	218	0	974,044	6	469	272	1	172,021	7,391	18,182	23,357	19	1,607,018
	2031	0	0	0	0	0	0	0	0	355,023	51,913	216	0	964,419	6	457	266	1	170,322	7,391	18,182	22,830	18	1,591,042
	2032	0	0	0	0	0	0	0	0	351,438	51,395	214	0	954,794	6	445	260	1	168,622	7,391	18,182	22,318	18	1,575,082
	2033	0	0	0	0	0	0	0	0	347,854	50,877	212	0	945,169	6	433	254	1	166,922	7,391	18,182	21,817	18	1,559,133
	2034	0	0	0	0	0	0	0	0	344,274	50,358	210	0	935,544	6	422	248	1	165,222	7,391	18,182	21,349	18	1,543,224
	2035	0	0	0	0	0	0	0	0	340,697	49,840	207	0	925,919	6	412	243	1	163,522	7,391	18,182	20,905	18	1,527,343
	2036	0	0	0	0	0	0	0	0	337,127	49,322	205	0	916,294	6	403	239	1	161,823	7,391	18,182	20,503	18	1,511,512
	2037	0	0	0	0	0	0	0	0	333,558	48,804	203	0	906,669	6	394	234	0	160,123	7,391	18,182	20,113	17	1,495,694
	TOTAL	0	14	1	34	6	0	4	12,830	11,747,471	1,714,466	7,134	0	31,850,850	211	20,401	11,121	18	5,625,033	221,715	545,445	957,515	610	52,714,880

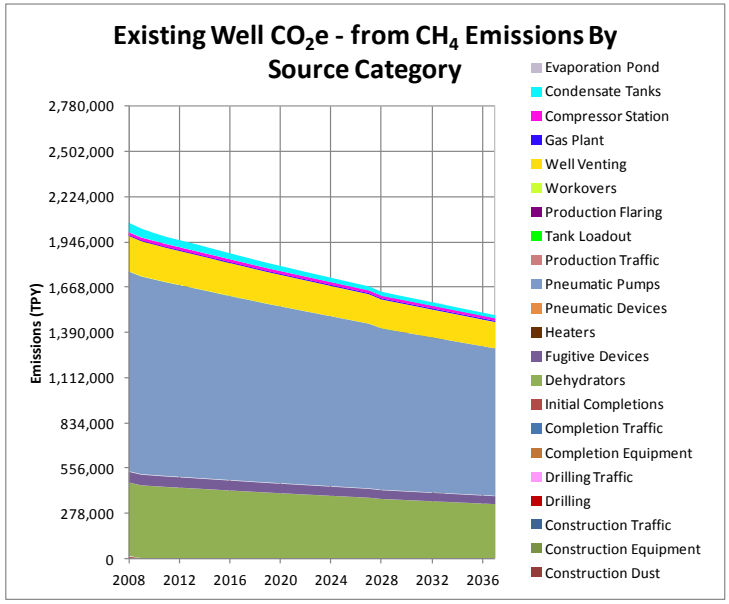

Figure 14. Existing Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 127. Existing Wells CO_2e - from N_2O Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-from N2O [tpy]	2008	0	183	5	2,490	41	1,984	26	0	0	0	3,884	0	0	60	0	182	10	0	4,096	5,974	0	0	18,935
	2009	0	0	0	0	0	0	0	0	0	0	3,845	0	0	59	0	172	10	0	4,096	5,974	0	0	14,156
	2010	0	0	0	0	0	0	0	0	0	0	3,805	0	0	59	0	152	10	0	4,096	5,974	0	0	14,095
	2011	0	0	0	0	0	0	0	0	0	0	3,766	0	0	58	0	140	10	0	4,096	5,974	0	0	14,043
	2012	0	0	0	0	0	0	0	0	0	0	3,729	0	0	57	0	137	10	0	4,096	5,974	0	0	14,003
	2013	0	0	0	0	0	0	0	0	0	0	3,692	0	0	57	0	136	10	0	4,096	5,974	0	0	13,964
	2014	0	0	0	0	0	0	0	0	0	0	3,656	0	0	56	0	130	9	0	4,096	5,974	0	0	13,921
	2015	0	0	0	0	0	0	0	0	0	0	3,619	0	0	56	0	124	9	0	4,096	5,974	0	0	13,878
	2016	0	0	0	0	0	0	0	0	0	0	3,583	0	0	55	0	118	9	0	4,096	5,974	0	0	13,835
	2017	0	0	0	0	0	0	0	0	0	0	3,546	0	0	55	0	113	9	0	4,096	5,974	0	0	13,793
	2018	0	0	0	0	0	0	0	0	0	0	3,510	0	0	54	0	109	9	0	4,096	5,974	0	0	13,752
	2019	0	0	0	0	0	0	0	0	0	0	3,473	0	0	53	0	105	9	0	4,096	5,974	0	0	13,711
	2020	0	0	0	0	0	0	0	0	0	0	3,440	0	0	53	0	102	9	0	4,096	5,974	0	0	13,673
	2021	0	0	0	0	0	0	0	0	0	0	3,406	0	0	52	0	99	9	0	4,096	5,974	0	0	13,636
	2022	0	0	0	0	0	0	0	0	0	0	3,373	0	0	52	0	94	9	0	4,096	5,974	0	0	13,597
	2023	0	0	0	0	0	0	0	0	0	0	3,339	0	0	51	0	92	9	0	4,096	5,974	0	0	13,560
	2024	0	0	0	0	0	0	0	0	0	0	3,306	0	0	51	0	89	9	0	4,096	5,974	0	0	13,524
	2025	0	0	0	0	0	0	0	0	0	0	3,272	0	0	50	0	87	8	0	4,096	5,974	0	0	13,487
	2026	0	0	0	0	0	0	0	0	0	0	3,239	0	0	50	0	84	8	0	4,096	5,974	0	0	13,451
	2027	0	0	0	0	0	0	0	0	0	0	3,205	0	0	49	0	82	8	0	4,096	5,974	0	0	13,415
	2028	0	0	0	0	0	0	0	0	0	0	3,141	0	0	48	0	80	8	0	4,096	5,974	0	0	13,348
	2029	0	0	0	0	0	0	0	0	0	0	3,111	0	0	48	0	77	8	0	4,096	5,974	0	0	13,313
	2030	0	0	0	0	0	0	0	0	0	0	3,081	0	0	47	0	75	8	0	4,096	5,974	0	0	13,281
	2031	0	0	0	0	0	0	0	0	0	0	3,050	0	0	47	0	74	8	0	4,096	5,974	0	0	13,248
	2032	0	0	0	0	0	0	0	0	0	0	3,020	0	0	46	0	72	8	0	4,096	5,974	0	0	13,215
	2033	0	0	0	0	0	0	0	0	0	0	2,989	0	0	46	0	70	8	0	4,096	5,974	0	0	13,183
	2034	0	0	0	0	0	0	0	0	0	0	2,959	0	0	45	0	69	8	0	4,096	5,974	0	0	13,150
	2035	0	0	0	0	0	0	0	0	0	0	2,928	0	0	45	0	67	8	0	4,096	5,974	0	0	13,118
	2036	0	0	0	0	0	0	0	0	0	0	2,898	0	0	44	0	66	8	0	4,096	5,974	0	0	13,086
	2037	0	0	0	0	0	0	0	0	0	0	2,868	0	0	44	0	65	7	0	4,096	5,974	0	0	13,053
	TOTAL	0	183	5	2,490	41	1,984	26	0	0	0	100,735	0	0	1,547	0	3,063	261	0	122,871	179,218	0	0	412,425

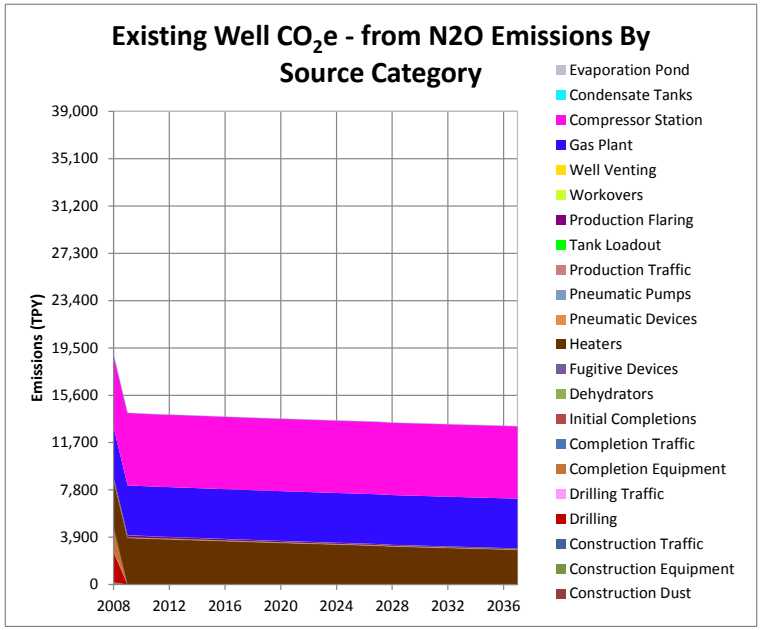

Figure 15. Existing Wells CO_2e - from N_2O Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 128. Existing Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-total [tpy]	2008	0	23,365	661	46,930	6,685	37,381	4,158	12,884	460,000	66,418	687,604	0	1,233,303	4,684	1,321	111,354	1,286	217,808	593,542	833,848	57,908	31	4,401,169
	2009	0	0	0	0	0	0	0	0	455,124	65,741	680,598	0	1,220,738	4,636	1,245	105,047	1,273	215,589	593,542	833,848	54,903	30	4,232,315
	2010	0	0	0	0	0	0	0	0	449,900	65,065	673,593	0	1,208,173	4,588	1,072	90,654	1,259	213,370	593,542	833,848	48,122	30	4,183,215
	2011	0	0	0	0	0	0	0	0	444,908	64,388	666,587	0	1,195,608	4,540	975	82,665	1,246	211,151	593,542	833,848	44,331	30	4,143,819
	2012	0	0	0	0	0	0	0	0	440,560	63,763	660,121	0	1,184,009	4,496	958	81,170	1,234	209,102	593,542	833,848	43,577	29	4,116,411
	2013	0	0	0	0	0	0	0	0	436,233	63,139	653,654	0	1,172,411	4,452	945	80,131	1,222	207,054	593,542	833,848	43,037	29	4,089,697
	2014	0	0	0	0	0	0	0	0	431,765	62,514	647,188	0	1,160,812	4,407	897	76,121	1,210	205,006	593,542	833,848	41,108	29	4,058,447
	2015	0	0	0	0	0	0	0	0	427,283	61,889	640,722	0	1,149,214	4,363	847	71,956	1,198	202,957	593,542	833,848	39,108	29	4,026,956
	2016	0	0	0	0	0	0	0	0	422,822	61,265	634,255	0	1,137,615	4,319	803	68,322	1,186	200,909	593,542	833,848	37,355	28	3,996,270
	2017	0	0	0	0	0	0	0	0	418,380	60,640	627,789	0	1,126,017	4,274	765	65,155	1,174	198,861	593,542	833,848	35,821	28	3,966,294
	2018	0	0	0	0	0	0	0	0	413,955	60,016	621,322	0	1,114,418	4,230	732	62,366	1,162	196,812	593,542	833,848	34,463	28	3,936,894
	2019	0	0	0	0	0	0	0	0	409,540	59,391	614,856	0	1,102,820	4,186	701	59,832	1,150	194,764	593,542	833,848	33,224	27	3,907,881
	2020	0	0	0	0	0	0	0	0	405,490	58,818	608,928	0	1,092,188	4,145	673	57,499	1,139	192,886	593,542	833,848	32,083	27	3,881,267
	2021	0	0	0	0	0	0	0	0	401,452	58,246	603,000	0	1,081,556	4,105	648	55,406	1,127	191,009	593,542	833,848	31,055	27	3,855,022
	2022	0	0	0	0	0	0	0	0	397,364	57,673	597,073	0	1,070,924	4,064	614	52,553	1,116	189,131	593,542	833,848	29,672	27	3,827,601
	2023	0	0	0	0	0	0	0	0	393,338	57,101	591,145	0	1,060,292	4,024	593	50,750	1,105	187,253	593,542	833,848	28,779	26	3,801,797
	2024	0	0	0	0	0	0	0	0	389,318	56,528	585,217	0	1,049,660	3,983	572	49,068	1,094	185,376	593,542	833,848	27,943	26	3,776,176
	2025	0	0	0	0	0	0	0	0	385,311	55,956	579,290	0	1,039,028	3,943	555	47,605	1,083	183,498	593,542	833,848	27,209	26	3,750,893
	2026	0	0	0	0	0	0	0	0	381,304	55,383	573,362	0	1,028,396	3,902	538	46,169	1,072	181,620	593,542	833,848	26,487	26	3,725,651
	2027	0	0	0	0	0	0	0	0	377,304	54,810	567,435	0	1,017,765	3,862	522	44,838	1,061	179,743	593,542	833,848	25,814	25	3,700,568
	2028	0	0	0	0	0	0	0	0	369,756	53,717	556,118	0	997,467	3,785	508	43,613	1,040	176,158	593,542	833,848	25,145	25	3,654,721
	2029	0	0	0	0	0	0	0	0	366,054	53,197	550,730	0	987,802	3,748	482	41,510	1,030	174,451	593,542	833,848	24,117	25	3,630,534
	2030	0	0	0	0	0	0	0	0	362,420	52,676	545,341	0	978,137	3,711	469	40,392	1,020	172,744	593,542	833,848	23,548	24	3,607,872
	2031	0	0	0	0	0	0	0	0	358,792	52,156	539,952	0	968,471	3,674	457	39,353	1,010	171,037	593,542	833,848	23,017	24	3,585,332
	2032	0	0	0	0	0	0	0	0	355,165	51,635	534,563	0	958,806	3,638	445	38,346	999	169,330	593,542	833,848	22,500	24	3,562,841
	2033	0	0	0	0	0	0	0	0	351,539	51,115	529,175	0	949,140	3,601	433	37,360	989	167,623	593,542	833,848	21,994	24	3,540,383
	2034	0	0	0	0	0	0	0	0	347,918	50,594	523,786	0	939,475	3,564	422	36,447	979	165,916	593,542	833,848	21,521	23	3,518,037
	2035	0	0	0	0	0	0	0	0	344,300	50,074	518,397	0	929,810	3,527	412	35,587	969	164,209	593,542	833,848	21,073	23	3,495,772
	2036	0	0	0	0	0	0	0	0	340,690	49,553	513,008	0	920,144	3,491	403	34,818	959	162,502	593,542	833,848	20,668	23	3,473,650
	2037	0	0	0	0	0	0	0	0	337,081	49,033	507,620	0	910,479	3,454	394	34,074	949	160,796	593,542	833,848	20,274	23	3,451,565
	TOTAL	0	23,365	661	46,930	6,685	37,381	4,158	12,884	11,875,065	1,722,495	17,832,428	0	31,984,677	121,396	20,401	1,740,161	33,342	5,648,668	17,806,267	25,015,436	965,855	794	114,899,049

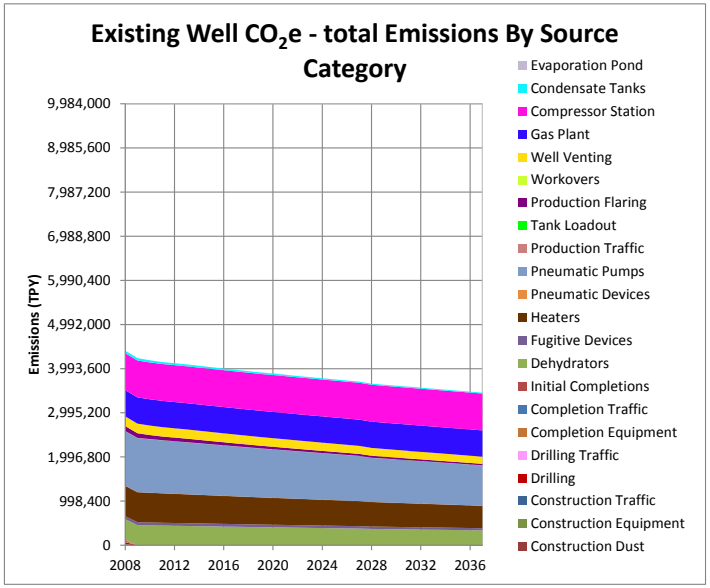

Figure 16. Existing Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.

Project Emissions Inventory for Future Wells

Table 129: Summary of Future Wells Activity Data by Project Year.

Year	Project Yr	Well Pads Constructed	No Action Spuds	Active Well Count	Annual Condensate Production (Mbbl/yr)	Annual Gas Production (MMSCF/yr)	Cumulative Well Pads Constructed	Cumulative Spuds	Cumulative Condensate Production (Mbbl)	Cumulative Gas Production (BSCF)
2008	1	0	0	0	0	0	0	0	0	0
2009	2	149	218	218	383	19,467	149	218	383	19
2010	3	200	292	510	1,180	59,873	350	510	1,563	79
2011	4	199	291	801	1,775	90,118	549	801	3,338	169
2012	5	195	285	1,086	2,201	111,714	744	1,086	5,539	281
2013	6	199	291	1,377	2,601	132,039	943	1,377	8,140	413
2014	7	197	288	1,664	2,897	147,076	1,140	1,664	11,038	560
2015	8	203	297	1,961	3,162	160,525	1,343	1,961	14,200	721
2016	9	159	232	2,193	3,346	169,835	1,502	2,193	17,546	891
2017	10	209	305	2,498	3,548	180,125	1,711	2,498	21,094	1,071
2018	11	229	335	2,833	4,105	208,392	1,940	2,833	25,200	1,279
2019	12	185	270	3,103	4,318	219,175	2,125	3,103	29,517	1,498
2020	13	185	270	3,373	4,474	227,096	2,310	3,373	33,991	1,725
2021	14	209	305	3,677	4,595	233,233	2,519	3,677	38,586	1,959
2022	15	198	289	3,966	4,925	249,985	2,717	3,966	43,510	2,209
2023	16	66	97	4,063	4,761	241,684	2,783	4,063	48,272	2,450
2024	17	0	0	4,063	4,193	212,837	2,783	4,063	52,465	2,663
2025	18	0	0	4,063	3,822	194,000	2,783	4,063	56,286	2,857
2026	19	0	0	4,063	3,558	180,603	2,783	4,063	59,844	3,038
2027	20	0	0	4,063	3,344	169,754	2,783	4,063	63,188	3,208
2028	21	0	0	4,063	3,162	160,490	2,783	4,063	66,350	3,368
2029	22	0	0	4,063	3,002	152,371	2,783	4,063	69,352	3,520
2030	23	0	0	4,063	2,859	145,103	2,783	4,063	72,210	3,665
2031	24	0	0	4,063	2,729	138,535	2,783	4,063	74,939	3,804
2032	25	0	0	4,063	2,610	132,497	2,783	4,063	77,550	3,937
2033	26	0	0	4,063	2,500	126,927	2,783	4,063	80,050	4,063
2034	27	0	0	4,063	2,398	121,740	2,783	4,063	82,448	4,185
2035	28	0	0	4,063	2,302	116,852	2,783	4,063	84,750	4,302
2036	29	0	0	4,063	2,211	112,229	2,783	4,063	86,961	4,414
2037	30	0	0	4,063	2,125	107,852	2,783	4,063	89,086	4,522
Total		**2,783**	**4,063**							

Table 130: Projection Parameters used in Future Year Emission Inventory Development for New Wells by Source Category.

Source Category	Projection
Added Compression (reciprocating)	totals for CY 2012+
Added Compression (turbine)	totals for CY 2012+
Added Gas Plant (Duct Burner)	totals for CY 2012+
Added Gas Plant (Flares)	totals for CY 2012+
Added Gas Plant (Fugitives)	totals for CY 2012+
Added Gas Plant (Heaters)	totals for CY 2012+
Added Gas Plant (Process)	totals for CY 2012+
Added Gas Plant (Recip Engines)	totals for CY 2012+
Added Gas Plant (Turbine Engines)	totals for CY 2012+
Completion Equipment (diesel ICE)	total spuds
Completion Traffic (HD)	total spuds
Completion Traffic (HD) Dust	total spuds
Completion Traffic (LD)	total spuds
Completion Traffic (LD) Dust	total spuds
Condensate Fugitive Devices	active well counts
Condensate Tank Breathing Flaring	breathing flares
Condensate Tank Breathing Losses	active well counts
Condensate Tank Flashing Flaring	flashing flares
Condensate Tank Flashing Losses	annual condensate production
Condensate Tank Working Flaring	working flares
Condensate Tank Working Losses	total turnovers per year
Construction Dust, Fugitive	new pads
Construction Dust, Wind Erosion	new pads
Construction Traffic, Road and Well pad (HD)	new pads
Construction Traffic, Road and Well pad (HD) Dust	new pads
Construction Traffic, Road and Well pad (LD)	new pads
Construction Traffic, Road and Well pad (LD) Dust	new pads
Dehydrator Flaring	dehydrator flares
Dehydrator Venting - Well Site	active well counts
Drilling Equip (diesel ICE 125HP)	total spuds
Drilling Equip (diesel ICE 1476HP)	total spuds
Drilling Traffic (HD)	total spuds
Drilling Traffic (HD) Dust	total spuds
Drilling Traffic (LD)	total spuds
Drilling Traffic (LD) Dust	total spuds
Evaporation Ponds	active well counts
Gas Stream Fugitive Devices	active well counts
Heaters	active well counts
Initial Completion Flaring	total spuds
Initial Completion Venting	total spuds
Pneumatic Devices	active well counts
Pneumatic Pump Flaring	pneumatic pump flares
Pneumatic Pumps	active well counts
Production Traffic (HD)	active well counts
Production Traffic (HD) Dust	active well counts
Production Traffic (LD)	active well counts
Production Traffic (LD) Dust	active well counts
Production Traffic, Central Facility (HD)	totals for CY 2012+
Production Traffic, Central Facility (HD) Dust	totals for CY 2012+
Tank Loadout (vapor losses)	annual condensate production
Well Pad Const Equip (diesel ICE)	new pads
Well Stream Fugitive Devices	active well counts
Well Venting	active well counts
Workover Equipment (diesel ICE)	active well counts
WorkoverTraffic (HD)	active well counts
WorkoverTraffic (HD) Dust	active well counts
WorkoverTraffic (LD)	active well counts
WorkoverTraffic (LD) Dust	active well counts

Table 131. Summary of Projection Factors used in Future Year Emission Inventory Development for New Wells.

Projection	New pads per Year	Active Well Counts per Year	Total Spuds per Year	Annual Gas Production (MMscf/yr)	Annual Condensate Production (bbl/yr)	Totals for CY 2012+	Total Turnovers per Year	Flashing Flares	Working Flares	Breathing Flares	Dehydrator Flares	Pneumatic Pump Flares	None
2008	0	0	0	0	0	0	0	0	0	0	0	0	1
2009	149	218	218	19467	383498	0	254	383498	254	218	218	218	1
2010	200	510	292	59873	1179503	0	781	1179503	781	510	540	510	1
2011	199	801	291	90118	1775323	0	1176	1775323	1176	801	839	801	1
2012	195	1086	285	111714	2200768	0	1457	2200768	1457	1086	1117	1086	1
2013	199	1377	291	132039	2601159	0	1723	2601159	1723	1377	1395	1377	1
2014	197	1664	288	147076	2897397	0	1919	2897397	1919	1664	1661	1664	1
2015	203	1961	297	160525	3162343	0	2094	3162343	2094	1961	1931	1961	1
2016	159	2193	232	169835	3345740	0	2216	3345740	2216	2193	2139	2193	1
2017	209	2498	305	180125	3548472	0	2498	3548472	2498	2498	2409	2498	1
2018	229	2833	335	208392	4105326	0	2833	4105326	2833	2833	2740	2833	1
2019	185	3103	270	219175	4317741	0	3103	4317741	3103	3103	2982	3103	1
2020	185	3373	270	227096	4473794	0	3373	4473794	3373	3373	3218	3373	1
2021	209	3677	305	233233	4594685	0	3677	4594685	3677	3677	3479	3677	1
2022	198	3966	289	249985	4924711	0	3966	4924711	3966	3966	3749	3966	1
2023	66	4063	97	241684	4761184	0	4063	4761184	4063	4063	3811	4063	1
2024	0	4063	0	212837	4192891	0	4063	4192891	4063	4063	3751	4063	1
2025	0	4063	0	194000	3821795	0	4063	3821795	4063	4063	3712	4063	1
2026	0	4063	0	180603	3557879	0	4063	3557879	4063	4063	3684	4063	1
2027	0	4063	0	169754	3344154	0	4063	3344154	4063	4063	3662	4063	1
2028	0	4063	0	160490	3161657	0	4063	3161657	4063	4063	3642	4063	1
2029	0	4063	0	152371	3001700	0	4063	3001700	4063	4063	3625	4063	1
2030	0	4063	0	145103	2858530	0	4063	2858530	4063	4063	3610	4063	1
2031	0	4063	0	138535	2729137	0	4063	2729137	4063	4063	3597	4063	1
2032	0	4063	0	132497	2610189	0	4063	2610189	4063	4063	3584	4063	1
2033	0	4063	0	126927	2500455	0	4063	2500455	4063	4063	3573	4063	1
2034	0	4063	0	121740	2398285	0	4063	2398285	4063	4063	3562	4063	1
2035	0	4063	0	116852	2301976	0	4063	2301976	4063	4063	3552	4063	1
2036	0	4063	0	112229	2210911	0	4063	2210911	4063	4063	3542	4063	1
2037	0	4063	0	107852	2124678	0	4063	2124678	4063	4063	3533	4063	1

Gas Composition Analysis

Table 132. Summary of Gas Composition Analysis as Provided in Table 133 through Table 139.

Property	Sales/Produced Gas	Fugitive (Post-Flash)	Flashing	Produced Water	Condensate (Post-Flash)	Regenerator Overhead Vent Stream	Wet Gas
VOC Fraction (molar)	5.39%	49.52%	49.51%	55.26%	39.40%	15.07%	5.30%
VOC/TOC (weight)	15.59%	75.85%	75.78%	92.48%	66.34%	50.39%	15.22%
VOC MW	57.50	64.95	64.85	69.75	63.01	79.73	56.65
VOC Fraction (weight)	14.60%	73.55%	73.46%	69.58%	66.34%	40.07%	14.25%
CO2 Fraction (weight)	6.07%	3.02%	3.04%	24.76%	0.00%	8.81%	6.09%
CH4 Fraction (weight)	68.75%	13.57%	13.5%	3.9%	21.2%	32.6%	69.0%
H2S Fraction (weight)	0.00%	0.00%	0.0%	0.0%	0.0%	0.0%	0.0%
Heat Content (BTU/SCF)	1000	-	-	-	-	-	-
benzene/VOC (weight)	0.40%	0.83%	0.82%	0.56%	0.48%	9.63%	0.41%
toluene/VOC (weight)	0.56%	1.17%	1.17%	1.13%	0.63%	15.90%	0.57%
ethylbenzene/VOC (weight)	0.02%	0.02%	0.02%	0.05%	0.01%	0.59%	0.02%
xylenes/VOC (weight)	0.32%	0.63%	0.63%	0.43%	0.35%	5.86%	0.18%
n-hexane/VOC (weight)	4.74%	3.96%	3.93%	5.01%	3.40%	2.61%	1.98%
formaldehyde/VOC (weight)	0%	0%	0%	0%	0%	0%	0%

ASSUMPTIONS

Data obtained from operators in blue text

Table 133. Sales Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	2.73%	2.73%	44.0	1.2	6.0666%	N		
Nitrogen	0.17%	0.17%	28.0	0.0	0.2420%	N		
Methane	84.99%	84.90%	16.0	13.6	68.7549%	N		
Ethane	6.81%	6.81%	30.1	2.0	10.3331%	N		
Propane	3.17%	3.17%	44.1	1.4	7.0516%	Y	48.29%	21.29
Isobutane	0.64%	0.64%	58.1	0.4	1.8647%	Y	12.77%	7.42
n-Butane	0.71%	0.71%	58.1	0.4	2.0830%	Y	14.26%	8.29
Isopentane	0.24%	0.24%	72.2	0.2	0.8812%	Y	6.03%	4.35
n-Pentane	0.20%	0.20%	72.2	0.1	0.7252%	Y	4.97%	3.58
Cyclopentane	0.00%	0.00%	70.1	0.0	0.0000%	Y	0.00%	0.00
n-Hexane	0.16%	0.16%	86.2	0.1	0.6928%	Y	4.74%	4.09
Cyclohexane	0.03%	0.03%	84.2	0.0	0.1349%	Y	0.92%	0.78
2,2-Dimethylbutane	0.00%	0.00%	86.2	0.0	0.0186%	Y	0.13%	0.11
2,3-Dimethylbutane	0.02%	0.02%	86.2	0.0	0.0712%	Y	0.49%	0.42
2-Methylpentane	0.05%	0.05%	86.2	0.0	0.2121%	Y	1.45%	1.25
3-Methylpentane	0.03%	0.03%	86.2	0.0	0.1091%	Y	0.75%	0.64
n-Heptane	0.06%	0.06%	100.2	0.1	0.2967%	Y	2.03%	2.04
Methylcyclohexane	0.03%	0.03%	98.2	0.0	0.1594%	Y	1.09%	1.07
2,2,4-Trimethylpentane	0.00%	0.00%	114.2	0.0	0.0218%	Y	0.15%	0.17
Benzene	0.01%	0.01%	78.1	0.0	0.0589%	Y	0.40%	0.31
Toluene	0.02%	0.02%	92.1	0.0	0.0811%	Y	0.56%	0.51
Ethylbenzene	0.00%	0.00%	106.2	0.0	0.0024%	Y	0.02%	0.02
m-Xylene	0.00%	0.00%	106.2	0.0	0.0250%	Y	0.17%	0.18
o-Xylene	0.00%	0.00%	106.2	0.0	0.0218%	Y	0.15%	0.16
n-Octane	0.00%	0.00%	114.2	0.0	0.0035%	Y	0.02%	0.03
n-Nonane	0.01%	0.01%	128.3	0.0	0.0886%	Y	0.61%	0.78
n-Decane	0.00%	0.00%	142.3	0.0	0.0000%	Y	0.00%	0.00
Total	**100.10%**	**100.00%**		**19.8**			**100.00%**	**57.5**

Table 134. Fugitive Post-Flash Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	2.79%	2.79%	44.0	1.2	3.0190%	N		
Nitrogen	0.02%	0.02%	28.0	0.0	0.0151%	N		
Methane	34.37%	34.37%	16.0	5.5	13.5728%	N		
Ethane	13.30%	13.30%	30.1	4.0	9.8429%	N		
Propane	17.80%	17.80%	44.1	7.9	19.3288%	Y	26.28%	11.59
Isobutane	6.84%	6.84%	58.1	4.0	9.7798%	Y	13.30%	7.73
n-Butane	9.37%	9.37%	58.1	5.4	13.4078%	Y	18.23%	10.60
Isopentane	4.55%	4.55%	72.2	3.3	8.0782%	Y	10.98%	7.92
n-Pentane	3.97%	3.97%	72.2	2.9	7.0578%	Y	9.60%	6.92
Cyclopentane	0.00%	0.00%	70.1	0.0	0.0000%	Y	0.00%	0.00
n-Hexane	1.37%	1.37%	86.2	1.2	2.9160%	Y	3.96%	3.42
Cyclohexane	0.30%	0.30%	84.2	0.3	0.6178%	Y	0.84%	0.71
2,2-Dimethylbutane	0.09%	0.09%	86.2	0.1	0.1907%	Y	0.26%	0.22
2,3-Dimethylbutane	0.35%	0.35%	86.2	0.3	0.7423%	Y	1.01%	0.87
2-Methylpentane	1.06%	1.06%	86.2	0.9	2.2383%	Y	3.04%	2.62
3-Methylpentane	0.54%	0.54%	86.2	0.5	1.1373%	Y	1.55%	1.33
n-Heptane	1.85%	1.85%	100.2	1.9	4.5651%	Y	6.21%	6.22
Methylcyclohexane	0.18%	0.18%	98.2	0.2	0.4350%	Y	0.59%	0.58
2,2,4-Trimethylpentane	0.07%	0.07%	114.2	0.1	0.1980%	Y	0.27%	0.31
Benzene	0.32%	0.32%	78.1	0.2	0.6104%	Y	0.83%	0.65
Toluene	0.38%	0.38%	92.1	0.3	0.8601%	Y	1.17%	1.08
Ethylbenzene	0.00%	0.00%	106.2	0.0	0.0114%	Y	0.02%	0.02
m-Xylene	0.16%	0.16%	106.2	0.2	0.4206%	Y	0.57%	0.61
o-Xylene	0.02%	0.02%	106.2	0.0	0.0399%	Y	0.05%	0.06
n-Octane	0.22%	0.22%	114.2	0.3	0.6172%	Y	0.84%	0.96
n-Nonane	0.05%	0.05%	128.3	0.1	0.1582%	Y	0.22%	0.28
n-Decane	0.04%	0.04%	142.3	0.1	0.1395%	Y	0.19%	0.27
Total	**100.00%**	**100.00%**		**40.6**			**100.00%**	**65.0**

Table 135. Flash Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	2.80%	2.80%	44.0	1.2	3.0392%	N		
Nitrogen	0.02%	0.02%	28.0	0.0	0.0149%	N		
Methane	34.25%	34.25%	16.0	5.5	13.5394%	N		
Ethane	13.42%	13.42%	30.1	4.0	9.9421%	N		
Propane	17.98%	17.98%	44.1	7.9	19.5446%	Y	26.60%	11.73
Isobutane	6.85%	6.85%	58.1	4.0	9.8099%	Y	13.35%	7.76
n-Butane	9.34%	9.34%	58.1	5.4	13.3756%	Y	18.21%	10.58
Isopentane	4.48%	4.48%	72.2	3.2	7.9707%	Y	10.85%	7.83
n-Pentane	3.91%	3.91%	72.2	2.8	6.9497%	Y	9.46%	6.83
Cyclopentane	0.00%	0.00%	70.1	0.0	0.0000%	Y	0.00%	0.00
n-Hexane	1.36%	1.36%	86.2	1.2	2.8850%	Y	3.93%	3.38
Cyclohexane	0.30%	0.30%	84.2	0.2	0.6125%	Y	0.83%	0.70
2,2-Dimethylbutane	0.09%	0.09%	86.2	0.1	0.1877%	Y	0.26%	0.22
2,3-Dimethylbutane	0.34%	0.34%	86.2	0.3	0.7319%	Y	1.00%	0.86
2-Methylpentane	1.04%	1.04%	86.2	0.9	2.2086%	Y	3.01%	2.59
3-Methylpentane	0.53%	0.53%	86.2	0.5	1.1231%	Y	1.53%	1.32
n-Heptane	1.85%	1.85%	100.2	1.9	4.5682%	Y	6.22%	6.23
Methylcyclohexane	0.18%	0.18%	98.2	0.2	0.4348%	Y	0.59%	0.58
2,2,4-Trimethylpentane	0.07%	0.07%	114.2	0.1	0.1981%	Y	0.27%	0.31
Benzene	0.31%	0.31%	78.1	0.2	0.6038%	Y	0.82%	0.64
Toluene	0.38%	0.38%	92.1	0.3	0.8615%	Y	1.17%	1.08
Ethylbenzene	0.00%	0.00%	106.2	0.0	0.0115%	Y	0.02%	0.02
m-Xylene	0.16%	0.16%	106.2	0.2	0.4243%	Y	0.58%	0.61
o-Xylene	0.02%	0.02%	106.2	0.0	0.0403%	Y	0.05%	0.06
n-Octane	0.22%	0.22%	114.2	0.3	0.6219%	Y	0.85%	0.97
n-Nonane	0.05%	0.05%	128.3	0.1	0.1598%	Y	0.22%	0.28
n-Decane	0.04%	0.04%	142.3	0.1	0.1410%	Y	0.19%	0.27
Total	**100.00%**	**100.00%**		**40.6**			**100.00%**	**64.9**

Table 136. Produced Water Working and Breathing Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	29.14%	29.14%	44.010	12.822	24.76%	N		
Nitrogen	0.00%	0.00%	28.010	0.000	0.00%	N		
Methane	12.59%	12.59%	16.040	2.019	3.90%	N		
Ethane	3.02%	3.02%	30.070	0.909	1.76%	N		
Propane	11.24%	11.24%	44.100	4.956	9.57%	Y	13.76%	6.066
Isobutane	8.05%	8.05%	58.120	4.679	9.04%	Y	12.99%	7.548
n-Butane	12.65%	12.65%	58.120	7.352	14.20%	Y	20.41%	11.861
Isopentane	6.97%	6.97%	72.150	5.031	9.72%	Y	13.96%	10.075
n-Pentane	5.97%	5.97%	72.150	4.308	8.32%	Y	11.96%	8.628
Cyclopentane	0.00%	0.00%	70.130	0.000	0.00%	Y	0.00%	0.000
n-Hexane	2.09%	2.09%	86.180	1.804	3.48%	Y	5.01%	4.316
Cyclohexane	3.09%	3.09%	84.160	2.600	5.02%	Y	7.22%	6.073
2,2-Dimethylbutane	0.00%	0.00%	86.177	0.000	0.00%	Y	0.00%	0.000
2,3-Dimethylbutane	0.00%	0.00%	86.177	0.000	0.00%	Y	0.00%	0.000
2-Methylpentane	0.00%	0.00%	86.177	0.000	0.00%	Y	0.00%	0.000
3-Methylpentane	0.00%	0.00%	86.177	0.000	0.00%	Y	0.00%	0.000
n-Heptane	3.55%	3.55%	100.202	3.558	6.87%	Y	9.88%	9.897
Methylcyclohexane	0.00%	0.00%	98.190	0.000	0.00%	Y	0.00%	0.000
2,2,4-Trimethylpentane	0.12%	0.12%	114.229	0.142	0.27%	Y	0.39%	0.451
Benzene	0.26%	0.26%	78.110	0.200	0.39%	Y	0.56%	0.434
Toluene	0.44%	0.44%	92.140	0.406	0.78%	Y	1.13%	1.038
Ethylbenzene	0.02%	0.02%	106.170	0.017	0.03%	Y	0.05%	0.051
m-Xylene	0.15%	0.15%	106.160	0.156	0.30%	Y	0.43%	0.458
o-Xylene	0.00%	0.00%	106.160	0.000	0.00%	Y	0.00%	0.000
n-Octane	0.36%	0.36%	114.229	0.415	0.80%	Y	1.15%	1.316
n-Nonane	0.12%	0.12%	128.255	0.149	0.29%	Y	0.41%	0.531
n-Decane	0.18%	0.18%	142.290	0.254	0.49%	Y	0.70%	1.003
Total	**100.00%**	**100.00%**		**51.777**			**100.00%**	**69.745**

Table 137. Condensate Tank Post-Flash Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	0.00%	0.00%	44.01	0.0000	0.00%	N		
Nitrogen	0.00%	0.00%	28.01	0.0000	0.00%	N		
Methane	46.18%	46.18%	16.04	7.4070	21.23%	N		
Ethane	14.42%	14.42%	30.07	4.3354	12.43%	N		
Propane	15.42%	15.42%	44.1	6.8008	19.50%	Y	29.39%	12.960
Isobutane	5.69%	5.70%	58.12	3.3100	9.49%	Y	14.30%	8.313
n-Butane	7.51%	7.51%	58.12	4.3644	12.51%	Y	18.86%	10.961
Isopentane	3.54%	3.54%	72.15	2.5570	7.33%	Y	11.05%	7.972
n-Pentane	2.87%	2.87%	72.15	2.0697	5.93%	Y	8.94%	6.453
n-Hexane	0.91%	0.91%	86.18	0.7863	2.25%	Y	3.40%	2.928
Cyclohexane	0.15%	0.15%	84.16	0.1247	0.36%	Y	0.54%	0.454
2,2-Dimethylbutane	0.07%	0.07%	86.177	0.0625	0.18%	Y	0.27%	0.233
2,3-Dimethylbutane	0.24%	0.24%	86.177	0.2072	0.59%	Y	0.90%	0.771
2-Methylpentane	0.71%	0.71%	86.177	0.6143	1.76%	Y	2.65%	2.287
3-Methylpentane	0.34%	0.34%	86.177	0.2936	0.84%	Y	1.27%	1.093
n-Heptane	1.23%	1.23%	100.202	1.2284	3.52%	Y	5.31%	5.319
Methylcyclohexane	0.10%	0.10%	98.19	0.0976	0.28%	Y	0.42%	0.414
2,2,4-Trimethylpentane	0.04%	0.04%	114.229	0.0491	0.14%	Y	0.21%	0.242
Benzene	0.14%	0.14%	78.11	0.1106	0.32%	Y	0.48%	0.373
Toluene	0.16%	0.16%	92.14	0.1455	0.42%	Y	0.63%	0.579
Ethylbenzene	0.00%	0.00%	106.17	0.0020	0.01%	Y	0.01%	0.009
Xylenes	0.08%	0.08%	106.17	0.0806	0.23%	Y	0.35%	0.370
n-Octane	0.11%	0.11%	114.2285	0.1306	0.37%	Y	0.56%	0.645
n-Nonane	0.04%	0.04%	128.255	0.0464	0.13%	Y	0.20%	0.257
n-Decane	0.04%	0.04%	142.29	0.0608	0.17%	Y	0.26%	0.374
Total	**100%**	**100%**		**34.8843**	**100%**		**100%**	**63.007**

Table 138. Regenerated Overhead Vent Stream Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Water	17.54%	17.54%	18.010	3.159	11.56%	N		
Carbon Dioxide	5.47%	5.47%	44.010	2.407	8.81%	N		
Nitrogen	0.11%	0.11%	28.010	0.032	0.12%	N		
Methane	55.61%	55.61%	16.040	8.920	32.64%	N		
Ethane	6.19%	6.19%	30.070	1.861	6.81%	N		
Propane	3.98%	3.98%	44.100	1.755	6.42%	Y	16.03%	7.069
Isobutane	1.07%	1.07%	58.120	0.622	2.28%	Y	5.68%	3.301
n-Butane	1.49%	1.49%	58.120	0.866	3.17%	Y	7.91%	4.597
Isopentane	0.57%	0.57%	72.150	0.413	1.51%	Y	3.77%	2.719
n-Pentane	0.58%	0.58%	72.150	0.421	1.54%	Y	3.85%	2.776
n-Hexane	0.33%	0.33%	86.180	0.286	1.05%	Y	2.61%	2.252
Cyclohexane	0.62%	0.62%	84.160	0.523	1.92%	Y	4.78%	4.024
Other Hexanes	0.37%	0.37%	86.180	0.320	1.17%	Y	2.92%	2.517
n-Heptane	0.61%	0.61%	100.202	0.615	2.25%	Y	5.62%	5.630
Methylcyclohexane	0.79%	0.79%	98.190	0.775	2.83%	Y	7.08%	6.947
2,2,4-Trimethylpentane	0.02%	0.02%	114.229	0.022	0.08%	Y	0.20%	0.226
Benzene	1.35%	1.35%	78.110	1.055	3.86%	Y	9.63%	7.522
Toluene	1.89%	1.89%	92.140	1.741	6.37%	Y	15.90%	14.654
Ethylbenzene	0.06%	0.06%	106.170	0.065	0.24%	Y	0.59%	0.628
Xylenes	0.60%	0.60%	106.170	0.641	2.35%	Y	5.86%	6.218
n-Octane	0.73%	0.73%	114.229	0.829	3.03%	Y	7.57%	8.652
Total	**100.00%**	**100.00%**		**27.329**	**100.00%**		**100.00%**	**79.734**

Table 139. Wet Gas Composition Analysis.

Component	Component Moles Percent	Normalized Mole	MW	Gas g/mol	% Wt	VOC species?	VOC renormalized wt%	VOC g/mol
Carbon Dioxide	2.73%	2.73%	44.010	1.203	6.09%	N		
Nitrogen	0.17%	0.17%	28.010	0.048	0.24%	N		
Methane	84.98%	84.98%	16.040	13.631	69.04%	N		
Ethane	6.81%	6.81%	30.070	2.049	10.38%	N		
Propane	3.17%	3.17%	44.100	1.398	7.08%	Y	49.67%	21.906
Isobutane	0.64%	0.64%	58.120	0.370	1.87%	Y	13.14%	7.634
n-Butane	0.71%	0.71%	58.120	0.413	2.09%	Y	14.67%	8.528
Isopentane	0.24%	0.24%	72.150	0.175	0.88%	Y	6.21%	4.478
n-Pentane	0.20%	0.20%	72.150	0.144	0.73%	Y	5.11%	3.686
n-Hexane	0.06%	0.06%	86.180	0.056	0.28%	Y	1.98%	1.710
Cyclohexane	0.03%	0.03%	84.160	0.027	0.14%	Y	0.95%	0.800
2,2-Dimethylbutane	0.00%	0.00%	86.177	0.004	0.02%	Y	0.13%	0.113
2,3-Dimethylbutane	0.02%	0.02%	86.177	0.014	0.07%	Y	0.50%	0.433
2-Methylpentane	0.05%	0.05%	86.177	0.042	0.21%	Y	1.49%	1.288
3-Methylpentane	0.03%	0.03%	86.177	0.022	0.11%	Y	0.77%	0.662
n-Heptane	0.06%	0.06%	100.202	0.059	0.30%	Y	2.09%	2.094
Methylcyclohexane	0.03%	0.03%	98.190	0.032	0.16%	Y	1.12%	1.103
2,2,4-Trimethylpentane	0.00%	0.00%	114.229	0.004	0.02%	Y	0.15%	0.176
Benzene	0.01%	0.01%	78.110	0.012	0.06%	Y	0.41%	0.323
Toluene	0.02%	0.02%	92.140	0.016	0.08%	Y	0.57%	0.525
Ethylbenzene	0.00%	0.00%	106.170	0.001	0.00%	Y	0.02%	0.020
m&p-Xylene	0.00%	0.00%	106.160	0.004	0.02%	Y	0.15%	0.164
o-Xylene	0.00%	0.00%	106.160	0.001	0.00%	Y	0.02%	0.024
n-Octane	0.01%	0.01%	114.229	0.016	0.08%	Y	0.56%	0.635
n-Nonane	0.01%	0.01%	128.255	0.008	0.04%	Y	0.27%	0.345
n-Decane	0.00%	0.00%	142.290	0.000	0.00%	Y	0.00%	0.000
Total	**100.00%**	**100.00%**		**19.745**	**100.00%**		**100.00%**	**56.648**

Table 140. Toxic Speciation Profiles used in Future Year Emission Inventory Development for Future Wells.

