Appendix H

Continental Divide-Creston Proposed Action Project Emissions Inventory

Contents

TABLES

FIGURES

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 Proposed Action Project Emissions Inventory

In Appendix H, we present the detailed emissions calculations used to develop the CD-C Project Emission Inventory for the Proposed Action.

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%

(shaded) 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.

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

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

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 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

MOVES Emissions (tons/year-well) = Emission factor (g/mile) * # Trips * Trip Distance (miles) / 453.6 (g/lb) * 2000 (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.

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

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

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 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

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.

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

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

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 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) = $58(U^*-U_t^*)^2 + 25(U^*-U_t^*)$ 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:

Emissions (tons/year-well) = Emission factor (g/hp-hr) * Horsepower * Time Used (hours) * Load / (453.6 (g/lb) * 2000 (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

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.

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

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

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 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	Heavy Oil	Water/Oil
		>20° API	<20° API	
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	8.3180	8.2488	10.3047	34.8841			101.69	
2,2,4-Trimethylpentane (isooctane)						0.4829	0.3565	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	4.4803	86.1766	0.0015	0.0016	86.18	Option 2: A=6.75483, B=1081.176, C=229.343
2,3-Dimethylbutane						2.5637	1.9666	3.2526	86.1800	0.0074	0.0058	86.18	Option 2: A=6.8098, B=1127.187, C=228.9
2-Methylpentane						2.2792	1.7948	2.9102	86.1900	0.0247	0.0176	86.18	Option 2: A=6.8391, B=1135.41, C=226.57
3-Methylpentane						1.8953	1.4637	2.4263	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)						22.7238	18.7796	27.2746	58.1238	0.0178	0.1251	58.12	Option 2: A=6.80896, B=935.86, C=238.73
Cyclohexene						0.8985	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	0.0567	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	0.3822	0.6807	100.2000	0.2288	0.0382	100.20	Option 3: A=37.358, B=8.2585
Hexane (-n)						1.5831	1.2100	2.0463	86.1700	0.0455	0.0226	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Isobutane						34.0780	28.4376	40.5351	58.1230	0.0088	0.0848	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	3,178.7515	3,618.8806	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	98.1860	0.0198	0.0028	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)						5.8179	4.6368	7.2392	72.1500	0.0326	0.0593	72.15	Option 3: A=27691, B=7.558
Propane						95.6603	82.2333	111.0438	44.0962	0.0065	0.1946	44.10	Option 2: A=6.80398, B=803.81, C=246.99
Toluene						0.2631	0.1907	0.3678	92.1300	0.0508	0.0042	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Xylenes (mixed isomers)						0.0699	0.0488	0.0969	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: THC component CO2 emissions: lb emitted/well	Moles C in compound/ Moles C in CO2	CO2 Emissions (tons/bbl)	CO component CO2 emissions potentials (tons/bbl)	Working 2008 CO2 emissions: THC component CO2 emissions: lb emitted/turnover	Moles C in compound /Moles C in CO2	CO2 Emissions (Tons/turnover)	CO component CO2 emissions potentials (tons/well)	Breathing 2008 CO2 emissions: THC component CO2 emissions: lb emitted/well	Moles C in compound/Moles C in CO2	CO2 Emissions (tons/well)	CO component CO2 emissions potentials (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 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	^oK		
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.

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

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

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 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.

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 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).

Pollutant	Emission Factors			
	Turbine		Reciprocating	
	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 0.21341975308642 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.

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	
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

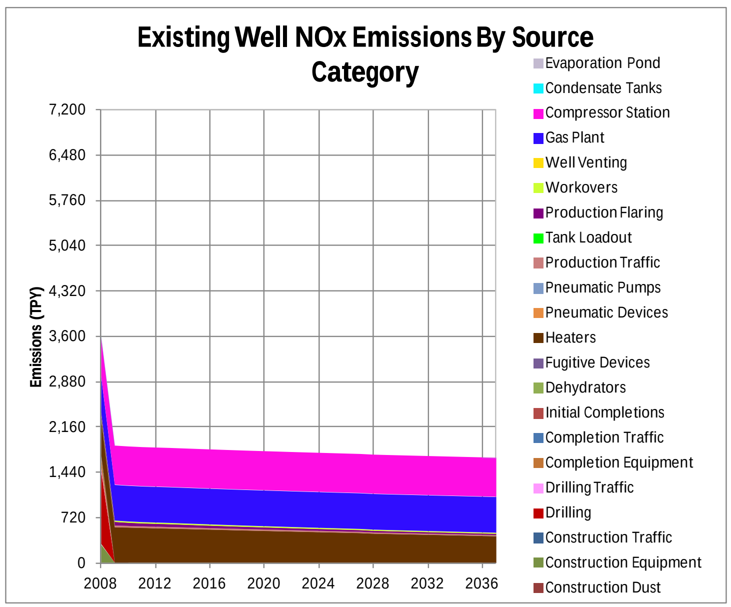

Figure 1. Existing Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year

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

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	
	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
VOC [tpy]	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

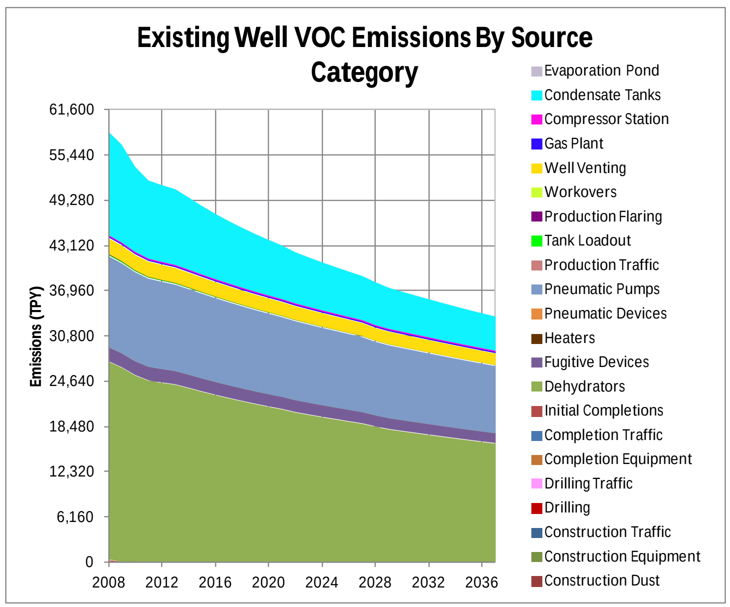

Figure 2. Existing Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

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

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	
	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
SO2 [tpy]	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

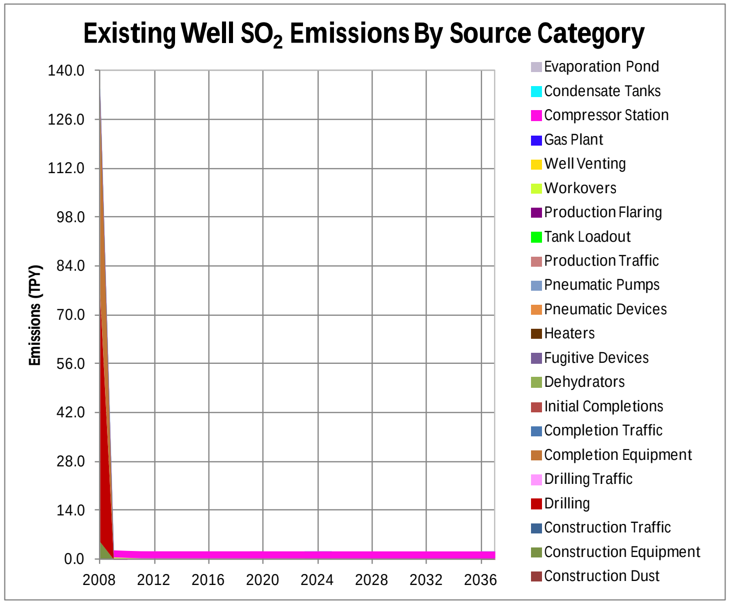

Figure 3. Existing Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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
PM10 [tpy]	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