Source Type for lookup	VOC fractions						Source
	benzene	toluene	ethylbenzene	xylenes	n-hexane	formaldehyde	
venting other than well venting, initial completion and dehydrator	0.403%	0.555%	0.017%	0.320%	4.744%	0.000%	Wamsutter Produced Gas Composition
flashing loss	0.822%	1.173%	0.016%	0.632%	3.927%	0.000%	Flash speciation from Wamsutter HYSYS
Fugitive -working/breathing loss	0.830%	1.169%	0.016%	0.626%	3.965%	0.000%	Wamsutter Fugitive Composition (Post Flash)
diesel ICE	1.045%	1.518%	0.179%	1.205%	0.000%	8.510%	SPECIATE4, Profile 4674
HD traffic	1.132%	0.613%	0.152%	0.801%	0.129%	7.924%	From Catherine Yanca at EPA based on CRC E-55/E-59 Study
LD traffic	3.711%	10.147%	1.459%	5.744%	0.879%	2.456%	From David Brzezinski at EPA and MOVES
natural gas external combustion (boiler/heater)	4.000%	2.000%	0.000%	0.000%	0.000%	8.000%	SPECIATE4, Profile 0003
dust	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
compressor engine, lean burn	0.373%	0.346%	0.034%	0.156%	0.941%	44.746%	AP-42, CH 3.2
compressor engine, rich burn	5.338%	1.885%	0.084%	0.659%	0.000%	69.257%	AP-42, CH 3.2
natural gas drilling engine	0.373%	0.346%	0.034%	0.156%	0.941%	44.746%	AP-42, CH 3.2
flaring	0.000%	0.000%	0.000%	0.000%	0.000%	40.000%	SPECIATE4, Profile 1001
diesel external combustion boiler	0.000%	0.000%	0.000%	0.000%	10.800%	48.700%	SPECIATE4, Profile 0002
Reciprocating Engine	1.182%	0.430%	0.107%	0.430%	0.215%	8.700%	SPECIATE4, Profile 1001
Turbine	0.000%	0.000%	0.000%	0.000%	0.000%	100.000%	SPECIATE4, Profile 0007
produced water evaporation	13.858%	18.028%	1.529%	24.393%	0.147%	0.000%	EPA, Water 9 model Output. Based on data from evaporation facilities at Wamsutter Operations Center
Tank -working/breathing loss	0.478%	0.629%	0.009%	0.348%	3.398%	0.000%	Wamsutter Condensate Composition (Post Flash)
Dehydrator Venting	9.631%	15.905%	0.591%	5.857%	2.613%	0.000%	Wamsutter Regenerator Overhead Vent Stream Composition
venting -Well Venting and Initial completion	0.414%	0.570%	0.019%	0.177%	1.984%	0.000%	Wamsutter Wet Gas Composition

Table 141. List of Toxics Speciation Profiles used in Future Year Emission Inventory Development for Future Wells by Source Category.

Source Category	Appropriate Speciation Profiles Used
Added Compression (reciprocating)	Reciprocating Engine
Added Compression (turbine)	Turbine
Added Gas Plant (Duct Burner)	natural gas external combustion (boiler/heater)
Added Gas Plant (Flares)	flaring
Added Gas Plant (Fugitives)	venting other than well venting, initial completion and dehydrator
Added Gas Plant (Heaters)	natural gas external combustion (boiler/heater)
Added Gas Plant (Process)	natural gas external combustion (boiler/heater)
Added Gas Plant (Recip Engines)	Reciprocating Engine
Added Gas Plant (Turbine Engines)	Turbine
Completion Equipment (diesel ICE)	diesel ICE
Completion Traffic (HD)	HD traffic
Completion Traffic (HD) Dust	dust
Completion Traffic (LD)	LD traffic
Completion Traffic (LD) Dust	dust
Condensate Fugitive Devices	Fugitive -working/breathing loss
Condensate Tank Breathing Flaring	flaring
Condensate Tank Breathing Losses	Tank -working/breathing loss
Condensate Tank Flashing Flaring	flaring
Condensate Tank Flashing Losses	flashing loss
Condensate Tank Working Flaring	flaring
Condensate Tank Working Losses	Tank -working/breathing loss
Construction Dust, Fugitive	dust
Construction Dust, Wind Erosion	dust
Construction Traffic, Road and Well pad (HD)	HD traffic
Construction Traffic, Road and Well pad (HD) Dust	dust
Construction Traffic, Road and Well pad (LD)	LD traffic
Construction Traffic, Road and Well pad (LD) Dust	dust
Dehydrator Flaring	flaring
Dehydrator Venting - Well Site	Dehydrator Venting
Drilling Equip (diesel ICE 125HP)	diesel ICE
Drilling Equip (diesel ICE 1476HP)	diesel ICE
Drilling Traffic (HD)	HD traffic
Drilling Traffic (HD) Dust	dust
Drilling Traffic (LD)	LD traffic
Drilling Traffic (LD) Dust	dust
Evaporation Ponds	produced water evaporation
Gas Stream Fugitive Devices	venting other than well venting, initial completion and dehydrator
Heaters	natural gas external combustion (boiler/heater)
Initial Completion Flaring	flaring
Initial Completion Venting	venting -Well Venting and Initial completion
Pneumatic Devices	venting other than well venting, initial completion and dehydrator
Pneumatic Pump Flaring	flaring
Pneumatic Pumps	venting other than well venting, initial completion and dehydrator
Production Traffic (HD)	HD traffic
Production Traffic (HD) Dust	dust
Production Traffic (LD)	LD traffic
Production Traffic (LD) Dust	dust
Production Traffic, Central Facility (HD)	HD traffic
Production Traffic, Central Facility (HD) Dust	dust
Tank Loadout (vapor losses)	Tank -working/breathing loss
Well Pad Const Equip (diesel ICE)	diesel ICE
Well Stream Fugitive Devices	venting other than well venting, initial completion and dehydrator
Well Venting	venting -Well Venting and Initial completion
Workover Equipment (diesel ICE)	diesel ICE
WorkoverTraffic (HD)	HD traffic
WorkoverTraffic (HD) Dust	dust
WorkoverTraffic (LD)	LD traffic
WorkoverTraffic (LD) Dust	dust

WYDEQ BACT Requirements Accounting

ASSUMPTIONS

Data obtained from operators in blue text

Table 142. Summary of Fraction and Number of Wells with WYDEQ BACT Control for Pneumatic Pumps.

			Pneumatic Pumps							
			New Equipment			Existing Equipment			Total Equipment meeting BACT	
Inventory_Year	Equipment Installed Population	Cumulative Equipment Population	Percent w/ no BACT	Absolute w/ no BACT	Absolute w/ BACT	Percent with BACT where BACT equipment is removed	Equipment with BACT equipment	Instances where BACT equipment taken offline	Percent	Absolute
New Project_2008	0	0								
New Project_2009	218	218	0.0%	0	218	0.0%	218	0	100%	218
New Project_2010	292	510	0.0%	0	292	0.0%	510	0	100%	510
New Project_2011	291	801	0.0%	0	291	0.0%	801	0	100%	801
New Project_2012	285	1,086	0.0%	0	285	0.0%	1086	0	100%	1086
New Project_2013	291	1,377	0.0%	0	291	0.0%	1377	0	100%	1377
New Project_2014	288	1,664	0.0%	0	288	0.0%	1664	0	100%	1664
New Project_2015	297	1,961	0.0%	0	297	0.0%	1961	0	100%	1961
New Project_2016	232	2,193	0.0%	0	232	0.0%	2193	0	100%	2193
New Project_2017	305	2,498	0.0%	0	305	0.0%	2498	0	100%	2498
New Project_2018	335	2,833	0.0%	0	335	0.0%	2833	0	100%	2833
New Project_2019	270	3,103	0.0%	0	270	0.0%	3103	0	100%	3103
New Project_2020	270	3,373	0.0%	0	270	0.0%	3373	0	100%	3373
New Project_2021	305	3,677	0.0%	0	305	0.0%	3677	0	100%	3677
New Project_2022	289	3,966	0.0%	0	289	0.0%	3966	0	100%	3966
New Project_2023	97	4,063	0.0%	0	97	0.0%	4063	0	100%	4063
New Project_2024	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2025	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2026	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2027	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2028	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2029	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2030	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2031	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2032	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2033	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2034	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2035	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2036	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2037	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
assumed										

Table 143. Summary of Fraction and Number of Wells with WYDEQ BACT Controls for Dehydrators.

			Dehydrators							
			New Equipment			Existing Equipment			Total Equipment meeting BACT requirements	
Inventory_Year	Equipment Installed Population	Cumulative Equipment Population	Percent w/ no BACT	Absolute w/ no BACT	Absolute w/ BACT	Percent with BACT where BACT equipment is removed	Equipment with BACT equipment	Instances where BACT equipment taken offline	Percent	Absolute
New Project_2008	0	0								
New Project_2009	218	218	0.0%	0	218	0.0%	218	0	100%	218
New Project_2010	292	510	0.0%	0	292	0.0%	510	0	100%	510
New Project_2011	291	801	0.0%	0	291	0.0%	801	0	100%	801
New Project_2012	285	1,086	0.0%	0	285	0.0%	1086	0	100%	1086
New Project_2013	291	1,377	0.0%	0	291	0.0%	1377	0	100%	1377
New Project_2014	288	1,664	0.0%	0	288	0.0%	1664	0	100%	1664
New Project_2015	297	1,961	0.0%	0	297	0.0%	1961	0	100%	1961
New Project_2016	232	2,193	0.0%	0	232	0.0%	2193	0	100%	2193
New Project_2017	305	2,498	0.0%	0	305	0.0%	2498	0	100%	2498
New Project_2018	335	2,833	0.0%	0	335	0.0%	2833	0	100%	2833
New Project_2019	270	3,103	0.0%	0	270	0.0%	3103	0	100%	3103
New Project_2020	270	3,373	0.0%	0	270	0.0%	3373	0	100%	3373
New Project_2021	305	3,677	0.0%	0	305	0.0%	3677	0	100%	3677
New Project_2022	289	3,966	0.0%	0	289	0.0%	3966	0	100%	3966
New Project_2023	97	4,063	0.0%	0	97	0.0%	4063	0	100%	4063
New Project_2024	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2025	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2026	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2027	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2028	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2029	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2030	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2031	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2032	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2033	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2034	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2035	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2036	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2037	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063

assumed

Table 144. Summary of Fraction and Number of Wells with WYDEQ BACT Control for Condensate Tanks.

			Condensate Tanks							
			New Equipment			Existing Equipment			Total Equipment meeting BACT requirements	
Inventory_Year	Equipment Installed Population	Cumulative Equipment Population	Percent w/ no BACT	Absolute w/ no BACT	Absolute w/ BACT	Percent with BACT where BACT equipment is removed	Equipment with BACT equipment	Instances where BACT equipment taken offline	Percent	Absolute
New Project_2008	0	0								
New Project_2009	218	218	0.0%	0	218	0.0%	218	0	100%	218
New Project_2010	292	510	0.0%	0	292	0.0%	510	0	100%	510
New Project_2011	291	801	0.0%	0	291	0.0%	801	0	100%	801
New Project_2012	285	1,086	0.0%	0	285	0.0%	1086	0	100%	1086
New Project_2013	291	1,377	0.0%	0	291	0.0%	1377	0	100%	1377
New Project_2014	288	1,664	0.0%	0	288	0.0%	1664	0	100%	1664
New Project_2015	297	1,961	0.0%	0	297	0.0%	1961	0	100%	1961
New Project_2016	232	2,193	0.0%	0	232	0.0%	2193	0	100%	2193
New Project_2017	305	2,498	0.0%	0	305	0.0%	2498	0	100%	2498
New Project_2018	335	2,833	0.0%	0	335	0.0%	2833	0	100%	2833
New Project_2019	270	3,103	0.0%	0	270	0.0%	3103	0	100%	3103
New Project_2020	270	3,373	0.0%	0	270	0.0%	3373	0	100%	3373
New Project_2021	305	3,677	0.0%	0	305	0.0%	3677	0	100%	3677
New Project_2022	289	3,966	0.0%	0	289	0.0%	3966	0	100%	3966
New Project_2023	97	4,063	0.0%	0	97	0.0%	4063	0	100%	4063
New Project_2024	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2025	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2026	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2027	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2028	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2029	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2030	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2031	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2032	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2033	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2034	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2035	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2036	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063
New Project_2037	0	4,063	0.0%	0	0	0.0%	4063	0	100%	4063

assumed

2009 Well Pad Construction Equipment Emissions

ASSUMPTIONS

Activity data obtained from operator in blue text

Assumptions:

*	Emission factors from EPA Federal Diesel Engine Standards		http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
*	VOC/THC=	1.053	Conversion for HC->VOC for diesel engines (EPA, 2005; EPA420-R-05-0159, p. 5)
*	37% of fine particles assumed to be filterable and all filterable are assigned to EC (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)		
*	63% of fine particles assumed to be filterable and all filterable are assigned to SOA (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)		
	EPA NONROAD model Fully Deteriorated Tier Emission Factors		
	N2O Emission factors (g/gallons) from The Climate Registry, General Reporting Protocol v1.1, Table 13.6		

Equations:

$$\text{Emissions (tons/year-well)} = \frac{\text{Emission factor (g/hp-hr)} * \text{Horsepower} * \text{Time Used (hours)} * \text{Load}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

PM2.5/PM10 =	97%	EPA (2004) NONROAD
VOC/HC=	1.053	EPA NONROAD HC Conversions
NMHC/THC=	98.40%	EPA NONROAD HC Conversions

SO_2 Emission Factor Calculation Information

2008 Fuel Sulfur content			0.0355	sulfur fuel weight percent from EPA's NMIM County Database
soxcnv	Tiers I-III		0.02247	grams PM sulfur/grams fuel sulfur consumed
soxcnv	Tier IV		0.3	
grams PM sulfate/grams PM sulfur			7	
soxbas			0.33	
Density of Diesel Fuel	7.09	lb/gallons		
Molecular weight of S	32	g/mol		
Molecular weight of S02	64	g/mol		
	453.6	g/lb		

$$CO_2 = (BSFC * 453.6 - HC) * 0.87 * (44/12)$$

$$SO_2 = (BSFC * 453.6 * (1 - soxcnv) - HC) * 0.01 * soxdsl * 2$$

where

SO_2 is in g/hp-hr
BSFC is the in-use adjusted fuel consumption in lb/hp-hr
453.6 is the conversion factor from pounds to grams
soxcnv is the fraction of fuel sulfur converted to direct PM
HC is the in-use adjusted hydrocarbon emissions in g/hp-hr
0.01 is the conversion factor from weight percent to weight fraction
soxdsl is the episodic weight percent of sulfur in nonroad diesel fuel
2 is the grams of SO_2 formed from a gram of sulfur

Table 145. 2009 Well Pad Construction Equipment Emissions (lb/well pad) by Pollutants and by Equipment Type.

Equipment			Activity & Emission Factors	Emissions (lb/well pad)
Engine 1	Engine Function		Loader	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		200	
	Horsepower Range		175-300	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.433	
	Fuel Consumption (Gallons)		293	
	Emission Factors (g/bhp-hr)	NOx	6.860	72.60
		VOC	1.021	10.80
		CO	8.501	89.96
		PM10	0.403	4.26
		PM2.5	0.391	4.13
		SO2	0.136	1.44
		CO2	623	6597.37
		CH4	0.016	0.16
		PM_filt	0.145	1.53
		PM_cond	0.246	2.60
		N2O	0.260	0.17
Engine 2	Engine Function		Dozer	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		500	
	Horsepower Range		300-600	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption (Gallons)		628	
	Emission Factors (g/bhp-hr)	NOx	6.860	181.49
		VOC	1.021	27.00
		CO	8.501	224.89
		PM10	0.403	10.65
		PM2.5	0.391	10.33
		SO2	0.116	3.07
		CO2	534	14120.07
		CH4	0.016	0.41
		PM_filt	0.145	3.82
		PM_cond	0.246	6.51
		N2O	0.260	0.36
Engine 3	Engine Function		Scraper	
	Number of Engines		2	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		700	
	Horsepower Range		600-750	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption (Gallons)		1758	
	Emission Factors (g/bhp-hr)	NOx	6.860	508.18
		VOC	1.021	75.61
		CO	8.501	629.70
		PM10	0.403	29.83
		PM2.5	0.391	28.93
		SO2	0.116	8.60
		CO2	534	39536.20
		CH4	0.016	1.15
		PM_filt	0.145	10.71
		PM_cond	0.246	18.23
	(g/gal) for N2O	N2O	0.260	1.01
Engine 4	Engine Function		Grader	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	

Equipment			Activity & Emission Factors	Emissions (lb/well pad)
	Rated horsepower		350	
	Horsepower Range		300-600	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption (Gallons)		440	
	Emission Factors (g/bhp-hr)	NOx	6.860	127.05
		VOC	1.021	18.90
		CO	8.501	157.43
		PM10	0.403	7.46
		PM2.5	0.391	7.23
		SO2	0.116	2.15
		CO2	534	9884.05
		CH4	0.016	0.29
		PM_filt	0.145	2.68
		PM_cond	0.246	4.56
	(g/gal) for N2O	N2O	0.260	0.25
Engine 5	Engine Function		Backhoe	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		60	
	Horsepower Range		50-75	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.481	
	Fuel Consumption (Gallons)		98	
	Emission Factors (g/bhp-hr)	NOx	6.860	21.78
		VOC	1.314	4.17
		CO	6.425	20.40
		PM10	1.076	3.42
		PM2.5	1.044	3.31
		SO2	0.151	0.48
		CO2	692	2196.89
		CH4	0.020	0.06
		PM_filt	0.386	1.23
		PM_cond	0.658	2.09
	(g/gal) for N2O	N2O	0.260	0.06
Engine 6	Engine Function		Roller	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		200	
	Horsepower Range		175-300	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption (Gallons)		251	
	Emission Factors (g/bhp-hr)	NOx	6.860	72.60
		VOC	1.021	10.80
		CO	8.501	89.96
		PM10	0.403	4.26
		PM2.5	0.391	4.13
		SO2	0.116	1.23
		CO2	534	5648.03
		CH4	0.016	0.16
		PM_filt	0.145	1.53
		PM_cond	0.246	2.60
	(g/gal) for N2O	N2O	0.260	0.14
Engine 7	Engine Function		Water Truck	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		210	
	Horsepower Range		175-300	
	Time used (hrs)		60	
	Load Factor		0.4	

Equipment			Activity & Emission Factors	Emissions (lb/well pad)
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption (Gallons)		264	
	Emission Factors (g/bhp-hr)	NOx	6.860	76.23
		VOC	1.021	11.34
		CO	8.501	94.46
		PM10	0.403	4.47
		PM2.5	0.391	4.34
		SO2	0.116	1.29
		CO2	534	5930.43
		CH4	0.016	0.17
		PM_filt	0.145	1.61
		PM_cond	0.246	2.73
	(g/gal) for N2O	N2O	0.260	0.15
Engine 8	Engine Function		Dump Truck	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		330	
	Horsepower Range		300-600	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption (Gallons)		414	
	Emission Factors (g/bhp-hr)	NOx	6.860	119.79
		VOC	1.021	17.82
		CO	8.501	148.43
		PM10	0.403	7.03
		PM2.5	0.391	6.82
		SO2	0.116	2.03
		CO2	534	9319.25
		CH4	0.016	0.27
		PM_filt	0.145	2.52
		PM_cond	0.246	4.30
	(g/gal) for N2O	N2O	0.260	0.24
Engine 9	Engine Function		Trencher	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 1	
	Rated horsepower		250	
	Horsepower Range		175-300	
	Time used (hrs)		60	
	Load Factor		0.4	
	BSFC (lb/hp-hr)		0.371	
	Fuel Consumption (Gallons)		314	
	Emission Factors (g/bhp-hr)	NOx	6.860	90.75
		VOC	1.021	13.50
		CO	8.501	112.45
		PM10	0.403	5.33
		PM2.5	0.391	5.17
		SO2	0.116	1.54
		CO2	534	7060.04
		CH4	0.016	0.21
		PM_filt	0.145	1.91
		PM_cond	0.246	3.25
	(g/gal) for N2O	N2O	0.260	0.18

Table 146. Summary of 2009 Well Pad Construction Emissions (lb/well pad) by Pollutants for All Equipment.

Equipment Type	Pollutant	Emissions (lb/year-well pad)
Well Pad Construction Equipment	NOx	1,270
	VOC	190
	CO	1,568
	PM10	77
	PM2.5	74
	SO2	22
	CO2	100,292
	CH4	3
	PM_filt	28
	PM_cond	47
	N2O	3

Table 147. 2009 Well Pad Construction Equipment Emissions in tons per Pad.

Description	Well Pad Construction Equipment Emissions (tons per pad)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Well Pad Const Equip (diesel ICE)	0.6352	0.0950	0.7838	0.0384	0.0372	0.0109	50.1462	0.0014	0.0138	0.0234	0.0013	new pads

Table 148. Percent Change in Emission from Base Year 2009 for Well Pad Construction (aggregate factors to apply to total emissions across all equipment types).

Technology Assumption	Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
Tier 1	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2019	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2020	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2021	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2022	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2023	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2024	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2025	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2026	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2027	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2028	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2029	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2030	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2031	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2032	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2033	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2034	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2035	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2036	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 1	2037	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Well Pad and Access Road Construction Traffic Emissions

ASSUMPTIONS

Data provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.

Data for Number of Days of Measurable (>0.01") Precipitation

Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE 2009 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH CONSTRUCTION TRAFFIC TO WELL.

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} \; \frac{*(365-P)}{365} \; *(\text{Control Efficiency})$$

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 149. Summary of Traffic Activity Data Associated with Well Pad and Access Road Construction Phase.

Equipment Type	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Pad
Light Truck	20	20	14
Heavy Truck	20	20	21

Table 150. 2009 Exhaust Emissions (lb/pad) Associated with Well Pad and Access Road Construction Traffic by Vehicle Type.

Vehicle Type	Pollutant	2009 Emission Factors (g/mile)	Base year Emissions (lb/well pad)
Light-Duty Truck	NOx	2.52	1.556
	SO2	0.01	0.009
	CO	18.19	11.227
	CO2	675.15	417
	VOC	1.48	0.913
	PM10	0.09	0.054
	PM2.5	0.08	0.051
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.08	0.052
	N2O	0.05	0.028
Heavy-Duty Truck	NOx	20.23	18.728
	SO2	0.08	0.074
	CO	15.07	13.952
	CO2	2612.44	2418.921
	VOC	1.86	1.724
	PM10	1.21	1.118
	PM2.5	1.17	1.084
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.084
	N2O	0.04	0.033

Table 151. Summary of 2009 Fugitive Dust Emissions (tons/pad) Associated with Well Pad and Access Road Construction Traffic.

Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
								Em. Factor (lb/VMT)	Emissions (tpy/pad)	Em. Factor (lb/VMT)	Emissions (tpy/pad)
Travel to well	Light truck	7,000	20	14	14	20	280	0.20	0.03	0.02	0.00
Travel to well	Heavy Truck	70,000	20	21	21	20	420	0.20	0.04	0.02	0.00
							Total		0.07		0.01

Table 152. 2009 Exhaust and Fugitive Dust Emissions Associated with Well Pad and Access Road Construction Traffic in tons per pad.

Description	Total Road and Well Pad Construction Traffic Emissions (tons per well pad)											Projection	Fugitive Road	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
Construction Traffic, Road and Well pad (LD)	0.0008	0.0005	0.0056	2.68E-05	2.55E-05	4.44E-06	0.2084	2.62E-05	0	0	1.41E-05	new pads	0.0277	0.0028
Construction Traffic, Road and Well pad (HD)	0.0094	0.0009	0.0070	0.0006	0.0005	3.72E-05	1.2095	4.18E-05	0	0	1.65E-05	new pads	0.0416	0.0041

Table 153. Percent Change in Emission from Base Year 2009 due to fleet turnover for Well Pad and Access Road Construction Traffic.

Year	Light-Duty Truck (%)											Heavy-Duty Truck (%)										
	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	-5%	-11%	-3%	0%	-4%	-6%	-6%	0%	0%	-3%	-7%	-10%	-45%	-4%	0%	-3%	-7%	-7%	0%	0%	4%	-5%
2011	-10%	-18%	-7%	-1%	-10%	-12%	-13%	0%	0%	-7%	-14%	-19%	-74%	-9%	0%	-10%	-18%	-18%	0%	0%	13%	-12%
2012	-16%	-27%	-11%	-2%	-16%	-19%	-19%	0%	0%	-11%	-21%	-28%	-75%	-14%	0%	-17%	-28%	-28%	0%	0%	20%	-17%
2013	-22%	-28%	-15%	-4%	-22%	-25%	-25%	0%	0%	-15%	-28%	-36%	-75%	-19%	0%	-25%	-37%	-37%	0%	0%	24%	-23%
2014	-28%	-29%	-18%	-5%	-27%	-30%	-31%	0%	0%	-18%	-34%	-44%	-76%	-24%	0%	-32%	-45%	-46%	0%	0%	28%	-28%
2015	-33%	-30%	-22%	-7%	-33%	-35%	-36%	0%	0%	-22%	-39%	-51%	-76%	-28%	0%	-38%	-53%	-53%	0%	0%	30%	-33%
2016	-38%	-31%	-26%	-8%	-38%	-40%	-40%	0%	0%	-25%	-44%	-57%	-76%	-33%	0%	-44%	-60%	-60%	0%	0%	31%	-37%
2017	-43%	-33%	-28%	-10%	-42%	-44%	-44%	0%	0%	-28%	-48%	-62%	-76%	-36%	0%	-49%	-66%	-66%	0%	0%	32%	-41%
2018	-47%	-34%	-31%	-11%	-46%	-48%	-48%	0%	0%	-30%	-52%	-67%	-76%	-39%	0%	-54%	-71%	-71%	0%	0%	33%	-44%
2019	-51%	-35%	-33%	-13%	-49%	-51%	-51%	0%	0%	-32%	-56%	-71%	-77%	-42%	0%	-59%	-75%	-75%	0%	0%	33%	-48%
2020	-54%	-36%	-34%	-14%	-52%	-54%	-54%	0%	0%	-34%	-59%	-74%	-77%	-44%	0%	-62%	-79%	-79%	0%	0%	34%	-50%
2021	-57%	-37%	-36%	-15%	-55%	-56%	-56%	0%	0%	-35%	-62%	-77%	-77%	-46%	0%	-66%	-82%	-82%	0%	0%	34%	-53%
2022	-64%	-39%	-40%	-18%	-62%	-61%	-62%	0%	0%	-38%	-69%	-83%	-77%	-50%	0%	-73%	-89%	-89%	0%	0%	35%	-60%
2023	-60%	-38%	-37%	-16%	-58%	-58%	-59%	0%	0%	-36%	-64%	-79%	-77%	-48%	0%	-69%	-85%	-85%	0%	0%	34%	-55%
2024	-62%	-39%	-39%	-17%	-60%	-60%	-60%	0%	0%	-37%	-67%	-81%	-77%	-49%	0%	-71%	-87%	-87%	0%	0%	34%	-58%
2025	-66%	-40%	-41%	-19%	-65%	-63%	-64%	0%	0%	-39%	-71%	-84%	-77%	-52%	0%	-76%	-90%	-90%	0%	0%	34%	-61%
2026	-68%	-41%	-42%	-20%	-67%	-64%	-65%	0%	0%	-38%	-72%	-85%	-77%	-53%	0%	-78%	-91%	-91%	0%	0%	36%	-63%
2027	-69%	-41%	-43%	-21%	-69%	-66%	-66%	0%	0%	-38%	-74%	-86%	-77%	-54%	0%	-79%	-92%	-92%	0%	0%	36%	-64%
2028	-71%	-42%	-44%	-21%	-70%	-67%	-68%	0%	0%	-39%	-75%	-87%	-77%	-54%	0%	-81%	-93%	-93%	0%	0%	36%	-65%
2029	-72%	-42%	-45%	-22%	-72%	-68%	-69%	0%	0%	-40%	-76%	-87%	-77%	-55%	0%	-82%	-94%	-94%	0%	0%	36%	-67%
2030	-73%	-42%	-46%	-22%	-73%	-69%	-69%	0%	0%	-40%	-77%	-88%	-77%	-56%	0%	-83%	-94%	-94%	0%	0%	35%	-67%
2031	-74%	-43%	-46%	-23%	-74%	-69%	-70%	0%	0%	-42%	-78%	-88%	-77%	-57%	0%	-84%	-95%	-95%	0%	0%	34%	-69%
2032	-74%	-43%	-47%	-23%	-75%	-70%	-71%	0%	0%	-42%	-79%	-88%	-77%	-57%	0%	-85%	-95%	-95%	0%	0%	34%	-69%
2033	-75%	-43%	-48%	-23%	-76%	-71%	-71%	0%	0%	-43%	-79%	-89%	-78%	-58%	0%	-85%	-95%	-95%	0%	0%	33%	-69%
2034	-76%	-44%	-48%	-24%	-76%	-71%	-72%	0%	0%	-43%	-79%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2035	-76%	-44%	-49%	-24%	-77%	-72%	-72%	0%	0%	-44%	-80%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2036	-77%	-44%	-49%	-24%	-77%	-72%	-73%	0%	0%	-44%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-70%
2037	-77%	-44%	-50%	-24%	-78%	-72%	-73%	0%	0%	-45%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-71%

2009 Completion Equipment Emissions

ASSUMPTIONS

Activity data obtained from operator in blue text

Assumptions:

Assumed that all equipment uses Tier 2 engines

*	Emission factors from EPA Federal Diesel Engine Standards		http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
*	VOC/THC=	1.053	Conversion for HC->VOC for diesel engines (EPA, 2005; EPA420-R-05-0159, p. 5)
*	37% of fine particles assumed to be filterable and all filterable are assigned to EC (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)		
*	63% of fine particles assumed to be filterable and all filterable are assigned to SOA (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)		
	EPA NONROAD model Fully Deteriorated Tier Emission Factors		
	N2O Emission factors (g/gallons) from The Climate Registry, General Reporting Protocol v1.1, Table 13.6		

Equations:

$$\text{Emissions (tons/year-well)} = \frac{\text{Emission factor (g/hp-hr)} * \text{Horsepower} * \text{Time Used (hours)} * \text{Load}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

PM2.5/PM10 =	97%	EPA (2004) NONROAD
VOC/HC=	1.053	EPA NONROAD HC Conversions
NMHC/THC=	98.40%	EPA NONROAD HC Conversions

SO_2 Emission Factor Calculation Information

2008 Fuel Sulfur content			0.0355	sulfur fuel weight percent from EPA's NMIM County Database
soxcnv	Tiers I-III		0.02247	grams PM sulfur/grams fuel sulfur consumed
soxcnv	Tier IV		0.3	
grams PM sulfate/grams PM sulfur			7	
soxbas			0.33	
Density of Diesel Fuel	7.09	lb/gallons		
Molecular weight of S	32	g/mol		
Molecular weight of S02	64	g/mol		
	453.6	g/lb		

The model does not require an SO_2 emission factors input file either. EPA will calculate SO_2 emission factors as shown in the equation below.

$$SO_2 = (BSFC * 453.6 * (1 - soxcnv) - HC) * 0.01 * soxdsl * 2 \qquad \text{[Equation 7]}$$

where

SO_2 is in g/hp-hr
BSFC is the in-use adjusted fuel consumption in lb/hp-hr
453.6 is the conversion factor from pounds to grams
soxcnv is the fraction of fuel sulfur converted to direct PM
HC is the in-use adjusted hydrocarbon emissions in g/hp-hr
0.01 is the conversion factor from weight percent to weight fraction
soxdsl is the episodic weight percent of sulfur in nonroad diesel fuel
2 is the grams of SO_2 formed from a gram of sulfur

$$CO_2 = (BSFC * 453.6 - HC) * 0.87 * (44/12)$$

Table 154. 2009 Completion Equipment Emissions (lb/spud) by Pollutants and by Equipment Type.

Equipment			Activity & Emission Factors	Emissions (lb/spud)
Engine 1	Engine Function		Frac Pump	
	Number of Engines		4	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		2250	
	Horsepower Range		>1200	
	Time used (hrs)		20	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.367	
	Fuel Consumption (Gallons)		2795	
	Emission Factors (g/bhp-hr)	NOx	4.534	539.74
		VOC	0.255	30.40
		CO	2.610	310.71
		PM10	0.149	17.75
		PM2.5	0.145	17.22
		SO2	0.115	13.73
		CO2	530	63127.33
		CH4	0.004	0.46
		PM_filt	0.054	6.37
		PM_cond	0.091	10.85
	(g/gal)	N2O	0.260	1.60
Engine 2	Engine Function		Hydraulic Triplex	
	Number of Engines		2	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		700	
	Horsepower Range		600-750	
	Time used (hrs)		20	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.367	
	Fuel Consumption (Gallons)		435	
	Emission Factors (g/bhp-hr)	NOx	4.534	83.96
		VOC	0.255	4.73
		CO	2.610	48.33
		PM10	0.149	2.76
		PM2.5	0.145	2.68
		SO2	0.115	2.14
		CO2	530	9819.81
		CH4	0.004	0.07
		PM_filt	0.054	0.99
		PM_cond	0.091	1.69
	(g/gal)	N2O	0.260	0.25
Engine 3	Engine Function		Blender	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		350	
	Horsepower Range		300-600	
	Time used (hrs)		20	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.367	
	Fuel Consumption (Gallons)		109	
	Emission Factors (g/bhp-hr)	NOx	4.534	20.99
		VOC	0.255	1.18
		CO	2.610	12.08
		PM10	0.149	0.69
		PM2.5	0.145	0.67
		SO2	0.115	0.53
		CO2	530	2454.95
		CH4	0.004	0.02
		PM_filt	0.054	0.25
		PM_cond	0.091	0.42
	(g/gal)	N2O	0.260	0.06

Equipment			Activity & Emission Factors	Emissions (lb/spud)
Engine 4	Engine Function		Pre gel	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		250	
	Horsepower Range		175-300	
	Time used (hrs)		20	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.367	
	Fuel Consumption (Gallons)		78	
	Emission Factors (g/bhp-hr)	NOx	4.676	15.46
		VOC	0.263	0.87
		CO	2.610	8.63
		PM10	0.149	0.49
		PM2.5	0.145	0.48
		SO2	0.115	0.38
		CO2	530	1753.46
		CH4	0.004	0.01
		PM_filt	0.054	0.18
		PM_cond	0.091	0.30
	(g/gal)	N2O	0.260	0.04
Engine 5	Engine Function		Frac Van	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		50	
	Horsepower Range		50-75	
	Time used (hrs)		20	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.408	
	Fuel Consumption (Gallons)		17	
	Emission Factors (g/bhp-hr)	NOx	5.313	3.51
		VOC	0.299	0.20
		CO	3.728	2.47
		PM10	0.298	0.20
		PM2.5	0.289	0.19
		SO2	0.128	0.08
		CO2	589	389.86
		CH4	0.005	0.00
		PM_filt	0.107	0.07
		PM_cond	0.182	0.12
	(g/gal)	N2O	0.260	0.01
Engine 6	Engine Function		Acid Pump	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		50	
	Horsepower Range		50-75	
	Time used (hrs)		20	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.408	
	Fuel Consumption (Gallons)		17	
	Emission Factors (g/bhp-hr)	NOx	5.313	3.51
		VOC	0.299	0.20
		CO	3.728	2.47
		PM10	0.298	0.20
		PM2.5	0.289	0.19
		SO2	0.128	0.08
		CO2	589	389.86
		CH4	0.005	0.00
		PM_filt	0.107	0.07
		PM_cond	0.182	0.12
	(g/gal)	N2O	0.260	0.01

Equipment			Activity & Emission Factors	Emissions (lb/spud)
Engine 7	Engine Function		Wireline	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		50	
	Horsepower Range		50-75	
	Time used (hrs)		20	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.408	
	Fuel Consumption (Gallons)		17	
	Emission Factors (g/bhp-hr)	NOx	5.313	3.51
		VOC	0.299	0.20
		CO	3.728	2.47
		PM10	0.298	0.20
		PM2.5	0.289	0.19
		SO2	0.128	0.08
		CO2	589	389.86
		CH4	0.005	0.00
		PM_filt	0.107	0.07
		PM_cond	0.182	0.12
	(g/gal)	N2O	0.260	0.01

Table 155. Summary of 2009 Completion Emissions (lb/year-spud) by Pollutants for All Equipment.

Equipment Type	Pollutant	Emissions (lb/year-spud)
Completion Equipment	NOx	671
	VOC	38
	CO	387
	PM10	22
	PM2.5	22
	SO2	17
	CO2	78,325
	CH4	1
	PM_filt	8
	PM_cond	14
	N2O	2

Table 156. 2009 Completion Construction Equipment Emissions in tons per spud.

Description	Completion Construction Equipment Emissions (tons per spud)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Completion Equipment (diesel ICE)	0.3353	0.0189	0.1936	0.0111	0.0108	0.0085	39.1626	0.0003	0.0040	0.0068	0.0010	total spuds

Table 157. Percent Change in Emission from Base Year 2009 for Completion Construction Equipment (aggregate factors to apply to total emissions across all equipment types).

Technology Assumption	Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
Tier 2	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2019	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2020	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2021	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2022	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2023	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2024	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2025	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2026	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2027	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2028	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2029	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2030	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2031	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2032	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2033	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2034	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2035	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2036	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2037	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Well Completion Traffic Emissions

ASSUMPTIONS

Data Provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.
Data for Number of Days of Measurable (>0.01") Precipitation
Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

MOVES Emissions (tons/year-well) = $\frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$

ASSUMPTIONS TO ESTIMATE 2009 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH WELL COMPLETION TRAFFIC.

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} \cdot \frac{(365-P)}{365} \cdot (\text{Control Efficiency})$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 158. Summary of Traffic Activity Data Associated with Well Completion Phase.

Equipment Type	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Well
Light Truck	20	20	66
Heavy Truck	20	20	138

Table 159. 2009 Exhaust Emissions (lb/spud) Associated with Well Completion Traffic by Vehicle Type.

Vehicle Type	Pollutant	2009 Emission Factors (g/mile)	Base year Emissions (lb/well pad)
Light-Duty Truck	NOx	2.52	7.334
	SO2	0.01	0.042
	CO	18.19	52.926
	CO2	675.15	1965
	VOC	1.48	4.302
	PM10	0.09	0.253
	PM2.5	0.08	0.240
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.08	0.247
	N2O	0.05	0.133
Heavy-Duty Truck	NOx	20.23	123.068
	SO2	0.08	0.489
	CO	15.07	91.682
	CO2	2612.44	15895.770
	VOC	1.86	11.326
	PM10	1.21	7.348
	PM2.5	1.17	7.123
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.549
	N2O	0.04	0.216

Table 160. Summary of 2009 Fugitive Dust Emissions (tons/spud) Associated with Well Completion Traffic.

Units	Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
									Em. Factor (lb/VMT)	Emissions (tpy/spud)	Em. Factor (lb/VMT)	Emissions (tpy/spud)
All Operators	Travel to well	Light truck	7,000	20	66	66	20	1320	0.20	0.13	0.02	0.01
	Travel to well	Heavy Truck	70,000	20	138	138	20	2760	0.20	0.27	0.02	0.03
								Total	**0.40**	**0.40**	**0.04**	**0.04**

Table 161. 2009 Exhaust and Fugitive Dust Emissions Associated with Well Completion Traffic in tons per spud.

Description	Total Completion Traffic Emissions (tons per pad)											Projection	Fugitive Road	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
Completion Traffic (LD)	0.0037	0.0022	0.0265	0.0001	0.0001	2.10E-05	0.9824	0.0001	0	0	6.65E-05	total spuds	0.1307	0.0130
Completion Traffic (HD)	0.0615	0.0057	0.0458	0.0037	0.0036	0.0002	7.9479	0.0003	0	0	0.0001	total spuds	0.2732	0.0271

Table 162. Percent Change in Emission from Base Year 2009 Due to Fleet Turnover for Well Completion Traffic.

	Light-Duty Truck											Heavy-Duty Truck										
Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	-5%	-11%	-3%	0%	-4%	-6%	-6%	0%	0%	-3%	-7%	-10%	-45%	-4%	0%	-3%	-7%	-7%	0%	0%	4%	-5%
2011	-10%	-18%	-7%	-1%	-10%	-12%	-13%	0%	0%	-7%	-14%	-19%	-74%	-9%	0%	-10%	-18%	-18%	0%	0%	13%	-12%
2012	-16%	-27%	-11%	-2%	-16%	-19%	-19%	0%	0%	-11%	-21%	-28%	-75%	-14%	0%	-17%	-28%	-28%	0%	0%	20%	-17%
2013	-22%	-28%	-15%	-4%	-22%	-25%	-25%	0%	0%	-15%	-28%	-36%	-75%	-19%	0%	-25%	-37%	-37%	0%	0%	24%	-23%
2014	-28%	-29%	-18%	-5%	-27%	-30%	-31%	0%	0%	-18%	-34%	-44%	-76%	-24%	0%	-32%	-45%	-46%	0%	0%	28%	-28%
2015	-33%	-30%	-22%	-7%	-33%	-35%	-36%	0%	0%	-22%	-39%	-51%	-76%	-28%	0%	-38%	-53%	-53%	0%	0%	30%	-33%
2016	-38%	-31%	-26%	-8%	-38%	-40%	-40%	0%	0%	-25%	-44%	-57%	-76%	-33%	0%	-44%	-60%	-60%	0%	0%	31%	-37%
2017	-43%	-33%	-28%	-10%	-42%	-44%	-44%	0%	0%	-28%	-48%	-62%	-76%	-36%	0%	-49%	-66%	-66%	0%	0%	32%	-41%
2018	-47%	-34%	-31%	-11%	-46%	-48%	-48%	0%	0%	-30%	-52%	-67%	-76%	-39%	0%	-54%	-71%	-71%	0%	0%	33%	-44%
2019	-51%	-35%	-33%	-13%	-49%	-51%	-51%	0%	0%	-32%	-56%	-71%	-77%	-42%	0%	-59%	-75%	-75%	0%	0%	33%	-48%
2020	-54%	-36%	-34%	-14%	-52%	-54%	-54%	0%	0%	-34%	-59%	-74%	-77%	-44%	0%	-62%	-79%	-79%	0%	0%	34%	-50%
2021	-57%	-37%	-36%	-15%	-55%	-56%	-56%	0%	0%	-35%	-62%	-77%	-77%	-46%	0%	-66%	-82%	-82%	0%	0%	34%	-53%
2022	-64%	-39%	-40%	-18%	-62%	-61%	-62%	0%	0%	-38%	-69%	-83%	-77%	-50%	0%	-73%	-89%	-89%	0%	0%	35%	-60%
2023	-60%	-38%	-37%	-16%	-58%	-58%	-59%	0%	0%	-36%	-64%	-79%	-77%	-48%	0%	-69%	-85%	-85%	0%	0%	34%	-55%
2024	-62%	-39%	-39%	-17%	-60%	-60%	-60%	0%	0%	-37%	-67%	-81%	-77%	-49%	0%	-71%	-87%	-87%	0%	0%	34%	-58%
2025	-66%	-40%	-41%	-19%	-65%	-63%	-64%	0%	0%	-39%	-71%	-84%	-77%	-52%	0%	-76%	-90%	-90%	0%	0%	34%	-61%
2026	-68%	-41%	-42%	-20%	-67%	-64%	-65%	0%	0%	-38%	-72%	-85%	-77%	-53%	0%	-78%	-91%	-91%	0%	0%	36%	-63%
2027	-69%	-41%	-43%	-21%	-69%	-66%	-66%	0%	0%	-38%	-74%	-86%	-77%	-54%	0%	-79%	-92%	-92%	0%	0%	36%	-64%
2028	-71%	-42%	-44%	-21%	-70%	-67%	-68%	0%	0%	-39%	-75%	-87%	-77%	-54%	0%	-81%	-93%	-93%	0%	0%	36%	-65%
2029	-72%	-42%	-45%	-22%	-72%	-68%	-69%	0%	0%	-40%	-76%	-87%	-77%	-55%	0%	-82%	-94%	-94%	0%	0%	36%	-67%
2030	-73%	-42%	-46%	-22%	-73%	-69%	-69%	0%	0%	-40%	-77%	-88%	-77%	-56%	0%	-83%	-94%	-94%	0%	0%	35%	-67%
2031	-74%	-43%	-46%	-23%	-74%	-69%	-70%	0%	0%	-42%	-78%	-88%	-77%	-57%	0%	-84%	-95%	-95%	0%	0%	34%	-69%
2032	-74%	-43%	-47%	-23%	-75%	-70%	-71%	0%	0%	-42%	-79%	-88%	-77%	-57%	0%	-85%	-95%	-95%	0%	0%	34%	-69%
2033	-75%	-43%	-48%	-23%	-76%	-71%	-71%	0%	0%	-43%	-79%	-89%	-78%	-58%	0%	-85%	-95%	-95%	0%	0%	33%	-69%
2034	-76%	-44%	-48%	-24%	-76%	-71%	-72%	0%	0%	-43%	-79%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2035	-76%	-44%	-49%	-24%	-77%	-72%	-72%	0%	0%	-44%	-80%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2036	-77%	-44%	-49%	-24%	-77%	-72%	-73%	0%	0%	-44%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-70%
2037	-77%	-44%	-50%	-24%	-78%	-72%	-73%	0%	0%	-45%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-71%

2009 Drilling Emissions

ASSUMPTIONS

Activity data obtained from the operators

Emission factors from EPA Federal Diesel

* Engine Tier 2 Standards http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
* Crankcase Emission factors are 2% of HC Exhaust Emission Factor for Tier II and earlier per
* EPA NONROAD Modeling Guidance p. 23 (EPA, 2004; EPA420-P-04-009).
* VOC/THC= 1.053 Conversion for HC->VOC for diesel engines (EPA, 2005; EPA420-R-05-0159, p. 5)
* 37% of fine particles assumed to be filterable and all filterable are assigned to EC (Source: AQTSD for Hell's Gulch and Hi
* 63% of fine particles assumed to be filterable and all filterable are assigned to SOA (Source: AQTSD for Hell's Gulch and
* For ICE 125 hp, assumed 50% load factor due to usage in only winter months

Equations:

$$\text{Emissions (tons/year-well)} = \frac{\text{Emission factor (g/hp-hr)} * \text{Horsepower} * \text{Time Used (hours)} * \text{Load}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

EPA Federal Tier 2 Standard Emission Rates

N2O Emission factors (g/gallons) from The Climate Registry, General Reporting Protocol v1.1, Table 13.6

PM2.5/PM10 =	97%	EPA (2004) NONROAD
VOC/HC	1.053	EPA NONROAD HC Conversions
NMHC/THC	98.40%	EPA NONROAD HC Conversions

SO_2 Emission Factor Calculation Information

2008 Fuel Sulfur content		0.0355	sulfur fuel weight percent
soxcnv	Tiers I-III	0.02247	grams PM sulfur/grams fuel sulfur consumed
soxcnv	Tier IV	0.3	
grams PM sulfate/grams PM sulfur		7	
soxbas		0.33	
Density of Diesel Fuel	7.09	lb/gallons	
Molecular weight of S	32	g/mol	
Molecular weight of S02	64	g/mol	
	453.6	g/lb	

$$CO_2 = (BSFC * 453.6 - HC) * 0.87 * (44/12)$$

$$SO_2 = (BSFC * 453.6 * (1 - soxcnv) - HC) * 0.01 * soxdsl * 2 \qquad \text{[Equation 7]}$$

where

SO_2 is in g/hp-hr
BSFC is the in-use adjusted fuel consumption in lb/hp-hr
453.6 is the conversion factor from pounds to grams
soxcnv is the fraction of fuel sulfur converted to direct PM
HC is the in-use adjusted hydrocarbon emissions in g/hp-hr
0.01 is the conversion factor from weight percent to weight fraction
soxdsl is the episodic weight percent of sulfur in nonroad diesel fuel
2 is the grams of SO_2 formed from a gram of sulfur

Table 163. 2009 Drilling Equipment Emissions (lb/spud) by Pollutants and by Equipment Type.