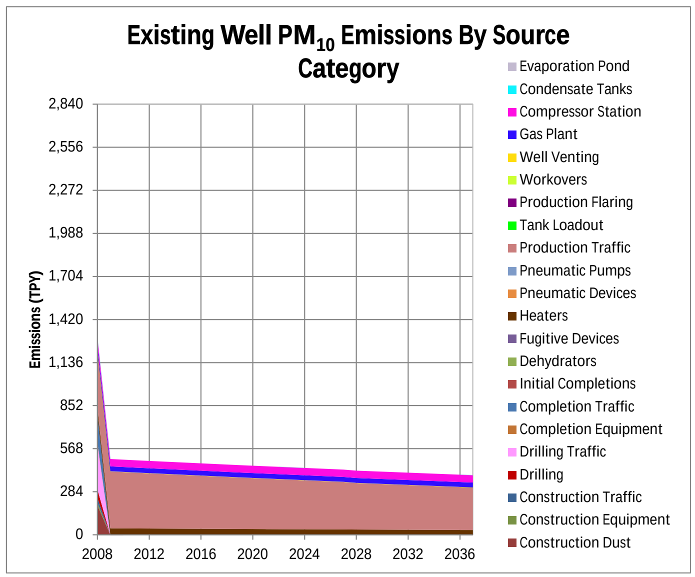

Figure 4. Existing Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

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

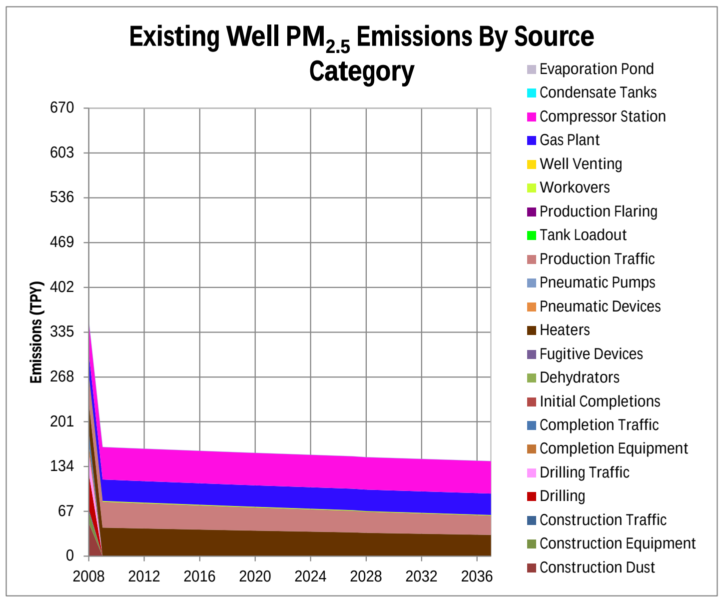

Figure 5. Existing Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

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

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	
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