Equipment			Activity & Emission Factors	Emissions (lb/well spud)
Engine 1	Engine Function		Cat 3512C	
	Number of Engines		3	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		1476	
	Horsepower Range		>1200	
	Time used (hrs)		240	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.334	
	Fuel Consumption (Gallons)		15033	
	Emission Factors (g/bhp-hr)	NOx	4.534	3186.65
		VOC	0.255	179.48
		CO	2.610	1834.42
		PM10	0.149	104.82
		PM2.5	0.145	101.68
		SO2	0.105	73.85
		CO2	483	339463.07
		CH4	0.004	2.73
		PM_filt	0.054	37.62
		PM_cond	0.091	64.06
	(g/gal)	N2O	0.260	8.62
Engine 2	Engine Function		Boiler	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		125	
	Horsepower Range		100-175	
	Time used (hrs)		240	
	Load Factor		0.5	
	BSFC (lb/hp-hr)		0.334	
	Fuel Consumption (Gallons)		707	
	Emission Factors (g/bhp-hr)	NOx	4.676	154.61
		VOC	0.263	8.71
		CO	3.728	123.30
		PM10	0.224	7.40
		PM2.5	0.217	7.18
		SO2	0.105	3.47
		CO2	483	15970.63
		CH4	0.004	0.13
		PM_filt	0.080	2.66
		PM_cond	0.137	4.52
	(g/gal)	N2O	0.260	0.41

Table 164. Summary of 2009 Drilling Equipment Emissions (lb/spud) by Pollutant and Engine Type.

Equipment Type	Pollutant	Engine 1	Engine 2
Drilling Equipment	NOx	3,187	155
	VOC	179	9
	CO	1,834	123
	PM10	105	7
	PM2.5	102	7
	SO2	74	3
	CO2	339,463	15,971
	CH4	3	0
	PM_filt	38	3
	PM_cond	64	5
	N2O	9	0

Table 165. 2009 Drilling Equipment Emissions in tons per spud.

Description	Drilling Equipment Emissions (tons per spud)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Drilling Equip (diesel ICE 1476HP)	1.5933	0.0897	0.9172	0.0524	0.0508	0.036927	169.7315	0.0014	0.0188	0.0320	0.0043	total spuds
Drilling Equip (diesel ICE 125HP)	0.0773	0.0044	0.0616	0.0037	0.0036	0.001737	7.9853	0.0001	0.0013	0.0023	0.0002	total spuds

Table 166. Drilling Equipment Tier Assumptions throughout the Project Life.

Year	Tier 2
2009	100%
2010	100%
2011	100%
2012	100%
2013	100%
2014	100%
2015	100%
2016	100%
2017	100%
2018	100%
2019	100%
2020	100%
2021	100%
2022	100%
2023	100%
2024	100%
2025	100%
2026	100%
2027	100%
2028	100%
2029	100%
2030	100%
2031	100%
2032	100%
2033	100%
2034	100%
2035	100%
2036	100%
2037	100%

Table 167. Percent Change in Emission from Base Year 2009 (aggregate factors to apply to total emissions to all Diesel ICE 1476 HP Engines) for Drilling Equipment.

Technology Assumption	Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
Tier 2	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2019	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2020	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2021	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2022	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2023	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2024	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2025	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2026	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2027	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2028	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2029	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2030	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2031	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2032	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2033	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2034	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2035	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2036	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2037	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 168. Percent Change in Emission from Base Year 2009 (aggregate factors to apply to total emissions to all Diesel ICE 125HP Engines) for Drilling Equipment.

Technology Assumption	Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
Tier 2	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2019	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2020	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2021	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2022	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2023	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2024	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2025	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2026	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2027	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2028	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2029	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2030	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2031	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2032	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2033	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2034	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2035	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2036	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2037	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Drilling Construction Traffic Emissions

ASSUMPTIONS

Data Provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.

Data for Number of Days of Measurable (>0.01") Precipitation

Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE 2009 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH DRILLING TRAFFIC.

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} \quad \frac{*(365-P)}{365} \quad *(\text{Control Efficiency})$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 169. Summary of Traffic Activity Data Associated with Drilling Phase.

Equipment Type	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Spud
Light Truck	20	20	98
Heavy Truck	20	20	224

Table 170. 2009 Exhaust Emissions (lb/spud) Associated with Drilling Traffic by Vehicle Type.

Vehicle Type	Pollutant	2009 Emission Factors (g/mile)	Base Year Emissions (lb/spud)
Light-Duty Truck	NOx	2.52	10.890
	SO2	0.01	0.062
	CO	18.19	78.587
	CO2	675.15	2917
	VOC	1.48	6.388
	PM10	0.09	0.376
	PM2.5	0.08	0.356
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.08	0.367
	N2O	0.05	0.198
Heavy-Duty Truck	NOx	20.23	199.762
	SO2	0.08	0.794
	CO	15.07	148.818
	CO2	2612.44	25801.829
	VOC	1.86	18.384
	PM10	1.21	11.928
	PM2.5	1.17	11.563
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.891
	N2O	0.04	0.351

Table 171. Summary of 2009 Fugitive Dust Emissions (tons/spud) Associated with Drilling Traffic.

Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
								Em. Factor (lb/VMT)	Emissions (tpy/spud)	Em. Factor (lb/VMT)	Emissions (tpy/spud)
Travel to well	Light truck	7,000	20	98	98	20	1960	0.20	0.19	0.02	0.02
Travel to well	Heavy Truck	70,000	20	224	224	20	4480	0.20	0.44	0.02	0.04
							Total		0.64		0.06

Table 172. 2009 Exhaust and Fugitive Dust Emissions Associated with Drilling Traffic in tons per spud.

Description	Total Drill Traffic Emissions (tons per spud)											Projection	Fugitive Road	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
Drilling Traffic (LD)	0.0054	0.0032	0.0393	0.0002	0.0002	3.11E-05	1.4587	0.0002	0	0	9.88E-05	total spuds	0.1940	0.0193
Drilling Traffic (HD)	0.0999	0.0092	0.0744	0.0060	0.0058	0.0004	12.9009	0.0004	0	0	0.0002	total spuds	0.4435	0.0440

Table 173. Percent Change in Emission from Base Year 2009 Due to Fleet Turnover for Drilling Traffic.

	Light-Duty Truck											Heavy-Duty Truck										
Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	-5%	-11%	-3%	0%	-4%	-6%	-6%	0%	0%	-3%	-7%	-10%	-45%	-4%	0%	-3%	-7%	-7%	0%	0%	4%	-5%
2011	-10%	-18%	-7%	-1%	-10%	-12%	-13%	0%	0%	-7%	-14%	-19%	-74%	-9%	0%	-10%	-18%	-18%	0%	0%	13%	-12%
2012	-16%	-27%	-11%	-2%	-16%	-19%	-19%	0%	0%	-11%	-21%	-28%	-75%	-14%	0%	-17%	-28%	-28%	0%	0%	20%	-17%
2013	-22%	-28%	-15%	-4%	-22%	-25%	-25%	0%	0%	-15%	-28%	-36%	-75%	-19%	0%	-25%	-37%	-37%	0%	0%	24%	-23%
2014	-28%	-29%	-18%	-5%	-27%	-30%	-31%	0%	0%	-18%	-34%	-44%	-76%	-24%	0%	-32%	-45%	-46%	0%	0%	28%	-28%
2015	-33%	-30%	-22%	-7%	-33%	-35%	-36%	0%	0%	-22%	-39%	-51%	-76%	-28%	0%	-38%	-53%	-53%	0%	0%	30%	-33%
2016	-38%	-31%	-26%	-8%	-38%	-40%	-40%	0%	0%	-25%	-44%	-57%	-76%	-33%	0%	-44%	-60%	-60%	0%	0%	31%	-37%
2017	-43%	-33%	-28%	-10%	-42%	-44%	-44%	0%	0%	-28%	-48%	-62%	-76%	-36%	0%	-49%	-66%	-66%	0%	0%	32%	-41%
2018	-47%	-34%	-31%	-11%	-46%	-48%	-48%	0%	0%	-30%	-52%	-67%	-76%	-39%	0%	-54%	-71%	-71%	0%	0%	33%	-44%
2019	-51%	-35%	-33%	-13%	-49%	-51%	-51%	0%	0%	-32%	-56%	-71%	-77%	-42%	0%	-59%	-75%	-75%	0%	0%	33%	-48%
2020	-54%	-36%	-34%	-14%	-52%	-54%	-54%	0%	0%	-34%	-59%	-74%	-77%	-44%	0%	-62%	-79%	-79%	0%	0%	34%	-50%
2021	-57%	-37%	-36%	-15%	-55%	-56%	-56%	0%	0%	-35%	-62%	-77%	-77%	-46%	0%	-66%	-82%	-82%	0%	0%	34%	-53%
2022	-64%	-39%	-40%	-18%	-62%	-61%	-62%	0%	0%	-38%	-69%	-83%	-77%	-50%	0%	-73%	-89%	-89%	0%	0%	35%	-60%
2023	-60%	-38%	-37%	-16%	-58%	-58%	-59%	0%	0%	-36%	-64%	-79%	-77%	-48%	0%	-69%	-85%	-85%	0%	0%	34%	-55%
2024	-62%	-39%	-39%	-17%	-60%	-60%	-60%	0%	0%	-37%	-67%	-81%	-77%	-49%	0%	-71%	-87%	-87%	0%	0%	34%	-58%
2025	-66%	-40%	-41%	-19%	-65%	-63%	-64%	0%	0%	-39%	-71%	-84%	-77%	-52%	0%	-76%	-90%	-90%	0%	0%	34%	-61%
2026	-68%	-41%	-42%	-20%	-67%	-64%	-65%	0%	0%	-38%	-72%	-85%	-77%	-53%	0%	-78%	-91%	-91%	0%	0%	36%	-63%
2027	-69%	-41%	-43%	-21%	-69%	-66%	-66%	0%	0%	-38%	-74%	-86%	-77%	-54%	0%	-79%	-92%	-92%	0%	0%	36%	-64%
2028	-71%	-42%	-44%	-21%	-70%	-67%	-68%	0%	0%	-39%	-75%	-87%	-77%	-54%	0%	-81%	-93%	-93%	0%	0%	36%	-65%
2029	-72%	-42%	-45%	-22%	-72%	-68%	-69%	0%	0%	-40%	-76%	-87%	-77%	-55%	0%	-82%	-94%	-94%	0%	0%	36%	-67%
2030	-73%	-42%	-46%	-22%	-73%	-69%	-69%	0%	0%	-40%	-77%	-88%	-77%	-56%	0%	-83%	-94%	-94%	0%	0%	35%	-67%
2031	-74%	-43%	-46%	-23%	-74%	-69%	-70%	0%	0%	-42%	-78%	-88%	-77%	-57%	0%	-84%	-95%	-95%	0%	0%	34%	-69%
2032	-74%	-43%	-47%	-23%	-75%	-70%	-71%	0%	0%	-42%	-79%	-88%	-77%	-57%	0%	-85%	-95%	-95%	0%	0%	34%	-69%
2033	-75%	-43%	-48%	-23%	-76%	-71%	-71%	0%	0%	-43%	-79%	-89%	-78%	-58%	0%	-85%	-95%	-95%	0%	0%	33%	-69%
2034	-76%	-44%	-48%	-24%	-76%	-71%	-72%	0%	0%	-43%	-79%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2035	-76%	-44%	-49%	-24%	-77%	-72%	-72%	0%	0%	-44%	-80%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2036	-77%	-44%	-49%	-24%	-77%	-72%	-73%	0%	0%	-44%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-70%
2037	-77%	-44%	-50%	-24%	-78%	-72%	-73%	0%	0%	-45%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-71%

2009 Initial Completion Venting Emissions

ASSUMPTIONS

As per the operators, 100% of the Completions will be controlled by Flare. Hence, there will be no venting emissions from this category.

Table 174. 2009 Initial Completion Venting Emissions in tons per pad.

Description	Well Completion Venting Emissions (tons/well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Initial Completion Venting	0	0	0	0	0	0	0	0	0	0	0	total spuds

Table 175. Percent Change in Emission from Base Year 2009 for Initial Completion Venting.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Initial Completion Flaring Emissions

ASSUMPTIONS

Activity data provided by operators in blue text

NOx, VOC, CH_4, N_2O and CO Emissions Calculation

$$E_{flare} = EF_i \times Q \times HV$$

where:

E_{flare} is the flaring emissions per well [lb/yr]

EF_i is the emissions factor for pollutant i [lb/MMBtu]

Q is the volume of gas flared supplied by operator [MMscf/yr]

HV is the heating value of the gas as provided by the operators [MMBtu/MMscf]

CO_2 Emissions ($tons\ per\ activity$) = (Total CO_2 Emission Potential of the Entire Gas – THC Component to CO_2 Emission Potential – CO Component to CO_2 Emission Potential) x Percentage of Production Controlled

$$THC\ \text{Component } CO_2 \text{ Emissions Potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \sum \frac{\left(\frac{\text{lb emissions emitted}}{\text{activity}}\right)_i \times \frac{No.of\ Moles\ of\ C\ in\ compound}{No.of\ Moles\ of\ C\ in\ CO2} \times \text{Molecular Weight of } CO_2 \text{ (lb/lb-mol)}}{\text{Molecular weight of Compound C (lb/lb-mol)} \times 2000}$$

$$\text{CO component } CO_2 \text{ emissions potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \frac{\text{CO emissions from flaring}\left(\frac{\text{lb}}{\text{activity}}\right) \times \frac{\text{No.of Moles of C in compound}}{\text{No.of Moles of C in CO2}} \times \text{Molecular Weight of CO2 (lb/lb-mol)}}{\text{Molecular weight of CO } \left(\frac{\text{lb}}{\text{lb-mol}}\right) \times 2000}$$

.

Where,

$_i$= each compound identified in flaring gas speciation profile

$(\text{lb emissions emitted/activity})_i$ = Total TOG Emissions (lb/activity) from flaring X Weight Fraction of the Compound i

Inputs		
Average Gas Volume Per Day	1,500.00	MCF/day
Average Days Per Completion	3.00	days/well
Percentage of Gas to Green Completions (Sales)	96%	
Percentage of Gas Flared	4%	
Volume Flared Per Day	60.00	MCF/day
Volume Flared Per Well	180.00	MCF/well
HHV of Flared Gas	1,137.21	Btu/scf

Table 176. Flaring Emission Factors.

Flaring Emission Factor (lb/MMBtu)*			Fraction of THC as CH4	N2O (lb/MMSCF)[b]	VOC/THC[c]
NOx	CO	THC			
0.068	0.37	0.14	25%	1.44	63%

*Emission Factors are from AP-42

b Emission Factor from API Compendium of greenhouse gas emissions methodologies for the oil and natural gas industry,2009 Table 4-11, GHG Emission Factors for Gas Flares in Developed Countries - Footnote C

[c]EPA SPECIATE Profile 0051

Table 177. Summary of 2009 CO_2 Emissions (tons/spud) Potential for All Gas Sample Species from Initial Completion Flaring.

Chemical	Mole %	Molecular Weight (g/mol)[1]	Weight %	lb/ MCF	lb CO_2/MCF	HHV (Btu/scf)[1]	CO2 emission potential of the entire gas (tons/spud)
Carbon Dioxide	2.7329%	44.010	6.0914%	3.07	3.07		0.28
Nitrogen	0.1713%	28.010	0.2430%	0.12			0.00
Methane	84.9820%	16.040	69.0362%	34.78	95.43	1010	8.59
Ethane	6.8128%	30.070	10.3753%	5.23	15.30	1769.7	1.38
Propane	3.1701%	44.100	7.0805%	3.57	10.68	2516.2	0.96
Isobutane	0.6361%	58.120	1.8723%	0.94	2.86	3252	0.26
n-Butane	0.7106%	58.120	2.0916%	1.05	3.19	3262.4	0.29
Isopentane	0.2421%	72.150	0.8846%	0.45	1.36	4000.9	0.12
n-Pentane	0.1993%	72.150	0.7282%	0.37	1.12	4008.7	0.10
n-Hexane	0.0648%	86.180	0.2828%	0.14	0.44	4756	0.04
Cyclohexane	0.0318%	84.160	0.1355%	0.07	0.21	4481.6	0.02
2,2-Dimethylbutane	0.0043%	86.177	0.0188%	0.01	0.03	4735.9	0.00
2,3-Dimethylbutane	0.0164%	86.177	0.0716%	0.04	0.11	4744.9	0.01
2-Methylpentane	0.0488%	86.177	0.2130%	0.11	0.33	4747.4	0.03
3-Methylpentane	0.0251%	86.177	0.1095%	0.06	0.17	4750.3	0.02
n-Heptane	0.0587%	100.202	0.2979%	0.15	0.46	5502.5	0.04
Methylcyclohexane	0.0322%	98.190	0.1601%	0.08	0.25	5215.9	0.02
2,2,4-Trimethylpentane	0.0038%	114.229	0.0220%	0.01	0.03	6146.27	0.00
Benzene	0.0149%	78.110	0.0589%	0.03	0.10	3741.9	0.01
Toluene	0.0174%	92.140	0.0812%	0.04	0.14	4474.9	0.01
Ethylbenzene	0.0005%	106.170	0.0027%	0.00	0.00	5222	0.00
m&p-Xylene	0.0041%	106.160	0.0220%	0.01	0.04	5207.7	0.00
o-Xylene	0.0006%	106.160	0.0032%	0.00	0.01	5209.7	0.00
n-Octane	0.0137%	114.229	0.0793%	0.04	0.12	6248.9	0.01
n-Nonane	0.0059%	128.255	0.0383%	0.02	0.06	6996.4	0.01
n-Decane	0.0000%	142.290	0.0000%	0.00	0.00	7743	0.00
Total	**100.0000%**	**19.74**	**100.0000%**	**50.38**	**135.51**	**1137.207149**	**12.20**
Total NMHC	**12.1139%**		**24.6294%**	**12.41**			
Total VOC	**5.3011%**		**14.2541%**	**7.18**			
Total HAPs	**0.1061%**		**0.4729%**	**0.24**			

[1] The molecular weights and the higher heating values are from GSPA Engineering Data Book, 12th Edition.

Table 178. Summary of 2009 THC and CO Component to CO_2 Emissions Potentials (tons/activity).

	MW (lb/lb-mol)	lb/well
TOG	31.47	35.82
CO	28.01	75.74

Name	HC?	VOC?	WEIGHT_PER (Flaring Speciation Profile (EPA SPECIATE 0051))	Molecular Weight (lb/lb-mol)[2]	THC component CO2 emissions potentials			CO component CO2 emissions potentials (tons/spud)
					lb emitted/spud	Moles C in compound/Moles C in CO2	CO2 Emissions (tons/spud)	
Ethane	Y	N	30	16.04	11	2	0.029	0.060
Formaldehyde	N	Y	20	30.03	7	1	0.005	
Methane	Y	N	20	28.01	7	1	0.006	
Propane	Y	Y	30	30.07	11	3	0.024	
			100		**36**		**0.064**	**0.060**

Table 179. 2009 Well Completion Flaring Emissions in tons per spud.

Description	Well Completion Flaring Emissions (tons/well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Initial Completion Flaring	0.0070	0.0090	0.0379	0	0	0	12.0729	0.0036	0	0	0.0001	total spuds

Table 180. Percent Change in Emission from Base Year 2009 for Well Completion Flaring.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Construction Fugitive Dust Emissions

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Watering control efficiency assumed to be 50%
Due to lack of information on soil moisture or silt content, used values from AP-42 Table 11-9.3

Activity data provided by operators in blue

Equations
Emissions equations from AP-42 Table 11.9-1 for Bulldozing Overburden emissions, Western Surface Coal Mining

For Total Suspended Particles (TSP) ≤ 30 microns:
Emissions (TSP lbs/hr) =[5.7 s^1.2 / M ^1.3] * Control Efficiency

For PM ≤ 15 microns:
Emissions (PM15 lbs/hr) =[1.0 s^1.5 / M ^1.4] * Control Efficiency

Emissions (PM10 lbs/hr) = PM15 * 0.75
Emissions (PM2.5 lbs/hr) = TSP * 0.105
See variables definition in following table:

Table 181. Parameters Used in Emission Equations.

Description	Parameter	Reference
Watering control efficiency	50%	Control of Open Fugitive Dust Sources, Section 5.3.1 Watering of Unpaved Surfaces (1988). EPA
M=soil moisture content	7.9	(AP-42 Table 11.9-3)
s=Soil silt content	6.9	(AP-42 Table 11.9-3)
PM10 multiplier	0.75	(AP-42 Table 11.9-1)
PM2.5 multiplier	0.105	(AP-42 Table 11.9-1)

Table 182. Summary of 2009 Well Pad and Pipeline Construction Equipment Utilization Data.

Phase	Equipment Type	# Units	Time Used Per Pad (hours)
Well Pad-Access Road Construction	Loader	1	60
Well Pad-Access Road Construction	Dozer	1	60
Well Pad-Access Road Construction	Scraper	2	60
Well Pad-Access Road Construction	Grader	1	60
Well Pad-Access Road Construction	Backhoe	1	60
Well Pad-Access Road Construction	Roller	1	60
Well Pad-Access Road Construction	Water Truck	1	60
Well Pad-Access Road Construction	Dump Truck	1	60
Well Pad-Access Road Construction	Trencher	1	60

* assumed hours of use consistent with activity estimates used in equipment exhaust emission estimates

Table 183. Summary of 2009 Fugitive Dust Emissions (tons/well pad) form Well Pad and Access Road Construction Equipment.

Fugitive Dust Emissions Per Well (tons/well)					
Phase	**Equipment Type**	**TSP**	**PM10**	**PM2.5**	**PM15**
Well Pad-Access Road Construction	Loader	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Dozer	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Scraper	0.1182	0.0226	0.0124	0.0301
Well Pad-Access Road Construction	Grader	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Backhoe	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Roller	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Water Truck	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Dump Truck	0.0591	0.0113	0.0062	0.0151
Well Pad-Access Road Construction	Trencher	0.0591	0.0113	0.0062	0.0151
	Total	**0.5911**	**0.1129**	**0.0621**	**0.1506**

Table 184. 2009 Construction Fugitive Dust Emissions in tons per well pad.

Description	Construction Fugitive Dust Emissions (tons per well pad)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Construction Dust, Fugitive	0	0	0	0.1129	0.0621	0	0	0	0	0	0	new pads

Table 185. Percent Change in Emission from Base Year 2009 for Construction Fugitive Dust.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Construction Wind Erosion Emissions

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Data obtained from operators in blue text

Disturbed Area Per Well:

Disturbed Ar 235224 ft^2 21853.05 m^2

1 Acre 43,560 square feet

* AP-42 methodology described to the right was implemented in a computer program with hourly wind speed data
* 2007, 2008, and 2009 Wind Speed data from the Wamsutter Station were used as inputs
* Of all years evaluated, 2007 showed the greatest per pad wind erosion emissions:

$$\text{Emissions}\left(\frac{\text{tons}}{\text{yr}}\right) = \frac{\text{k* Erosion Potential (g/m2/year) * Disturbed Area (m2) * (\#Disturbances/year)}}{\text{453.6 (g/lb) *2000 (lbs/ton)}}$$

Friction Velocity $U^* = 0.053\ U_{10}^*$ (AP-42 Section 13.2.5.3 Equation 4)

Erosion Potential P (g/m^2-time) = $58(U^*-U_t^*)^2 + 25(U^*-Ut^*)$ for $U^*>U_t^*$; P=0 otherwise (AP-42 Section 13.2.5.3 Equation 3)

k is a particle size multiplier that depends on the aerodynamic size of the particle (from AP-42 Section 13.2.5.3).
k = 0.5 for PM10
k = 0.075 for PM2.5

1.02 m/s	=	Threshold friction velocity for well pads (AP-42 Table 13.2.5-2 Overburden, Western Surface Coal Mine)
1.33 m/s	=	Threshold friction velocity for roads (AP-42 Table 13.2.5-2 Roadbed Material)
0.5	=	Particle size multiplier for PM10
0.075	=	Particle size multiplier for PM2.5
1 squ mile	=	640 acres

Table 186. 2009 Construction Dust Wind Erosion Emissions in tons per well pad.

Description	Construction Dust Wind Erosion Emissions (tons/well pad)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Construction Dust, Wind Erosion	0	0	0	0.3061	0.0459	0	0	0	0	0	0	new pads

Table 187. Percent Change in Emission from Base Year 2009 for Construction Dust Wind Erosion.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Workover Equipment Emissions

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Activity data obtained from operators in blue text

Assumptions:

* Emission factors from EPA Federal Diesel Engine Standards http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
* Crankcase Emission factors are 2% of HC Exhaust Emission Factor for Tier II and earlier per
* EPA NONROAD Modeling Guidance p. 23 (EPA, 2004; EPA420-P-04-009).
* VOC/THC= 1.053 Conversion for HC->VOC for diesel engines (EPA, 2005; EPA420-R-05-0159, p. 5)
* 37% of fine particles assumed to be filterable and all filterable are assigned to EC (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)
* 63% of fine particles assumed to be filterable and all filterable are assigned to SOA (Source: AQTSD for Hell's Gulch and Hightower Mountain Natural Gas Development Projects; March 2008, p.10)

EPA Federal Diesel Tier 2 Emission Factors

N2O Emission factors (g/gallons) from The Climate Registry, General Reporting Protocol v1.1, Table 13.6

Equations:

$$\text{Emissions (tons/year-well)} = \frac{\text{Emission factor (g/hp-hr)} * \text{Horsepower} * \text{Time Used (hours)} * \text{Load}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

PM2.5/PM10 =	97%	EPA (2004) NONROAD
VOC/HC	1.053	EPA NONROAD HC Conversions
NMHC/THC	98.40%	EPA NONROAD HC Conversions

SO2 Emission Factor Calculation Information

2008 Fuel Sulfur content		0.0355	sulfur fuel weight percent From NMIM
soxcnv	Tiers I-III	0.02247	grams PM sulfur/grams fuel sulfur consumed
soxcnv	Tier IV	0.3	
grams PM sulfate/grams PM sulfur		7	
soxbas		0.33	
Density of Diesel Fuel	7.09	lb/gallons	
Molecular weight of S	32	g/mol	
Molecular weight of S02	64	g/mol	
	453.6	g/lb	

$$CO_2 = (BSFC * 453.6 - HC) * 0.87 * (44/12)$$

The model does not require an SO_2 emission factors input file either. EPA will calculate SO_2 emission factors as shown in the equation below.

$$SO_2 = (BSFC * 453.6 * (1 - soxcnv) - HC) * 0.01 * soxdsl * 2 \qquad \text{[Equation 7]}$$

where

SO_2 is in g/hp-hr
BSFC is the in-use adjusted fuel consumption in lb/hp-hr
453.6 is the conversion factor from pounds to grams
soxcnv is the fraction of fuel sulfur converted to direct PM
HC is the in-use adjusted hydrocarbon emissions in g/hp-hr
0.01 is the conversion factor from weight percent to weight fraction
soxdsl is the episodic weight percent of sulfur in nonroad diesel fuel
2 is the grams of SO_2 formed from a gram of sulfur

Table 188. 2009 Workover Rig Emissions (lb/well) by Pollutants and by Equipment Type.

Equipment			Activity & Emission	Emissions (lb/well)
Engine 1	Engine Function		Rig	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		475	
	Horsepower Range		300-600	
	Time used (hrs)		36	
	Well workover frequency (events/yr)		0.07	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.367	
	Fuel Consumption (Gallons)		18	
	Emission Factors (g/bhp-hr)	NOx	4.534	3.42
		VOC	0.255	0.19
		CO	2.610	1.97
		PM10	0.149	0.11
		PM2.5	0.145	0.11
		SO2	0.115	0.09
		CO2	530	399.81
		CH4	0.004	0.00
		PM_filt	0.054	0.04
		PM_cond	0.091	0.07
		N2O	0.260	0.01
Engine 2	Engine Function		Snubbing unit	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		475	
	Horsepower Range		300-600	
	Time used (hrs)		36	
	Well workeover requirement (Yrs)		0.07	
	Load Factor		0.3	
	BSFC (lb/hp-hr)		0.367	
	Fuel Consumption (Gallons)		18	
	Emission Factors (g/bhp-hr)	NOx	4.534	3.42
		VOC	0.255	0.19
		CO	2.610	1.97
		PM10	0.149	0.11
		PM2.5	0.145	0.11
		SO2	0.115	0.09
		CO2	530	399.81
		CH4	0.004	0.00
		PM_filt	0.054	0.04
		PM_cond	0.091	0.07
		N2O	0.260	0.01
Engine 3	Engine Function		Light plant	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 2	
	Rated horsepower		45	
	Horsepower Range		25-50	
	Well workeover requirement (Yrs)		0.07	
	Time used (hrs)		36	
	Load Factor		0.7	
	BSFC (lb/hp-hr)		0.408	
	Fuel Consumption (Gallons)		4	
	Emission Factors (g/bhp-hr)	NOx	5.313	0.89
		VOC	0.299	0.05
		CO	4.101	0.68
		PM10	0.447	0.07
		PM2.5	0.434	0.07
		SO2	0.128	0.02
		CO2	589	98.24
		CH4	0.005	0.00
		PM_filt	0.161	0.03
		PM_cond	0.273	0.05
		N2O	0.260	0.00

Table 189. Summary of 2009 Workover Rig Emissions (lb/well) by Pollutants for All Equipment.

Equipment Type	Pollutant	Emissions (lb/year-well)
Workover Rig Equipment	NOx	8
	VOC	0
	CO	5
	PM10	0
	PM2.5	0
	SO2	0
	CO2	898
	CH4	0
	PM_filt	0
	PM_cond	0
	N2O	0

Table 190. 2009 Workover Rig Equipment Emissions in tons per well.

Description	Workover Rig Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Workover Equipment (diesel IC	0.0039	0.0002	0.0023	0.0001	0.0001	0.0001	0.4489	0.000003	0.0001	0.0001	0.00001	active well counts

Table 191. Percent Change in Emission from Base Year 2009 (aggregate factors to apply to total emissions across all equipment types) for Workover Rig Equipment.

Technology Assumption	Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
Tier 2	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2019	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2020	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2021	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2022	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2023	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2024	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2025	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2026	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2027	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2028	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2029	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2030	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2031	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2032	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2033	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2034	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2035	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2036	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2037	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Workover Traffic Emissions

ASSUMPTIONS

Data provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.

Data for Number of Days of Measurable (>0.01") Precipitation

Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE 2009 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH WORKOVER TRAFFIC.

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} \cdot \frac{(365-P)}{365} \cdot (\text{Control Efficiency})$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 192. Summary of Traffic Activity Data Associated with Well Workover Phase.

Equipment Type	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Well	Well workover frequency (events/yr)
Light Truck	20	20	6	0.07
Heavy Truck	20	20	8	0.07

Table 193. 2009 Exhaust Emissions (lb/well) Associated with Workover Traffic by Vehicle Type.

Vehicle Type	Pollutant	2009 Emission Factors (g/mile)	Base year Emissions (lb/well)
Light-Duty Truck	NOx	2.52	0.044
	SO2	0.01	0.000
	CO	18.19	0.321
	CO2	675.15	11.907
	VOC	1.48	0.026
	PM10	0.09	0.002
	PM2.5	0.08	0.001
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.08	0.001
	N2O	0.05	0.001
Heavy-Duty Truck	NOx	20.23	0.476
	SO2	0.08	0.002
	CO	15.07	0.354
	CO2	2612.44	61.433
	VOC	1.86	0.044
	PM10	1.21	0.028
	PM2.5	1.17	0.028
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.002
	N2O	0.04	0.001

Table 194. Summary of 2009 Fugitive Dust Emissions (tons/well) Associated with Workover Traffic.

Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
								Em. Factor (lb/VMT)	Emissions (tpy/well)	Em. Factor (lb/VMT)	Emissions (tpy/well)
Travel to well	Light truck	7,000	20	6	0.4	20	8	0.20	0.00	0.02	0.00
Travel to well	Heavy Truck	70,000	20	8	1	20	10.67	0.20	0.00	0.02	0.00
							Total	**0.40**	**0.00**	**0.04**	**0.00**

Table 195. 2009 Exhaust and Fugitive Dust Emissions Associated with Workover Rigs Traffic in tons per well.

Description	Total Workover Traffic Emissions (tons per well)											Projection	Fugitive Road	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
WorkoverTraffic (LD)	2.22E-05	1.30E-05	0.0002	7.67E-07	7.27E-07	1.27E-07	0.0060	7.50E-07	0	0	4.03E-07	active well counts	0.0008	0.0001
WorkoverTraffic (HD)	0.0002	2.19E-05	0.0002	1.42E-05	1.38E-05	9.45E-07	0.0307	1.06E-06	0	0	4.18E-07	active well counts	0.0011	0.0001

Table 196. Percent Change in Emission from Base Year 2009 due to fleet turnover for Workover Rigs Traffic.

Year	Light-Duty Truck											Heavy-Duty Truck										
	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	-5%	-11%	-3%	0%	-4%	-6%	-6%	0%	0%	-3%	-7%	-10%	-45%	-4%	0%	-3%	-7%	-7%	0%	0%	4%	-5%
2011	-10%	-18%	-7%	-1%	-10%	-12%	-13%	0%	0%	-7%	-14%	-19%	-74%	-9%	0%	-10%	-18%	-18%	0%	0%	13%	-12%
2012	-16%	-27%	-11%	-2%	-16%	-19%	-19%	0%	0%	-11%	-21%	-28%	-75%	-14%	0%	-17%	-28%	-28%	0%	0%	20%	-17%
2013	-22%	-28%	-15%	-4%	-22%	-25%	-25%	0%	0%	-15%	-28%	-36%	-75%	-19%	0%	-25%	-37%	-37%	0%	0%	24%	-23%
2014	-28%	-29%	-18%	-5%	-27%	-30%	-31%	0%	0%	-18%	-34%	-44%	-76%	-24%	0%	-32%	-45%	-46%	0%	0%	28%	-28%
2015	-33%	-30%	-22%	-7%	-33%	-35%	-36%	0%	0%	-22%	-39%	-51%	-76%	-28%	0%	-38%	-53%	-53%	0%	0%	30%	-33%
2016	-38%	-31%	-26%	-8%	-38%	-40%	-40%	0%	0%	-25%	-44%	-57%	-76%	-33%	0%	-44%	-60%	-60%	0%	0%	31%	-37%
2017	-43%	-33%	-28%	-10%	-42%	-44%	-44%	0%	0%	-28%	-48%	-62%	-76%	-36%	0%	-49%	-66%	-66%	0%	0%	32%	-41%
2018	-47%	-34%	-31%	-11%	-46%	-48%	-48%	0%	0%	-30%	-52%	-67%	-76%	-39%	0%	-54%	-71%	-71%	0%	0%	33%	-44%
2019	-51%	-35%	-33%	-13%	-49%	-51%	-51%	0%	0%	-32%	-56%	-71%	-77%	-42%	0%	-59%	-75%	-75%	0%	0%	33%	-48%
2020	-54%	-36%	-34%	-14%	-52%	-54%	-54%	0%	0%	-34%	-59%	-74%	-77%	-44%	0%	-62%	-79%	-79%	0%	0%	34%	-50%
2021	-57%	-37%	-36%	-15%	-55%	-56%	-56%	0%	0%	-35%	-62%	-77%	-77%	-46%	0%	-66%	-82%	-82%	0%	0%	34%	-53%
2022	-64%	-39%	-40%	-18%	-62%	-61%	-62%	0%	0%	-38%	-69%	-83%	-77%	-50%	0%	-73%	-89%	-89%	0%	0%	35%	-60%
2023	-60%	-38%	-37%	-16%	-58%	-58%	-59%	0%	0%	-36%	-64%	-79%	-77%	-48%	0%	-69%	-85%	-85%	0%	0%	34%	-55%
2024	-62%	-39%	-39%	-17%	-60%	-60%	-60%	0%	0%	-37%	-67%	-81%	-77%	-49%	0%	-71%	-87%	-87%	0%	0%	34%	-58%
2025	-66%	-40%	-41%	-19%	-65%	-63%	-64%	0%	0%	-39%	-71%	-84%	-77%	-52%	0%	-76%	-90%	-90%	0%	0%	34%	-61%
2026	-68%	-41%	-42%	-20%	-67%	-64%	-65%	0%	0%	-38%	-72%	-85%	-77%	-53%	0%	-78%	-91%	-91%	0%	0%	36%	-63%
2027	-69%	-41%	-43%	-21%	-69%	-66%	-66%	0%	0%	-38%	-74%	-86%	-77%	-54%	0%	-79%	-92%	-92%	0%	0%	36%	-64%
2028	-71%	-42%	-44%	-21%	-70%	-67%	-68%	0%	0%	-39%	-75%	-87%	-77%	-54%	0%	-81%	-93%	-93%	0%	0%	36%	-65%
2029	-72%	-42%	-45%	-22%	-72%	-68%	-69%	0%	0%	-40%	-76%	-87%	-77%	-55%	0%	-82%	-94%	-94%	0%	0%	36%	-67%
2030	-73%	-42%	-46%	-22%	-73%	-69%	-69%	0%	0%	-40%	-77%	-88%	-77%	-56%	0%	-83%	-94%	-94%	0%	0%	35%	-67%
2031	-74%	-43%	-46%	-23%	-74%	-69%	-70%	0%	0%	-42%	-78%	-88%	-77%	-57%	0%	-84%	-95%	-95%	0%	0%	34%	-69%
2032	-74%	-43%	-47%	-23%	-75%	-70%	-71%	0%	0%	-42%	-79%	-88%	-77%	-57%	0%	-85%	-95%	-95%	0%	0%	34%	-69%
2033	-75%	-43%	-48%	-23%	-76%	-71%	-71%	0%	0%	-43%	-79%	-89%	-78%	-58%	0%	-85%	-95%	-95%	0%	0%	33%	-69%
2034	-76%	-44%	-48%	-24%	-76%	-71%	-72%	0%	0%	-43%	-79%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2035	-76%	-44%	-49%	-24%	-77%	-72%	-72%	0%	0%	-44%	-80%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2036	-77%	-44%	-49%	-24%	-77%	-72%	-73%	0%	0%	-44%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-70%
2037	-77%	-44%	-50%	-24%	-78%	-72%	-73%	0%	0%	-45%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-71%

2009 Heater Emissions

ASSUMPTIONS

Data provided by operators in blue text

Assumptions

Assume no controls on the heater

Assume 10 percent of all new wells have tank heaters

Equations

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (lbs/MMscf)} * \text{Heater Size (Btu/hr)} * \text{Time On (Hours/Year)}}{\text{Fuel Heat Value (Btu/scf)} * 1\text{x}10^{6}\ \text{(scf/MMscf)} * 2000\ \text{(lbs/ton)}}$$

Table 197. Natural Gas Fired Heaters Emission Factors (lb/MMscf).

Heaters (lb/MMscf) (from AP-42 Tables 1.4-1 and 1.4-2)										
NOx	SO2	CO	VOC	PM10	PM2.5	PM_filt	PM_cond	CO2	CH4	N2O
100	0.6	84	5.5	7.6	7.6	1.9	5.7	120,000	2.3	2.2

Table 198. Summary of Heaters Operational Data.

Equipment Type	Heat Input (btu/hr)	Local Heating Value (Btu/scf)	# Units/well	Time Used Per Unit (hours)	Cycle Fraction	Actual Firing hours
Dehydrator Heater	500,000	1000	1	8760	0.5	4380
Separator Heater	500,000	1000	1	6552	0.5	3276
Tank Heater	500,000	1000	0.1	6750	0.5	3375

Table 199. 2009 Well-site Heater/Reboiler Emissions (lbs/well).

Equipment Type	NOx	SO2	CO	VOC	PM10	PM2.5	PM_filt	PM_cond	CO2	CH4	N2O
Dehydrator Heater	219.0000	0.0000	183.9600	12.0450	16.6440	16.6440	4.1610	12.4830	262800	5.0370	4.8180
Separator Heater	163.8000	0.0000	137.5920	9.0090	12.4488	12.4488	3.1122	9.3366	196560	3.7674	3.6036
Tank Heater	16.8750	0.0000	14.1750	0.9281	1.2825	1.2825	0.3206	0.9619	20250	0.3881	0.3713

Table 200. 2009 Heater/Reboiler Emissions in tons per well.

Description	Heater/Reboiler Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Heaters	0.1998	0.0110	0.1679	0.0152	0.0152	0	239.8050	0.0046	0.0038	0.0114	0.0044	active well counts

Table 201. Percent Change in Emission from Base Year 2009 for Heaters/Reboilers.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Fugitive Devices Emissions

ASSUMPTIONS

Activity data provided by operators in blue text

Hours of operation was assumed to be year round 24-7

Equation

$$E_{fugitive} = EF_i \times N \times t_{annual} \times Y$$

where:

$E_{fugitive}$ is the fugitive VOC emissions per well [ton-VOC/yr]

EF_i is the emission factor of TOC [kg/hr/source]

N is the total number of devices

Y is the ratio of VOC to TOC in the vented gas

t_{annual} is total annual hours of operation

CH_4 and CO_2 emissions

Emissions.CH_4 = Emission.VOC * WeightFraction.CH_4 / WeightFraction.CO_2

Emissions.CO_2 = Emission.VOC * WeightFraction.CO_2 / WeightFraction.VOC

Table 202. Total Organic Compound (TOC) Emission Factor (kg/hr/component).

Well Equipment Component	Gas	Light Oil >20° API	Heavy Oil <20° API	Water/Oil
valves	4.50E-03	2.50E-03	8.40E-06	9.80E-05
pump seals	2.40E-03	1.30E-02	3.20E-05	2.40E-05
others	8.80E-03	7.50E-03	3.20E-05	1.40E-02
connectors	2.00E-04	2.10E-04	7.50E-06	1.10E-04
flanges	3.90E-04	1.10E-04	3.90E-07	2.90E-06
open-ended lines	2.00E-03	1.40E-03	1.40E-04	2.50E-04

Emission Factors are from EPA, 1995 -AP-42 Table 2-4. "Oil and Gas Production Operations Average Emission Factors"
Do not calculate fugitives from pipelines containing only water

"Other" category includes compressor seals, pressure relief valves, diaphragms, drains, dump arms, l

Table 203. VOC, CO_2 and CH_4 Sales Gas and Condensate Gas Weight Fractions.

	Sales Gas	Fugitive- Post Flash
VOC Fraction (weight)	14.60%	73.55%
CO2 Fraction (weight)	6.07%	3.02%
CH4 Fraction (weight)	68.75%	13.57%

Table 204. 2009 TOC and VOC Emissions (lbs/well) by Media and Equipment Type.

Media	Type	Well Equipment Component Counts			TOC Emission Factor	TOC Emissions (lbs/yr)			VOC Emissions (lbs/yr)		
		Well Stream	Gas	Condensate	(kg / hr / component)	Well Stream	Gas	Condensate	Well Stream	Gas	Condensate
Gas	valves	10	10	-	4.50E-03	869	869	0	135.48	135.48	0.00
	pump seals	1	0	-	2.40E-03	46	0	0	7.23	0.00	0.00
	others	0	0	-	8.80E-03	0	0	0	0.00	0.00	0.00
	connectors	150	50	-	2.00E-04	579	193	0	90.32	30.11	0.00
	flanges	15	15	-	3.90E-04	113	113	0	17.61	17.61	0.00
	open-ended lines	0	0	-	2.00E-03	0	0	0	0.00	0.00	0.00
Light Oil >20º API	valves	-	-	20	2.50E-03	0	0	966	0.00	0.00	732.57
	pump seals	-	-	0	1.30E-02	0	0	0	0.00	0.00	0.00
	others	-	-	0	7.50E-03	0	0	0	0.00	0.00	0.00
	connectors	-	-	50	2.10E-04	0	0	203	0.00	0.00	153.84
	flanges	-	-	10	1.10E-04	0	0	21	0.00	0.00	16.12
	open-ended lines	-	-	0	1.40E-03	0	0	0	0.00	0.00	0.00
Heavy Oil <20º API	valves	-	-	-	8.40E-06	0	0	0	0.00	0.00	0.00
	pump seals	-	-	-	3.20E-05	0	0	0	0.00	0.00	0.00
	others	-	-	-	3.20E-05	0	0	0	0.00	0.00	0.00
	connectors	-	-	-	7.50E-06	0	0	0	0.00	0.00	0.00
	flanges	-	-	-	3.90E-07	0	0	0	0.00	0.00	0.00
	open-ended lines	-	-	-	1.40E-04	0	0	0	0.00	0.00	0.00
Water/Oil	valves	-	-	-	9.80E-05	0	0	0	0.00	0.00	0.00
	pump seals	-	-	-	2.40E-05	0	0	0	0.00	0.00	0.00
	others	-	-	-	1.40E-02	0	0	0	0.00	0.00	0.00
	connectors	-	-	-	1.10E-04	0	0	0	0.00	0.00	0.00
	flanges	-	-	-	2.90E-06	0	0	0	0.00	0.00	0.00
	open-ended lines	-	-	-	2.50E-04	0	0	0	0.00	0.00	0.00

Table 205. 2009 Fugitive Device Emissions in tons per well.

Description	Fugitive Device Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Well Stream Fugitive Devices	0	0.1253	0	0	0	0	0.0521	0.5900	0	0	0	active well counts
Gas Stream Fugitive Devices	0	0.0916	0	0	0	0	0.0381	0.4313	0	0	0	active well counts
Condensate Fugitive Devices	0	0.4513	0	0	0	0	0.0185	0.0833	0	0	0	active well counts

Table 206. Percent Change in Emission from Base Year 2009 for Fugitive Devices.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Pneumatic Devices Emissions

ASSUMPTIONS

As per operator's input no bleed devices are used exclusively, hence zero emissions from this category

Table 207. Summary of 2009 Pneumatic Devices Emissions in tons per well.

Description	Pneumatic Devices Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CH4	CO2	PM_filt	PM_cond	N2O	
Pneumatic Devices	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	active well counts

Table 208. Percent Change in Emission from Base Year 2009 for Pneumatic Devices.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Tank Loadout (vapor losses) Emissions

ASSUMPTIONS

Data Provided by operator in blue text
Method from Wyoming Permitting Guidance for Oil and Gas Production Facilities
Wyoming DEQ, March, 2010, Chapter 6, Section 2, p.65 for Crude Oil, RVP 5
After AP-42, Section 5.2.1

$$\text{Emissions VOC (tpy)} = \frac{\text{Loading Loss (lbs/1000 gal)} * \text{truck load rate (bbl/year)} * 42\ \text{(gal/bbl)} * \text{VOC mass fraction}}{2000\ \text{(lbs/ton)}}$$

Loading losses determined using AP-42 Section 5.2.2.1.1 Equation 1

LL =12.46 x S x P x M/T

LL=Loading Loss in (lbs/1000gallons)

S= Saturation Factor
P = true vapor pressure of liquid loaded (psia)
M = molecular weight of tank vapors (lb/(lb-mol))
T = temperature of bulk liquid loaded (R=F+460)

Table 209. VOC, CO_2 and CH_4 Condensate Post-Flash Gas Weight Fractions.

Compound	
Methane (weight)	21.23%
CO2 (weight)	0.00%
VOC Fraction (weight)	66.34%

Table 210. Summary of Truck Load Activity Data.

Type of Petroleum Liquid Loaded	Saturation Factor	True Vapor Pressure of Liquid Loaded (psia)	Molecular Weight of Vapors (lb/lb-mole)	Temperature of Bulk Liquid (°R)	Mode of Operation	Loading Losses (lb/1000 gallons)	Capacity of Truck
Condensate RVP 8	0.6	7.2	50	520	Submerged loading: dedicated normal service	5.18	80 bbl

Table 211. 2009 Well Site Condensate Tank Loadout Emissions in tons per barrel.

Description	Base Year Well Site Condensate Tank Loadout Emissions (tons per barrel)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Tank Loadout (vapor losses)	0	7.21E-05	0	0	0	0	0	2.31E-05	0	0	0	annual condensate production

Table 212. Percent Change in Emission from Base Year 2009 for Condensate Tank Loadout.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Well Venting Emissions

ASSUMPTIONS

Data provided by operator in blue

Well venting includes all emissions from venting categories other than fugitive devices, pneumatic devices, chemical injection pumps, tank load out, condensate tanks, completion and dehydrator venting.

Table 213. Well Venting VOC, CH_4 and CO_2 Emission Factors (tons/well).

	Weight Fraction (%)	Emission Factor (tons/yr/well)
Venting VOC Emission Factor		0.75
Methane (weight)	69.04%	3.624
Carbon Dioxide (weight)	6.09%	0.320
VOC Fraction (weight)	14.25%	

Table 214. 2009 Well Venting Emissions in tons per well.

Description	Base Year Well Venting Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Well Venting	0	0.7483	0	0	0	0	0.3198	3.6240	0	0	0	active well counts

Table 215. Percent Change in Emission from Base Year 2009 for Well Venting.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2009 Condensate Tank Flashing/Working/Breathing Venting Emissions

ASSUMPTIONS

As per operator's input 100% production will be controlled with flare, hence zero venting emissions from this category.

Table 216. Summary of 2009 Condensate Tank Flashing, Working and Breathing Emissions in tons per activity.

Description	Condensate Tank Venting Emissions											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Condensate Tank Flashing Losses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	annual condensate production
Condensate Tank Working Losses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	total turnovers per year
Condensate Tank Breathing Losses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	active well counts

Table 217. Percent Change in Emission from Base Year 2009 for Condensate Tank Losses.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2010	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2011	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2012	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2013	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2014	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2015	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2016	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2017	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2018	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2019	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2020	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2021	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2022	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2023	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2024	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2025	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2026	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2027	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2028	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2029	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2030	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2031	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2032	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2033	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2034	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2035	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2036	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%
2037	0%	0%	0%	0%	0.00%	0%	0%	0%	0%	0.00%	0%

2009 Dehydrator Venting Emissions

ASSUMPTIONS

As per operator's input 100% gas will be controlled with flare, hence zero venting emissions from this category

Table 218. 2009 Dehydrator Venting Emissions in tons per well by Project Year.

Dehydrator Venting Emissions - Weighted Average (tons per well)											Projection
NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts
0.0000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000	active well counts

2009 Chemical Injection Pump Venting Emissions

ASSUMPTIONS

As per operator's input 100% gas will be controlled with flare, hence zero venting emissions from this category

Table 219. 2009 Chemical Injection Pump Venting Emissions in tons per well.

Description	Chemical Injection Pump Emissions (tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Pneumatic Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	active well counts

Table 220. Percent Change in Emission from Base Year 2009 for Chemical Injection Pump Venting.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4
2009	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2010	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2011	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2012	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2013	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2014	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2015	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2016	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2017	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2018	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2019	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2020	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2021	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2022	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2023	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2024	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2025	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2026	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2027	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2028	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2029	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2030	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2031	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2032	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2033	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2034	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2035	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2036	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%
2037	0%	0%	0%	0.00%	0.00%	0%	0%	0%	0%	0.00%

2009 Production Flaring Emissions (Condensate Tank Flaring, Dehydrator Flaring and Chemical Injection Pump Flaring Emissions)

ASSUMPTIONS

100%	percentage of flashing controlled
100%	percentage of working controlled
100%	percentage of breathing controlled
	percentage of dehydrator emissions controlled
100%	
100%	percentage of pneumatic pump emissions controlled

NOx, VOC, CH_4, N_2O and CO Emissions Calculation

$$E_{flare} = EF_i \times Q \times HV$$

where:

E_{flare} is the flaring emissions per well [lb/yr]

EF_i is the emissions factor for pollutant i [lb/MMBtu]

Q is the volume of gas flared supplied by operator [MMscf/yr]

HV is the heating value of the gas as provided by the operators [MMBtu/MMscf]

CO_2 Emissions $(tons\ per\ activity)$ = (Total CO_2 Emission Potential of the Entire Gas – THC Component to CO_2 Emission Potential – CO Component to CO_2 Emission Potential) x Percentage of Production Controlled

$$THC\ \text{Component } CO_2 \text{ Emissions Potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \sum \frac{\left(\frac{\text{lb emissions emitted}}{\text{activity}}\right)_i \times \frac{No.\ of\ Moles\ of\ C\ in\ compound}{No.\ of\ Moles\ of\ C\ in\ CO2} \times \text{Molecular Weight of } CO_2 \text{ (lb/lb-mol)}}{\text{Molecular weight of Compound C (lb/lb-mol)} \times 2000}$$

$$\text{CO component } CO_2 \text{ emissions potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \frac{\text{CO emissions from flaring}\left(\frac{\text{lb}}{\text{activity}}\right) \times \frac{\text{No.of Moles of C in compound}}{\text{No.of Moles of C in CO2}} \times \text{Molecular Weight of CO2 (lb/lb-mol)}}{\text{Molecular weight of CO } \left(\frac{\text{lb}}{\text{lb-mol}}\right) \times 2000}$$

.

Where,

$_i$= each compound identified in flaring gas speciation profile

(lb emissions emitted/activity)$_i$ = Total TOG Emissions (lb/activity) from flaring X Weight Fraction of the Compound

Table 221. Flaring Emission Factors.

Flaring Emission Factor (lb/MMBtu)*			Fraction of THC as CH4	N2O (lb/MMSCF)[b]	VOC/THC[c]
NOx	CO	THC			
0.068	0.37	0.14	25%	1.44	63%

*Emission Factors are from AP-42

b Emission Factor from API Compendium of greenhouse gas emissions methodologies for the oil and natural gas industry,2009 Table 4-11, GHG Emission Factors for Gas Flares in Developed Countries - Footnote C

[c]EPA SPECIATE Profile 0051

Table 222. 2009 Flaring Emissions in tons per activity metric of each Category.

Description	Flaring Emissions (tons per activity metric)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Condensate Tank Flashing Flaring	2.91E-05	3.75E-05	0.0002	0	0	0	0.0586	1.50E-05	0	0	2.74E-07	flashing flares
Condensate Tank Working Flaring	0.0001	0.0002	0.0008	0	0	0	0.0361	7.51E-05	0	0	1.53E-06	working flares
Condensate Tank Breathing Flaring	0.0037	0.0048	0.0204	0	0	0	0.9267	0.0019	0	0	3.93E-05	breathing flares
Dehydrator Flaring	0.0267	0.0343	0.1451	0	0	0	53.1885	0.0137	0	0	0.0004	dehydrator flares
Pneumatic Pump Flaring	0.0458	0.0589	0.2492	0	0	0	79.6451	0.0236	0	0	0.0008	pneumatic pump flares

Note: Detailed Flaring Emissions calculations for condensate tanks are summarized in Table 224 to Table 229, dehydrator is in Table 231 to Table 233 and pneumatic pumps are in Table 235 to Table 238.

Table 223. Change in Per Surrogate Flaring Activity (Multiplicative Scalar).

Year	flashing	working	breathing	dehydrator*	pneumatic pump
2009	100%	100%	100%	100%	100%
2010	100%	100%	100%	106%	100%
2011	100%	100%	100%	105%	100%
2012	100%	100%	100%	103%	100%
2013	100%	100%	100%	101%	100%
2014	100%	100%	100%	100%	100%
2015	100%	100%	100%	98%	100%
2016	100%	100%	100%	98%	100%
2017	100%	100%	100%	96%	100%
2018	100%	100%	100%	97%	100%
2019	100%	100%	100%	96%	100%
2020	100%	100%	100%	95%	100%
2021	100%	100%	100%	95%	100%
2022	100%	100%	100%	95%	100%
2023	100%	100%	100%	94%	100%
2024	100%	100%	100%	92%	100%
2025	100%	100%	100%	91%	100%
2026	100%	100%	100%	91%	100%
2027	100%	100%	100%	90%	100%
2028	100%	100%	100%	90%	100%
2029	100%	100%	100%	89%	100%
2030	100%	100%	100%	89%	100%
2031	100%	100%	100%	89%	100%
2032	100%	100%	100%	88%	100%
2033	100%	100%	100%	88%	100%
2034	100%	100%	100%	88%	100%
2035	100%	100%	100%	87%	100%
2036	100%	100%	100%	87%	100%
2037	100%	100%	100%	87%	100%

* incorporates changes over time in per well dehydrator emissions

2009 Condensate Tank Flashing/Working/Breathing Flaring Emissions

ASSUMPTIONS

Data provided by operator in blue text

Condensate	2246.45	Btu/scf
Total Flash @	381.05	SCF/Bbl Produced

[1] 2008 HYSYS model runs for the Wamsutter Operations Center at 365 psig.

100% percentage of condensate volume controlled

NOx, VOC, CH_4, N_2O and CO Emissions Calculation

$$E_{flare} = EF_i \times Q \times HV$$

where:

E_{flare} is the flaring emissions per well [lb/yr]

EF_i is the emissions factor for pollutant i [lb/MMBtu]

Q is the volume of gas flared supplied by operator [MMscf/yr]

HV is the heating value of the gas as provided by the operators [MMBtu/MMscf]

CO_2 Emissions ($tons\ per\ activity$) = (Total CO_2 Emission Potential of the Entire Gas – THC Component to CO_2 Emission Potential – CO Component to CO_2 Emission Potential) x Percentage of Production Controlled

$$THC\ \text{Component } CO_2 \text{ Emissions Potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \sum \frac{\left(\frac{\text{lb emissions emitted}}{\text{activity}}\right)_i \times \frac{No.of\ Moles\ of\ C\ in\ compound}{No.of\ Moles\ of\ C\ in\ CO2} \times \text{Molecular Weight of } CO_2 \text{ (lb/lb-mol)}}{\text{Molecular weight of Compound C (lb/lb-mol)} \times 2000}$$

$$\text{CO component } CO_2 \text{ emissions potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \frac{\text{CO emissions from flaring}\left(\frac{\text{lb}}{\text{activity}}\right) \times \frac{\text{No.of Moles of C in compound}}{\text{No.of Moles of C in CO2}} \times \text{Molecular Weight of CO2 (lb/lb-mol)}}{\text{Molecular weight of CO } \left(\frac{\text{lb}}{\text{lb-mol}}\right) \times 2000}$$

.

Where,

$_i$= each compound identified in flaring gas speciation profile

$(\text{lb emissions emitted/activity})_i$ = Total TOG Emissions (lb/activity) from flaring X Weight Fraction of the Compound

Table 224. Flaring Emission Factors.

Flaring Emission Factor (lb/MMBtu)*			Fraction of THC as CH4	N2O (lb/MMSCF)[b]	VOC/THC[c]
NOx	CO	THC			
0.068	0.37	0.14	25%	1.44	63%

*Emission Factors are from AP-42

b Emission Factor from API Compendium of greenhouse gas emissions methodologies for the oil and natural gas industry,2009 Table 4-11, GHG Emission Factors for Gas Flares in Developed Countries - Footnote C

[c]EPA SPECIATE Profile 0051

Table 225. 2009 CO_2 Emissions (tons/bbl) Potential for All Gas Sample Species from Flashing Loss.

Assumptions

365.00	PSIG Separator Pressure
75.00	Degrees F Temperature (Tank)
379.48	SCF/lb-mole

Chemical	Mole %[1]	Molecular Weight (lb/lb-mol)[2]	Pounds per Bbl @ 365 psig	lb/ MMscf	lb CO_2/ MMscf	HHV (Btu/scf)[2]	2009 CO_2 emission potential of the entire gas (tons/bbl)
Carbon Dioxide	2.80%	44.01	1.24	3249.9	3249.9	0	6.E-04
Nitrogen	0.02%	28.01	0.01	16.0		0	0.E+00
Methane	34.25%	16.04	5.52	14478.2	39724.7	1010	8.E-03
Ethane	13.42%	30.07	4.05	10631.5	31120.1	1770	6.E-03
Propane	17.98%	44.10	7.96	20899.7	62571.2	2516	1.E-02
Isobutane	6.85%	58.12	4.00	10490.1	31773.5	3252	6.E-03
n-Butane	9.34%	58.12	5.45	14303.0	43322.4	3262	8.E-03
Isopentane	4.48%	72.15	3.25	8523.4	25995.4	4001	5.E-03
n-Pentane	3.91%	72.15	2.83	7431.5	22665.4	4009	4.E-03
n-Hexane	1.36%	86.18	1.18	3085.0	9452.7	4756	2.E-03
Cyclohexane	0.30%	84.16	0.25	654.9	2054.9	4482	4.E-04
2,2-Dimethylbutane	0.09%	86.18	0.08	200.7	614.9	4736	1.E-04
2,3-Dimethylbutane	0.34%	86.18	0.30	782.7	2398.2	4745	5.E-04
2-Methylpentane	1.04%	86.18	0.90	2361.7	7236.8	4747	1.E-03
3-Methylpentane	0.53%	86.18	0.46	1200.9	3679.9	4750	7.E-04
n-Heptane	1.85%	100.20	1.86	4884.9	15018.6	5503	3.E-03
Methylcyclohexane	0.18%	98.19	0.18	465.0	1667.3	5216	3.E-04
2,2,4-Trimethylpentane	0.07%	114.23	0.08	211.8	652.9	6249	1.E-04
Benzene	0.31%	78.11	0.25	645.7	2182.9	3742	4.E-04
Toluene	0.38%	92.14	0.35	921.2	3080.1	4475	6.E-04
Ethylbenzene	0.00%	106.17	0.00	12.3	40.8	5222	8.E-06
m-Xylene	0.16%	106.16	0.17	453.7	1504.8	5208	3.E-04
o-Xylene	0.02%	106.16	0.02	43.1	142.8	5210	3.E-05
n-Octane	0.22%	114.23	0.25	665.0	2049.8	6249	4.E-04
n-Nonane	0.05%	128.26	0.07	170.9	527.7	6996	1.E-04
n-Decane	0.04%	142.29	0.06	150.8	466.4	7743	9.E-05
VOC	**100.00%**	**40.58**	**40.75**	**106933.7**	**309944.3**	**2246.4540**	**0.1**
Total VOC	**49.51%**		**29.93**	**78558.2**			

[1] The flash gas composition is based on the 2008 HYSYS model for Wamsutter at 365 psig.
[2] The molecular weights and the higher heating values are from the "GSPA Engineering Data Book", Twelfth Edition, Section 23 Physical Properties, 2004.

Table 226. 2009 CO_2 Emissions (tons/turnover) Potential for All Gas Sample Species from Working Loss.

From EPA's TANKS 4.09 Output based on the condensate composition from 2007 Wamsutter HYSYS model.

Throughput	1509.94	bbls/yr
Turnovers:	2.93	
Vapor Density	0.06	lb/ft^3

Components	Working Loss (lbs/yr)	Working Loss (lb/ turnover well)	Weight %	Molecular Weight (lb/lb-mol)[1]	Mole %	HHV (Btu/scf)[1]	lb/ MMscf	lb CO_2/ MMscf	2009 CO_2 emission potential of the entire gas (Tons/turnover)
Methane	78.28	26.72	21.23%	16.04	46.18%	1010	19518.8	53555.1	0.0121
Ethane	45.81	15.63	12.43%	30.07	14.42%	1770	11424.6	33441.8	0.0044
Propane	71.86	24.53	19.50%	44.10	15.42%	2516	17921.3	53654.3	0.0111
Isobutane	34.98	11.94	9.49%	58.12	5.70%	3252	8722.4	26419.2	0.0027
n-Butane	46.12	15.74	12.51%	58.12	7.51%	3262	11501.0	34835.5	0.0046
Isopentane	27.02	9.22	7.33%	72.15	3.54%	4001	6738.2	20550.9	0.0016
n-Pentane	21.87	7.46	5.93%	72.15	2.87%	4009	5454.1	16634.4	0.0011
n-Hexane	8.31	2.84	2.25%	86.18	0.91%	4756	2072.0	6348.6	0.0002
Cyclohexane	1.32	0.45	0.36%	84.16	0.15%	4482	328.7	1031.2	0.0000
2,2-Dimethylbuta	0.66	0.23	0.18%	86.18	0.07%	4736	164.6	504.4	0.0000
2,3-Dimethylbuta	2.19	0.75	0.59%	86.18	0.24%	4745	545.9	1672.8	0.0000
2-Methylpentane	6.49	2.22	1.76%	86.18	0.71%	4747	1618.7	4960.0	0.0001
3-Methylpentane	3.10	1.06	0.84%	86.18	0.34%	4750	773.6	2370.4	0.0000
n-Heptane	12.98	4.43	3.52%	100.20	1.23%	5503	3237.1	9952.4	0.0004
Methylcyclohexa	1.03	0.35	0.28%	98.19	0.10%	5216	257.3	922.5	0.0000
2,2,4-Trimethylpe	0.52	0.18	0.14%	114.23	0.04%	6249	129.4	398.8	0.0000
Benzene	1.17	0.40	0.32%	78.11	0.14%	3742	291.3	984.9	0.0000
Toluene	1.54	0.53	0.42%	92.14	0.16%	4475	383.4	1281.9	0.0000
Ethylbenzene	0.02	0.01	0.01%	106.17	0.00%	5222	5.2	17.2	0.0000
Xylenes	0.85	0.29	0.23%	106.17	0.08%	5208	212.3	704.2	0.0000
n-Octane	1.38	0.47	0.37%	114.23	0.11%	6249	344.1	1060.6	0.0000
n-Nonane	0.49	0.17	0.13%	128.26	0.04%	6996	122.2	377.5	0.0000
n-Decane	0.64	0.22	0.17%	142.29	0.04%	7743	160.1	495.3	0.0000
THC	**368.63**	**125.81**	**100.00%**	**34.88**	**100.00%**	**2016.172946**	**91926.45836**	**272173.93**	**0.04**
VOC	**244.54**	**83.46**	**66.34%**		**39.40%**		**60983.02218**		

[1] The molecular weights and the higher heating values are from the "GSPA Engineering Data Book", Twelfth Edition, Section 23 Physical Properties, 2004.

Table 227. 2009 CO_2 Emissions (tons/well) Potential for All Gas Sample Species from Breathing Loss.

From EPA's TANKS 4.09 Output based on the condensate composition from 2007 Wamsutter HYSYS model.

Throughput	1509.94	bbls/yr
Turnovers:	2.93	
Vapor Density	0.06	lb/ft^3

Components	Breathing Loss (lbs/well)	Weight %	Molecular Weight (lb/lb-mol)[1]	Mole %	HHV (Btu/scf)[1]	lb/ MMscf	lb CO_2/ MMscf	2009 CO_2 emission potential of the entire gas (tons/well)
Methane	686.48	21.23%	16.04	46.18%	1010	19518.83	53555.1	0.31
Ethane	401.75	12.43%	30.07	14.42%	1770	11424.60	33441.8	0.11
Propane	630.14	19.50%	44.10	15.42%	2516	17921.33	53654.3	0.29
Isobutane	306.72	9.49%	58.12	5.70%	3252	8722.37	26419.2	0.07
n-Butane	404.46	12.51%	58.12	7.51%	3262	11501.01	34835.5	0.12
Isopentane	236.95	7.33%	72.15	3.54%	4001	6738.23	20550.9	0.04
n-Pentane	191.8	5.93%	72.15	2.87%	4009	5454.10	16634.4	0.03
n-Hexane	72.84	2.25%	86.18	0.91%	4756	2071.95	6348.6	0.00
Cyclohexane	11.54	0.36%	84.16	0.15%	4482	328.67	1031.2	0.00
2,2-Dimethylbutane	5.79	0.18%	86.18	0.07%	4736	164.62	504.4	0.00
2,3-Dimethylbutane	19.19	0.59%	86.18	0.24%	4745	545.93	1672.8	0.00
2-Methylpentane	56.93	1.76%	86.18	0.71%	4747	1618.72	4960.0	0.00
3-Methylpentane	27.22	0.84%	86.18	0.34%	4750	773.58	2370.4	0.00
n-Heptane	113.84	3.52%	100.20	1.23%	5503	3237.08	9952.4	0.01
Methylcyclohexane	9.06	0.28%	98.19	0.10%	5216	257.26	922.5	0.00
2,2,4-Trimethylpentane	4.54	0.14%	114.23	0.04%	6249	129.39	398.8	0.00
Benzene	10.23	0.32%	78.11	0.14%	3742	291.33	984.9	0.00
Toluene	13.46	0.42%	92.14	0.16%	4475	383.41	1281.9	0.00
Ethylbenzene	0.19	0.01%	106.17	0.00%	5222	5.20	17.2	0.00
Xylenes	7.48	0.23%	106.17	0.08%	5208	212.35	704.2	0.00
n-Octane	12.1	0.37%	114.23	0.11%	6249	344.11	1060.6	0.00
n-Nonane	4.3	0.13%	128.26	0.04%	6996	122.24	377.5	0.00
n-Decane	5.65	0.17%	142.29	0.04%	7743	160.14	495.3	0.00
THC	**3232.66**	**100.00%**	**34.88**	**100.00%**	**2016.172946**	**91926.45836**	**272173.9343**	**0.98**
VOC	**2144.43**	**66.34%**		**39.40%**		**60983.02218**		

Table 228. Summary of 2009 THC and CO Component to CO_2 Emissions Potentials (tons/activity).

	MW (lb/lb-mol)	Flashing (lb/bbl)	Working (lb/turnover)	Breathing (lb/well)
TOG	31.47	0.15	0.75	19.30
CO	28.01	0.32	1.59	40.80

Name	HC?	VOC?	WEIGHT_PER (Flaring Speciation Profile (EPA SPECIATE 0051))	Molecular Weight (lb/lb-mol) [2]	Flashing 2009 CO2 Emissions				Working 2009 CO2 Emissions				Breathing 2009 CO2 Emissions			
					THC component CO2 emissions			CO component CO2 emissions potentials (tons/bbl)	THC component CO2 emissions potentials			CO component CO2 emissions potentials (tons/turnover)	THC component CO2 emissions			CO component CO2 emissions potentials (tons/well)
					lb emitted/well	Moles C in compound/ Moles C in CO2	CO2 Emissions (tons/bbl)		lb emitted/turnover	Moles C in compound/ Moles C in CO2	CO2 Emissions (tons/turnover)		lb emitted/well	Moles C in compound/Moles C in CO2	CO2 Emissions (tons/well)	
Ethane	Y	N	30	30.07	0.04	2	0.0001	0.0002	0.23	2	0.0003	0.0012	5.79	2	0.0085	0.0321
Formaldehyde	N	Y	20	30.03	0.03	1	0.0000		0.15	1	0.0001		3.86	1	0.0028	
Methane	Y	N	20	16.04	0.03	1	0.0000		0.15	1	0.0002		3.86	1	0.0053	
Propane	Y	Y	30	44.10	0.04	3	0.0001		0.23	3	0.0003		5.79	3	0.0087	
			100		**0.15**		**0.0002**	**0.0002**	**0.75**		**0.0010**	**0.0012**	**19.30**		**0.0253**	**0.0321**

Table 229. 2009 Condensate Tank Flaring Emissions per activity metric of each Category.

Description	Flaring Emissions (tons per activity metric)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Condensate Tank Flashing Flaring	2.91E-05	3.75E-05	0.0002	0	0	0	0.0586	1.50E-05	0	0	2.74E-07	flashing flares
Condensate Tank Working Flaring	0.0001	0.0002	0.0008	0	0	0	0.0361	7.51E-05	0	0	1.53E-06	working flares
Condensate Tank Breathing Flaring	0.0037	0.0048	0.0204	0	0	0	0.9267	0.0019	0	0	3.93E-05	breathing flares

2009 Dehydrator Flaring Emissions

ASSUMPTIONS

Data Provided by operator in blue text
Assume no change in pressure (365 psi)
Assume one dehydrator per well
Total Waste Gas Stream (MMscf/yr/ well) =0.0013*Flow (MMSCF/yr/well)+0.5094

NOx, VOC, CH_4, N_2O and CO Emissions Calculation

$$E_{flare} = EF_i \times Q \times HV$$

where:

E_{flare} is the flaring emissions per well [lb/yr]

EF_i is the emissions factor for pollutant i [lb/MMBtu]

Q is the volume of gas flared supplied by operator [MMscf/yr]

HV is the heating value of the gas as provided by the operators [MMBtu/MMscf]

CO_2 Emissions $(tons\ per\ activity)$ = (Total CO_2 Emission Potential of the Entire Gas – THC Component to CO_2 Emission Potential – CO Component to CO_2 Emission Potential) x Percentage of Production Controlled

$$THC\ \text{Component } CO_2 \text{ Emissions Potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \sum \frac{\left(\frac{\text{lb emissions emitted}}{\text{activity}}\right)_i \times \frac{No.\ of\ Moles\ of\ C\ in\ compound}{No.\ of\ Moles\ of\ C\ in\ CO2} \times \text{Molecular Weight of } CO_2 \text{ (lb/lb-mol)}}{\text{Molecular weight of Compound C (lb/lb-mol)} \times 2000}$$

$$\text{CO component } CO_2 \text{ emissions potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \frac{\text{CO emissions from flaring}\left(\frac{\text{lb}}{\text{activity}}\right) \times \frac{\text{No.of Moles of C in compound}}{\text{No.of Moles of C in CO2}} \times \text{Molecular Weight of CO2 (lb/lb-mol)}}{\text{Molecular weight of CO } \left(\frac{\text{lb}}{\text{lb-mol}}\right) \times 2000}$$

.

Where,

$_i$= each compound identified in flaring gas speciation profile

$(\text{lb emissions emitted/activity})_i$ = Total TOG Emissions (lb/activity) from flaring X Weight Fraction of the Compound

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Table 230. Flaring Emission Factors.

Flaring Emission Factor (lb/MMBtu)*			Fraction of THC as CH4	N2O (lb/MMSCF)[b]	VOC/THC[c]
NOx	CO	THC			
0.068	0.37	0.14	25%	1.44	63%

*Emission Factors are from AP-42

b Emission Factor from API Compendium of greenhouse gas emissions methodologies for the oil and natural gas industry,2009 Table 4-11, GHG Emission Factors for Gas Flares in Developed Countries - Footnote C

[c]EPA SPECIATE Profile 0051

Table 231. 2009 CO_2 Emissions (tons/well) Potential for All Gas Sample Species from Dehydrator Flaring.

Chemical	Mole %[1]	Molecular Weight (lb/lb-mol)[2]	lb/ MMscf	lb CO_2/ MMscf	HHV (Btu/scf)[2]	2009 CO_2 emission potential of the entire gas (tons/well)
Water	17.54%	18.01	8060.8		0.0	0.00
Carbon Dioxide	5.47%	44.01	6142.9	6142.9	0	1.92
Nitrogen	0.11%	28.01	80.8		0	0.00
Methane	55.61%	16.04	22761.2	62451.3	1010	19.53
Ethane	6.19%	30.07	4749.6	13903.0	1770	4.35
Propane	3.98%	44.10	4478.8	13408.9	2516	4.19
Isobutane	1.07%	58.12	1586.9	4806.5	3252	1.50
n-Butane	1.49%	58.12	2209.8	6693.2	3262	2.09
Isopentane	0.57%	72.15	1053.1	3211.8	4001	1.00
n-Pentane	0.58%	72.15	1075.2	3279.2	4009	1.03
n-Hexane	0.33%	86.18	730.1	2237.1	4756	0.70
Cyclohexane	0.62%	84.16	1335.8	4191.1	4482	1.31
Other Hexanes	0.37%	86.18	815.9	2499.8	4745	0.78
n-Heptane	0.61%	100.20	1569.9	4826.8	5503	1.51
Methylcyclohexane	0.79%	98.19	1976.9	7088.5	5216	2.22
2,2,4-Trimethylpentane	0.02%	114.23	55.4	170.7	6249	0.05
Benzene	1.35%	78.11	2690.8	9096.5	3742	2.85
Toluene	1.89%	92.14	4443.7	14857.6	4475	4.65
Ethylbenzene	0.06%	106.17	165.3	548.0	5222	0.17
Xylenes	0.60%	106.17	1636.3	5426.4	5208	1.70
n-Octane	0.73%	114.23	2116.2	6522.5	6249	2.04
Total	**100.00%**	**27.33**	**69735.3**	**171362.1**	**1253.5833**	**53.6**
Total VOC	**15.07%**		**27940.0**			

[1] Mole percent is based on the GLYCalc run at 0.25 MMscf/day for Wamsutter.

[2] The molecular weights and the higher heating values are from GSPA Engineering Data Book, 12th Edition.

Assumptions

0.0821	L-atm/K-mol
298.15	^{o}K
1	1 atm
1 ft3	28.31685 L
453.59237	mol/lb-mol
391.90	scf/lbmol

Table 232. Summary of 2009 THC and CO Component to CO_2 Emissions Potentials (tons/activity).

	MW (lb/lb-mol)	lb/well
TOG	31.47	137.23
CO	28.01	290.14

Name	HC?	VOC?	WEIGHT_PER (Flaring Speciation Profile (EPA SPECIATE 0051))	Molecular Weight (lb/lb-mol)2	THC component CO2 emissions potentials			CO component
					lb emitted/well	Mole % C in compound/Mole % C in CO2	2009 CO_2 Emissions (tons/well)	2009 CO_2 emissions potentials (tons/well)
Ethane	Y	N	30	30.07	41	2	0.1	0.2
Formaldehyde	N	Y	20	30.03	27	1	0.0	
Methane	Y	N	20	16.04	27	1	0.0	
Propane	Y	Y	30	44.10	41	3	0.1	
			100		137		0.18	0.23

Table 233. 2009 Dehydrator Flaring Emissions in tons per activity.

Description	Flaring Emissions (tons per activity metric)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Dehydrator Flaring	0.0267	0.0343	0.1451	0	0	0	53.1885	0.0137	0	0	0.0004	dehydrator flares

2009 Chemical Injection Pump Flaring Emissions

ASSUMPTIONS

Data provided by operators in blue text

NOx, VOC, CH_4, N_2O and CO Emissions Calculation

$$E_{flare} = EF_i \times Q \times HV$$

where:

E_{flare} is the flaring emissions per well [lb/yr]

EF_i is the emissions factor for pollutant i [lb/MMBtu]

Q is the volume of gas flared supplied by operator [MMscf/yr]

HV is the heating value of the gas as provided by the operators [MMBtu/MMscf]

CO_2 Emissions ($tons\ per\ activity$) = (Total CO_2 Emission Potential of the Entire Gas – THC Component to CO_2 Emission Potential – CO Component to CO_2 Emission Potential) x Percentage of Production Controlled

$$THC\ \text{Component } CO_2 \text{ Emissions Potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \sum \frac{\left(\frac{\text{lb emissions emitted}}{\text{activity}}\right)_i \times \frac{No.\ of\ Moles\ of\ C\ in\ compound}{No.\ of\ Moles\ of\ C\ in\ CO2} \times \text{Molecular Weight of } CO_2 \text{ (lb/lb-mol)}}{\text{Molecular weight of Compound C (lb/lb-mol)} \times 2000}$$

$$\text{CO component } CO_2 \text{ emissions potentials } \left(\frac{\text{tons}}{\text{activity}}\right) = \frac{\text{CO emissions from flaring } \left(\frac{\text{lb}}{\text{activity}}\right) \times \frac{\text{No.of Moles of C in compound}}{\text{No.of Moles of C in CO2}} \times \text{Molecular Weight of CO2 (lb/lb-mol)}}{\text{Molecular weight of CO } \left(\frac{\text{lb}}{\text{lb-mol}}\right) \times 2000}$$

Where,

$_i$= each compound identified in flaring gas speciation profile

(lb emissions emitted/activity)$_i$ = Total TOG Emissions (lb/activity) from flaring X Weight Fraction of the Compound

VOC Fraction (molar)	5.39%	
VOC molecular weight	57.50	
R	0.08206	L atm / K-mol
standard temp	298.15	K
standard press	1	atm
MCF to 1000 liter conversion	28.317	1000L/MCF
L/mol	24.47	L/mol
	28.32	L/SCF
	453.59237	mol/lb-mol
	391.90	scf/lbmol

Table 234. Flaring Emission Factors.

Flaring Emission Factor (lb/MMBtu)*			Fraction of THC as CH4	N2O (lb/MMSCF)[b]	VOC/THC[c]
NOx	CO	THC			
0.068	0.37	0.14	25%	1.44	63%

*Emission Factors are from AP-42

b Emission Factor from API Compendium of greenhouse gas emissions methodologies for the oil and natural gas industry,2009 Table 4-11, GHG Emission Factors for Gas Flares in Developed Countries - Footnote C

[c]EPA SPECIATE Profile 0051

Table 235. Summary of Chemical Injection Pump Data.

Type	Gallons Used	Gallons/well	SCF/Gallon	Number of Pump	Days Used in Quarter	SCF/Pump/Minute	Vented Volume (MCF/year)	Vented Volume (MMSCF/year)
Methanol	1,381,989	1,368	47	1	-	-	64.31	0.06
Glycol Heat Medium Pumps	-	-	-	1	273	2.84	1,116.73	1.12
Total	-	-	-	-	-	-	1181.04	1.18

Table 236. 2009 CO_2 Emissions (tons/well) Potential for All Gas Sample Species from Pump Flaring.

Component	Mole %[1]	Molecular Weight (lb/lb-mol)[2]	Weight %	lb/ MMscf	lb CO_2/ MMscf	HHV (Btu/scf)[2]	CO2 emission potential of the entire gas (tons/well)
Carbon Dioxide	2.73%	44.01	6.07%	3066.1	3066.1	0	1.8106
Nitrogen	0.17%	28.01	0.24%	122.3		0	0.0000
Methane	84.90%	16.04	68.75%	34749.6	95344.9	1010	56.3030
Ethane	6.81%	30.07	10.33%	5222.5	15287.1	1770	9.0273
Propane	3.17%	44.10	7.05%	3564.0	10670.1	2516	6.3009
Isobutane	0.64%	58.12	1.86%	942.4	2854.6	3252	1.6857
n-Butane	0.71%	58.12	2.08%	1052.8	3188.8	3262	1.8830
Isopentane	0.24%	72.15	0.88%	445.4	1358.3	4001	0.8021
n-Pentane	0.20%	72.15	0.73%	366.5	1117.8	4009	0.6601
n-Hexane	0.16%	86.18	0.69%	350.1	1072.8	4756	0.6335
Cyclohexane	0.03%	84.16	0.13%	68.2	213.9	4482	0.1263
2,2-Dimethylbutane	0.00%	86.18	0.02%	9.4	28.8	4736	0.0170
2,3-Dimethylbutane	0.02%	86.18	0.07%	36.0	110.3	4745	0.0652
2-Methylpentane	0.05%	86.18	0.21%	107.2	328.5	4747	0.1940
3-Methylpentane	0.03%	86.18	0.11%	55.1	168.9	4750	0.0997
n-Heptane	0.06%	100.20	0.30%	149.9	461.0	5503	0.2722
Methylcyclohexane	0.03%	98.19	0.16%	80.6	288.9	5216	0.1706
2,2,4-Trimethylpentane	0.00%	114.23	0.02%	11.0	34.0	6249	0.0201
Benzene	0.01%	78.11	0.06%	29.8	100.6	3742	0.0594
Toluene	0.02%	92.14	0.08%	41.0	137.0	4475	0.0809
Ethylbenzene	0.00%	106.17	0.00%	1.2	4.1	5222	0.0024
m-Xylene	0.00%	106.16	0.03%	12.6	41.9	5208	0.0247
o-Xylene	0.00%	106.16	0.02%	11.0	36.5	5210	0.0216
n-Octane	0.00%	114.23	0.00%	1.8	5.4	6249	0.0032
n-Nonane	0.01%	128.26	0.09%	44.8	138.2	6996	0.0816
n-Decane	0.00%	142.29	0.00%	0.0	0.0	7743	0.0000
Total	**100.00%**	**19.81**	**100.00%**	**50541.4**	**136,059**	**1140.5805**	**80.3**
Total VOC	**5.39%**		**14.60%**	**7380.8**			

1 Mole percentage of the sales gas

2 The molecular weights and the higher heating values are from GSPA Engineering Data Book, 12th Edition.

Table 237. Summary of 2009 THC and CO Component to CO_2 Emissions Potentials (tons/activity).

Name	HC?	VOC?	WEIGHT_PER	Molecular Weight (lb/lb-mol)[2]	THC component CO2 emissions potentials			CO component CO2 emissions potentials (tons/well)
					lb emitted/well	Moles C in compound/Moles C in CO2	CO2 Emissions (tons/well)	
Ethane	Y	N	30	30.07	71	2	0.1	0.4
Formaldehyde	N	Y	20	30.03	47	1	0.0	
Methane	Y	N	20	16.04	47	1	0.1	
Propane	Y	Y	30	44.10	71	3	0.1	
			100		**236**		**0.31**	**0.39**

Table 238. 2009 Chemical Injection Pump Flaring Emissions in tons per well.

Description	Flaring Emissions (tons per activity metric)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Pneumatic Pump Flaring	0.0458	0.0589	0.2492	0	0	0	79.6451	0.0236	0	0	0.0008	pneumatic pump flares

2009 Production Traffic Emissions

ASSUMPTIONS

Data Provided by operators in blue text
Emission Factor Estimates Based on EPA MOVES model runs
BLM, 2003 after (EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06))
Heavy truck weighs 70,000 lbs
Light truck weighs 7,000 lbs
EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)

Assumed 50% fugitive dust control resulting from watering.
Data for Number of Days of Measurable (>0.01") Precipitation
Data assumed representative of project area from Western Regional Climate Center for WAMSUTTER, WY (data source nearest project area). Mean for data from 1948-2004 is
Measurable precip (>0.01") occurred on 48 days/year
http://www.wrcc.dri.edu/htmlfiles/wy/wy.01.html

Equations

$$\text{MOVES Emissions (tons/year-well)} = \frac{\text{Emission factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

ASSUMPTIONS TO ESTIMATE 2009 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH PRODUCTION TRAFFIC.

Source for Data for Constants: EPA (1995), AP-42, Section 13.2.2 Unpaved Roads (11/06). Table 13.2.2-2.

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C$$

$$E\ [\text{lb/VMT}] = \frac{k(s/12)^a(W/3)^d}{(M/0.2)^c} * \frac{(365-P)}{365} * (\text{Control Efficiency})$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Constant	PM_{10}	$PM_{2.5}$
k	1.8	0.18
a	1.00	1.00
d	0.50	0.50
c	0.2	0.2
C	0.00047	0.00036

Variable Description	Value	Reference
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%)	5.1	EPA, *AP-42*, Volume I, Section 13.2.2 Unpaved Roads (11/06)
W = mean vehicle weight (tons)	35	Heavy truck weighs 70000 lbs
W = mean vehicle weight (tons)	3.5	Light truck weighs 7000 lbs
M = surface material moisture content (%)	2.4	AP-42 Table 11.9-3 as in Jonah EIS Table B.1.3
Control efficiency for watering (%) =	50	EPA, *Control of Open Fugitive Dust Sources*, Section 5.3.1 Watering of Unpaved Surfaces (1988)
P = Precipitation Days (>0.01" rainfall)	48	Precipitation days at Wamsutter, WY from NCDC climatology

Table 239. Summary of Traffic Activity Data Associated with Production Traffic.

Equipment Type	Field		
	Mean Vehicle Speed (mph)	Round Trip Off-Road Trip Distance (miles)	Number of Round Trips Per Well or Central Facilities (annual)
Light Truck	20	20	52
Heavy Truck	20	20	14
Heavy Trucks - Central Facility	0	0	0

Production traffic assumes that vehicles end up at the central facility

Table 240. 2009 Exhaust Emissions (lb/well) Associated with Production Traffic by Vehicle Type.

Vehicle Type	Pollutant	2009 Emission Factors (g/mile)	Base year Emissions (lb/well)
Light-Duty Truck	NOx	2.52	5.779
	SO2	0.01	0.033
	CO	18.19	41.699
	CO2	675.15	1548
	VOC	1.48	3.390
	PM10	0.09	0.199
	PM2.5	0.08	0.189
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.08	0.195
	N2O	0.05	0.105
Heavy-Duty Truck	NOx	20.23	12.485
	SO2	0.08	0.050
	CO	15.07	9.301
	CO2	2612.44	1612.614
	VOC	1.86	1.149
	PM10	1.21	0.745
	PM2.5	1.17	0.723
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.056
	N2O	0.04	0.022
Heavy-Duty Diesel Truck Travel to Central Facility	NOx	20.23	0.000
	SO2	0.08	0.000
	CO	15.07	0.000
	CO2	2612.44	0.000
	VOC	1.86	0.000
	PM10	1.21	0.000
	PM2.5	1.17	0.000
	PM_filt	-	0.000
	PM_cond	-	0.000
	CH4	0.09	0.000
	N2O	0.04	0.000

* units are lb totals for travel to central facility

Table 241. Summary of 2009 Fugitive Dust Emissions (tons/well) Associated with Production Traffic.

Activity	Vehicle Type	Av. Vehicle Weight (lb)	Mean vehicle speed (mph)	# of Visits per Year	Total # of Round Trips	Round Trip Distance (mi)	Total Miles Traveled	PM_{10}		$PM_{2.5}$	
								Em. Factor (lb/VMT)	Emissions (tpy/well)	Em. Factor (lb/VMT)	Emissions (tpy/well)
Travel to well	Light truck	7,000	20	52	52	20	1040	0.20	0.10	0.02	0.01
Travel to well	Heavy Truck	70,000	20	14	14	20	280	0.20	0.03	0.02	0.00
Travel to Central Facility	Heavy Truck	70,000	0	0	0	0	0	0.00	0.00	0.02	0.00
							Total	**0.40**	**0.13**	**0.06**	**0.01**

Table 242. 2009 Exhaust and Fugitive Dust Emissions Associated with Production Traffic in tons per well.

Description	Total Production Traffic Emissions (tons per well)											Projection	Fugitive Road	
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O		PM10	PM2.5
Production Traffic (LD)	0.0029	0.0017	0.0208	9.97E-05	9.45E-05	1.65E-05	0.7740	9.74E-05	0	0	5.24E-05	active well counts	0.1030	0.0102
Production Traffic (HD)	0.0062	0.0006	0.0047	0.0004	0.0004	2.48E-05	0.8063	2.79E-05	0	0	1.10E-05	active well counts	0.0277	0.0028
Production Traffic, Central Facility (HD)	0	0	0	0	0	0	0	0	0	0	0	totals for CY 2012+	0	0

Table 243. Percent Change in Emission from Base Year 2009 due to fleet turnover for Production Traffic.

	Light-Duty Truck											Heavy-Duty Truck										
Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4	N2O
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	-5%	-11%	-3%	0%	-4%	-6%	-6%	0%	0%	-3%	-7%	-10%	-45%	-4%	0%	-3%	-7%	-7%	0%	0%	4%	-5%
2011	-10%	-18%	-7%	-1%	-10%	-12%	-13%	0%	0%	-7%	-14%	-19%	-74%	-9%	0%	-10%	-18%	-18%	0%	0%	13%	-12%
2012	-16%	-27%	-11%	-2%	-16%	-19%	-19%	0%	0%	-11%	-21%	-28%	-75%	-14%	0%	-17%	-28%	-28%	0%	0%	20%	-17%
2013	-22%	-28%	-15%	-4%	-22%	-25%	-25%	0%	0%	-15%	-28%	-36%	-75%	-19%	0%	-25%	-37%	-37%	0%	0%	24%	-23%
2014	-28%	-29%	-18%	-5%	-27%	-30%	-31%	0%	0%	-18%	-34%	-44%	-76%	-24%	0%	-32%	-45%	-46%	0%	0%	28%	-28%
2015	-33%	-30%	-22%	-7%	-33%	-35%	-36%	0%	0%	-22%	-39%	-51%	-76%	-28%	0%	-38%	-53%	-53%	0%	0%	30%	-33%
2016	-38%	-31%	-26%	-8%	-38%	-40%	-40%	0%	0%	-25%	-44%	-57%	-76%	-33%	0%	-44%	-60%	-60%	0%	0%	31%	-37%
2017	-43%	-33%	-28%	-10%	-42%	-44%	-44%	0%	0%	-28%	-48%	-62%	-76%	-36%	0%	-49%	-66%	-66%	0%	0%	32%	-41%
2018	-47%	-34%	-31%	-11%	-46%	-48%	-48%	0%	0%	-30%	-52%	-67%	-76%	-39%	0%	-54%	-71%	-71%	0%	0%	33%	-44%
2019	-51%	-35%	-33%	-13%	-49%	-51%	-51%	0%	0%	-32%	-56%	-71%	-77%	-42%	0%	-59%	-75%	-75%	0%	0%	33%	-48%
2020	-54%	-36%	-34%	-14%	-52%	-54%	-54%	0%	0%	-34%	-59%	-74%	-77%	-44%	0%	-62%	-79%	-79%	0%	0%	34%	-50%
2021	-57%	-37%	-36%	-15%	-55%	-56%	-56%	0%	0%	-35%	-62%	-77%	-77%	-46%	0%	-66%	-82%	-82%	0%	0%	34%	-53%
2022	-64%	-39%	-40%	-18%	-62%	-61%	-62%	0%	0%	-38%	-69%	-83%	-77%	-50%	0%	-73%	-89%	-89%	0%	0%	35%	-60%
2023	-60%	-38%	-37%	-16%	-58%	-58%	-59%	0%	0%	-36%	-64%	-79%	-77%	-48%	0%	-69%	-85%	-85%	0%	0%	34%	-55%
2024	-62%	-39%	-39%	-17%	-60%	-60%	-60%	0%	0%	-37%	-67%	-81%	-77%	-49%	0%	-71%	-87%	-87%	0%	0%	34%	-58%
2025	-66%	-40%	-41%	-19%	-65%	-63%	-64%	0%	0%	-39%	-71%	-84%	-77%	-52%	0%	-76%	-90%	-90%	0%	0%	34%	-61%
2026	-68%	-41%	-42%	-20%	-67%	-64%	-65%	0%	0%	-38%	-72%	-85%	-77%	-53%	0%	-78%	-91%	-91%	0%	0%	36%	-63%
2027	-69%	-41%	-43%	-21%	-69%	-66%	-66%	0%	0%	-38%	-74%	-86%	-77%	-54%	0%	-79%	-92%	-92%	0%	0%	36%	-64%
2028	-71%	-42%	-44%	-21%	-70%	-67%	-68%	0%	0%	-39%	-75%	-87%	-77%	-54%	0%	-81%	-93%	-93%	0%	0%	36%	-65%
2029	-72%	-42%	-45%	-22%	-72%	-68%	-69%	0%	0%	-40%	-76%	-87%	-77%	-55%	0%	-82%	-94%	-94%	0%	0%	36%	-67%
2030	-73%	-42%	-46%	-22%	-73%	-69%	-69%	0%	0%	-40%	-77%	-88%	-77%	-56%	0%	-83%	-94%	-94%	0%	0%	35%	-67%
2031	-74%	-43%	-46%	-23%	-74%	-69%	-70%	0%	0%	-42%	-78%	-88%	-77%	-57%	0%	-84%	-95%	-95%	0%	0%	34%	-69%
2032	-74%	-43%	-47%	-23%	-75%	-70%	-71%	0%	0%	-42%	-79%	-88%	-77%	-57%	0%	-85%	-95%	-95%	0%	0%	34%	-69%
2033	-75%	-43%	-48%	-23%	-76%	-71%	-71%	0%	0%	-43%	-79%	-89%	-78%	-58%	0%	-85%	-95%	-95%	0%	0%	33%	-69%
2034	-76%	-44%	-48%	-24%	-76%	-71%	-72%	0%	0%	-43%	-79%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2035	-76%	-44%	-49%	-24%	-77%	-72%	-72%	0%	0%	-44%	-80%	-89%	-78%	-59%	0%	-86%	-95%	-95%	0%	0%	33%	-70%
2036	-77%	-44%	-49%	-24%	-77%	-72%	-73%	0%	0%	-44%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-70%
2037	-77%	-44%	-50%	-24%	-78%	-72%	-73%	0%	0%	-45%	-80%	-89%	-78%	-60%	0%	-87%	-96%	-96%	0%	0%	32%	-71%

2009 Compressor Emissions

ASSUMPTIONS

Data provided by operators in blue text
Additional compressor stations will come online from 2012.