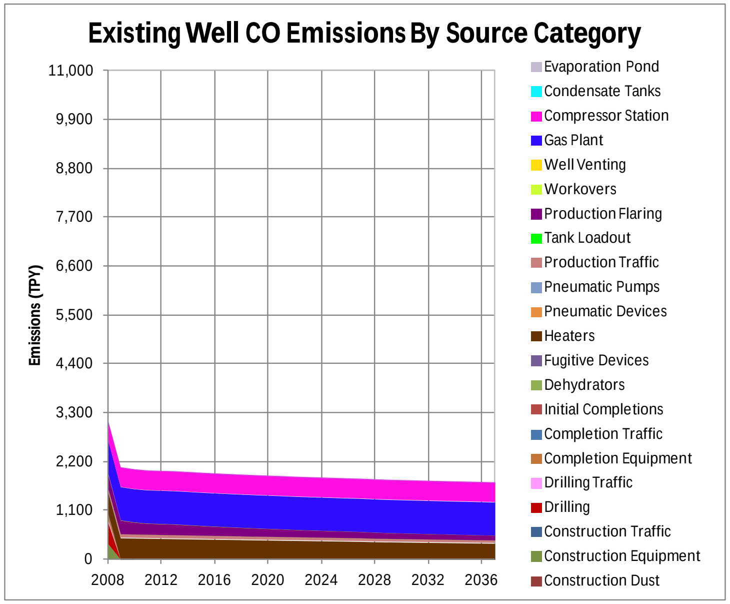

Figure 6. Existing Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

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

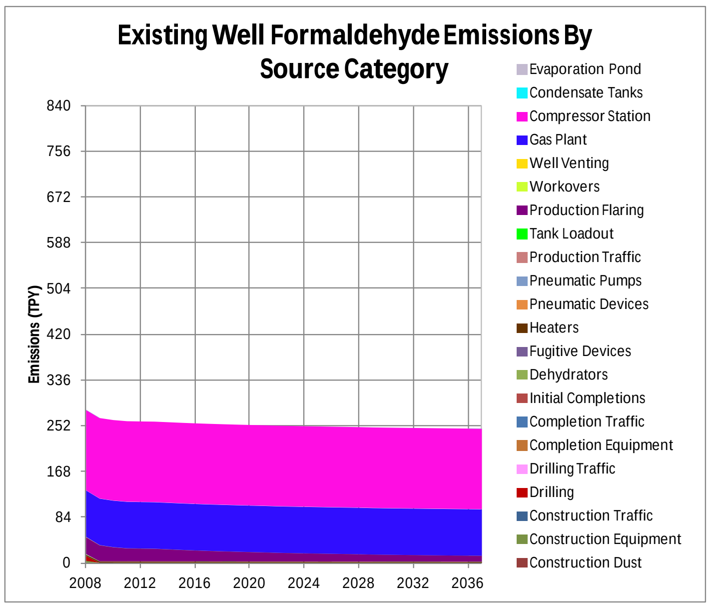

Figure 7. Existing Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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
n-hexane [tpy]	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