Equations:

$$\text{Emissions (tons/year)} = \frac{\text{Emission factor (g/hp-hr)} * \text{Horsepower} * \text{Time Used (hours)} * \text{Load}}{453.5\ \text{(g/lb)} * 2000\ \text{(lbs/ton)}}$$

Table 244. Compressor Engines Activity Data.

Existing Capacity (Wamsutter and Table Rock)	32,810	hp
	1,000	mmscfd
Normalized Capacity	32.81	hp/mmscfd
Gas Production capacity to be added	760	mmscfd
Additional horsepower needed	24,936	hp
	Reciprocating Engines	**Turbine**
Fraction of horsepower at existing stations	2.7%	97.3%
Additional horsepower needed by type	684	24,252
Estimated Load Factor	100%	100%

Table 245. Compressor Engine Emission Factors (turbine and rich burn SI) and Compressor Emissions in lbs per year.

Pollutant	Emission Factors				Emissions (lb/yr)	
	Turbine		Reciprocating			
	EF (g/hp-hr)	source	EF (g/hp-hr)	source	Turbine	Reciprocating
NOx	0.21	Average turbine emission factor from the existing Echo Springs Facility	0.7	Assumed BACT level	99,955	9,247
CO	0.21	min of existing turbines	2.0	Assumed BACT level	98,354	26,419
VOC	0.01	min of existing turbines	0.1	min of existing reciprocating engines	4,215	1,230
PM10	0.0240	EPA,AP-42 Turbine EFs	0.0704	EPA,AP-42, 4-Stroke Rich Burn Engine Efs	11,217	930
PM2.5	0.0240	EPA,AP-42 Turbine EFs	0.0704	EPA,AP-42, 4-Stroke Rich Burn Engine Efs	11,217	930
SO2	0.0000		0.0000		0	0
CO2	399.1680	EPA,AP-42 Turbine EFs	399.1680	EPA,AP-42, 4-Stroke Rich Burn Engine Efs	186,950,734	5,272,819
CH4	0.0210	SPECIATE Profile	0.7669	SPECIATE Profile	9,835	10,130
PM_cond	0.0171	EPA,AP-42 Turbine EFs	0.0360	EPA,AP-42, 4-Stroke Rich Burn Engine Efs	7,988	475
PM_filt	0.0069	EPA,AP-42 Turbine EFs	0.0345	EPA,AP-42, 4-Stroke Rich Burn Engine Efs	3,229	455
N2O	0.0109	EPA,AP-42 Turbine EFs	0.0008	API Compendium	5,099	10

Table 246. Compression Station Emissions (tons/yr).

Description	Compression Station Emissions (tons)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Added Compression (turbine)	49.9777	2.1076	49.1769	5.6085	5.6085	0.0000	93,475	4.9177	1.6146	3.9939	2.5493	totals for CY 2012+
Added Compression (reciprocating)	4.6233	0.6149	13.2095	0.4652	0.4652	0.0000	2,636	5.0652	0.2277	0.2375	0.0050	totals for CY 2012+

New Gas Plants Emissions

ASSUMPTIONS

Data provided by operators in blue text
Additional Gas Production Capacity will be added from 2012.

Existing Capacity (Echo Spring Gas Plant)	740	mmscfd
Gas Production capacity to be added	760	mmscfd
Additional horsepower needed	24,936	hp

Table 247. New Gas Plant Emissions by Source in tons per year.

Description	Well Pad Construction Equipment Emissions (tons)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Added Gas Plant (Recip Engines)	43.2959	5.7583	123.7024	4.3565	4.3565	0	24689.0265	47.4337	2.1322	2.2243	0.0470	totals for CY 2012+
Added Gas Plant (Turbine Engines)	195.2504	8.3969	195.9274	22.3451	22.3451	0	372418.7367	19.5927	6.4327	15.9124	10.1569	totals for CY 2012+
Added Gas Plant (Duct Burner)	17.4087	0.8511	9.6715	1.4701	1.4701	0.1161	23211.6324	0.4449	0.3675	1.1026	0.4255	totals for CY 2012+
Added Gas Plant (Heaters)	77.0640	6.6152	53.5697	6.5076	6.5076	0.5138	102751.9589	1.9694	1.6269	4.8807	1.8838	totals for CY 2012+
Added Gas Plant (Flares)	39.5405	36.4595	111.2270	0	0	0	65678.3294	3.7403	0	0	0.8349	totals for CY 2012+
Added Gas Plant (Process)	10.4757	10.3730	9.5514	0.7962	0.7962	0.0629	12570.8108	0.2409	0.1990	0.5971	0.2305	totals for CY 2012+
Added Gas Plant (Fugitives)	0	3.7000	0	0	0	0	1.5371	17.4200	0	0	0	totals for CY 2012+

Table 248. Summary of New Gas Plant Emissions by source in tons per year.

Unit		NOx	CO	VOC	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	Units
Engines	Total Engine Capacity	100,406	100,406	100,406	100,406	100,406	100,406	100,406	100,406	100,406	100406.00	100406.00	hp
	Normalized Capacity	136	136	136	136	136	136	136	136	136	136	136	hp/mmscfd
	Added Capacity	760	760	760	760	760	760	760	760	760	760.00	760.00	mmscfd
	Additional Capacity Needed	103,120	103,120	103,120	103,120	103,120	103,120	103,120	103,120	103,120	103119.68	103119.68	hp
	Fraction Recip Engines	0.062	0.062	0.062	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
	Recip Engine Capacity	6,413	6,413	6,413	6,413	6,413	6,413	6,413	6,413	6,413	6412.76	6412.76	hp
	Load Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
	Assumed BACT Emission Factor	0.7	2.0	1.0	0.0704	0.0704	0.0000	399	1	0.0345	0.0360	0.0008	g/hp-hr
	VOC/HC			9.3%									SPECIATE Profile 1001
	Recip Engine Emissions	43	124	5.8	4	4	0	24,689	47	2	2	0	t/yr
	Turbine Fraction	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	
	Turbine Capacity	96,707	96,707	96,707	96,707	96,707	96,707	96,707	96,707	96,707	96,707	96,707	hp
	Load Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
	Assumed BACT Level	0.209	0.210	0.030	0.0240	0.0240	0.0000	399.1680	0.0210	0.0069	0.0171	0.0109	g/hp-hr
	Assumed BACT Level	15											
	VOC/HC			30%									SPECIATE Profile 0007
	Turbine Emissions	195	196	8	22	22	0	372,419	20	6	16	10	t/yr
Duct Burner	Duct Burner												
	Existing Capacity	43	43	43	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	mmbtu/hr
	Normalized Capacity	0.058	0.058	0.058	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	mmbtu/mmscfd
	Added Capacity	760	760	760	760	760	760	760	760	760	760	760	mmscf/d
	Additional Capacity Needed	44	44	44	44.16	44.16	44.16	44.16	44.16	44.16	44.16	44.16	mmbtu/hr
	BACT Level Assumed	0.09	0.05	0.01	0.01	0.01	0.00	120.00	0.00	0.00	0.01	0.0022	lbs/mmbtu
	VOC/HC			44%									SPECIATE Profile 0003
	Duct Burner Emissions	17.4	9.7	0.85	1.5	1.5	0.1	23211.6	0.4	0.4	1.1	0.4	t/yr
	Total Engine Emissions	**256**	**329**	**15**	**28**	**28**	**0**	**420319**	**67**	**9**	**19**	**11**	**t/yr**
Heaters	Existing Heater Capacity	190	190	190	190	190	190	190	190	190	190	190	mmbtu/hr
	Normalized Capacity	0.257	0.257	0.257	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	mmbtu/mmscfd
	Added Capacity	760	760	760	760	760	760	760	760	760	760	760	mmscf/d
	Additional Capacity Needed	195	195	195	195	195	195	195	195	195	195	195	mmbtu/hr
	BACT level assumed	0.09	0.06	0.02	0.01	0.01	0.00	120.00	0.00	0.00	0.01	0.0022	lbs/mmbtu
	VOC/HC			44%									SPECIATE Profile 0003
	Heater Emissions	**77.1**	**53.6**	**6.62**	**6.5**	**6.5**	**0.5**	**102752.0**	**2.0**	**1.6**	**4.9**	**1.9**	**t/yr**
Flares	Emissions from Flaring at 740 mmscfd	38.5	108.3	35.5	0.00	0.00	0.00	63,950	4	0.00	0.00	0.81	t/yr
	Emissions from Flaring at 760 mmscfd	39.5	111.2	36.5	0.00	0.00	0.00	65,678	4	0.00	0.00	0.83	t/yr
Process	Process Emissions at 740 mmscfd	10.2	9.3	10.1	0.78	0.78	0.06	12240.00	0.23	0.19	0.58	0.22	t/yr
	Process Emissions at 760 mmscfd	10.5	9.6	10.4	0.80	0.80	0.06	12570.81	0.24	0.20	0.60	0.23	t/yr
Fugitive	Fugitive Emissions at 740 mmscfd	0	0	3.7	0.00	0.00	0.00	1.54	17.42	0.00	0.00	0.00	t/yr
	Fugitive Emissions at 760 mmscfd	0	0	3.7	0.00	0.00	0.00	1.54	17.42	0.00	0.00	0.00	t/yr
	Facility Total	**383**	**504**	**72**	**35**	**35**	**1**	**601322**	**91**	**11**	**25**	**14**	**t/yr**

2009 Evaporative Pond Emissions

Data provided by operators in blue text.

Table 249. 2009 Emissions (tons/year) from Wamsutter North and South Evaporation Ponds.

Parameter		Wamsutter North Pond	Wamsutter South Pond
VOC Emissions (tpy)		4.67	5.85
Emissions (tpy) based on Water 9 model Output*	Benzene	0.62	0.84
	Ethylbenzene	0.07	0.09
	Hexane (-n)	0.01	0.01
	Methanol	2.09	2.31
	Toluene	0.80	1.11
	Xylene	0.92	1.25
	Xylene (-o)	0.17	0.24

**based on data from evaporation facilities at Wamsutter Operations Center*

Table 250. 2009 Average VOC emissions (tons/year).

Average VOC emissions per evaporation basin (tpy)	5.26
Average Evaporation Facilities per well	0.033%
Average VOC emissions per well (tpy)	0.002

Based on two existing evaporation facilities for 1500 CDC wells. Only 25% of project wells are assumed to be associated with an evaporation pond

Table 251. VOC, CO_2 and CH_4 Weight Fractions.

Component	% Wt	Average per Well Emissions (TPY)
Methane	3.90%	0.0001
Carbon Dioxide	24.76%	0.0006
VOC Fraction (weight)	69.58%	

Table 252. 2009 Evaporation Pond Emissions in tons per well.

Description	Evaporation Pond Emissions -Weighted Average(tons per well)											Projection
	NOx	VOC	CO	PM10	PM2.5	SO2	CO2	CH4	PM_filt	PM_cond	N2O	
Evaporation Ponds	0	0.0018	0	0	0	0	0.0006	0.0001	0	0	0	active well counts

Table 253. Percent Change in Emission from Base Year 2009 for Evaporation Ponds.

Year	NOx	SO2	CO	CO2	VOC	PM10	PM2.5	PM_filt	PM_cond	CH4
2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2011	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2016	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2017	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2018	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2019	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2022	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2025	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2026	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2027	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2029	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2031	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2032	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2034	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2036	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 254. New Project Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production															Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
NOx [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	95	2	364	23	73	14	2	0	0	44	0	0	2	0	28	1	0	0	0	0	0	646
	2010	0	127	2	488	28	98	17	2	0	0	102	0	0	4	0	74	2	0	0	0	0	0	945
	2011	0	126	2	485	25	97	15	2	0	0	160	0	0	6	0	114	3	0	0	0	0	0	1,037
	2012	0	124	1	476	22	96	13	2	0	0	217	0	0	8	0	148	4	0	174	25	0	0	1,310
	2013	0	126	1	485	20	97	12	2	0	0	275	0	0	9	0	181	5	0	174	25	0	0	1,414
	2014	0	125	1	481	17	97	11	2	0	0	333	0	0	10	0	211	6	0	174	25	0	0	1,492
	2015	0	129	1	496	16	100	10	2	0	0	392	0	0	10	0	241	8	0	174	25	0	0	1,603
	2016	0	101	1	388	11	78	7	2	0	0	438	0	0	10	0	263	8	0	174	25	0	0	1,505
	2017	0	133	1	509	13	102	8	2	0	0	499	0	0	10	0	292	10	0	174	25	0	0	1,776
	2018	0	146	1	560	12	112	7	2	0	0	566	0	0	10	0	333	11	0	174	25	0	0	1,960
	2019	0	117	1	451	9	90	5	2	0	0	620	0	0	10	0	359	12	0	174	25	0	0	1,875
	2020	0	117	1	451	8	91	5	2	0	0	674	0	0	10	0	384	13	0	174	25	0	0	1,953
	2021	0	133	1	509	8	102	5	2	0	0	735	0	0	10	0	409	14	0	174	25	0	0	2,126
	2022	0	126	0	483	6	97	3	2	0	0	793	0	0	9	0	440	15	0	174	25	0	0	2,172
	2023	0	42	0	162	2	33	1	1	0	0	812	0	0	10	0	442	16	0	174	25	0	0	1,720
	2024	0	0	0	0	0	0	0	0	0	0	812	0	0	10	0	424	16	0	174	25	0	0	1,460
	2025	0	0	0	0	0	0	0	0	0	0	812	0	0	8	0	412	16	0	174	25	0	0	1,447
	2026	0	0	0	0	0	0	0	0	0	0	812	0	0	8	0	404	16	0	174	25	0	0	1,438
	2027	0	0	0	0	0	0	0	0	0	0	812	0	0	7	0	397	16	0	174	25	0	0	1,431
	2028	0	0	0	0	0	0	0	0	0	0	812	0	0	7	0	391	16	0	174	25	0	0	1,424
	2029	0	0	0	0	0	0	0	0	0	0	812	0	0	7	0	386	16	0	174	25	0	0	1,419
	2030	0	0	0	0	0	0	0	0	0	0	812	0	0	6	0	381	16	0	174	25	0	0	1,414
	2031	0	0	0	0	0	0	0	0	0	0	812	0	0	6	0	377	16	0	174	25	0	0	1,410
	2032	0	0	0	0	0	0	0	0	0	0	812	0	0	6	0	373	16	0	174	25	0	0	1,406
	2033	0	0	0	0	0	0	0	0	0	0	812	0	0	6	0	370	16	0	174	25	0	0	1,402
	2034	0	0	0	0	0	0	0	0	0	0	812	0	0	6	0	367	16	0	174	25	0	0	1,399
	2035	0	0	0	0	0	0	0	0	0	0	812	0	0	6	0	364	16	0	174	25	0	0	1,396
	2036	0	0	0	0	0	0	0	0	0	0	812	0	0	6	0	361	16	0	174	25	0	0	1,393
	2037	0	0	0	0	0	0	0	0	0	0	812	0	0	6	0	358	16	0	174	25	0	0	1,390
	TOTAL	0	1,768	14	6,788	217	1,363	135	28	0	0	18,027	0	0	223	0	9,285	348	0	4,521	645	0	0	43,362

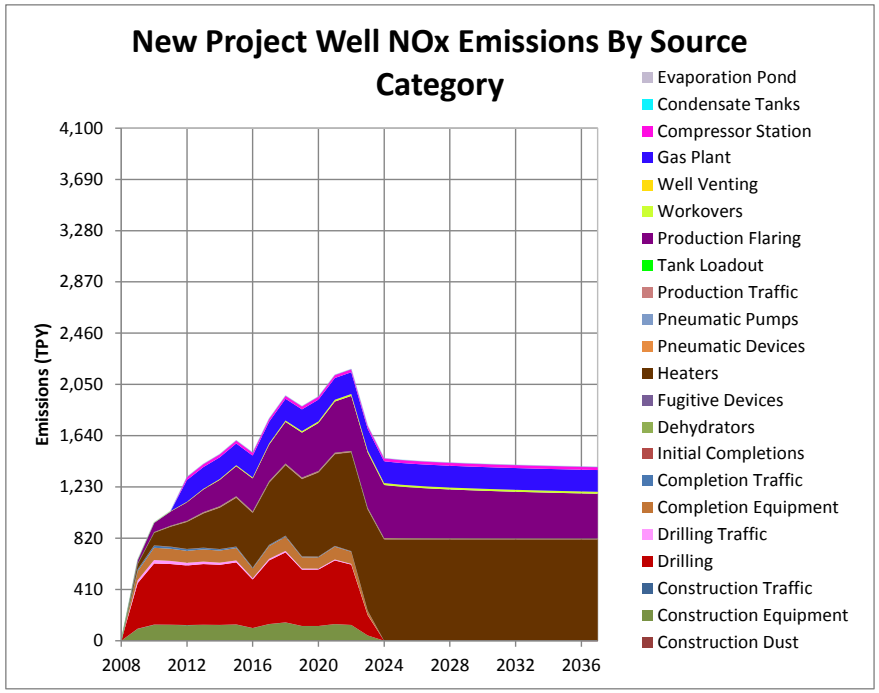

Figure 17. New Project Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 255. New Project Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
VOC [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	14	0	21	3	4	2	2	0	146	2	0	0	1	28	36	0	163	0	0	0	0	421
	2010	0	19	0	28	4	6	2	3	0	341	6	0	0	1	85	95	0	382	0	0	0	1	972
	2011	0	19	0	27	3	5	2	3	0	535	9	0	0	2	128	147	0	599	0	0	0	1	1,481
	2012	0	19	0	27	3	5	2	3	0	726	12	0	0	2	159	190	0	813	33	1	0	2	1,996
	2013	0	19	0	27	3	5	2	3	0	920	15	0	0	2	188	233	0	1,030	33	1	0	2	2,484
	2014	0	19	0	27	2	5	2	3	0	1,112	18	0	0	3	209	272	0	1,245	33	1	0	3	2,955
	2015	0	19	0	28	2	6	1	3	0	1,310	22	0	0	3	228	310	0	1,468	33	1	0	3	3,438
	2016	0	15	0	22	2	4	1	2	0	1,466	24	0	0	3	241	339	0	1,641	33	1	0	4	3,799
	2017	0	20	0	29	2	6	1	3	0	1,669	27	0	0	3	256	375	1	1,869	33	1	0	4	4,299
	2018	0	22	0	32	2	6	1	3	0	1,893	31	0	0	3	296	429	1	2,120	33	1	0	5	4,878
	2019	0	18	0	25	1	5	1	2	0	2,073	34	0	0	3	311	462	1	2,322	33	1	0	5	5,299
	2020	0	18	0	25	1	5	1	2	0	2,253	37	0	0	4	323	494	1	2,524	33	1	0	6	5,727
	2021	0	20	0	29	1	6	1	3	0	2,457	40	0	0	4	331	527	1	2,751	33	1	0	6	6,211
	2022	0	19	0	27	1	5	1	3	0	2,650	44	0	0	3	355	567	1	2,968	33	1	0	7	6,684
	2023	0	6	0	9	0	2	0	1	0	2,715	45	0	0	4	343	569	1	3,040	33	1	0	7	6,776
	2024	0	0	0	0	0	0	0	0	0	2,715	45	0	0	3	302	546	1	3,040	33	1	0	7	6,693
	2025	0	0	0	0	0	0	0	0	0	2,715	45	0	0	3	276	530	1	3,040	33	1	0	7	6,651
	2026	0	0	0	0	0	0	0	0	0	2,715	45	0	0	3	257	519	1	3,040	33	1	0	7	6,621
	2027	0	0	0	0	0	0	0	0	0	2,715	45	0	0	3	241	511	1	3,040	33	1	0	7	6,596
	2028	0	0	0	0	0	0	0	0	0	2,715	45	0	0	3	228	503	1	3,040	33	1	0	7	6,575
	2029	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	216	497	1	3,040	33	1	0	7	6,557
	2030	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	206	491	1	3,040	33	1	0	7	6,541
	2031	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	197	485	1	3,040	33	1	0	7	6,526
	2032	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	188	481	1	3,040	33	1	0	7	6,513
	2033	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	180	476	1	3,040	33	1	0	7	6,500
	2034	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	173	472	1	3,040	33	1	0	7	6,488
	2035	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	166	468	1	3,040	33	1	0	7	6,478
	2036	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	159	464	1	3,040	33	1	0	7	6,467
	2037	0	0	0	0	0	0	0	0	0	2,715	45	0	0	2	153	461	1	3,040	33	1	0	7	6,457
	TOTAL	0	264	2	382	31	77	20	36	0	60,274	991	0	0	74	6,423	11,948	20	67,497	852	32	0	158	149,082

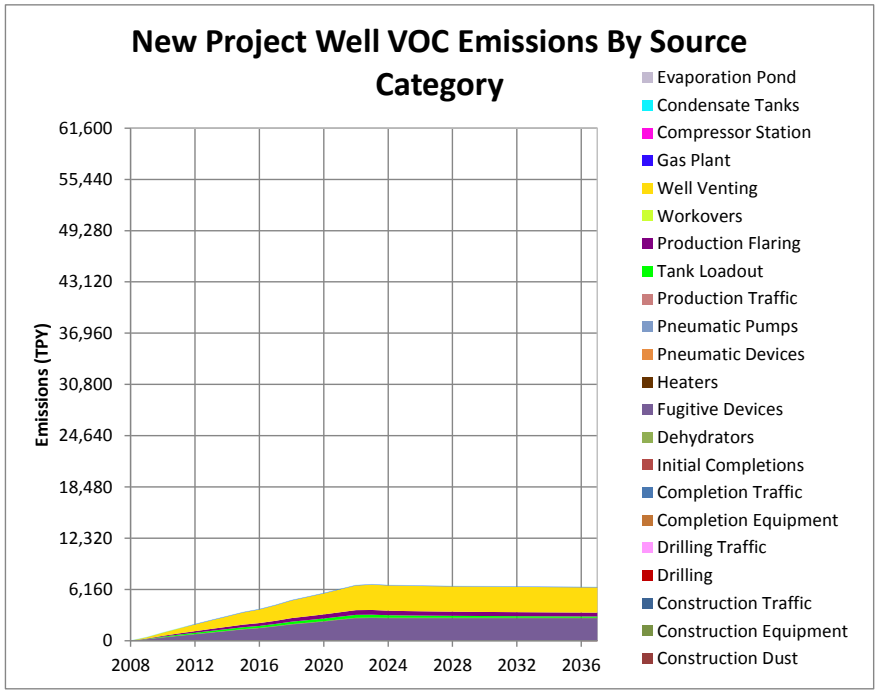

Figure 18. New Project Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 256. New Project Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
SO2 [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	2	0	8	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
	2010	0	1	0	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
	2011	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	0	4	0	19	1	4	0	0	0	0	0	0	0	1	0	0	0	0	8	0	0	0	37

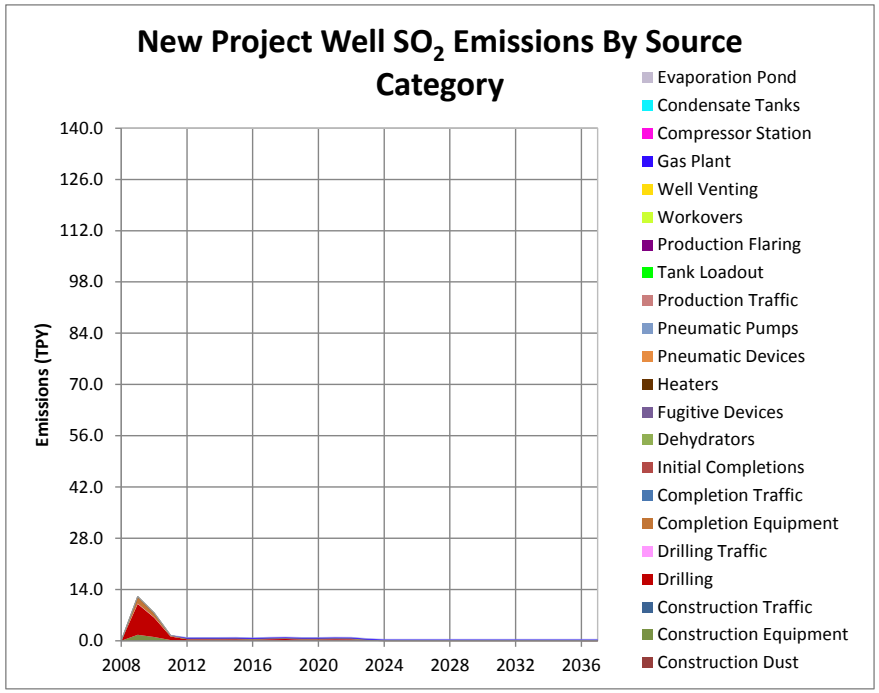

Figure 19. New Project Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 257. New Project Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
PM10 [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	63	6	10	12	140	2	89	0	0	0	3	0	0	29	0	0	0	0	0	0	0	0	355
	2010	84	8	14	16	188	3	119	0	0	0	8	0	0	68	0	0	0	0	0	0	0	0	508
	2011	83	8	14	16	187	3	118	0	0	0	12	0	0	106	0	0	0	0	0	0	0	0	548
	2012	82	7	14	16	183	3	116	0	0	0	16	0	0	144	0	0	0	0	16	3	0	0	601
	2013	83	8	14	16	186	3	118	0	0	0	21	0	0	183	0	0	0	0	16	3	0	0	652
	2014	83	8	14	16	184	3	117	0	0	0	25	0	0	221	0	0	0	0	16	3	0	0	690
	2015	85	8	14	17	190	3	120	0	0	0	30	0	0	260	0	0	0	0	16	3	0	0	747
	2016	67	6	11	13	148	3	94	0	0	0	33	0	0	291	0	0	0	0	16	3	0	0	686
	2017	87	8	15	17	195	3	123	0	0	0	38	0	0	332	0	0	0	0	16	3	0	0	837
	2018	96	9	16	19	214	4	136	0	0	0	43	0	0	376	0	0	0	0	16	3	0	0	932
	2019	77	7	13	15	172	3	109	0	0	0	47	0	0	412	0	0	0	0	16	3	0	0	875
	2020	77	7	13	15	172	3	109	0	0	0	51	0	0	447	0	0	1	0	16	3	0	0	915
	2021	87	8	14	17	195	3	123	0	0	0	56	0	0	488	0	0	1	0	16	3	0	0	1,011
	2022	83	8	14	16	184	3	117	0	0	0	60	0	0	526	0	0	1	0	16	3	0	0	1,031
	2023	28	3	5	5	62	1	39	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	763
	2024	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2025	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2026	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2027	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2028	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2029	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2030	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2031	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2032	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2033	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2034	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2035	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2036	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	2037	0	0	0	0	0	0	0	0	0	0	62	0	0	539	0	0	1	0	16	3	0	0	620
	TOTAL	1,166	107	194	228	2,602	45	1,649	0	0	0	1,370	0	0	11,964	0	0	14	0	419	72	0	0	19,828

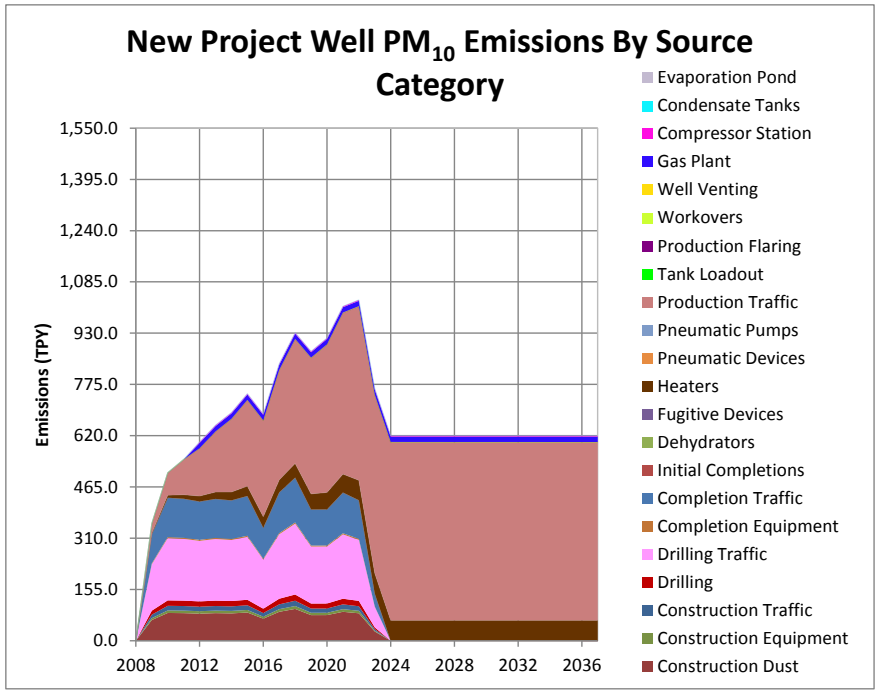

Figure 20. New Project Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 258. New Project Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
PM2.5 [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	16	6	1	12	15	2	10	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	68
	2010	22	7	1	16	20	3	13	0	0	0	8	0	0	7	0	0	0	0	0	0	0	0	97
	2011	21	7	1	16	20	3	13	0	0	0	12	0	0	11	0	0	0	0	0	0	0	0	105
	2012	21	7	1	16	19	3	12	0	0	0	16	0	0	15	0	0	0	0	16	3	0	0	130
	2013	21	7	1	16	20	3	12	0	0	0	21	0	0	19	0	0	0	0	16	3	0	0	140
	2014	21	7	1	16	19	3	12	0	0	0	25	0	0	22	0	0	0	0	16	3	0	0	147
	2015	22	8	1	16	20	3	12	0	0	0	30	0	0	26	0	0	0	0	16	3	0	0	158
	2016	17	6	1	13	15	3	10	0	0	0	33	0	0	29	0	0	0	0	16	3	0	0	146
	2017	23	8	1	17	20	3	13	0	0	0	38	0	0	33	0	0	0	0	16	3	0	0	175
	2018	25	9	2	18	22	4	14	0	0	0	43	0	0	38	0	0	0	0	16	3	0	0	192
	2019	20	7	1	15	17	3	11	0	0	0	47	0	0	41	0	0	0	0	16	3	0	0	182
	2020	20	7	1	15	17	3	11	0	0	0	51	0	0	45	0	0	0	0	16	3	0	0	190
	2021	23	8	1	17	20	3	12	0	0	0	56	0	0	49	0	0	1	0	16	3	0	0	208
	2022	21	7	1	16	19	3	12	0	0	0	60	0	0	53	0	0	1	0	16	3	0	0	211
	2023	7	2	0	5	6	1	4	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	162
	2024	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2025	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2026	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2027	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2028	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2029	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2030	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2031	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2032	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2033	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2034	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2035	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2036	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	2037	0	0	0	0	0	0	0	0	0	0	62	0	0	54	0	0	1	0	16	3	0	0	135
	TOTAL	300	104	20	221	269	44	170	0	0	0	1,370	0	0	1,196	0	0	13	0	419	72	0	0	4,198

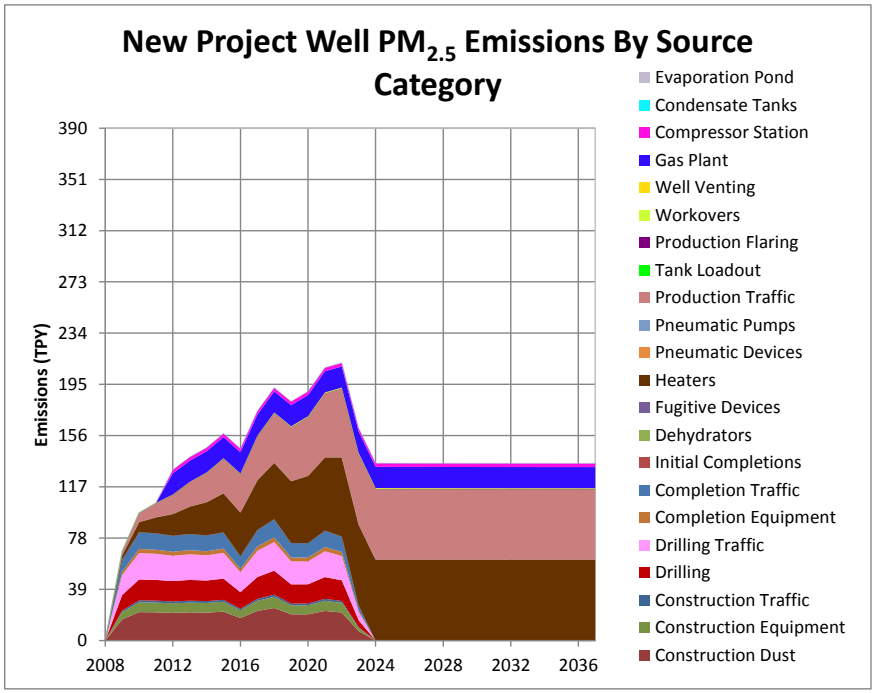

Figure 21. New Project Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 259. New Project Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	117	2	213	25	42	16	8	0	0	37	0	0	6	0	151	1	0	0	0	0	0	617
	2010	0	157	2	286	32	57	20	11	0	0	86	0	0	13	0	403	1	0	0	0	0	0	1,069
	2011	0	156	2	284	30	56	19	11	0	0	134	0	0	19	0	620	2	0	0	0	0	0	1,335
	2012	0	153	2	279	28	55	18	11	0	0	182	0	0	25	0	804	3	0	229	28	0	0	1,818
	2013	0	156	2	284	27	56	17	11	0	0	231	0	0	30	0	987	3	0	229	28	0	0	2,062
	2014	0	155	2	282	26	56	16	11	0	0	279	0	0	35	0	1,150	4	0	229	28	0	0	2,272
	2015	0	159	2	291	25	57	16	11	0	0	329	0	0	39	0	1,311	5	0	229	28	0	0	2,503
	2016	0	125	1	227	18	45	12	9	0	0	368	0	0	41	0	1,433	5	0	229	28	0	0	2,542
	2017	0	164	2	298	23	59	15	12	0	0	419	0	0	45	0	1,587	6	0	229	28	0	0	2,886
	2018	0	180	2	328	24	65	15	13	0	0	476	0	0	50	0	1,814	7	0	229	28	0	0	3,229
	2019	0	145	1	264	19	52	12	10	0	0	521	0	0	53	0	1,955	7	0	229	28	0	0	3,296
	2020	0	145	1	264	18	52	12	10	0	0	566	0	0	56	0	2,087	8	0	229	28	0	0	3,477
	2021	0	164	2	298	20	59	13	12	0	0	617	0	0	59	0	2,227	8	0	229	28	0	0	3,735
	2022	0	155	1	283	18	56	11	11	0	0	666	0	0	60	0	2,396	9	0	229	28	0	0	3,923
	2023	0	52	0	95	6	19	4	4	0	0	682	0	0	64	0	2,406	9	0	229	28	0	0	3,598
	2024	0	0	0	0	0	0	0	0	0	0	682	0	0	62	0	2,307	9	0	229	28	0	0	3,318
	2025	0	0	0	0	0	0	0	0	0	0	682	0	0	60	0	2,242	9	0	229	28	0	0	3,251
	2026	0	0	0	0	0	0	0	0	0	0	682	0	0	58	0	2,197	9	0	229	28	0	0	3,203
	2027	0	0	0	0	0	0	0	0	0	0	682	0	0	57	0	2,159	9	0	229	28	0	0	3,165
	2028	0	0	0	0	0	0	0	0	0	0	682	0	0	57	0	2,128	9	0	229	28	0	0	3,133
	2029	0	0	0	0	0	0	0	0	0	0	682	0	0	56	0	2,100	9	0	229	28	0	0	3,104
	2030	0	0	0	0	0	0	0	0	0	0	682	0	0	55	0	2,075	9	0	229	28	0	0	3,079
	2031	0	0	0	0	0	0	0	0	0	0	682	0	0	54	0	2,053	9	0	229	28	0	0	3,055
	2032	0	0	0	0	0	0	0	0	0	0	682	0	0	54	0	2,032	9	0	229	28	0	0	3,034
	2033	0	0	0	0	0	0	0	0	0	0	682	0	0	53	0	2,013	9	0	229	28	0	0	3,014
	2034	0	0	0	0	0	0	0	0	0	0	682	0	0	52	0	1,995	9	0	229	28	0	0	2,996
	2035	0	0	0	0	0	0	0	0	0	0	682	0	0	52	0	1,978	9	0	229	28	0	0	2,978
	2036	0	0	0	0	0	0	0	0	0	0	682	0	0	51	0	1,963	9	0	229	28	0	0	2,962
	2037	0	0	0	0	0	0	0	0	0	0	682	0	0	50	0	1,948	9	0	229	28	0	0	2,946
	TOTAL	0	2,181	26	3,977	340	787	216	154	0	0	15,142	0	0	1,365	0	50,521	208	0	5,945	736	0	0	81,600

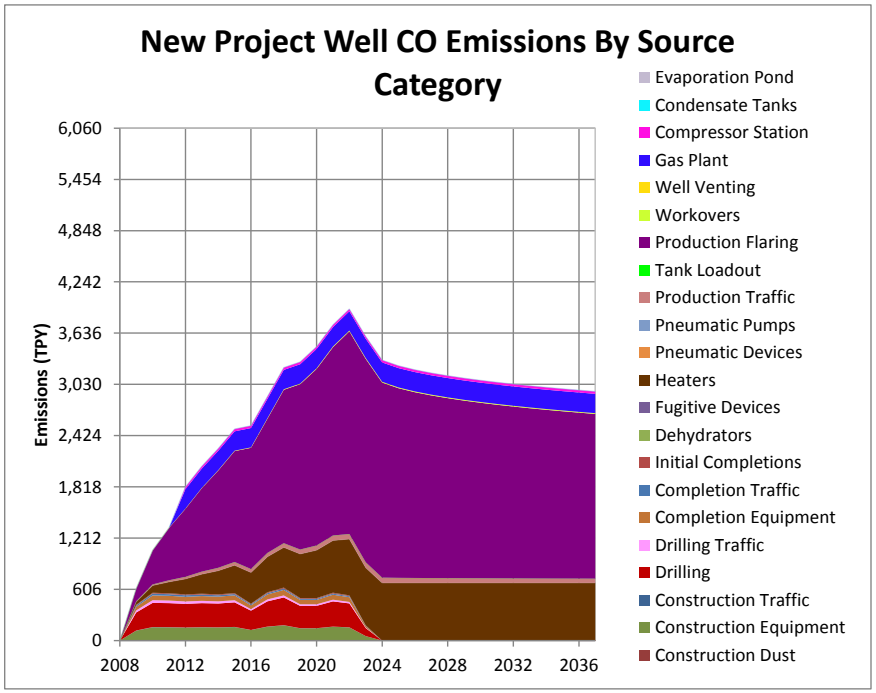

Figure 22. New Project Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 260. New Project Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
formaldehyde [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	1	0	2	0	0	0	1	0	0	0	0	0	0	0	14	0	0	0	0	0	0	19
	2010	0	2	0	2	0	0	0	1	0	0	0	0	0	0	0	38	0	0	0	0	0	0	45
	2011	0	2	0	2	0	0	0	1	0	0	1	0	0	0	0	59	0	0	0	0	0	0	65
	2012	0	2	0	2	0	0	0	1	0	0	1	0	0	0	0	76	0	0	11	1	0	0	95
	2013	0	2	0	2	0	0	0	1	0	0	1	0	0	0	0	93	0	0	11	1	0	0	113
	2014	0	2	0	2	0	0	0	1	0	0	1	0	0	0	0	109	0	0	11	1	0	0	128
	2015	0	2	0	2	0	0	0	1	0	0	2	0	0	0	0	124	0	0	11	1	0	0	144
	2016	0	1	0	2	0	0	0	1	0	0	2	0	0	0	0	136	0	0	11	1	0	0	154
	2017	0	2	0	2	0	0	0	1	0	0	2	0	0	0	0	150	0	0	11	1	0	0	171
	2018	0	2	0	3	0	1	0	1	0	0	2	0	0	0	0	172	0	0	11	1	0	0	193
	2019	0	1	0	2	0	0	0	1	0	0	3	0	0	0	0	185	0	0	11	1	0	0	205
	2020	0	1	0	2	0	0	0	1	0	0	3	0	0	0	0	197	0	0	11	1	0	0	218
	2021	0	2	0	2	0	0	0	1	0	0	3	0	0	0	0	211	0	0	11	1	0	0	232
	2022	0	2	0	2	0	0	0	1	0	0	3	0	0	0	0	227	0	0	11	1	0	0	248
	2023	0	1	0	1	0	0	0	0	0	0	4	0	0	0	0	228	0	0	11	1	0	0	245
	2024	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	218	0	0	11	1	0	0	234
	2025	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	212	0	0	11	1	0	0	228
	2026	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	208	0	0	11	1	0	0	224
	2027	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	204	0	0	11	1	0	0	220
	2028	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	201	0	0	11	1	0	0	217
	2029	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	199	0	0	11	1	0	0	215
	2030	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	196	0	0	11	1	0	0	212
	2031	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	194	0	0	11	1	0	0	210
	2032	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	192	0	0	11	1	0	0	208
	2033	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	190	0	0	11	1	0	0	206
	2034	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	189	0	0	11	1	0	0	205
	2035	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	187	0	0	11	1	0	0	203
	2036	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	186	0	0	11	1	0	0	202
	2037	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	184	0	0	11	1	0	0	200
	TOTAL	0	22	0	33	2	7	1	15	0	0	79	0	0	3	0	4,779	2	0	294	26	0	0	5,262

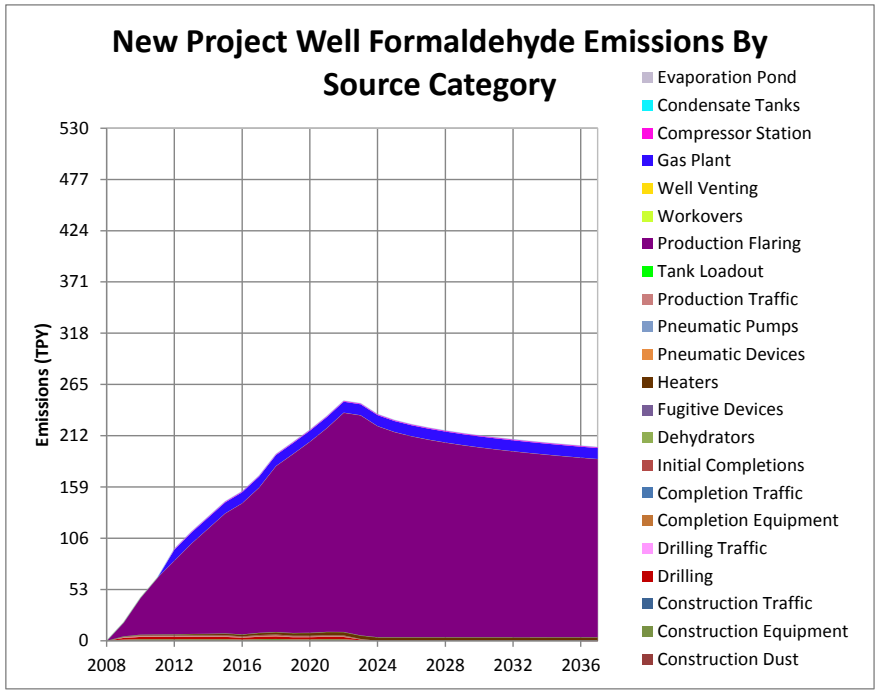

Figure 23. New Project Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 261. New Project Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
n-hexane [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	0	0	0	0	0	0	0	0	6	0	0	0	0	1	0	0	3	0	0	0	0	10
	2010	0	0	0	0	0	0	0	0	0	14	0	0	0	0	3	0	0	8	0	0	0	0	25
	2011	0	0	0	0	0	0	0	0	0	23	0	0	0	0	4	0	0	12	0	0	0	0	39
	2012	0	0	0	0	0	0	0	0	0	31	0	0	0	0	5	0	0	16	0	0	0	0	52
	2013	0	0	0	0	0	0	0	0	0	39	0	0	0	0	6	0	0	20	0	0	0	0	66
	2014	0	0	0	0	0	0	0	0	0	47	0	0	0	0	7	0	0	25	0	0	0	0	79
	2015	0	0	0	0	0	0	0	0	0	55	0	0	0	0	8	0	0	29	0	0	0	0	92
	2016	0	0	0	0	0	0	0	0	0	62	0	0	0	0	8	0	0	33	0	0	0	0	103
	2017	0	0	0	0	0	0	0	0	0	70	0	0	0	0	9	0	0	37	0	0	0	0	116
	2018	0	0	0	0	0	0	0	0	0	80	0	0	0	0	10	0	0	42	0	0	0	0	132
	2019	0	0	0	0	0	0	0	0	0	87	0	0	0	0	11	0	0	46	0	0	0	0	144
	2020	0	0	0	0	0	0	0	0	0	95	0	0	0	0	11	0	0	50	0	0	0	0	156
	2021	0	0	0	0	0	0	0	0	0	104	0	0	0	0	11	0	0	55	0	0	0	0	170
	2022	0	0	0	0	0	0	0	0	0	112	0	0	0	0	12	0	0	59	0	0	0	0	183
	2023	0	0	0	0	0	0	0	0	0	115	0	0	0	0	12	0	0	60	0	0	0	0	187
	2024	0	0	0	0	0	0	0	0	0	115	0	0	0	0	10	0	0	60	0	0	0	0	185
	2025	0	0	0	0	0	0	0	0	0	115	0	0	0	0	9	0	0	60	0	0	0	0	184
	2026	0	0	0	0	0	0	0	0	0	115	0	0	0	0	9	0	0	60	0	0	0	0	184
	2027	0	0	0	0	0	0	0	0	0	115	0	0	0	0	8	0	0	60	0	0	0	0	183
	2028	0	0	0	0	0	0	0	0	0	115	0	0	0	0	8	0	0	60	0	0	0	0	183
	2029	0	0	0	0	0	0	0	0	0	115	0	0	0	0	7	0	0	60	0	0	0	0	182
	2030	0	0	0	0	0	0	0	0	0	115	0	0	0	0	7	0	0	60	0	0	0	0	182
	2031	0	0	0	0	0	0	0	0	0	115	0	0	0	0	7	0	0	60	0	0	0	0	182
	2032	0	0	0	0	0	0	0	0	0	115	0	0	0	0	6	0	0	60	0	0	0	0	181
	2033	0	0	0	0	0	0	0	0	0	115	0	0	0	0	6	0	0	60	0	0	0	0	181
	2034	0	0	0	0	0	0	0	0	0	115	0	0	0	0	6	0	0	60	0	0	0	0	181
	2035	0	0	0	0	0	0	0	0	0	115	0	0	0	0	6	0	0	60	0	0	0	0	181
	2036	0	0	0	0	0	0	0	0	0	115	0	0	0	0	5	0	0	60	0	0	0	0	180
	2037	0	0	0	0	0	0	0	0	0	115	0	0	0	0	5	0	0	60	0	0	0	0	180
	TOTAL	0	0	0	0	0	0	0	0	0	2,542	0	0	0	1	218	0	0	1,339	2	0	0	0	4,103

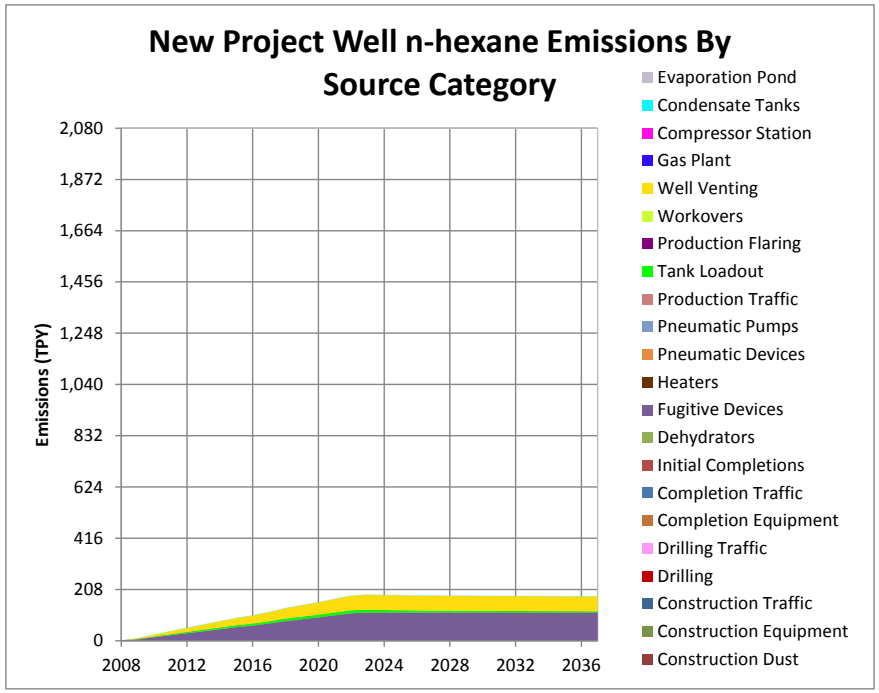

Figure 24. New Project Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 262. New Project Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
n-hexane [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	0	0	0	0	0	0	0	0	6	0	0	0	0	1	0	0	3	0	0	0	0	10
	2010	0	0	0	0	0	0	0	0	0	14	0	0	0	0	3	0	0	8	0	0	0	0	25
	2011	0	0	0	0	0	0	0	0	0	23	0	0	0	0	4	0	0	12	0	0	0	0	39
	2012	0	0	0	0	0	0	0	0	0	31	0	0	0	0	5	0	0	16	0	0	0	0	52
	2013	0	0	0	0	0	0	0	0	0	39	0	0	0	0	6	0	0	20	0	0	0	0	66
	2014	0	0	0	0	0	0	0	0	0	47	0	0	0	0	7	0	0	25	0	0	0	0	79
	2015	0	0	0	0	0	0	0	0	0	55	0	0	0	0	8	0	0	29	0	0	0	0	92
	2016	0	0	0	0	0	0	0	0	0	62	0	0	0	0	8	0	0	33	0	0	0	0	103
	2017	0	0	0	0	0	0	0	0	0	70	0	0	0	0	9	0	0	37	0	0	0	0	116
	2018	0	0	0	0	0	0	0	0	0	80	0	0	0	0	10	0	0	42	0	0	0	0	132
	2019	0	0	0	0	0	0	0	0	0	87	0	0	0	0	11	0	0	46	0	0	0	0	144
	2020	0	0	0	0	0	0	0	0	0	95	0	0	0	0	11	0	0	50	0	0	0	0	156
	2021	0	0	0	0	0	0	0	0	0	104	0	0	0	0	11	0	0	55	0	0	0	0	170
	2022	0	0	0	0	0	0	0	0	0	112	0	0	0	0	12	0	0	59	0	0	0	0	183
	2023	0	0	0	0	0	0	0	0	0	115	0	0	0	0	12	0	0	60	0	0	0	0	187
	2024	0	0	0	0	0	0	0	0	0	115	0	0	0	0	10	0	0	60	0	0	0	0	185
	2025	0	0	0	0	0	0	0	0	0	115	0	0	0	0	9	0	0	60	0	0	0	0	184
	2026	0	0	0	0	0	0	0	0	0	115	0	0	0	0	9	0	0	60	0	0	0	0	184
	2027	0	0	0	0	0	0	0	0	0	115	0	0	0	0	8	0	0	60	0	0	0	0	183
	2028	0	0	0	0	0	0	0	0	0	115	0	0	0	0	8	0	0	60	0	0	0	0	183
	2029	0	0	0	0	0	0	0	0	0	115	0	0	0	0	7	0	0	60	0	0	0	0	182
	2030	0	0	0	0	0	0	0	0	0	115	0	0	0	0	7	0	0	60	0	0	0	0	182
	2031	0	0	0	0	0	0	0	0	0	115	0	0	0	0	7	0	0	60	0	0	0	0	182
	2032	0	0	0	0	0	0	0	0	0	115	0	0	0	0	6	0	0	60	0	0	0	0	181
	2033	0	0	0	0	0	0	0	0	0	115	0	0	0	0	6	0	0	60	0	0	0	0	181
	2034	0	0	0	0	0	0	0	0	0	115	0	0	0	0	6	0	0	60	0	0	0	0	181
	2035	0	0	0	0	0	0	0	0	0	115	0	0	0	0	6	0	0	60	0	0	0	0	181
	2036	0	0	0	0	0	0	0	0	0	115	0	0	0	0	5	0	0	60	0	0	0	0	180
	2037	0	0	0	0	0	0	0	0	0	115	0	0	0	0	5	0	0	60	0	0	0	0	180
	TOTAL	0	0	0	0	0	0	0	0	0	2,542	0	0	0	1	218	0	0	1,339	2	0	0	0	4,103

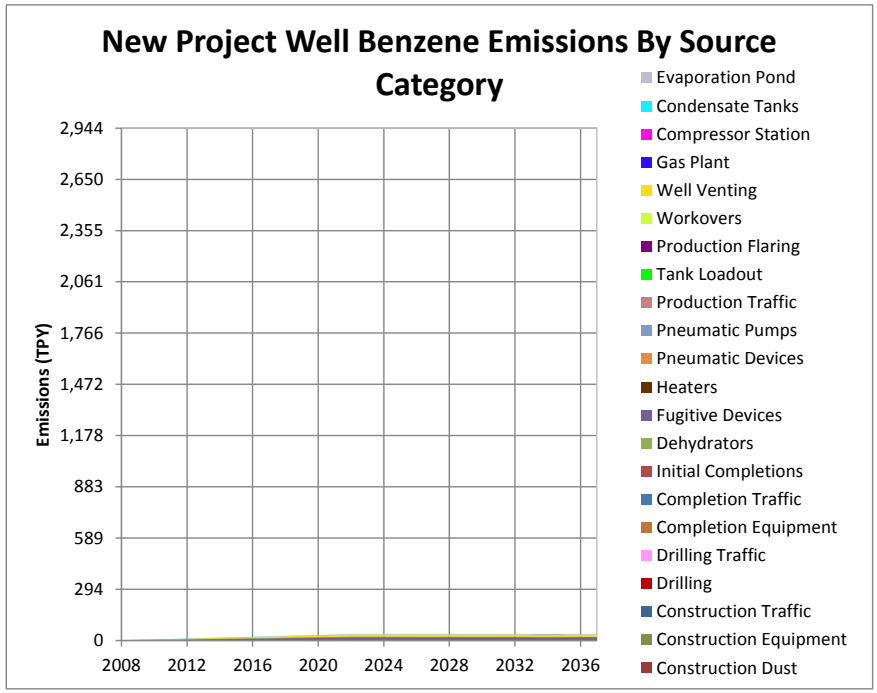

Figure 25. New Project Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 263. New Project Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
ethylbenzene [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	TOTAL	0	0	0	1	0	0	0	0	0	10	0	0	0	1	1	0	0	13	0	0	0	2	28

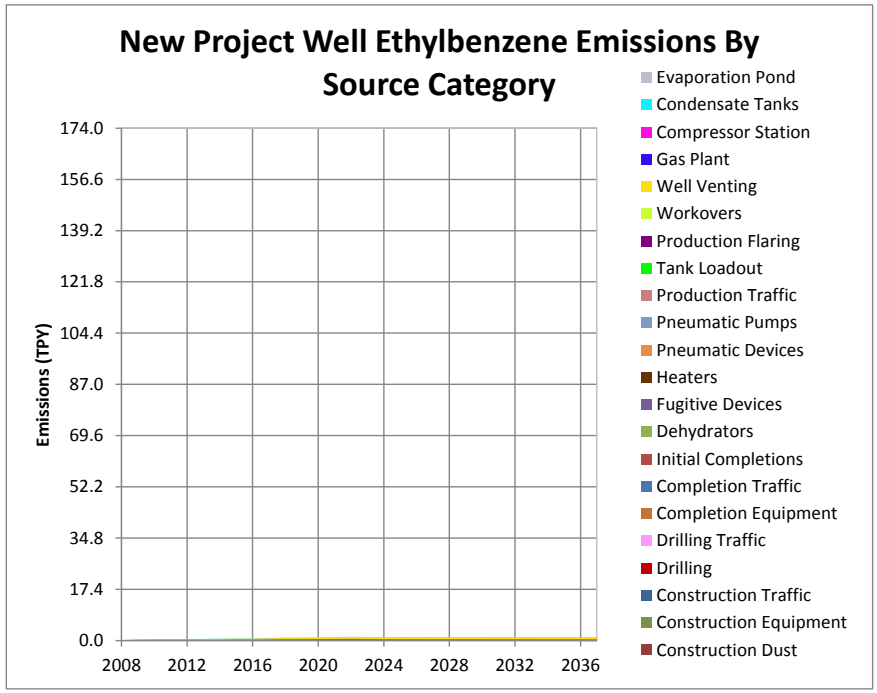

Figure 26. New Project Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 264. New Project Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

Pollutant	Year	Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
		Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
toluene [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	3
	2010	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	2	0	0	0	0	7
	2011	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	0	3	0	0	0	0	11
	2012	0	0	0	0	0	0	0	0	0	7	0	0	0	0	1	0	0	5	0	0	0	0	15
	2013	0	0	0	0	0	0	0	0	0	9	0	0	0	0	1	0	0	6	0	0	0	0	18
	2014	0	0	0	0	0	0	0	0	0	11	0	0	0	0	1	0	0	7	0	0	0	1	21
	2015	0	0	0	0	0	0	0	0	0	13	0	0	0	0	1	0	0	8	0	0	0	1	25
	2016	0	0	0	0	0	0	0	0	0	14	0	0	0	0	2	0	0	9	0	0	0	1	27
	2017	0	0	0	0	0	0	0	0	0	16	1	0	0	0	2	0	0	11	0	0	0	1	31
	2018	0	0	0	0	0	0	0	0	0	18	1	0	0	0	2	0	0	12	0	0	0	1	35
	2019	0	0	0	0	0	0	0	0	0	20	1	0	0	0	2	0	0	13	0	0	0	1	38
	2020	0	0	0	0	0	0	0	0	0	22	1	0	0	0	2	0	0	14	0	0	0	1	41
	2021	0	0	0	0	0	0	0	0	0	24	1	0	0	0	2	0	0	16	0	0	0	1	45
	2022	0	0	0	0	0	0	0	0	0	26	1	0	0	0	2	0	0	17	0	0	0	1	48
	2023	0	0	0	0	0	0	0	0	0	26	1	0	0	0	2	0	0	17	0	0	0	1	49
	2024	0	0	0	0	0	0	0	0	0	26	1	0	0	0	2	0	0	17	0	0	0	1	48
	2025	0	0	0	0	0	0	0	0	0	26	1	0	0	0	2	0	0	17	0	0	0	1	48
	2026	0	0	0	0	0	0	0	0	0	26	1	0	0	0	2	0	0	17	0	0	0	1	48
	2027	0	0	0	0	0	0	0	0	0	26	1	0	0	0	2	0	0	17	0	0	0	1	48
	2028	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	48
	2029	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	48
	2030	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	48
	2031	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	47
	2032	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	47
	2033	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	47
	2034	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	47
	2035	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	47
	2036	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	47
	2037	0	0	0	0	0	0	0	0	0	26	1	0	0	0	1	0	0	17	0	0	0	1	47
	TOTAL	0	4	0	6	1	1	1	0	0	585	20	0	0	6	40	0	0	384	5	0	0	29	1,082

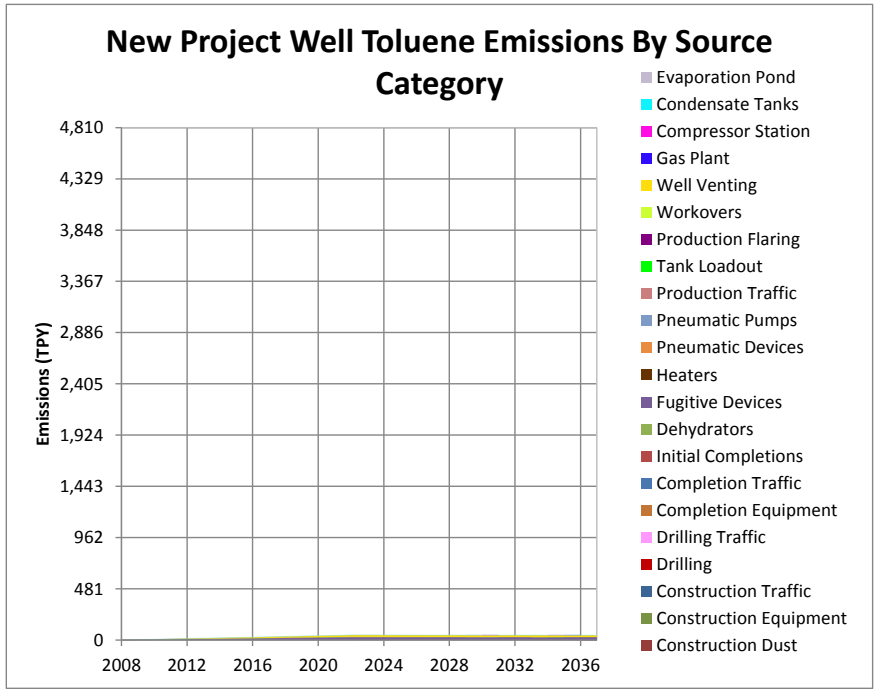

Figure 27. New Project Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 265. New Project Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
xylenes [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
	2010	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	4
	2011	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	5
	2012	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	1	0	0	0	0	7
	2013	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	0	2	0	0	0	1	9
	2014	0	0	0	0	0	0	0	0	0	6	0	0	0	0	1	0	0	2	0	0	0	1	10
	2015	0	0	0	0	0	0	0	0	0	7	0	0	0	0	1	0	0	3	0	0	0	1	12
	2016	0	0	0	0	0	0	0	0	0	8	0	0	0	0	1	0	0	3	0	0	0	1	13
	2017	0	0	0	0	0	0	0	0	0	9	0	0	0	0	1	0	0	3	0	0	0	1	15
	2018	0	0	0	0	0	0	0	0	0	10	0	0	0	0	1	0	0	4	0	0	0	1	17
	2019	0	0	0	0	0	0	0	0	0	11	0	0	0	0	1	0	0	4	0	0	0	1	18
	2020	0	0	0	0	0	0	0	0	0	12	0	0	0	0	1	0	0	4	0	0	0	1	20
	2021	0	0	0	0	0	0	0	0	0	13	0	0	0	0	1	0	0	5	0	0	0	2	21
	2022	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	23
	2023	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	23
	2024	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	23
	2025	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	23
	2026	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2027	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2028	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2029	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2030	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2031	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2032	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2033	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2034	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2035	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2036	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	2037	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	5	0	0	0	2	22
	TOTAL	0	3	0	5	1	1	0	0	0	318	0	0	0	3	22	0	0	120	0	0	0	39	512

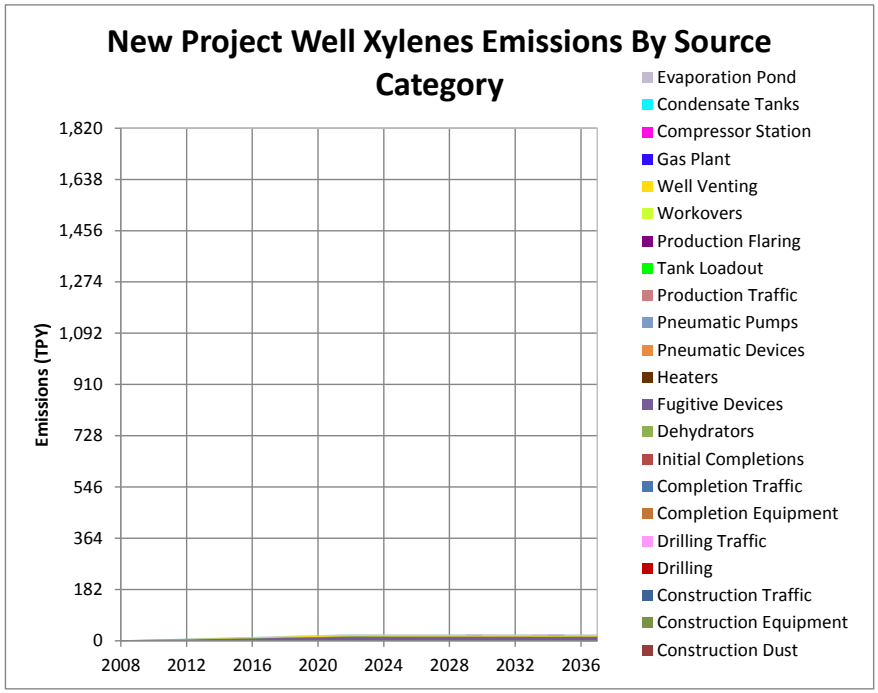

Figure 28. New Project Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 266. New Project Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2 [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	7,485	212	38,728	3,129	8,534	1,946	2,631	0	24	52,258	0	0	352	0	51,634	98	70	0	0	0	0	167,101
	2010	0	10,042	284	51,960	4,196	11,450	2,609	3,530	0	55	122,372	0	0	823	0	138,992	229	163	0	0	0	0	346,707
	2011	0	9,980	282	51,637	4,166	11,379	2,590	3,508	0	87	192,049	0	0	1,286	0	213,265	360	256	0	0	0	0	490,846
	2012	0	9,793	276	50,669	4,082	11,166	2,538	3,442	0	118	260,421	0	0	1,735	0	275,918	488	347	273,000	43,635	0	1	937,628
	2013	0	9,980	280	51,637	4,153	11,379	2,582	3,508	0	150	330,098	0	0	2,184	0	337,636	618	440	273,000	43,635	0	1	1,071,283
	2014	0	9,886	277	51,153	4,108	11,272	2,554	3,475	0	181	399,123	0	0	2,622	0	392,326	747	532	273,000	43,635	0	1	1,194,894
	2015	0	10,198	285	52,767	4,230	11,628	2,629	3,585	0	213	470,325	0	0	3,066	0	446,131	880	627	273,000	43,635	0	1	1,323,200
	2016	0	7,968	222	41,229	3,299	9,085	2,050	2,801	0	238	525,958	0	0	3,401	0	486,653	985	701	273,000	43,635	0	1	1,401,228
	2017	0	10,463	291	54,139	4,324	11,930	2,687	3,678	0	271	599,011	0	0	3,842	0	537,422	1,121	799	273,000	43,635	0	2	1,546,615
	2018	0	11,508	319	59,544	4,747	13,121	2,949	4,045	0	308	679,358	0	0	4,323	0	614,703	1,272	906	273,000	43,635	0	2	1,713,741
	2019	0	9,263	257	47,926	3,815	10,561	2,370	3,256	0	337	744,028	0	0	4,702	0	661,763	1,393	992	273,000	43,635	0	2	1,807,298
	2020	0	9,271	256	47,966	3,812	10,570	2,368	3,259	0	366	808,752	0	0	5,075	0	705,231	1,514	1,078	273,000	43,635	0	2	1,916,156
	2021	0	10,463	289	54,139	4,297	11,930	2,669	3,678	0	399	881,804	0	0	5,499	0	750,745	1,651	1,176	273,000	43,635	0	2	2,045,376
	2022	0	9,925	272	51,355	4,061	11,317	2,522	3,489	0	431	951,101	0	0	5,836	0	807,749	1,781	1,268	273,000	43,635	0	2	2,167,744
	2023	0	3,329	92	17,226	1,365	3,796	848	1,170	0	441	974,345	0	0	6,040	0	809,259	1,824	1,299	273,000	43,635	0	3	2,137,672
	2024	0	0	0	0	0	0	0	0	0	441	974,345	0	0	6,009	0	772,764	1,824	1,299	273,000	43,635	0	3	2,073,320
	2025	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,952	0	748,933	1,824	1,299	273,000	43,635	0	3	2,049,432
	2026	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,927	0	731,985	1,824	1,299	273,000	43,635	0	3	2,032,459
	2027	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,906	0	718,260	1,824	1,299	273,000	43,635	0	3	2,018,713
	2028	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,887	0	706,540	1,824	1,299	273,000	43,635	0	3	2,006,974
	2029	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,870	0	696,268	1,824	1,299	273,000	43,635	0	3	1,996,685
	2030	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,855	0	687,074	1,824	1,299	273,000	43,635	0	3	1,987,476
	2031	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,841	0	678,764	1,824	1,299	273,000	43,635	0	3	1,979,153
	2032	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,828	0	671,126	1,824	1,299	273,000	43,635	0	3	1,971,501
	2033	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,816	0	664,079	1,824	1,299	273,000	43,635	0	3	1,964,442
	2034	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,806	0	657,518	1,824	1,299	273,000	43,635	0	3	1,957,870
	2035	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,797	0	651,333	1,824	1,299	273,000	43,635	0	3	1,951,677
	2036	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,789	0	645,485	1,824	1,299	273,000	43,635	0	3	1,945,821
	2037	0	0	0	0	0	0	0	0	0	441	974,345	0	0	5,781	0	639,947	1,824	1,299	273,000	43,635	0	3	1,940,275
	TOTAL	0	139,557	3,894	722,077	57,785	159,120	35,912	49,053	0	9,800	21,631,836	0	0	132,850	0	16,899,500	40,496	28,844	7,098,005	1,134,503	0	56	48,143,288

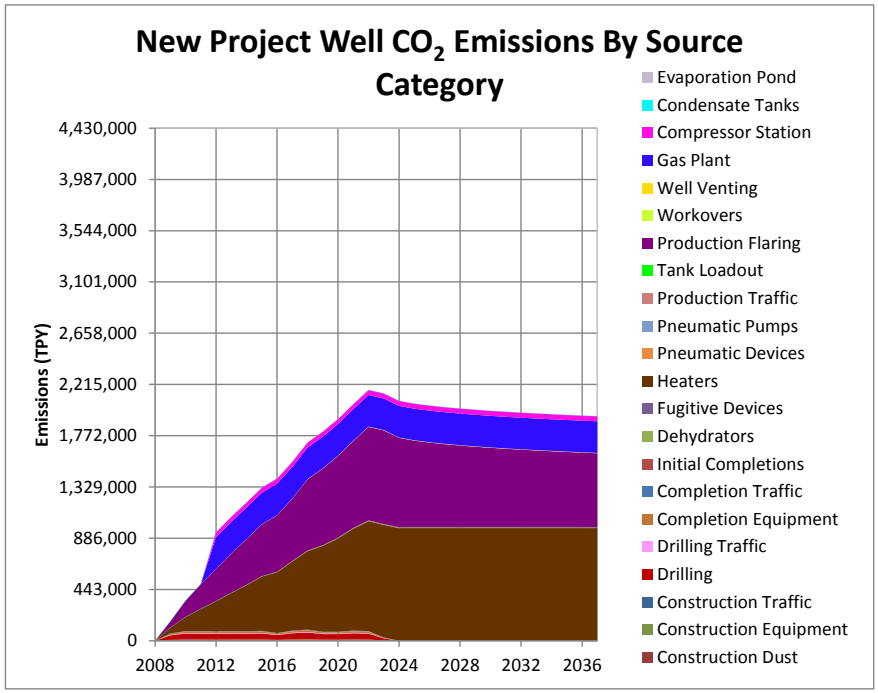

Figure 29. New Project Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 267. New Project Wells CO_2e - from CH4 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-from CH4 [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	5	0	7	3	1	2	16	0	5,055	21	0	0	1	186	301	0	16,585	0	0	0	0	22,182
	2010	0	6	0	9	4	2	2	22	0	11,837	49	0	0	1	572	801	0	38,836	0	0	0	1	52,142
	2011	0	6	0	9	4	2	3	22	0	18,577	77	0	0	2	860	1,231	0	60,948	0	0	0	2	81,743
	2012	0	6	0	9	4	2	3	21	0	25,190	105	0	0	3	1,067	1,598	0	82,647	866	95	0	2	111,617
	2013	0	6	0	9	4	2	3	22	0	31,930	133	0	0	3	1,261	1,960	0	104,759	866	95	0	3	141,056
	2014	0	6	0	9	4	2	3	22	0	38,606	161	0	0	4	1,404	2,285	0	126,665	866	95	0	3	170,135
	2015	0	6	0	9	5	2	3	22	0	45,494	189	0	0	5	1,533	2,605	0	149,261	866	95	0	4	200,099
	2016	0	5	0	7	4	1	2	17	0	50,875	212	0	0	5	1,621	2,847	0	166,917	866	95	0	5	223,480
	2017	0	6	0	9	5	2	3	23	0	57,941	241	0	0	6	1,720	3,152	0	190,101	866	95	0	5	254,176
	2018	0	7	0	10	5	2	3	25	0	65,713	273	0	0	6	1,990	3,603	0	215,600	866	95	0	6	288,205
	2019	0	6	0	8	4	2	3	20	0	71,968	299	0	0	7	2,093	3,884	0	236,123	866	95	0	6	315,385
	2020	0	6	0	8	4	2	3	20	0	78,229	326	0	0	7	2,168	4,146	0	256,664	866	95	0	7	342,552
	2021	0	6	0	9	5	2	3	23	0	85,295	355	0	0	8	2,227	4,423	0	279,848	866	95	0	8	373,173
	2022	0	6	0	9	4	2	3	22	0	91,998	383	0	0	8	2,387	4,760	0	301,840	866	95	0	8	402,391
	2023	0	2	0	3	1	1	1	7	0	94,247	392	0	0	9	2,307	4,779	0	309,216	866	95	0	8	411,935
	2024	0	0	0	0	0	0	0	0	0	94,247	392	0	0	9	2,032	4,582	0	309,216	866	95	0	8	411,448
	2025	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,852	4,454	0	309,216	866	95	0	8	411,140
	2026	0	0	0	0	0	0	0	0	0	94,247	392	0	0	9	1,724	4,363	0	309,216	866	95	0	8	410,921
	2027	0	0	0	0	0	0	0	0	0	94,247	392	0	0	9	1,621	4,290	0	309,216	866	95	0	8	410,744
	2028	0	0	0	0	0	0	0	0	0	94,247	392	0	0	9	1,532	4,227	0	309,216	866	95	0	8	410,593
	2029	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,455	4,172	0	309,216	866	95	0	8	410,460
	2030	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,385	4,122	0	309,216	866	95	0	8	410,341
	2031	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,323	4,078	0	309,216	866	95	0	8	410,234
	2032	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,265	4,036	0	309,216	866	95	0	8	410,135
	2033	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,212	3,999	0	309,216	866	95	0	8	410,044
	2034	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,162	3,963	0	309,216	866	95	0	8	409,959
	2035	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,116	3,930	0	309,216	866	95	0	8	409,879
	2036	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,071	3,899	0	309,216	866	95	0	8	409,803
	2037	0	0	0	0	0	0	0	0	0	94,247	392	0	0	8	1,030	3,869	0	309,216	866	95	0	8	409,732
	TOTAL	0	84	4	122	60	24	38	306	0	2,092,410	8,707	0	0	191	43,175	100,360	6	6,865,040	22,518	2,475	0	186	9,135,705

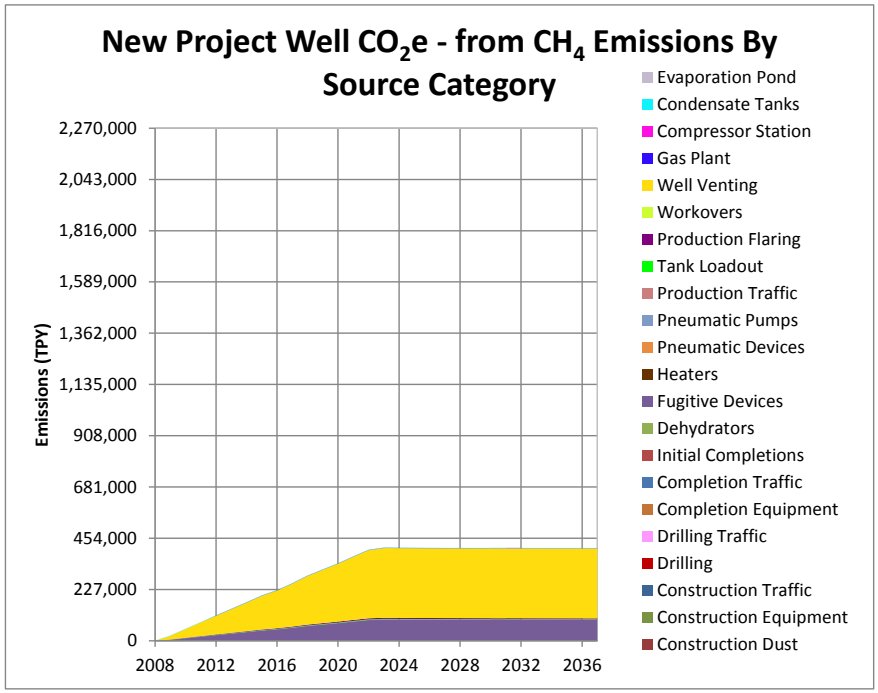

Figure 30. New Project Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 268. New Project Wells CO_2e - from N_2O Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-from N2O [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	59	1	305	19	67	12	9	0	0	297	0	0	4	0	123	1	0	0	0	0	0	897
	2010	0	79	2	409	23	90	15	12	0	0	695	0	0	10	0	316	2	0	0	0	0	0	1,653
	2011	0	79	2	406	22	90	14	12	0	0	1,091	0	0	14	0	488	3	0	0	0	0	0	2,220
	2012	0	77	1	399	20	88	13	11	0	0	1,480	0	0	17	0	641	4	0	1,911	359	0	0	5,022
	2013	0	79	1	406	19	90	12	12	0	0	1,876	0	0	20	0	794	5	0	1,911	359	0	0	5,584
	2014	0	78	1	403	17	89	11	12	0	0	2,268	0	0	22	0	936	6	0	1,911	359	0	0	6,113
	2015	0	81	1	415	16	91	10	12	0	0	2,673	0	0	24	0	1,077	7	0	1,911	359	0	0	6,679
	2016	0	63	1	324	12	71	8	9	0	0	2,989	0	0	25	0	1,186	8	0	1,911	359	0	0	6,967
	2017	0	83	1	426	15	94	9	12	0	0	3,404	0	0	26	0	1,324	9	0	1,911	359	0	0	7,674
	2018	0	91	1	469	15	103	10	13	0	0	3,861	0	0	28	0	1,510	10	0	1,911	359	0	0	8,381
	2019	0	73	1	377	11	83	7	11	0	0	4,229	0	0	28	0	1,636	11	0	1,911	359	0	0	8,738
	2020	0	73	1	377	11	83	7	11	0	0	4,596	0	0	29	0	1,756	12	0	1,911	359	0	0	9,227
	2021	0	83	1	426	11	94	7	12	0	0	5,012	0	0	29	0	1,887	13	0	1,911	359	0	0	9,845
	2022	0	78	1	404	9	89	6	12	0	0	5,405	0	0	26	0	2,032	14	0	1,911	359	0	0	10,347
	2023	0	26	0	136	3	30	2	4	0	0	5,538	0	0	30	0	2,054	14	0	1,911	359	0	0	10,107
	2024	0	0	0	0	0	0	0	0	0	0	5,538	0	0	28	0	1,997	14	0	1,911	359	0	0	9,848
	2025	0	0	0	0	0	0	0	0	0	0	5,538	0	0	25	0	1,960	14	0	1,911	359	0	0	9,808
	2026	0	0	0	0	0	0	0	0	0	0	5,538	0	0	24	0	1,934	14	0	1,911	359	0	0	9,780
	2027	0	0	0	0	0	0	0	0	0	0	5,538	0	0	23	0	1,913	14	0	1,911	359	0	0	9,758
	2028	0	0	0	0	0	0	0	0	0	0	5,538	0	0	22	0	1,894	14	0	1,911	359	0	0	9,738
	2029	0	0	0	0	0	0	0	0	0	0	5,538	0	0	21	0	1,879	14	0	1,911	359	0	0	9,722
	2030	0	0	0	0	0	0	0	0	0	0	5,538	0	0	20	0	1,864	14	0	1,911	359	0	0	9,707
	2031	0	0	0	0	0	0	0	0	0	0	5,538	0	0	19	0	1,851	14	0	1,911	359	0	0	9,693
	2032	0	0	0	0	0	0	0	0	0	0	5,538	0	0	19	0	1,840	14	0	1,911	359	0	0	9,681
	2033	0	0	0	0	0	0	0	0	0	0	5,538	0	0	18	0	1,829	14	0	1,911	359	0	0	9,669
	2034	0	0	0	0	0	0	0	0	0	0	5,538	0	0	18	0	1,818	14	0	1,911	359	0	0	9,659
	2035	0	0	0	0	0	0	0	0	0	0	5,538	0	0	18	0	1,809	14	0	1,911	359	0	0	9,649
	2036	0	0	0	0	0	0	0	0	0	0	5,538	0	0	18	0	1,800	14	0	1,911	359	0	0	9,640
	2037	0	0	0	0	0	0	0	0	0	0	5,538	0	0	17	0	1,791	14	0	1,911	359	0	0	9,631
	TOTAL	0	1,103	17	5,682	223	1,252	142	163	0	0	122,941	0	0	621	0	43,940	319	0	49,687	9,347	0	0	235,435

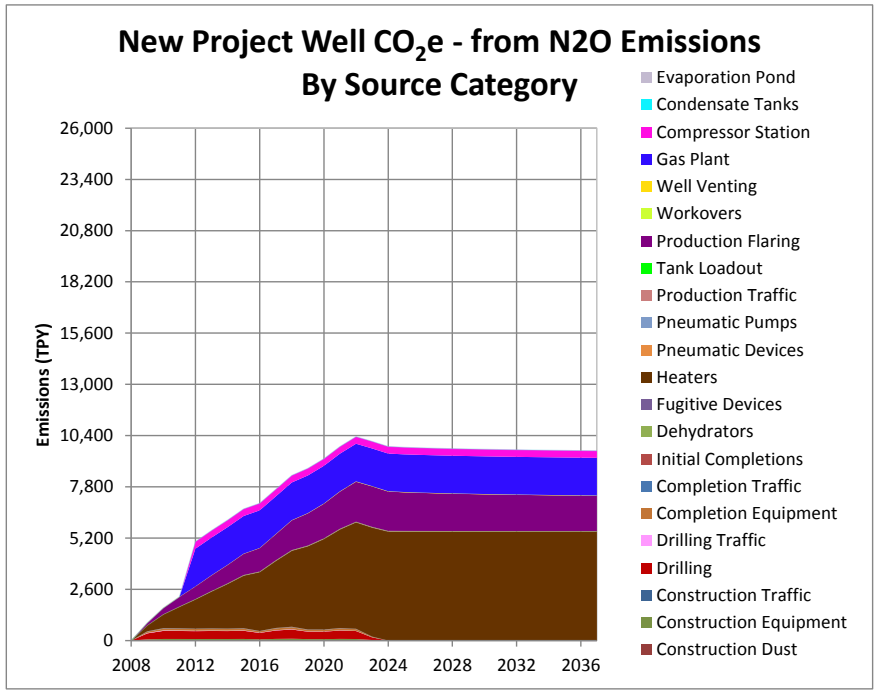

Figure 31. New Project Wells CO_2e - from N_2O Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 269. New Project Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-total [tpy]	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	7,549	213	39,039	3,151	8,603	1,960	2,656	0	5,079	52,576	0	0	357	186	52,057	99	16,654	0	0	0	1	190,179
	2010	0	10,128	286	52,378	4,223	11,542	2,627	3,564	0	11,892	123,116	0	0	834	572	140,109	231	38,999	0	0	0	1	400,502
	2011	0	10,065	284	52,052	4,191	11,470	2,607	3,541	0	18,664	193,218	0	0	1,302	860	214,985	362	61,204	0	0	0	2	574,809
	2012	0	9,876	278	51,076	4,106	11,255	2,553	3,475	0	25,308	262,005	0	0	1,755	1,067	278,158	491	82,994	275,777	44,089	0	3	1,054,268
	2013	0	10,065	282	52,052	4,176	11,470	2,597	3,541	0	32,079	332,107	0	0	2,207	1,261	340,391	623	105,200	275,777	44,089	0	4	1,217,923
	2014	0	9,971	279	51,564	4,130	11,363	2,567	3,508	0	38,787	401,552	0	0	2,649	1,404	395,546	753	127,197	275,777	44,089	0	4	1,371,142
	2015	0	10,285	287	53,191	4,251	11,721	2,642	3,619	0	45,707	473,187	0	0	3,095	1,533	449,813	888	149,889	275,777	44,089	0	5	1,529,978
	2016	0	8,036	223	41,561	3,314	9,158	2,060	2,828	0	51,113	529,159	0	0	3,431	1,621	490,686	993	167,618	275,777	44,089	0	6	1,631,675
	2017	0	10,552	293	54,574	4,343	12,026	2,699	3,713	0	58,213	602,656	0	0	3,874	1,720	541,899	1,130	190,900	275,777	44,089	0	7	1,808,465
	2018	0	11,606	321	60,023	4,767	13,227	2,962	4,084	0	66,021	683,492	0	0	4,357	1,990	619,816	1,282	216,506	275,777	44,089	0	8	2,010,328
	2019	0	9,342	258	48,311	3,830	10,646	2,380	3,287	0	72,306	748,556	0	0	4,737	2,093	667,283	1,404	237,115	275,777	44,089	0	8	2,131,421
	2020	0	9,349	257	48,352	3,827	10,655	2,377	3,290	0	78,596	813,674	0	0	5,111	2,168	711,134	1,526	257,742	275,777	44,089	0	9	2,267,934
	2021	0	10,552	290	54,574	4,313	12,026	2,679	3,713	0	85,695	887,171	0	0	5,536	2,227	757,055	1,664	281,024	275,777	44,089	0	10	2,428,395
	2022	0	10,010	273	51,768	4,075	11,408	2,530	3,522	0	92,429	956,889	0	0	5,870	2,387	814,541	1,795	303,108	275,777	44,089	0	11	2,580,482
	2023	0	3,358	92	17,364	1,370	3,826	851	1,181	0	94,688	980,275	0	0	6,078	2,307	816,091	1,839	310,516	275,777	44,089	0	11	2,559,715
	2024	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	6,045	2,032	779,344	1,839	310,516	275,777	44,089	0	11	2,494,616
	2025	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,986	1,852	755,347	1,839	310,516	275,777	44,089	0	11	2,470,380
	2026	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,959	1,724	738,282	1,839	310,516	275,777	44,089	0	11	2,453,160
	2027	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,938	1,621	724,462	1,839	310,516	275,777	44,089	0	11	2,439,215
	2028	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,917	1,532	712,661	1,839	310,516	275,777	44,089	0	11	2,427,305
	2029	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,899	1,455	702,318	1,839	310,516	275,777	44,089	0	11	2,416,867
	2030	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,883	1,385	693,060	1,839	310,516	275,777	44,089	0	11	2,407,523
	2031	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,868	1,323	684,693	1,839	310,516	275,777	44,089	0	11	2,399,079
	2032	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,855	1,265	677,002	1,839	310,516	275,777	44,089	0	11	2,391,317
	2033	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,843	1,212	669,906	1,839	310,516	275,777	44,089	0	11	2,384,156
	2034	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,832	1,162	663,299	1,839	310,516	275,777	44,089	0	11	2,377,488
	2035	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,823	1,116	657,072	1,839	310,516	275,777	44,089	0	11	2,371,205
	2036	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,814	1,071	651,183	1,839	310,516	275,777	44,089	0	11	2,365,264
	2037	0	0	0	0	0	0	0	0	0	94,688	980,275	0	0	5,806	1,030	645,607	1,839	310,516	275,777	44,089	0	11	2,359,638
	TOTAL	0	140,744	3,915	727,881	58,068	160,397	36,091	49,521	0	2,102,209	21,763,483	0	0	133,662	43,175	17,043,799	40,821	6,893,884	7,170,211	1,146,325	0	242	57,514,428

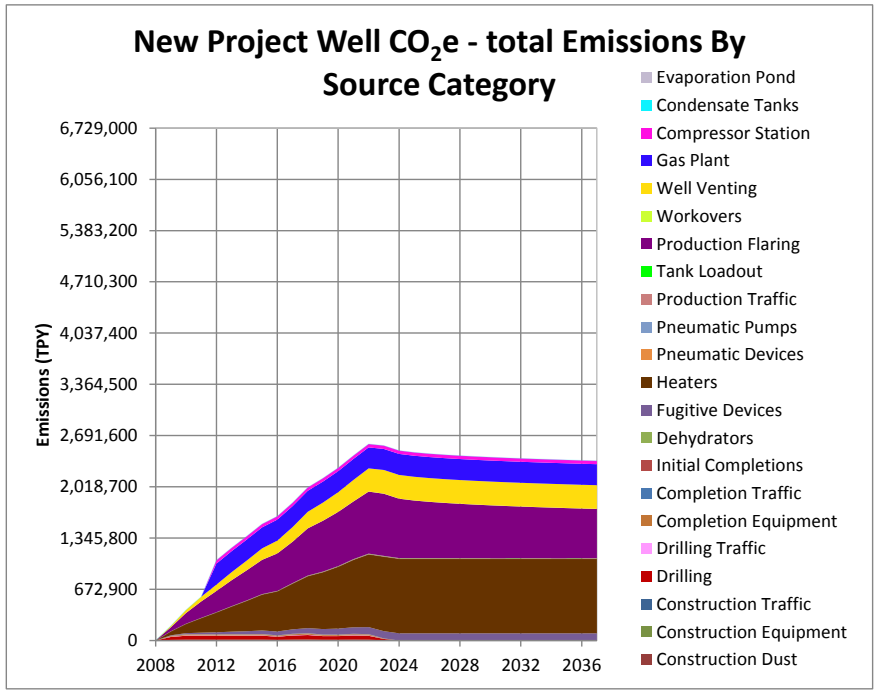

Figure 32. New Project Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.