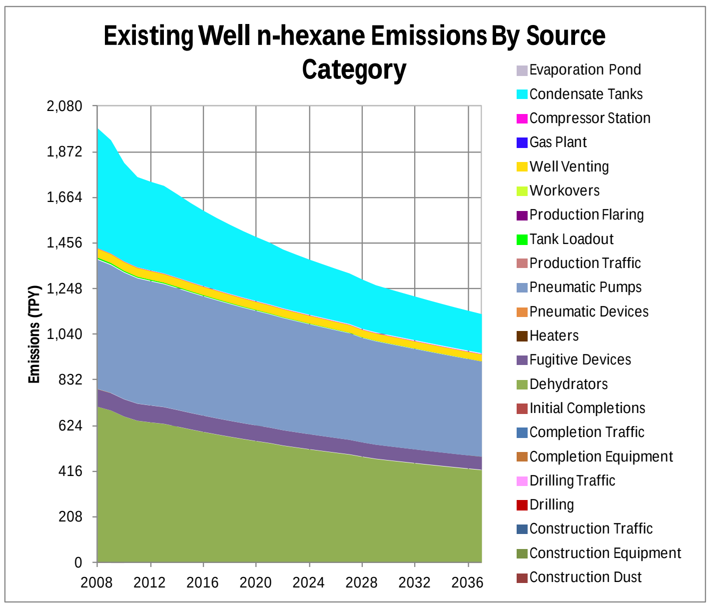

Figure 8. Existing Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

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

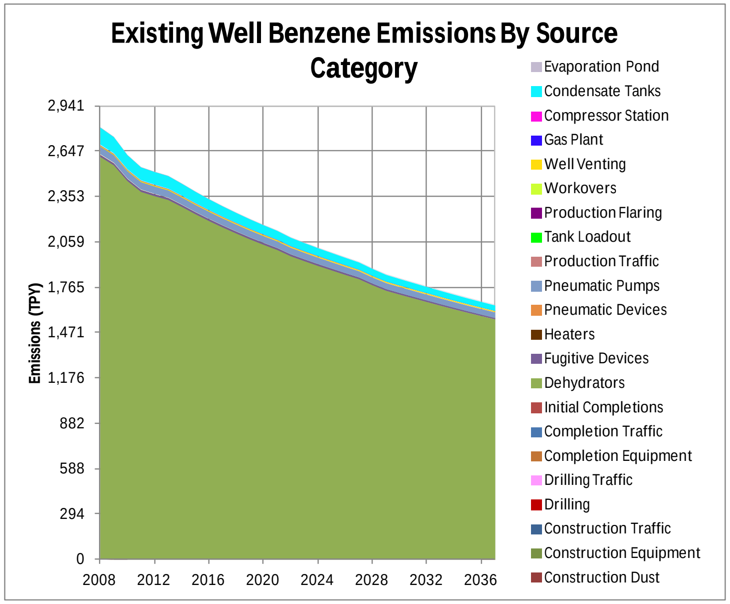

Figure 9. Existing Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

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

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	
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

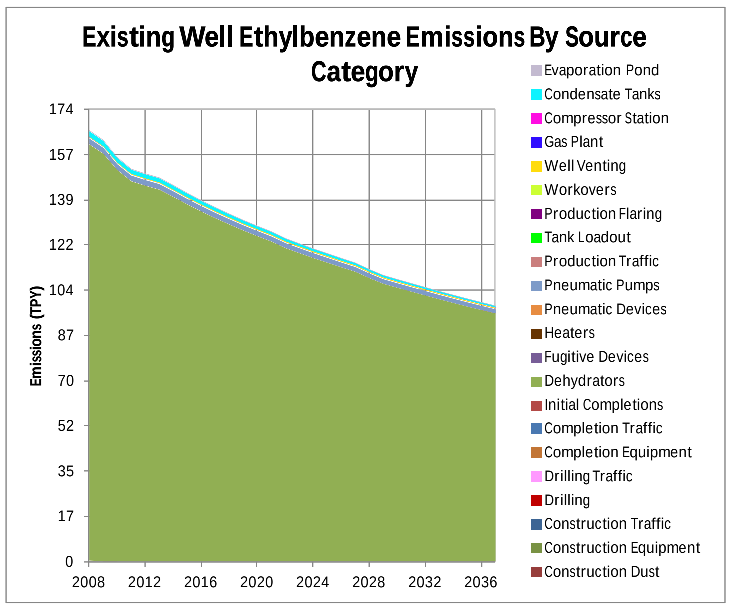

Figure 10. Existing Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

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

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	
	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
toluene [tpy]	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