Total Project Emissions Summary

Table 270. Total New and Existing Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
NOx [tpy]	2008	0	293	5	1,166	52	169	32	0	0	0	570	0	0	29	0	62	20	0	568	621	0	0	3,587
	2009	0	95	2	364	23	73	14	2	0	0	607	0	0	30	0	86	21	0	568	621	0	0	2,505
	2010	0	127	2	488	28	98	17	2	0	0	660	0	0	32	0	125	22	0	568	621	0	0	2,791
	2011	0	126	2	485	25	97	15	2	0	0	712	0	0	34	0	161	23	0	568	621	0	0	2,872
	2012	0	124	1	476	22	96	13	2	0	0	764	0	0	35	0	194	24	0	742	645	0	0	3,138
	2013	0	126	1	485	20	97	12	2	0	0	816	0	0	36	0	227	24	0	742	645	0	0	3,236
	2014	0	125	1	481	17	97	11	2	0	0	869	0	0	36	0	255	25	0	742	645	0	0	3,306
	2015	0	129	1	496	16	100	10	2	0	0	923	0	0	37	0	283	26	0	742	645	0	0	3,409
	2016	0	101	1	388	11	78	7	2	0	0	964	0	0	36	0	303	27	0	742	645	0	0	3,303
	2017	0	133	1	509	13	102	8	2	0	0	1,019	0	0	36	0	330	28	0	742	645	0	0	3,567
	2018	0	146	1	560	12	112	7	2	0	0	1,081	0	0	36	0	370	29	0	742	645	0	0	3,744
	2019	0	117	1	451	9	90	5	2	0	0	1,129	0	0	36	0	395	30	0	742	645	0	0	3,652
	2020	0	117	1	451	8	91	5	2	0	0	1,178	0	0	35	0	418	31	0	742	645	0	0	3,723
	2021	0	133	1	509	8	102	5	2	0	0	1,234	0	0	35	0	442	32	0	742	645	0	0	3,890
	2022	0	126	0	483	6	97	3	2	0	0	1,287	0	0	33	0	472	33	0	742	645	0	0	3,929
	2023	0	42	0	162	2	33	1	1	0	0	1,302	0	0	34	0	473	33	0	742	645	0	0	3,470
	2024	0	0	0	0	0	0	0	0	0	0	1,297	0	0	33	0	454	33	0	742	645	0	0	3,204
	2025	0	0	0	0	0	0	0	0	0	0	1,292	0	0	32	0	441	33	0	742	645	0	0	3,185
	2026	0	0	0	0	0	0	0	0	0	0	1,287	0	0	31	0	432	32	0	742	645	0	0	3,170
	2027	0	0	0	0	0	0	0	0	0	0	1,282	0	0	31	0	424	32	0	742	645	0	0	3,156
	2028	0	0	0	0	0	0	0	0	0	0	1,273	0	0	30	0	418	32	0	742	645	0	0	3,139
	2029	0	0	0	0	0	0	0	0	0	0	1,268	0	0	29	0	412	32	0	742	645	0	0	3,128
	2030	0	0	0	0	0	0	0	0	0	0	1,264	0	0	29	0	407	32	0	742	645	0	0	3,118
	2031	0	0	0	0	0	0	0	0	0	0	1,259	0	0	28	0	402	31	0	742	645	0	0	3,108
	2032	0	0	0	0	0	0	0	0	0	0	1,255	0	0	28	0	397	31	0	742	645	0	0	3,099
	2033	0	0	0	0	0	0	0	0	0	0	1,250	0	0	28	0	393	31	0	742	645	0	0	3,090
	2034	0	0	0	0	0	0	0	0	0	0	1,246	0	0	27	0	390	31	0	742	645	0	0	3,081
	2035	0	0	0	0	0	0	0	0	0	0	1,241	0	0	27	0	386	31	0	742	645	0	0	3,073
	2036	0	0	0	0	0	0	0	0	0	0	1,237	0	0	27	0	383	31	0	742	645	0	0	3,064
	2037	0	0	0	0	0	0	0	0	0	0	1,232	0	0	26	0	380	31	0	742	645	0	0	3,056
	TOTAL	0	2,061	19	7,954	270	1,531	167	28	0	0	32,797	0	0	957	0	10,314	870	0	21,564	19,260	0	0	97,793

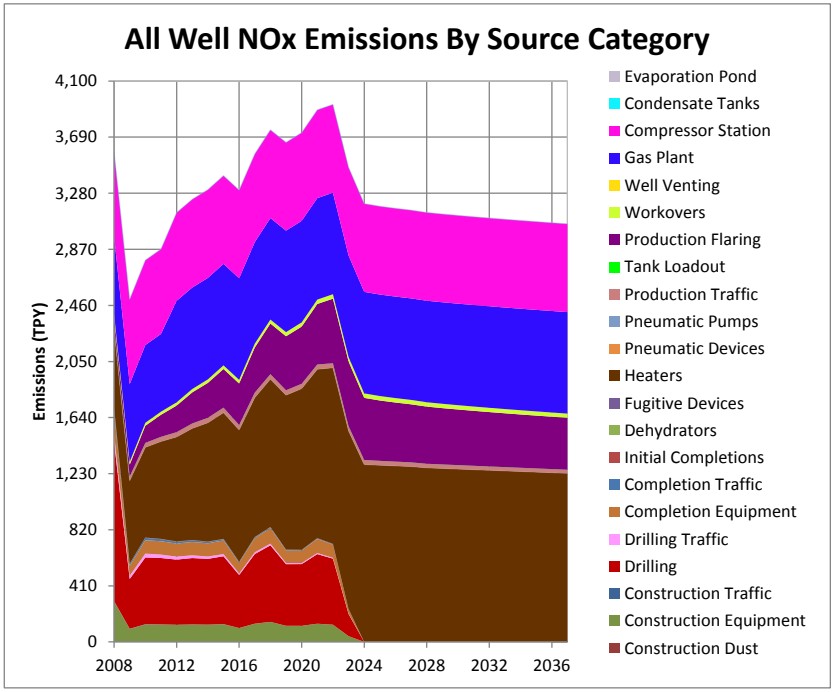

Figure 33. Total New and Existing Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 271. Total New and Existing Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
VOC [tpy]	2008	0	44	1	106	6	0	4	130	27,096	1,904	31	0	12,422	7	197	79	2	2,133	198	221	14,072	20	58,672
	2009	0	14	0	21	3	4	2	2	26,548	2,031	33	0	12,295	7	213	111	2	2,274	198	221	13,311	20	57,310
	2010	0	19	0	28	4	6	2	3	25,484	2,206	36	0	12,169	8	244	161	2	2,471	198	221	11,585	20	54,868
	2011	0	19	0	27	3	5	2	3	24,751	2,381	39	0	12,042	8	273	207	2	2,667	198	221	10,624	21	53,495
	2012	0	19	0	27	3	5	2	3	24,463	2,554	42	0	11,925	9	301	250	2	2,860	231	222	10,438	21	53,376
	2013	0	19	0	27	3	5	2	3	24,206	2,730	45	0	11,808	9	328	292	2	3,057	231	222	10,307	21	53,319
	2014	0	19	0	27	2	5	2	3	23,736	2,904	48	0	11,692	9	342	328	2	3,253	231	222	9,821	22	52,668
	2015	0	19	0	28	2	6	1	3	23,244	3,085	51	0	11,575	9	354	364	2	3,455	231	222	9,316	22	51,990
	2016	0	15	0	22	2	4	1	2	22,781	3,222	53	0	11,458	9	361	390	2	3,608	231	222	8,875	22	51,282
	2017	0	20	0	29	2	6	1	3	22,347	3,408	56	0	11,341	10	370	424	2	3,816	231	222	8,490	23	50,801
	2018	0	22	0	32	2	6	1	3	21,938	3,614	59	0	11,224	10	405	476	3	4,047	231	222	8,150	23	50,467
	2019	0	18	0	25	1	5	1	2	21,545	3,776	62	0	11,108	10	416	508	3	4,228	231	222	7,840	23	50,024
	2020	0	18	0	25	1	5	1	2	21,179	3,940	65	0	11,000	10	423	538	3	4,412	231	222	7,555	24	49,652
	2021	0	20	0	29	1	6	1	3	20,830	4,127	68	0	10,893	10	428	569	3	4,622	231	222	7,298	24	49,384
	2022	0	19	0	27	1	5	1	3	20,403	4,304	71	0	10,786	9	446	607	3	4,819	231	222	6,951	24	48,933
	2023	0	6	0	9	0	2	0	1	20,072	4,352	72	0	10,679	10	431	608	3	4,874	231	222	6,729	24	48,326
	2024	0	0	0	0	0	0	0	0	19,751	4,336	71	0	10,572	9	387	584	3	4,855	231	222	6,521	24	47,567
	2025	0	0	0	0	0	0	0	0	19,449	4,319	71	0	10,465	9	358	568	3	4,837	231	222	6,340	24	46,896
	2026	0	0	0	0	0	0	0	0	19,149	4,303	71	0	10,358	9	337	556	3	4,818	231	222	6,162	24	46,241
	2027	0	0	0	0	0	0	0	0	18,858	4,286	71	0	10,251	8	319	546	3	4,800	231	222	5,996	24	45,614
	2028	0	0	0	0	0	0	0	0	18,445	4,255	70	0	10,046	8	303	538	3	4,765	231	222	5,837	23	44,747
	2029	0	0	0	0	0	0	0	0	18,076	4,240	70	0	9,949	8	288	530	3	4,748	231	222	5,580	23	43,968
	2030	0	0	0	0	0	0	0	0	17,816	4,225	70	0	9,852	8	276	523	3	4,732	231	222	5,440	23	43,419
	2031	0	0	0	0	0	0	0	0	17,564	4,210	69	0	9,754	8	265	517	3	4,715	231	222	5,310	23	42,890
	2032	0	0	0	0	0	0	0	0	17,314	4,195	69	0	9,657	7	254	511	3	4,698	231	222	5,184	23	42,369
	2033	0	0	0	0	0	0	0	0	17,066	4,180	69	0	9,560	7	245	506	3	4,681	231	222	5,060	23	41,853
	2034	0	0	0	0	0	0	0	0	16,826	4,166	69	0	9,462	7	236	501	2	4,665	231	222	4,945	22	41,354
	2035	0	0	0	0	0	0	0	0	16,591	4,151	68	0	9,365	7	227	497	2	4,648	231	222	4,836	22	40,868
	2036	0	0	0	0	0	0	0	0	16,367	4,136	68	0	9,268	7	219	493	2	4,631	231	222	4,738	22	40,405
	2037	0	0	0	0	0	0	0	0	16,146	4,121	68	0	9,170	7	212	488	2	4,615	231	222	4,643	22	39,948
	TOTAL	0	308	3	488	37	77	23	166	620,038	109,661	1,804	0	322,148	252	9,459	13,272	75	122,803	6,804	6,656	227,956	677	1,442,705

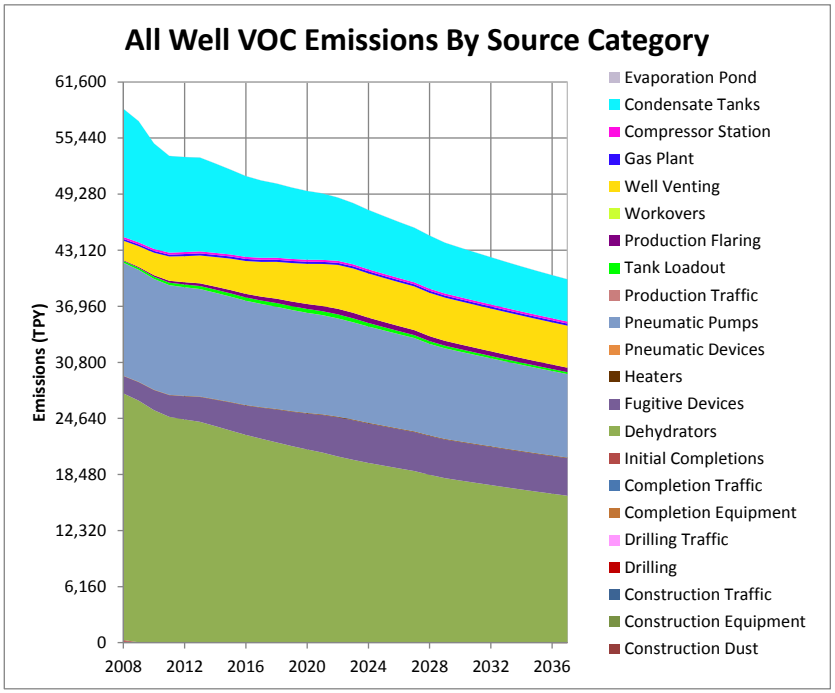

Figure 34. Total New and Existing Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 272. Total New and Existing Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
SO2 [tpy]	2008	0	5	0	71	0	56	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	135
	2009	0	3	0	19	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	29
	2010	0	2	0	12	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	19
	2011	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	5
	2012	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2013	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2014	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2015	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2016	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2017	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2018	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2019	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2020	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2021	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2022	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
	2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
	TOTAL	0	12	0	112	1	65	1	0	0	0	0	0	0	7	0	0	2	0	18	61	0	0	279

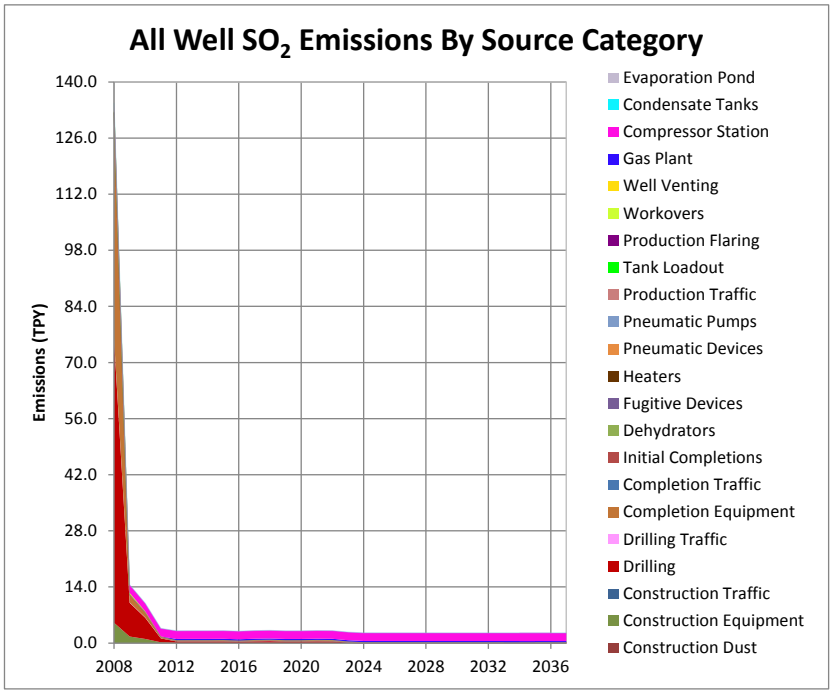

Figure 35. Total New and Existing Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 273. Total New and Existing Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
PM10 [tpy]	2008	194	18	32	56	298	12	188	0	0	0	43	0	0	379	0	0	1	0	32	49	0	0	1,302
	2009	63	6	10	12	140	2	89	0	0	0	46	0	0	404	0	0	1	0	32	49	0	0	855
	2010	84	8	14	16	188	3	119	0	0	0	50	0	0	439	0	0	1	0	32	49	0	0	1,004
	2011	83	8	14	16	187	3	118	0	0	0	54	0	0	474	0	0	1	0	32	49	0	0	1,040
	2012	82	7	14	16	183	3	116	0	0	0	58	0	0	508	0	0	1	0	48	51	0	0	1,088
	2013	83	8	14	16	186	3	118	0	0	0	62	0	0	543	0	0	1	0	48	51	0	0	1,135
	2014	83	8	14	16	184	3	117	0	0	0	66	0	0	578	0	0	2	0	48	51	0	0	1,169
	2015	85	8	14	17	190	3	120	0	0	0	70	0	0	614	0	0	2	0	48	51	0	0	1,223
	2016	67	6	11	13	148	3	94	0	0	0	73	0	0	641	0	0	2	0	48	51	0	0	1,157
	2017	87	8	15	17	195	3	123	0	0	0	77	0	0	678	0	0	2	0	48	51	0	0	1,305
	2018	96	9	16	19	214	4	136	0	0	0	82	0	0	719	0	0	2	0	48	51	0	0	1,395
	2019	77	7	13	15	172	3	109	0	0	0	86	0	0	751	0	0	2	0	48	51	0	0	1,335
	2020	77	7	13	15	172	3	109	0	0	0	90	0	0	783	0	0	2	0	48	51	0	0	1,371
	2021	87	8	14	17	195	3	123	0	0	0	94	0	0	820	0	0	2	0	48	51	0	0	1,463
	2022	83	8	14	16	184	3	117	0	0	0	98	0	0	855	0	0	2	0	48	51	0	0	1,479
	2023	28	3	5	5	62	1	39	0	0	0	99	0	0	865	0	0	2	0	48	51	0	0	1,208
	2024	0	0	0	0	0	0	0	0	0	0	99	0	0	862	0	0	2	0	48	51	0	0	1,061
	2025	0	0	0	0	0	0	0	0	0	0	98	0	0	858	0	0	2	0	48	51	0	0	1,058
	2026	0	0	0	0	0	0	0	0	0	0	98	0	0	855	0	0	2	0	48	51	0	0	1,054
	2027	0	0	0	0	0	0	0	0	0	0	97	0	0	852	0	0	2	0	48	51	0	0	1,050
	2028	0	0	0	0	0	0	0	0	0	0	97	0	0	845	0	0	2	0	48	51	0	0	1,043
	2029	0	0	0	0	0	0	0	0	0	0	96	0	0	842	0	0	2	0	48	51	0	0	1,040
	2030	0	0	0	0	0	0	0	0	0	0	96	0	0	839	0	0	2	0	48	51	0	0	1,037
	2031	0	0	0	0	0	0	0	0	0	0	96	0	0	836	0	0	2	0	48	51	0	0	1,033
	2032	0	0	0	0	0	0	0	0	0	0	95	0	0	833	0	0	2	0	48	51	0	0	1,030
	2033	0	0	0	0	0	0	0	0	0	0	95	0	0	830	0	0	2	0	48	51	0	0	1,027
	2034	0	0	0	0	0	0	0	0	0	0	95	0	0	827	0	0	2	0	48	51	0	0	1,023
	2035	0	0	0	0	0	0	0	0	0	0	94	0	0	824	0	0	2	0	48	51	0	0	1,020
	2036	0	0	0	0	0	0	0	0	0	0	94	0	0	822	0	0	2	0	48	51	0	0	1,017
	2037	0	0	0	0	0	0	0	0	0	0	94	0	0	819	0	0	2	0	48	51	0	0	1,013
	TOTAL	1,360	124	226	284	2,900	58	1,837	0	0	0	2,493	0	0	21,797	0	0	49	0	1,379	1,528	0	0	34,034

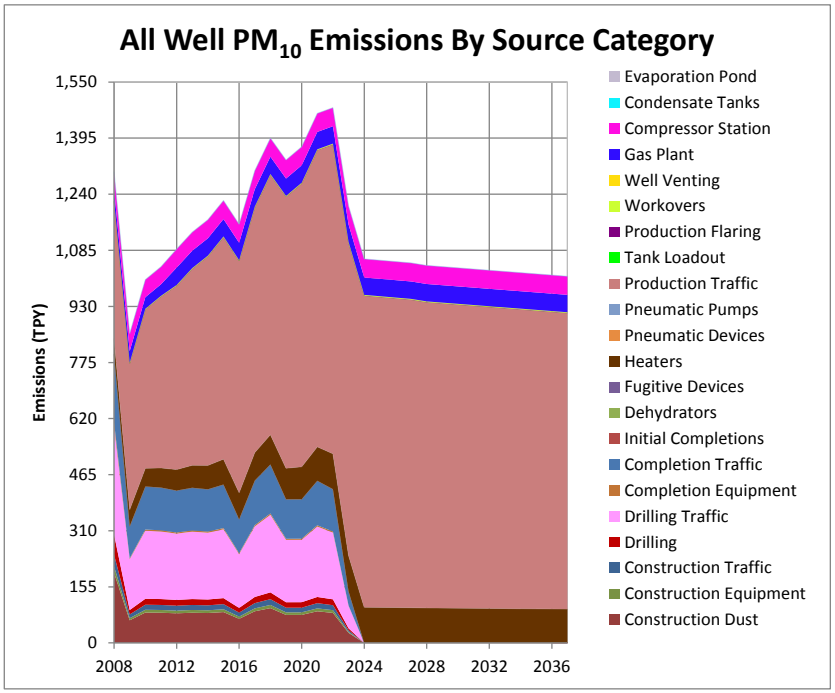

Figure 36. Total New and Existing Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 274. Total New and Existing Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
PM2.5 [tpy]	2008	50	17	3	54	32	12	20	0	0	0	43	0	0	39	0	0	1	0	32	49	0	0	353
	2009	16	6	1	12	15	2	10	0	0	0	46	0	0	42	0	0	1	0	32	49	0	0	231
	2010	22	7	1	16	20	3	13	0	0	0	50	0	0	45	0	0	1	0	32	49	0	0	260
	2011	21	7	1	16	20	3	13	0	0	0	54	0	0	49	0	0	1	0	32	49	0	0	266
	2012	21	7	1	16	19	3	12	0	0	0	58	0	0	52	0	0	1	0	48	51	0	0	291
	2013	21	7	1	16	20	3	12	0	0	0	62	0	0	56	0	0	1	0	48	51	0	0	300
	2014	21	7	1	16	19	3	12	0	0	0	66	0	0	59	0	0	1	0	48	51	0	0	306
	2015	22	8	1	16	20	3	12	0	0	0	70	0	0	63	0	0	2	0	48	51	0	0	316
	2016	17	6	1	13	15	3	10	0	0	0	73	0	0	65	0	0	2	0	48	51	0	0	304
	2017	23	8	1	17	20	3	13	0	0	0	77	0	0	69	0	0	2	0	48	51	0	0	331
	2018	25	9	2	18	22	4	14	0	0	0	82	0	0	73	0	0	2	0	48	51	0	0	348
	2019	20	7	1	15	17	3	11	0	0	0	86	0	0	76	0	0	2	0	48	51	0	0	337
	2020	20	7	1	15	17	3	11	0	0	0	90	0	0	79	0	0	2	0	48	51	0	0	344
	2021	23	8	1	17	20	3	12	0	0	0	94	0	0	83	0	0	2	0	48	51	0	0	362
	2022	21	7	1	16	19	3	12	0	0	0	98	0	0	86	0	0	2	0	48	51	0	0	364
	2023	7	2	0	5	6	1	4	0	0	0	99	0	0	87	0	0	2	0	48	51	0	0	314
	2024	0	0	0	0	0	0	0	0	0	0	99	0	0	87	0	0	2	0	48	51	0	0	287
	2025	0	0	0	0	0	0	0	0	0	0	98	0	0	87	0	0	2	0	48	51	0	0	286
	2026	0	0	0	0	0	0	0	0	0	0	98	0	0	86	0	0	2	0	48	51	0	0	285
	2027	0	0	0	0	0	0	0	0	0	0	97	0	0	86	0	0	2	0	48	51	0	0	284
	2028	0	0	0	0	0	0	0	0	0	0	97	0	0	85	0	0	2	0	48	51	0	0	283
	2029	0	0	0	0	0	0	0	0	0	0	96	0	0	85	0	0	2	0	48	51	0	0	282
	2030	0	0	0	0	0	0	0	0	0	0	96	0	0	85	0	0	2	0	48	51	0	0	282
	2031	0	0	0	0	0	0	0	0	0	0	96	0	0	84	0	0	2	0	48	51	0	0	281
	2032	0	0	0	0	0	0	0	0	0	0	95	0	0	84	0	0	2	0	48	51	0	0	280
	2033	0	0	0	0	0	0	0	0	0	0	95	0	0	84	0	0	2	0	48	51	0	0	280
	2034	0	0	0	0	0	0	0	0	0	0	95	0	0	83	0	0	2	0	48	51	0	0	279
	2035	0	0	0	0	0	0	0	0	0	0	94	0	0	83	0	0	2	0	48	51	0	0	278
	2036	0	0	0	0	0	0	0	0	0	0	94	0	0	83	0	0	2	0	48	51	0	0	278
	2037	0	0	0	0	0	0	0	0	0	0	94	0	0	82	0	0	2	0	48	51	0	0	277
	TOTAL	350	121	23	275	301	56	191	0	0	0	2,493	0	0	2,205	0	0	47	0	1,379	1,528	0	0	8,970

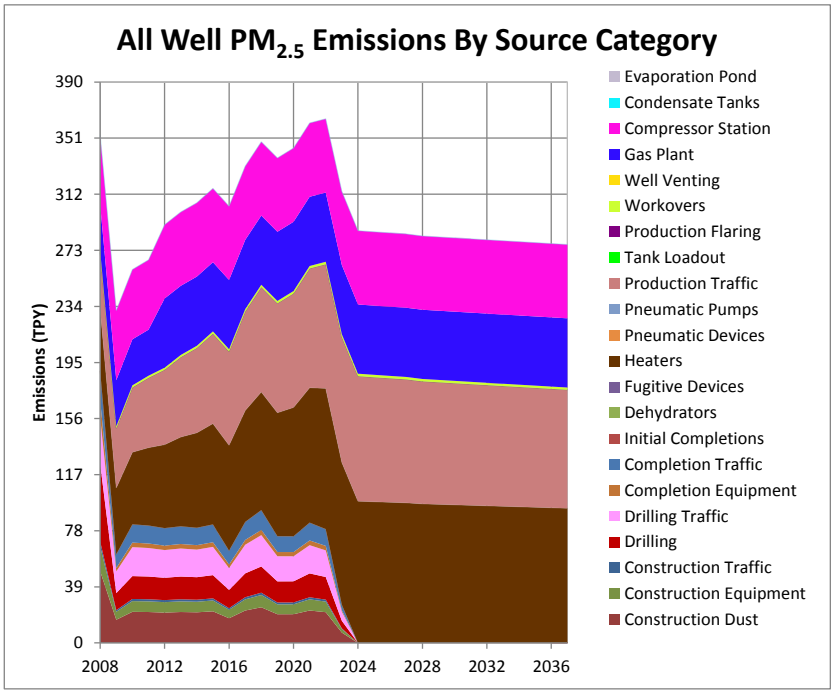

Figure 37. Total New and Existing Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 275. Total New and Existing Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO [tpy]	2008	0	362	6	504	56	132	36	0	0	0	478	0	0	79	0	335	8	0	741	449	0	0	3,185
	2009	0	117	2	213	25	42	16	8	0	0	510	0	0	83	0	469	9	0	741	449	0	0	2,684
	2010	0	157	2	286	32	57	20	11	0	0	554	0	0	90	0	682	9	0	741	449	0	0	3,090
	2011	0	156	2	284	30	56	19	11	0	0	598	0	0	95	0	876	10	0	741	449	0	0	3,329
	2012	0	153	2	279	28	55	18	11	0	0	642	0	0	100	0	1,057	10	0	969	477	0	0	3,802
	2013	0	156	2	284	27	56	17	11	0	0	686	0	0	105	0	1,236	11	0	969	477	0	0	4,038
	2014	0	155	2	282	26	56	16	11	0	0	730	0	0	108	0	1,388	12	0	969	477	0	0	4,231
	2015	0	159	2	291	25	57	16	11	0	0	775	0	0	112	0	1,538	12	0	969	477	0	0	4,445
	2016	0	125	1	227	18	45	12	9	0	0	809	0	0	114	0	1,650	13	0	969	477	0	0	4,469
	2017	0	164	2	298	23	59	15	12	0	0	856	0	0	117	0	1,794	13	0	969	477	0	0	4,799
	2018	0	180	2	328	24	65	15	13	0	0	908	0	0	120	0	2,013	14	0	969	477	0	0	5,129
	2019	0	145	1	264	19	52	12	10	0	0	949	0	0	123	0	2,148	15	0	969	477	0	0	5,184
	2020	0	145	1	264	18	52	12	10	0	0	990	0	0	125	0	2,273	15	0	969	477	0	0	5,353
	2021	0	164	2	298	20	59	13	12	0	0	1,037	0	0	128	0	2,407	16	0	969	477	0	0	5,600
	2022	0	155	1	283	18	56	11	11	0	0	1,081	0	0	128	0	2,568	16	0	969	477	0	0	5,775
	2023	0	52	0	95	6	19	4	4	0	0	1,093	0	0	131	0	2,572	17	0	969	477	0	0	5,440
	2024	0	0	0	0	0	0	0	0	0	0	1,089	0	0	129	0	2,469	16	0	969	477	0	0	5,150
	2025	0	0	0	0	0	0	0	0	0	0	1,085	0	0	126	0	2,400	16	0	969	477	0	0	5,074
	2026	0	0	0	0	0	0	0	0	0	0	1,081	0	0	123	0	2,350	16	0	969	477	0	0	5,018
	2027	0	0	0	0	0	0	0	0	0	0	1,077	0	0	122	0	2,309	16	0	969	477	0	0	4,971
	2028	0	0	0	0	0	0	0	0	0	0	1,069	0	0	120	0	2,274	16	0	969	477	0	0	4,925
	2029	0	0	0	0	0	0	0	0	0	0	1,065	0	0	118	0	2,240	16	0	969	477	0	0	4,886
	2030	0	0	0	0	0	0	0	0	0	0	1,061	0	0	117	0	2,212	16	0	969	477	0	0	4,853
	2031	0	0	0	0	0	0	0	0	0	0	1,058	0	0	116	0	2,186	16	0	969	477	0	0	4,822
	2032	0	0	0	0	0	0	0	0	0	0	1,054	0	0	114	0	2,163	16	0	969	477	0	0	4,793
	2033	0	0	0	0	0	0	0	0	0	0	1,050	0	0	113	0	2,141	16	0	969	477	0	0	4,766
	2034	0	0	0	0	0	0	0	0	0	0	1,046	0	0	112	0	2,120	16	0	969	477	0	0	4,741
	2035	0	0	0	0	0	0	0	0	0	0	1,043	0	0	110	0	2,101	16	0	969	477	0	0	4,716
	2036	0	0	0	0	0	0	0	0	0	0	1,039	0	0	109	0	2,083	16	0	969	477	0	0	4,693
	2037	0	0	0	0	0	0	0	0	0	0	1,035	0	0	108	0	2,066	15	0	969	477	0	0	4,671
	TOTAL	0	2,544	32	4,481	395	918	252	154	0	0	27,549	0	0	3,393	0	56,120	423	0	28,163	14,206	0	0	138,631

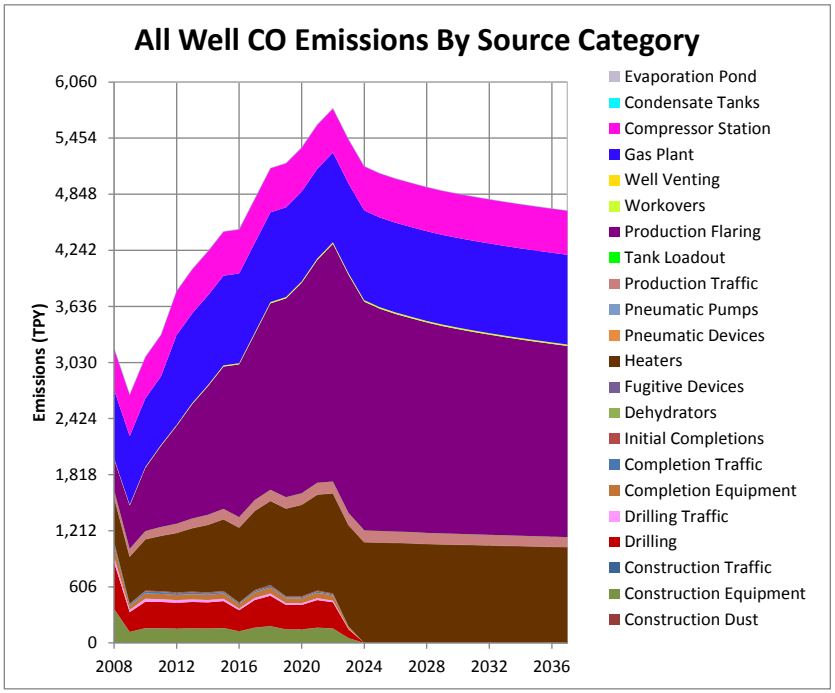

Figure 38. Total New and Existing Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 276. Total New and Existing Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
formaldehyde [tpy]	2008	0	4	0	9	0	0	0	0	0	0	3	0	0	0	0	32	0	0	85	148	0	0	282
	2009	0	1	0	2	0	0	0	1	0	0	3	0	0	0	0	44	0	0	85	148	0	0	285
	2010	0	2	0	2	0	0	0	1	0	0	3	0	0	0	0	64	0	0	85	148	0	0	307
	2011	0	2	0	2	0	0	0	1	0	0	3	0	0	0	0	83	0	0	85	148	0	0	326
	2012	0	2	0	2	0	0	0	1	0	0	3	0	0	0	0	100	0	0	96	149	0	0	355
	2013	0	2	0	2	0	0	0	1	0	0	4	0	0	0	0	117	0	0	96	149	0	0	373
	2014	0	2	0	2	0	0	0	1	0	0	4	0	0	0	0	131	0	0	96	149	0	0	387
	2015	0	2	0	2	0	0	0	1	0	0	4	0	0	0	0	145	0	0	96	149	0	0	402
	2016	0	1	0	2	0	0	0	1	0	0	4	0	0	0	0	156	0	0	96	149	0	0	411
	2017	0	2	0	2	0	0	0	1	0	0	4	0	0	0	0	170	0	0	96	149	0	0	427
	2018	0	2	0	3	0	1	0	1	0	0	5	0	0	0	0	190	0	0	96	149	0	0	448
	2019	0	1	0	2	0	0	0	1	0	0	5	0	0	0	0	203	0	0	96	149	0	0	460
	2020	0	1	0	2	0	0	0	1	0	0	5	0	0	0	0	215	0	0	96	149	0	0	472
	2021	0	2	0	2	0	0	0	1	0	0	5	0	0	0	0	228	0	0	96	149	0	0	485
	2022	0	2	0	2	0	0	0	1	0	0	6	0	0	0	0	243	0	0	96	149	0	0	501
	2023	0	1	0	1	0	0	0	0	0	0	6	0	0	0	0	243	0	0	96	149	0	0	497
	2024	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	234	0	0	96	149	0	0	486
	2025	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	227	0	0	96	149	0	0	479
	2026	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	222	0	0	96	149	0	0	474
	2027	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	218	0	0	96	149	0	0	470
	2028	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	215	0	0	96	149	0	0	467
	2029	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	212	0	0	96	149	0	0	464
	2030	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	209	0	0	96	149	0	0	461
	2031	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	207	0	0	96	149	0	0	459
	2032	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	205	0	0	96	149	0	0	456
	2033	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	203	0	0	96	149	0	0	454
	2034	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	201	0	0	96	149	0	0	452
	2035	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	199	0	0	96	149	0	0	451
	2036	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	197	0	0	96	149	0	0	449
	2037	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	195	0	0	96	149	0	0	447
	TOTAL	0	26	0	42	2	7	1	15	0	0	144	0	0	9	0	5,309	6	0	2,847	4,480	0	0	12,889

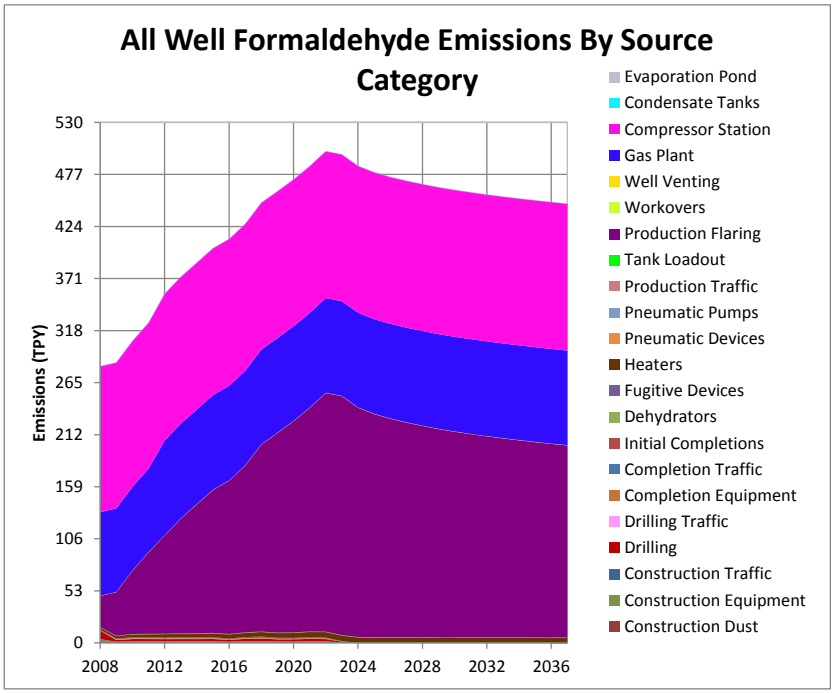

Figure 39. Total New and Existing Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 277. Total New and Existing Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
n-hexane [tpy]	2008	0	0	0	0	0	0	0	3	708	80	0	0	589	0	7	0	0	42	0	1	547	0	1,978
	2009	0	0	0	0	0	0	0	0	694	86	0	0	583	0	7	0	0	45	0	1	517	0	1,934
	2010	0	0	0	0	0	0	0	0	666	93	0	0	577	0	8	0	0	49	0	1	450	0	1,845
	2011	0	0	0	0	0	0	0	0	647	100	0	0	571	0	9	0	0	53	0	1	412	0	1,795
	2012	0	0	0	0	0	0	0	0	639	108	0	0	566	0	10	0	0	57	0	1	405	0	1,786
	2013	0	0	0	0	0	0	0	0	633	115	0	0	560	0	11	0	0	61	0	1	400	0	1,781
	2014	0	0	0	0	0	0	0	0	620	123	0	0	555	0	12	0	0	65	0	1	381	0	1,756
	2015	0	0	0	0	0	0	0	0	607	130	0	0	549	0	12	0	0	69	0	1	361	0	1,730
	2016	0	0	0	0	0	0	0	0	595	136	0	0	544	0	12	0	0	72	0	1	344	0	1,704
	2017	0	0	0	0	0	0	0	0	584	144	0	0	538	0	13	0	0	76	0	1	328	0	1,684
	2018	0	0	0	0	0	0	0	0	573	152	0	0	532	0	14	0	0	80	0	1	315	0	1,669
	2019	0	0	0	0	0	0	0	0	563	159	0	0	527	0	14	0	0	84	0	1	303	0	1,652
	2020	0	0	0	0	0	0	0	0	553	166	0	0	522	0	14	0	0	88	0	1	292	0	1,637
	2021	0	0	0	0	0	0	0	0	544	174	0	0	517	0	15	0	0	92	0	1	282	0	1,625
	2022	0	0	0	0	0	0	0	0	533	182	0	0	512	0	15	0	0	96	0	1	268	0	1,607
	2023	0	0	0	0	0	0	0	0	525	184	0	0	507	0	15	0	0	97	0	1	260	0	1,588
	2024	0	0	0	0	0	0	0	0	516	183	0	0	502	0	13	0	0	96	0	1	252	0	1,563
	2025	0	0	0	0	0	0	0	0	508	182	0	0	496	0	12	0	0	96	0	1	244	0	1,541
	2026	0	0	0	0	0	0	0	0	500	181	0	0	491	0	11	0	0	96	0	1	237	0	1,520
	2027	0	0	0	0	0	0	0	0	493	181	0	0	486	0	11	0	0	95	0	1	231	0	1,499
	2028	0	0	0	0	0	0	0	0	482	179	0	0	477	0	10	0	0	95	0	1	225	0	1,470
	2029	0	0	0	0	0	0	0	0	472	179	0	0	472	0	10	0	0	94	0	1	215	0	1,444
	2030	0	0	0	0	0	0	0	0	466	178	0	0	467	0	9	0	0	94	0	1	209	0	1,426
	2031	0	0	0	0	0	0	0	0	459	178	0	0	463	0	9	0	0	94	0	1	204	0	1,408
	2032	0	0	0	0	0	0	0	0	452	177	0	0	458	0	9	0	0	93	0	1	199	0	1,391
	2033	0	0	0	0	0	0	0	0	446	176	0	0	453	0	8	0	0	93	0	1	195	0	1,373
	2034	0	0	0	0	0	0	0	0	440	176	0	0	449	0	8	0	0	93	0	1	190	0	1,357
	2035	0	0	0	0	0	0	0	0	434	175	0	0	444	0	8	0	0	92	0	1	186	0	1,341
	2036	0	0	0	0	0	0	0	0	428	174	0	0	440	0	7	0	0	92	0	1	182	0	1,325
	2037	0	0	0	0	0	0	0	0	422	174	0	0	435	0	7	0	0	92	0	1	178	0	1,310
	TOTAL	0	0	0	0	0	0	0	3	16,202	4,625	0	0	15,282	2	321	0	0	2,437	12	43	8,812	1	47,741

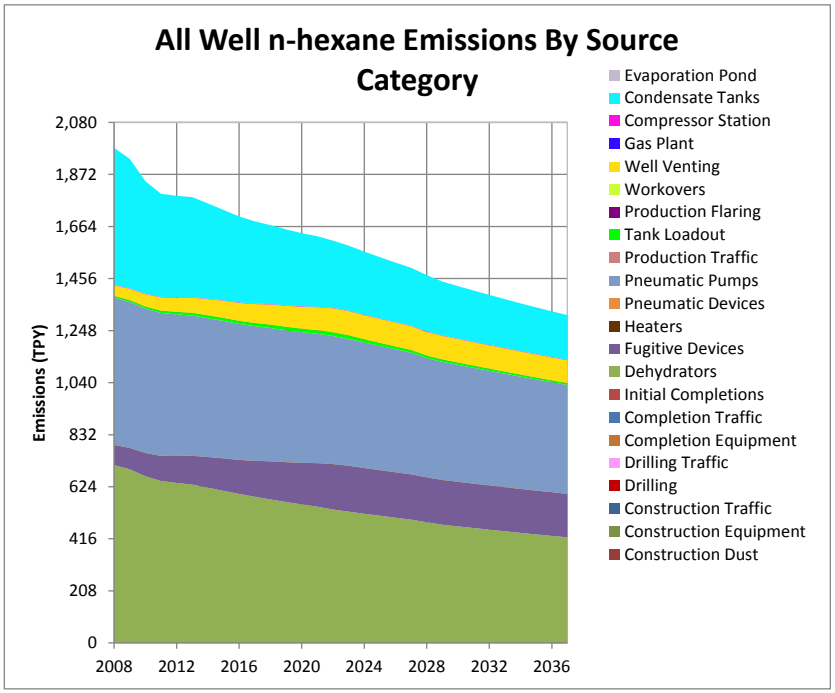

Figure 40. Total New and Existing Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 278. Total New and Existing Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
benzene [tpy]	2008	0	0	0	1	0	0	0	1	2,610	13	1	0	50	0	1	0	0	9	2	1	112	3	2,804
	2009	0	0	0	0	0	0	0	0	2,557	14	1	0	50	0	1	0	0	9	2	1	106	3	2,744
	2010	0	0	0	0	0	0	0	0	2,454	15	1	0	49	0	1	0	0	10	2	1	92	3	2,630
	2011	0	0	0	0	0	0	0	0	2,384	16	2	0	49	0	1	0	0	11	2	1	84	3	2,553
	2012	0	0	0	0	0	0	0	0	2,356	18	2	0	48	0	1	0	0	12	2	1	82	3	2,526
	2013	0	0	0	0	0	0	0	0	2,331	19	2	0	48	0	2	0	0	13	2	1	81	3	2,502
	2014	0	0	0	0	0	0	0	0	2,286	20	2	0	47	0	2	0	0	13	2	1	77	3	2,455
	2015	0	0	0	0	0	0	0	0	2,239	21	2	0	47	0	2	0	0	14	2	1	73	3	2,405
	2016	0	0	0	0	0	0	0	0	2,194	22	2	0	46	0	2	0	0	15	2	1	70	3	2,358
	2017	0	0	0	0	0	0	0	0	2,152	24	2	0	46	0	2	0	0	16	2	1	67	3	2,315
	2018	0	0	0	0	0	0	0	0	2,113	25	2	0	45	0	2	0	0	17	2	1	64	3	2,275
	2019	0	0	0	0	0	0	0	0	2,075	26	2	0	45	0	2	0	0	17	2	1	61	3	2,236
	2020	0	0	0	0	0	0	0	0	2,040	27	3	0	44	0	2	0	0	18	2	1	59	3	2,200
	2021	0	0	0	0	0	0	0	0	2,006	29	3	0	44	0	2	0	0	19	2	1	57	3	2,167
	2022	0	0	0	0	0	0	0	0	1,965	30	3	0	43	0	2	0	0	20	2	1	54	3	2,125
	2023	0	0	0	0	0	0	0	0	1,933	30	3	0	43	0	2	0	0	20	2	1	52	3	2,091
	2024	0	0	0	0	0	0	0	0	1,902	30	3	0	43	0	2	0	0	20	2	1	51	3	2,057
	2025	0	0	0	0	0	0	0	0	1,873	30	3	0	42	0	2	0	0	20	2	1	49	3	2,026
	2026	0	0	0	0	0	0	0	0	1,844	30	3	0	42	0	2	0	0	20	2	1	48	3	1,994
	2027	0	0	0	0	0	0	0	0	1,816	30	3	0	41	0	2	0	0	20	2	1	46	3	1,964
	2028	0	0	0	0	0	0	0	0	1,776	29	3	0	40	0	1	0	0	20	2	1	45	3	1,922
	2029	0	0	0	0	0	0	0	0	1,741	29	3	0	40	0	1	0	0	20	2	1	43	3	1,884
	2030	0	0	0	0	0	0	0	0	1,716	29	3	0	40	0	1	0	0	20	2	1	42	3	1,857
	2031	0	0	0	0	0	0	0	0	1,691	29	3	0	39	0	1	0	0	19	2	1	41	3	1,831
	2032	0	0	0	0	0	0	0	0	1,667	29	3	0	39	0	1	0	0	19	2	1	40	3	1,805
	2033	0	0	0	0	0	0	0	0	1,644	29	3	0	39	0	1	0	0	19	2	1	39	3	1,780
	2034	0	0	0	0	0	0	0	0	1,620	29	3	0	38	0	1	0	0	19	2	1	38	3	1,755
	2035	0	0	0	0	0	0	0	0	1,598	29	3	0	38	0	1	0	0	19	2	1	37	3	1,731
	2036	0	0	0	0	0	0	0	0	1,576	29	3	0	37	0	1	0	0	19	2	1	36	3	1,708
	2037	0	0	0	0	0	0	0	0	1,555	28	3	0	37	0	1	0	0	19	2	1	36	3	1,685
	TOTAL	0	3	0	5	1	1	0	1	59,713	758	72	0	1,299	8	45	0	1	508	72	21	1,783	94	64,384

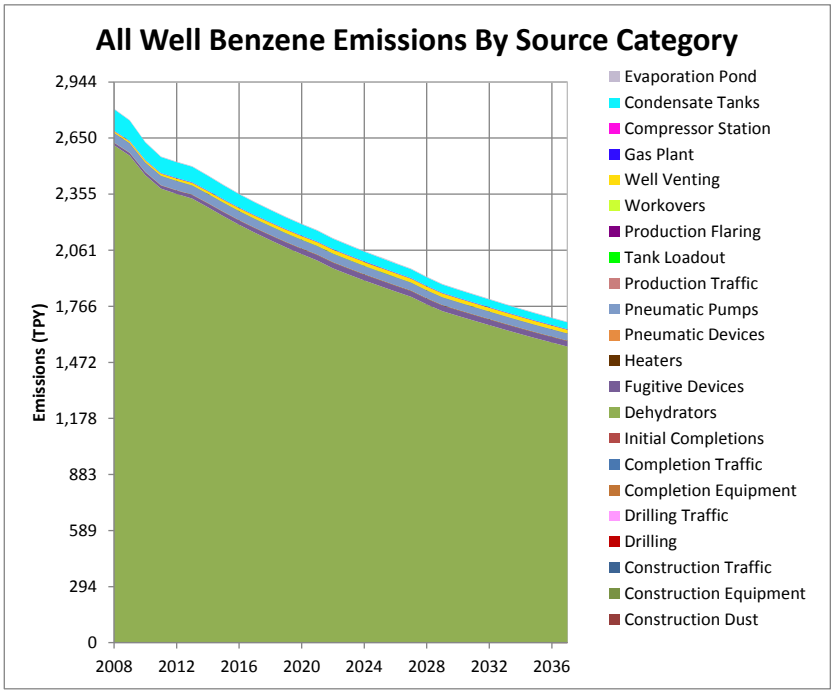

Figure 41. Total New and Existing Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 279. Total New and Existing Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
ethylbenzene [tpy]	2008	0	0	0	0	0	0	0	0	160	0	0	0	2	0	0	0	0	0	0	0	2	0	166
	2009	0	0	0	0	0	0	0	0	157	0	0	0	2	0	0	0	0	0	0	0	2	0	162
	2010	0	0	0	0	0	0	0	0	151	0	0	0	2	0	0	0	0	0	0	0	2	0	156
	2011	0	0	0	0	0	0	0	0	146	0	0	0	2	0	0	0	0	1	0	0	2	0	152
	2012	0	0	0	0	0	0	0	0	145	0	0	0	2	0	0	0	0	1	0	0	2	0	150
	2013	0	0	0	0	0	0	0	0	143	0	0	0	2	0	0	0	0	1	0	0	2	0	148
	2014	0	0	0	0	0	0	0	0	140	0	0	0	2	0	0	0	0	1	0	0	1	0	146
	2015	0	0	0	0	0	0	0	0	137	0	0	0	2	0	0	0	0	1	0	0	1	0	143
	2016	0	0	0	0	0	0	0	0	135	1	0	0	2	0	0	0	0	1	0	0	1	0	140
	2017	0	0	0	0	0	0	0	0	132	1	0	0	2	0	0	0	0	1	0	0	1	0	137
	2018	0	0	0	0	0	0	0	0	130	1	0	0	2	0	0	0	0	1	0	0	1	0	135
	2019	0	0	0	0	0	0	0	0	127	1	0	0	2	0	0	0	0	1	0	0	1	0	133
	2020	0	0	0	0	0	0	0	0	125	1	0	0	2	0	0	0	0	1	0	0	1	0	130
	2021	0	0	0	0	0	0	0	0	123	1	0	0	2	0	0	0	0	1	0	0	1	0	128
	2022	0	0	0	0	0	0	0	0	121	1	0	0	2	0	0	0	0	1	0	0	1	0	126
	2023	0	0	0	0	0	0	0	0	119	1	0	0	2	0	0	0	0	1	0	0	1	0	124
	2024	0	0	0	0	0	0	0	0	117	1	0	0	2	0	0	0	0	1	0	0	1	0	122
	2025	0	0	0	0	0	0	0	0	115	1	0	0	2	0	0	0	0	1	0	0	1	0	120
	2026	0	0	0	0	0	0	0	0	113	1	0	0	2	0	0	0	0	1	0	0	1	0	118
	2027	0	0	0	0	0	0	0	0	112	1	0	0	2	0	0	0	0	1	0	0	1	0	116
	2028	0	0	0	0	0	0	0	0	109	1	0	0	2	0	0	0	0	1	0	0	1	0	114
	2029	0	0	0	0	0	0	0	0	107	1	0	0	2	0	0	0	0	1	0	0	1	0	112
	2030	0	0	0	0	0	0	0	0	105	1	0	0	2	0	0	0	0	1	0	0	1	0	110
	2031	0	0	0	0	0	0	0	0	104	1	0	0	2	0	0	0	0	1	0	0	1	0	108
	2032	0	0	0	0	0	0	0	0	102	1	0	0	2	0	0	0	0	1	0	0	1	0	107
	2033	0	0	0	0	0	0	0	0	101	1	0	0	2	0	0	0	0	1	0	0	1	0	105
	2034	0	0	0	0	0	0	0	0	100	1	0	0	2	0	0	0	0	1	0	0	1	0	104
	2035	0	0	0	0	0	0	0	0	98	1	0	0	2	0	0	0	0	1	0	0	1	0	103
	2036	0	0	0	0	0	0	0	0	97	1	0	0	2	0	0	0	0	1	0	0	1	0	101
	2037	0	0	0	0	0	0	0	0	96	1	0	0	2	0	0	0	0	1	0	0	1	0	100
	TOTAL	0	1	0	1	0	0	0	0	3,667	17	0	0	54	3	1	0	0	23	2	2	34	10	3,816

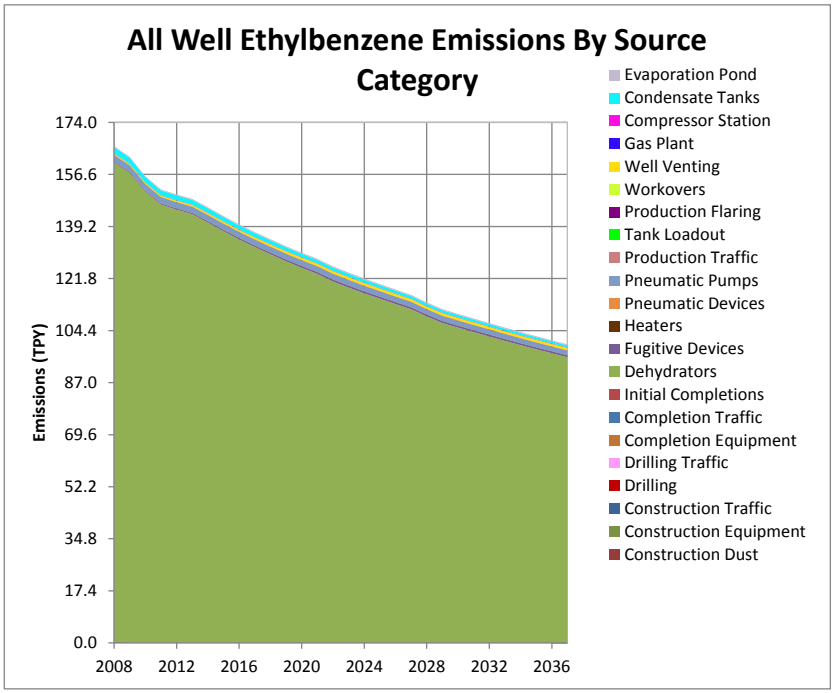

Figure 42. Total New and Existing Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 280. Total New and Existing Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
toluene [tpy]	2008	0	1	0	2	0	0	0	1	4,310	18	1	0	69	1	1	0	0	12	1	0	159	4	4,579
	2009	0	0	0	0	0	0	0	0	4,222	20	1	0	68	1	1	0	0	13	1	0	151	4	4,482
	2010	0	0	0	0	0	0	0	0	4,053	21	1	0	68	1	2	0	0	14	1	0	130	4	4,296
	2011	0	0	0	0	0	0	0	0	3,937	23	1	0	67	1	2	0	0	15	1	0	119	4	4,170
	2012	0	0	0	0	0	0	0	0	3,891	25	1	0	66	1	2	0	0	16	1	0	117	4	4,125
	2013	0	0	0	0	0	0	0	0	3,850	26	1	0	66	1	2	0	0	17	1	0	116	4	4,085
	2014	0	0	0	0	0	0	0	0	3,775	28	1	0	65	1	2	0	0	19	1	0	110	4	4,007
	2015	0	0	0	0	0	0	0	0	3,697	30	1	0	64	1	2	0	0	20	1	0	104	4	3,925
	2016	0	0	0	0	0	0	0	0	3,623	31	1	0	64	1	2	0	0	21	1	0	99	4	3,848
	2017	0	0	0	0	0	0	0	0	3,554	33	1	0	63	1	2	0	0	22	1	0	95	4	3,777
	2018	0	0	0	0	0	0	0	0	3,489	35	1	0	62	1	3	0	0	23	1	0	91	4	3,711
	2019	0	0	0	0	0	0	0	0	3,427	37	1	0	62	1	3	0	0	24	1	0	87	4	3,647
	2020	0	0	0	0	0	0	0	0	3,368	38	1	0	61	1	3	0	0	25	1	0	84	4	3,588
	2021	0	0	0	0	0	0	0	0	3,313	40	1	0	60	1	3	0	0	26	1	0	81	4	3,532
	2022	0	0	0	0	0	0	0	0	3,245	42	1	0	60	1	3	0	0	27	1	0	77	4	3,462
	2023	0	0	0	0	0	0	0	0	3,192	42	1	0	59	1	3	0	0	28	1	0	74	4	3,407
	2024	0	0	0	0	0	0	0	0	3,141	42	1	0	59	1	2	0	0	28	1	0	72	4	3,352
	2025	0	0	0	0	0	0	0	0	3,093	42	1	0	58	1	2	0	0	28	1	0	70	4	3,301
	2026	0	0	0	0	0	0	0	0	3,046	42	1	0	58	1	2	0	0	27	1	0	68	4	3,250
	2027	0	0	0	0	0	0	0	0	2,999	42	1	0	57	1	2	0	0	27	1	0	66	4	3,201
	2028	0	0	0	0	0	0	0	0	2,934	41	1	0	56	1	2	0	0	27	1	0	64	4	3,131
	2029	0	0	0	0	0	0	0	0	2,875	41	1	0	55	1	2	0	0	27	1	0	61	4	3,069
	2030	0	0	0	0	0	0	0	0	2,833	41	1	0	55	1	2	0	0	27	1	0	59	4	3,025
	2031	0	0	0	0	0	0	0	0	2,793	41	1	0	54	1	2	0	0	27	1	0	58	4	2,983
	2032	0	0	0	0	0	0	0	0	2,754	41	1	0	54	1	2	0	0	27	1	0	56	4	2,940
	2033	0	0	0	0	0	0	0	0	2,714	41	1	0	53	1	2	0	0	27	1	0	55	4	2,899
	2034	0	0	0	0	0	0	0	0	2,676	40	1	0	53	1	1	0	0	27	1	0	54	4	2,858
	2035	0	0	0	0	0	0	0	0	2,639	40	1	0	52	1	1	0	0	26	1	0	53	4	2,819
	2036	0	0	0	0	0	0	0	0	2,603	40	1	0	51	1	1	0	0	26	1	0	51	4	2,781
	2037	0	0	0	0	0	0	0	0	2,568	40	1	0	51	1	1	0	0	26	1	0	50	4	2,744
	TOTAL	0	5	0	7	1	1	1	1	98,614	1,064	36	0	1,789	20	59	0	1	700	34	11	2,530	122	104,995

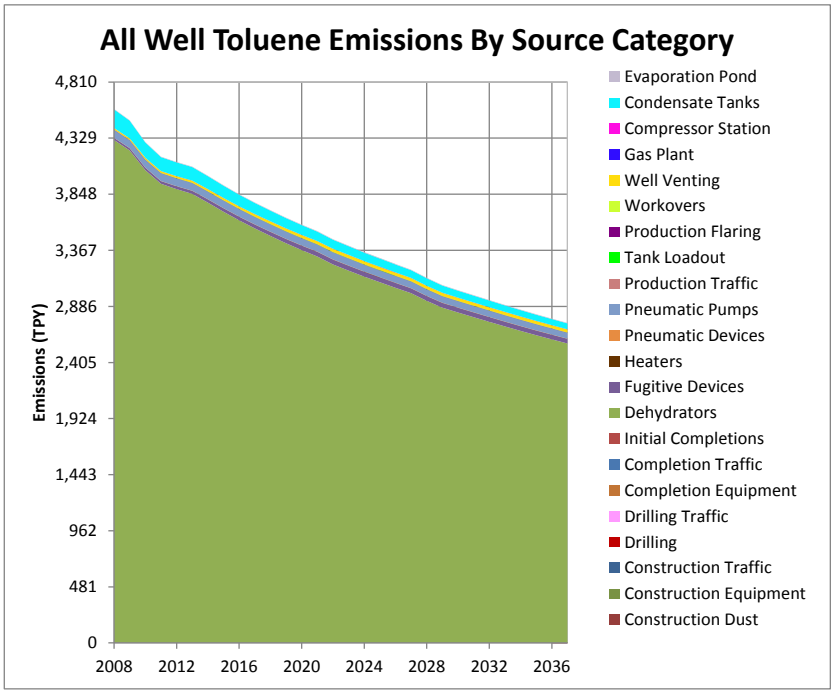

Figure 43. Total New and Existing Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 281. Total New and Existing Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
xylenes [tpy]	2008	0	1	0	1	0	0	0	0	1,587	10	0	0	40	0	1	0	0	4	0	0	86	5	1,735
	2009	0	0	0	0	0	0	0	0	1,555	11	0	0	39	0	1	0	0	4	0	0	81	5	1,697
	2010	0	0	0	0	0	0	0	0	1,493	12	0	0	39	0	1	0	0	4	0	0	70	5	1,625
	2011	0	0	0	0	0	0	0	0	1,450	13	0	0	39	0	1	0	0	5	0	0	64	5	1,578
	2012	0	0	0	0	0	0	0	0	1,433	13	0	0	38	0	1	0	0	5	0	0	63	5	1,561
	2013	0	0	0	0	0	0	0	0	1,418	14	0	0	38	0	1	0	0	5	0	0	62	5	1,546
	2014	0	0	0	0	0	0	0	0	1,390	15	0	0	37	0	1	0	0	6	0	0	59	5	1,516
	2015	0	0	0	0	0	0	0	0	1,361	16	0	0	37	0	1	0	0	6	0	0	56	5	1,485
	2016	0	0	0	0	0	0	0	0	1,334	17	0	0	37	0	1	0	0	6	0	0	53	5	1,456
	2017	0	0	0	0	0	0	0	0	1,309	18	0	0	36	0	1	0	0	7	0	0	51	6	1,430
	2018	0	0	0	0	0	0	0	0	1,285	19	0	0	36	0	1	0	0	7	0	0	49	6	1,405
	2019	0	0	0	0	0	0	0	0	1,262	20	0	0	36	0	1	0	0	7	0	0	47	6	1,381
	2020	0	0	0	0	0	0	0	0	1,240	21	0	0	35	0	1	0	0	8	0	0	45	6	1,358
	2021	0	0	0	0	0	0	0	0	1,220	22	0	0	35	0	1	0	0	8	0	0	44	6	1,337
	2022	0	0	0	0	0	0	0	0	1,195	23	0	0	35	0	2	0	0	9	0	0	41	6	1,311
	2023	0	0	0	0	0	0	0	0	1,176	23	0	0	34	0	2	0	0	9	0	0	40	6	1,290
	2024	0	0	0	0	0	0	0	0	1,157	23	0	0	34	0	1	0	0	9	0	0	39	6	1,269
	2025	0	0	0	0	0	0	0	0	1,139	23	0	0	34	0	1	0	0	9	0	0	38	6	1,250
	2026	0	0	0	0	0	0	0	0	1,121	23	0	0	33	0	1	0	0	9	0	0	37	6	1,230
	2027	0	0	0	0	0	0	0	0	1,104	23	0	0	33	0	1	0	0	9	0	0	36	6	1,212
	2028	0	0	0	0	0	0	0	0	1,080	22	0	0	32	0	1	0	0	8	0	0	35	6	1,186
	2029	0	0	0	0	0	0	0	0	1,059	22	0	0	32	0	1	0	0	8	0	0	33	6	1,162
	2030	0	0	0	0	0	0	0	0	1,043	22	0	0	32	0	1	0	0	8	0	0	32	6	1,145
	2031	0	0	0	0	0	0	0	0	1,029	22	0	0	31	0	1	0	0	8	0	0	31	6	1,129
	2032	0	0	0	0	0	0	0	0	1,014	22	0	0	31	0	1	0	0	8	0	0	31	6	1,113
	2033	0	0	0	0	0	0	0	0	999	22	0	0	31	0	1	0	0	8	0	0	30	5	1,098
	2034	0	0	0	0	0	0	0	0	985	22	0	0	30	0	1	0	0	8	0	0	29	5	1,082
	2035	0	0	0	0	0	0	0	0	972	22	0	0	30	0	1	0	0	8	0	0	28	5	1,067
	2036	0	0	0	0	0	0	0	0	959	22	0	0	30	0	1	0	0	8	0	0	28	5	1,053
	2037	0	0	0	0	0	0	0	0	946	22	0	0	29	0	1	0	0	8	0	0	27	5	1,039
	TOTAL	0	4	0	6	1	1	1	0	36,314	578	0	0	1,032	11	33	0	1	218	9	9	1,367	165	39,748

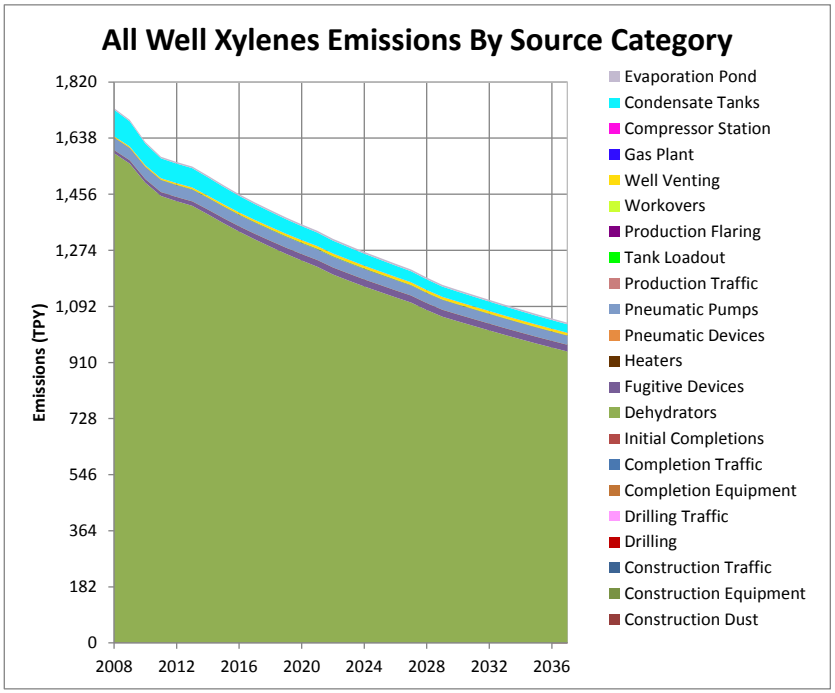

Figure 44. Total New and Existing Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 282. Total New and Existing Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2 [tpy]	2008	0	23,168	655	44,407	6,637	35,396	4,128	54	5,232	310	683,444	0	5,160	4,616	0	110,507	1,275	911	582,056	809,692	540	7	2,318,196
	2009	0	7,485	212	38,728	3,129	8,534	1,946	2,631	5,143	330	728,740	0	5,108	4,921	0	155,878	1,360	972	582,056	809,692	509	7	2,357,381
	2010	0	10,042	284	51,960	4,196	11,450	2,609	3,530	4,996	359	791,890	0	5,055	5,345	0	228,942	1,478	1,056	582,056	809,692	438	7	2,515,386
	2011	0	9,980	282	51,637	4,166	11,379	2,590	3,508	4,894	387	854,605	0	5,003	5,761	0	295,280	1,595	1,140	582,056	809,692	399	7	2,644,361
	2012	0	9,793	276	50,669	4,082	11,166	2,538	3,442	4,842	415	916,548	0	4,954	6,166	0	356,450	1,711	1,222	855,056	853,327	391	8	3,083,058
	2013	0	9,980	280	51,637	4,153	11,379	2,582	3,508	4,793	444	979,799	0	4,905	6,571	0	417,137	1,830	1,306	855,056	853,327	386	8	3,209,083
	2014	0	9,886	277	51,153	4,108	11,272	2,554	3,475	4,722	472	1,042,396	0	4,857	6,966	0	467,844	1,947	1,390	855,056	853,327	367	8	3,322,079
	2015	0	10,198	285	52,767	4,230	11,628	2,629	3,585	4,651	502	1,107,171	0	4,808	7,365	0	517,513	2,068	1,476	855,056	853,327	346	8	3,439,614
	2016	0	7,968	222	41,229	3,299	9,085	2,050	2,801	4,584	524	1,156,376	0	4,760	7,657	0	554,427	2,161	1,542	855,056	853,327	328	8	3,507,406
	2017	0	10,463	291	54,139	4,324	11,930	2,687	3,678	4,519	554	1,223,002	0	4,711	8,055	0	602,052	2,285	1,631	855,056	853,327	313	8	3,643,026
	2018	0	11,508	319	59,544	4,747	13,121	2,949	4,045	4,458	588	1,296,922	0	4,663	8,492	0	676,563	2,424	1,729	855,056	853,327	299	8	3,800,764
	2019	0	9,263	257	47,926	3,815	10,561	2,370	3,256	4,398	614	1,355,164	0	4,614	8,827	0	721,107	2,533	1,807	855,056	853,327	287	8	3,885,189
	2020	0	9,271	256	47,966	3,812	10,570	2,368	3,259	4,343	641	1,413,996	0	4,570	9,160	0	762,258	2,643	1,885	855,056	853,327	275	8	3,985,666
	2021	0	10,463	289	54,139	4,297	11,930	2,669	3,678	4,290	671	1,481,157	0	4,525	9,545	0	805,695	2,769	1,975	855,056	853,327	265	9	4,106,748
	2022	0	9,925	272	51,355	4,061	11,317	2,522	3,489	4,232	700	1,544,562	0	4,481	9,841	0	859,866	2,888	2,060	855,056	853,327	251	9	4,220,213
	2023	0	3,329	92	17,226	1,365	3,796	848	1,170	4,181	708	1,561,914	0	4,436	10,005	0	859,586	2,920	2,083	855,056	853,327	242	9	4,182,293
	2024	0	0	0	0	0	0	0	0	4,130	705	1,556,023	0	4,392	9,934	0	821,421	2,909	2,075	855,056	853,327	234	9	4,110,215
	2025	0	0	0	0	0	0	0	0	4,082	702	1,550,131	0	4,347	9,838	0	796,138	2,898	2,067	855,056	853,327	227	9	4,078,822
	2026	0	0	0	0	0	0	0	0	4,033	700	1,544,239	0	4,303	9,772	0	777,764	2,887	2,059	855,056	853,327	220	8	4,054,370
	2027	0	0	0	0	0	0	0	0	3,986	697	1,538,347	0	4,258	9,712	0	762,717	2,876	2,051	855,056	853,327	213	8	4,033,251
	2028	0	0	0	0	0	0	0	0	3,904	692	1,527,100	0	4,173	9,617	0	749,782	2,855	2,036	855,056	853,327	207	8	4,008,758
	2029	0	0	0	0	0	0	0	0	3,854	689	1,521,743	0	4,133	9,564	0	737,422	2,845	2,029	855,056	853,327	197	8	3,990,869
	2030	0	0	0	0	0	0	0	0	3,811	687	1,516,387	0	4,093	9,512	0	727,118	2,835	2,022	855,056	853,327	192	8	3,975,049
	2031	0	0	0	0	0	0	0	0	3,769	685	1,511,031	0	4,052	9,462	0	717,778	2,825	2,015	855,056	853,327	187	8	3,960,195
	2032	0	0	0	0	0	0	0	0	3,727	682	1,505,675	0	4,012	9,413	0	709,140	2,815	2,008	855,056	853,327	182	8	3,946,045
	2033	0	0	0	0	0	0	0	0	3,685	680	1,500,319	0	3,971	9,365	0	701,115	2,805	2,001	855,056	853,327	177	8	3,932,509
	2034	0	0	0	0	0	0	0	0	3,644	677	1,494,963	0	3,931	9,318	0	693,648	2,795	1,993	855,056	853,327	173	8	3,919,533
	2035	0	0	0	0	0	0	0	0	3,603	675	1,489,606	0	3,890	9,273	0	686,609	2,785	1,986	855,056	853,327	168	8	3,906,988
	2036	0	0	0	0	0	0	0	0	3,563	672	1,484,250	0	3,850	9,229	0	679,998	2,775	1,979	855,056	853,327	165	8	3,894,873
	2037	0	0	0	0	0	0	0	0	3,523	670	1,478,894	0	3,810	9,185	0	673,722	2,765	1,972	855,056	853,327	161	8	3,883,093
	TOTAL	0	162,724	4,549	766,483	64,422	194,517	40,040	49,107	127,593	17,829	39,356,395	0	133,827	252,488	0	18,625,477	73,559	52,479	24,559,686	25,425,276	8,340	241	109,915,033

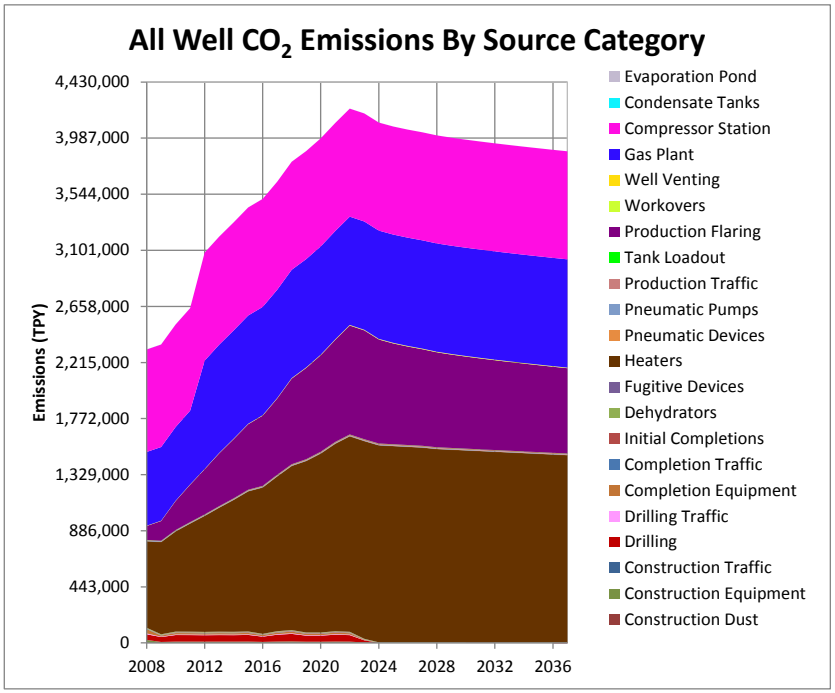

Figure 45. Total New and Existing Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 283. Total New and Existing Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-from CH4 [tpy]	2008	0	14	1	34	6	0	4	12,830	454,768	66,108	275	0	1,228,142	8	1,321	665	1	216,897	7,391	18,182	57,368	24	2,064,038
	2009	0	5	0	7	3	1	2	16	449,981	70,490	293	0	1,215,630	9	1,431	931	1	231,271	7,391	18,182	54,394	24	2,050,060
	2010	0	6	0	9	4	2	2	22	444,904	76,598	319	0	1,203,117	9	1,643	1,354	1	251,313	7,391	18,182	47,684	24	2,052,584
	2011	0	6	0	9	4	2	3	22	440,014	82,664	344	0	1,190,605	10	1,836	1,741	1	271,216	7,391	18,182	43,932	24	2,058,004
	2012	0	6	0	9	4	2	3	21	435,718	88,656	369	0	1,179,055	11	2,024	2,099	1	290,874	8,257	18,277	43,186	25	2,068,596
	2013	0	6	0	9	4	2	3	22	431,440	94,774	394	0	1,167,505	11	2,206	2,455	1	310,947	8,257	18,277	42,650	25	2,078,988
	2014	0	6	0	9	4	2	3	22	427,042	100,829	420	0	1,155,955	12	2,301	2,757	1	330,813	8,257	18,277	40,741	26	2,087,476
	2015	0	6	0	9	5	2	3	22	422,632	107,095	446	0	1,144,405	12	2,380	3,055	1	351,370	8,257	18,277	38,762	26	2,096,762
	2016	0	5	0	7	4	1	2	17	418,238	111,854	465	0	1,132,855	13	2,425	3,277	1	366,986	8,257	18,277	37,027	26	2,099,737
	2017	0	6	0	9	5	2	3	23	413,861	118,299	492	0	1,121,305	13	2,485	3,564	1	388,130	8,257	18,277	35,508	27	2,110,266
	2018	0	7	0	10	5	2	3	25	409,497	125,449	522	0	1,109,756	14	2,721	4,000	1	411,589	8,257	18,277	34,164	27	2,124,324
	2019	0	6	0	8	4	2	3	20	405,142	131,083	545	0	1,098,206	14	2,794	4,267	1	430,072	8,257	18,277	32,937	27	2,131,664
	2020	0	6	0	8	4	2	3	20	401,147	136,773	569	0	1,087,618	15	2,842	4,516	1	448,743	8,257	18,277	31,808	28	2,140,635
	2021	0	6	0	9	5	2	3	23	397,162	143,270	596	0	1,077,031	15	2,875	4,781	1	470,057	8,257	18,277	30,790	28	2,153,187
	2022	0	6	0	9	4	2	3	22	393,132	149,403	622	0	1,066,443	15	3,001	5,102	1	490,179	8,257	18,277	29,421	29	2,163,927
	2023	0	2	0	3	1	1	1	7	389,157	151,081	629	0	1,055,856	16	2,900	5,110	1	495,686	8,257	18,277	28,537	29	2,155,550
	2024	0	0	0	0	0	0	0	0	385,187	150,511	626	0	1,045,268	15	2,604	4,905	1	493,817	8,257	18,277	27,709	28	2,137,206
	2025	0	0	0	0	0	0	0	0	381,229	149,941	624	0	1,034,681	15	2,407	4,768	1	491,947	8,257	18,277	26,982	28	2,119,157
	2026	0	0	0	0	0	0	0	0	377,271	149,372	622	0	1,024,094	15	2,262	4,669	1	490,077	8,257	18,277	26,267	28	2,101,210
	2027	0	0	0	0	0	0	0	0	373,318	148,802	619	0	1,013,506	15	2,143	4,587	1	488,207	8,257	18,277	25,601	28	2,083,360
	2028	0	0	0	0	0	0	0	0	365,852	147,714	615	0	993,294	15	2,040	4,517	1	484,637	8,257	18,277	24,937	27	2,050,182
	2029	0	0	0	0	0	0	0	0	362,200	147,196	613	0	983,669	15	1,937	4,450	1	482,938	8,257	18,277	23,919	27	2,033,497
	2030	0	0	0	0	0	0	0	0	358,609	146,677	610	0	974,044	15	1,854	4,394	1	481,238	8,257	18,277	23,357	27	2,017,359
	2031	0	0	0	0	0	0	0	0	355,023	146,159	608	0	964,419	15	1,779	4,343	1	479,538	8,257	18,277	22,830	27	2,001,275
	2032	0	0	0	0	0	0	0	0	351,438	145,641	606	0	954,794	14	1,710	4,296	1	477,838	8,257	18,277	22,318	27	1,985,217
	2033	0	0	0	0	0	0	0	0	347,854	145,123	604	0	945,169	14	1,645	4,253	1	476,138	8,257	18,277	21,817	26	1,969,177
	2034	0	0	0	0	0	0	0	0	344,274	144,605	602	0	935,544	14	1,584	4,212	1	474,439	8,257	18,277	21,349	26	1,953,183
	2035	0	0	0	0	0	0	0	0	340,697	144,087	600	0	925,919	14	1,528	4,173	1	472,739	8,257	18,277	20,905	26	1,937,222
	2036	0	0	0	0	0	0	0	0	337,127	143,569	597	0	916,294	14	1,474	4,137	1	471,039	8,257	18,277	20,503	26	1,921,315
	2037	0	0	0	0	0	0	0	0	333,558	143,051	595	0	906,669	14	1,424	4,103	1	469,339	8,257	18,277	20,113	26	1,905,426
	TOTAL	0	98	5	156	66	24	42	13,136	11,747,471	3,806,876	15,841	0	31,850,850	402	63,575	111,481	24	12,490,073	244,234	547,920	957,515	796	61,850,585

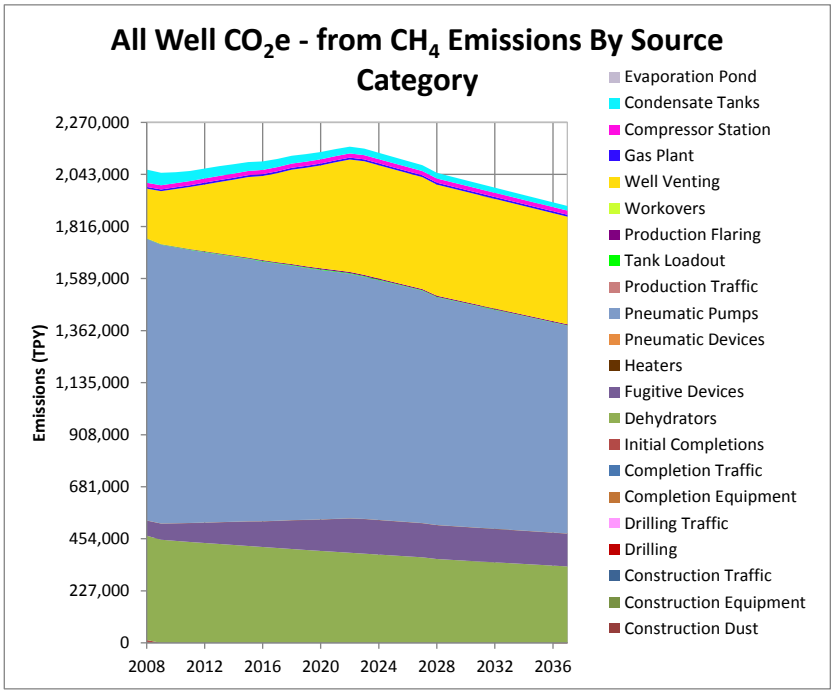

Figure 46. Total New and Existing Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 284. Total New and Existing Wells CO_2e - from N2O Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-from N2O [tpy]	2008	0	183	5	2,490	41	1,984	26	0	0	0	3,884	0	0	60	0	182	10	0	4,096	5,974	0	0	18,935
	2009	0	59	1	305	19	67	12	9	0	0	4,142	0	0	64	0	295	11	0	4,096	5,974	0	0	15,053
	2010	0	79	2	409	23	90	15	12	0	0	4,501	0	0	68	0	467	12	0	4,096	5,974	0	0	15,748
	2011	0	79	2	406	22	90	14	12	0	0	4,857	0	0	72	0	628	13	0	4,096	5,974	0	0	16,263
	2012	0	77	1	399	20	88	13	11	0	0	5,209	0	0	75	0	779	14	0	6,007	6,333	0	0	19,025
	2013	0	79	1	406	19	90	12	12	0	0	5,569	0	0	77	0	930	14	0	6,007	6,333	0	0	19,548
	2014	0	78	1	403	17	89	11	12	0	0	5,924	0	0	79	0	1,065	15	0	6,007	6,333	0	0	20,034
	2015	0	81	1	415	16	91	10	12	0	0	6,292	0	0	80	0	1,201	16	0	6,007	6,333	0	0	20,557
	2016	0	63	1	324	12	71	8	9	0	0	6,572	0	0	80	0	1,304	17	0	6,007	6,333	0	0	20,802
	2017	0	83	1	426	15	94	9	12	0	0	6,951	0	0	81	0	1,438	18	0	6,007	6,333	0	0	21,467
	2018	0	91	1	469	15	103	10	13	0	0	7,371	0	0	82	0	1,619	19	0	6,007	6,333	0	0	22,133
	2019	0	73	1	377	11	83	7	11	0	0	7,702	0	0	81	0	1,741	20	0	6,007	6,333	0	0	22,448
	2020	0	73	1	377	11	83	7	11	0	0	8,036	0	0	81	0	1,858	21	0	6,007	6,333	0	0	22,900
	2021	0	83	1	426	11	94	7	12	0	0	8,418	0	0	81	0	1,986	22	0	6,007	6,333	0	0	23,481
	2022	0	78	1	404	9	89	6	12	0	0	8,778	0	0	78	0	2,126	23	0	6,007	6,333	0	0	23,944
	2023	0	26	0	136	3	30	2	4	0	0	8,877	0	0	81	0	2,145	23	0	6,007	6,333	0	0	23,668
	2024	0	0	0	0	0	0	0	0	0	0	8,843	0	0	79	0	2,086	23	0	6,007	6,333	0	0	23,371
	2025	0	0	0	0	0	0	0	0	0	0	8,810	0	0	75	0	2,047	23	0	6,007	6,333	0	0	23,295
	2026	0	0	0	0	0	0	0	0	0	0	8,776	0	0	73	0	2,018	23	0	6,007	6,333	0	0	23,231
	2027	0	0	0	0	0	0	0	0	0	0	8,743	0	0	72	0	1,995	23	0	6,007	6,333	0	0	23,172
	2028	0	0	0	0	0	0	0	0	0	0	8,679	0	0	70	0	1,975	22	0	6,007	6,333	0	0	23,086
	2029	0	0	0	0	0	0	0	0	0	0	8,649	0	0	68	0	1,956	22	0	6,007	6,333	0	0	23,035
	2030	0	0	0	0	0	0	0	0	0	0	8,618	0	0	67	0	1,940	22	0	6,007	6,333	0	0	22,987
	2031	0	0	0	0	0	0	0	0	0	0	8,588	0	0	66	0	1,925	22	0	6,007	6,333	0	0	22,941
	2032	0	0	0	0	0	0	0	0	0	0	8,557	0	0	65	0	1,912	22	0	6,007	6,333	0	0	22,896
	2033	0	0	0	0	0	0	0	0	0	0	8,527	0	0	64	0	1,899	22	0	6,007	6,333	0	0	22,852
	2034	0	0	0	0	0	0	0	0	0	0	8,496	0	0	63	0	1,887	22	0	6,007	6,333	0	0	22,809
	2035	0	0	0	0	0	0	0	0	0	0	8,466	0	0	63	0	1,876	22	0	6,007	6,333	0	0	22,767
	2036	0	0	0	0	0	0	0	0	0	0	8,435	0	0	62	0	1,866	22	0	6,007	6,333	0	0	22,726
	2037	0	0	0	0	0	0	0	0	0	0	8,405	0	0	61	0	1,856	22	0	6,007	6,333	0	0	22,684
	TOTAL	0	1,286	21	8,172	264	3,236	168	163	0	0	223,676	0	0	2,168	0	47,003	580	0	172,558	188,565	0	0	647,859

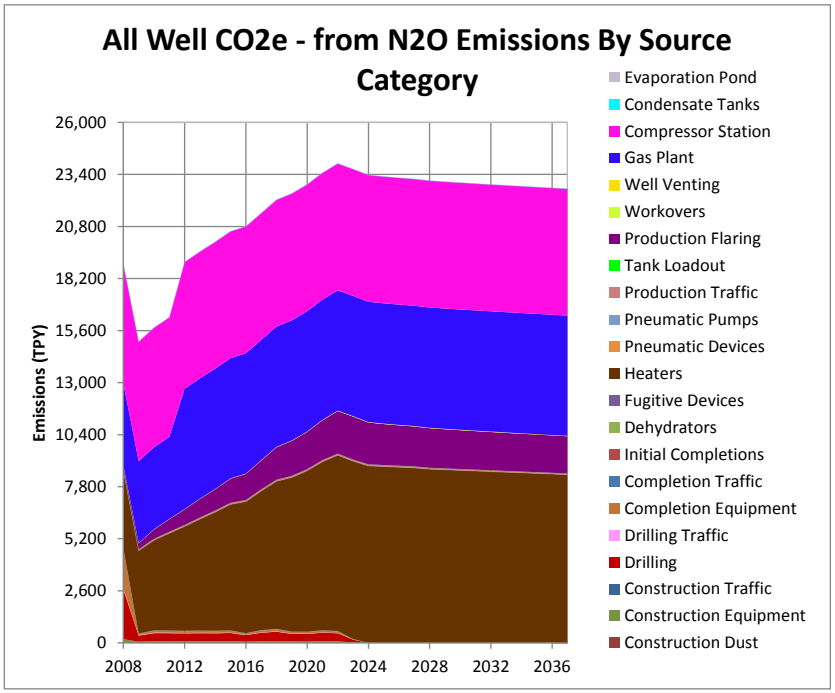

Figure 47. Total New and Existing Wells CO_2e - from N_2O Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 285. Total New and Existing Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.

		Construction			Drilling		Completion			Production														Total (Costruction + Drilling + Completion + Production)
Pollutant	Year	Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
CO2e-total [tpy]	2008	0	23,365	661	46,930	6,685	37,381	4,158	12,884	460,000	66,418	687,604	0	1,233,303	4,684	1,321	111,354	1,286	217,808	593,542	833,848	57,908	31	4,401,169
	2009	0	7,549	213	39,039	3,151	8,603	1,960	2,656	455,124	70,820	733,175	0	1,220,738	4,993	1,431	157,104	1,371	232,243	593,542	833,848	54,903	31	4,422,494
	2010	0	10,128	286	52,378	4,223	11,542	2,627	3,564	449,900	76,957	796,709	0	1,208,173	5,423	1,643	230,763	1,490	252,369	593,542	833,848	48,122	31	4,583,717
	2011	0	10,065	284	52,052	4,191	11,470	2,607	3,541	444,908	83,052	859,806	0	1,195,608	5,843	1,836	297,649	1,609	272,355	593,542	833,848	44,331	32	4,718,628
	2012	0	9,876	278	51,076	4,106	11,255	2,553	3,475	440,560	89,071	922,126	0	1,184,009	6,251	2,024	359,328	1,726	292,096	869,320	877,937	43,577	32	5,170,679
	2013	0	10,065	282	52,052	4,176	11,470	2,597	3,541	436,233	95,218	985,762	0	1,172,411	6,659	2,206	420,522	1,845	312,254	869,320	877,937	43,037	33	5,307,620
	2014	0	9,971	279	51,564	4,130	11,363	2,567	3,508	431,765	101,301	1,048,740	0	1,160,812	7,056	2,301	471,667	1,963	332,203	869,320	877,937	41,108	33	5,429,589
	2015	0	10,285	287	53,191	4,251	11,721	2,642	3,619	427,283	107,596	1,113,909	0	1,149,214	7,458	2,380	521,769	2,086	352,846	869,320	877,937	39,108	34	5,556,934
	2016	0	8,036	223	41,561	3,314	9,158	2,060	2,828	422,822	112,378	1,163,414	0	1,137,615	7,750	2,425	559,008	2,178	368,527	869,320	877,937	37,355	34	5,627,945
	2017	0	10,552	293	54,574	4,343	12,026	2,699	3,713	418,380	118,853	1,230,445	0	1,126,017	8,149	2,485	607,054	2,304	389,760	869,320	877,937	35,821	35	5,774,759
	2018	0	11,606	321	60,023	4,767	13,227	2,962	4,084	413,955	126,037	1,304,814	0	1,114,418	8,587	2,721	682,182	2,444	413,318	869,320	877,937	34,463	35	5,947,221
	2019	0	9,342	258	48,311	3,830	10,646	2,380	3,287	409,540	131,697	1,363,411	0	1,102,820	8,922	2,794	727,115	2,554	431,879	869,320	877,937	33,224	36	6,039,302
	2020	0	9,349	257	48,352	3,827	10,655	2,377	3,290	405,490	137,414	1,422,602	0	1,092,188	9,256	2,842	768,632	2,665	450,629	869,320	877,937	32,083	36	6,149,201
	2021	0	10,552	290	54,574	4,313	12,026	2,679	3,713	401,452	143,941	1,490,171	0	1,081,556	9,641	2,875	812,462	2,791	472,032	869,320	877,937	31,055	37	6,283,417
	2022	0	10,010	273	51,768	4,075	11,408	2,530	3,522	397,364	150,103	1,553,962	0	1,070,924	9,934	3,001	867,094	2,911	492,239	869,320	877,937	29,672	37	6,408,084
	2023	0	3,358	92	17,364	1,370	3,826	851	1,181	393,338	151,789	1,571,420	0	1,060,292	10,102	2,900	866,841	2,944	497,769	869,320	877,937	28,779	37	6,361,511
	2024	0	0	0	0	0	0	0	0	389,318	151,216	1,565,492	0	1,049,660	10,029	2,604	828,411	2,933	495,891	869,320	877,937	27,943	37	6,270,792
	2025	0	0	0	0	0	0	0	0	385,311	150,644	1,559,565	0	1,039,028	9,928	2,407	802,953	2,922	494,014	869,320	877,937	27,209	37	6,221,273
	2026	0	0	0	0	0	0	0	0	381,304	150,071	1,553,637	0	1,028,396	9,861	2,262	784,451	2,911	492,136	869,320	877,937	26,487	36	6,178,811
	2027	0	0	0	0	0	0	0	0	377,304	149,499	1,547,710	0	1,017,765	9,799	2,143	769,300	2,900	490,258	869,320	877,937	25,814	36	6,139,783
	2028	0	0	0	0	0	0	0	0	369,756	148,405	1,536,393	0	997,467	9,702	2,040	756,274	2,878	486,674	869,320	877,937	25,145	36	6,082,027
	2029	0	0	0	0	0	0	0	0	366,054	147,885	1,531,004	0	987,802	9,647	1,937	743,827	2,868	484,967	869,320	877,937	24,117	35	6,047,401
	2030	0	0	0	0	0	0	0	0	362,420	147,364	1,525,616	0	978,137	9,594	1,854	733,452	2,858	483,260	869,320	877,937	23,548	35	6,015,396
	2031	0	0	0	0	0	0	0	0	358,792	146,844	1,520,227	0	968,471	9,543	1,779	724,046	2,848	481,553	869,320	877,937	23,017	35	5,984,411
	2032	0	0	0	0	0	0	0	0	355,165	146,323	1,514,838	0	958,806	9,493	1,710	715,347	2,838	479,846	869,320	877,937	22,500	35	5,954,157
	2033	0	0	0	0	0	0	0	0	351,539	145,803	1,509,449	0	949,140	9,444	1,645	707,266	2,828	478,139	869,320	877,937	21,994	34	5,924,538
	2034	0	0	0	0	0	0	0	0	347,918	145,282	1,504,061	0	939,475	9,396	1,584	699,747	2,818	476,432	869,320	877,937	21,521	34	5,895,525
	2035	0	0	0	0	0	0	0	0	344,300	144,762	1,498,672	0	929,810	9,350	1,528	692,658	2,808	474,725	869,320	877,937	21,073	34	5,866,977
	2036	0	0	0	0	0	0	0	0	340,690	144,241	1,493,283	0	920,144	9,305	1,474	686,002	2,798	473,018	869,320	877,937	20,668	34	5,838,914
	2037	0	0	0	0	0	0	0	0	337,081	143,721	1,487,894	0	910,479	9,260	1,424	679,681	2,788	471,311	869,320	877,937	20,274	34	5,811,203
	TOTAL	0	164,108	4,575	774,811	64,753	197,778	40,249	62,406	11,875,065	3,824,705	39,595,911	0	31,984,677	255,058	63,575	18,783,960	74,163	12,542,552	24,976,478	26,161,761	965,855	1,037	172,413,477

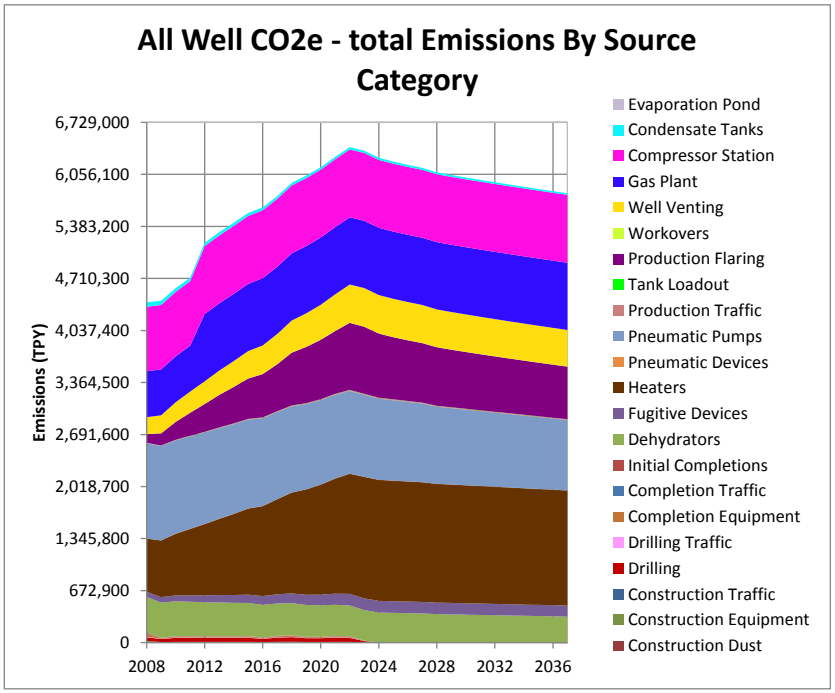

Figure 48. Total New and Existing Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.