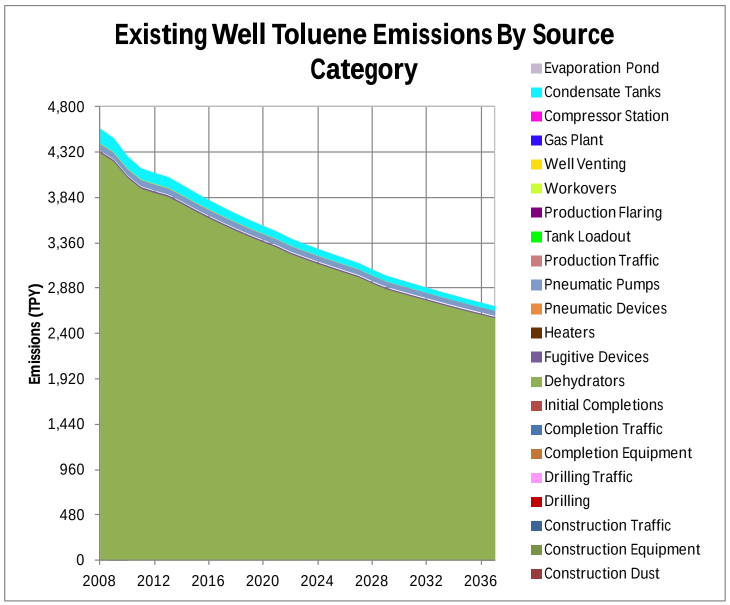

Figure 11. Existing Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

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

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	
	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
xylenes [tpy]	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

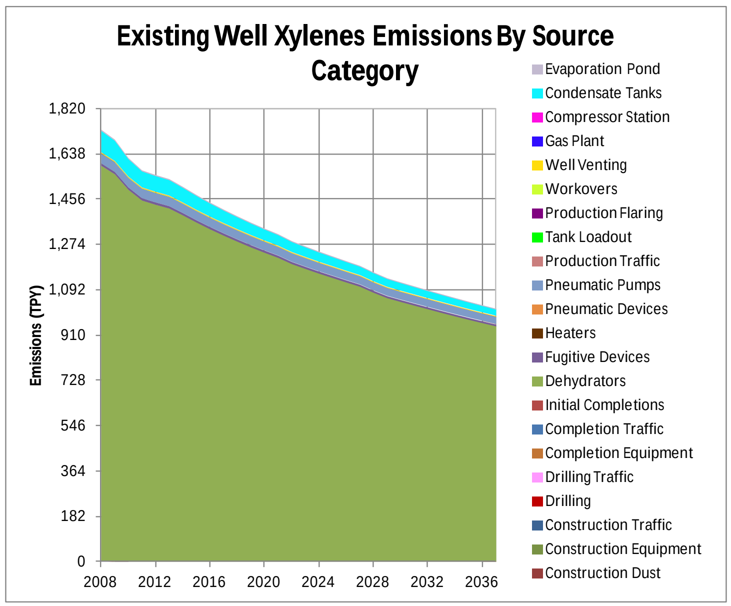

Figure 12. Existing Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

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

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	
	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
CO2 [tpy]	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

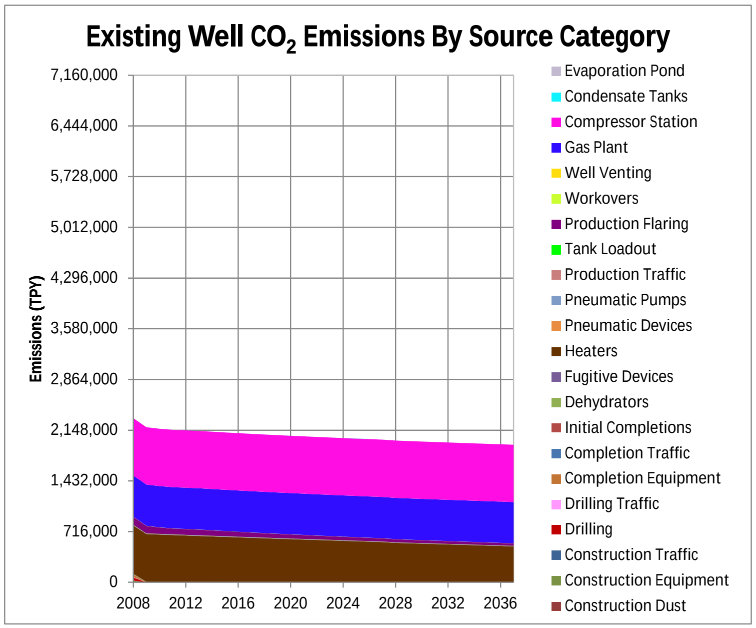

Figure 13. Existing Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

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

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	
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

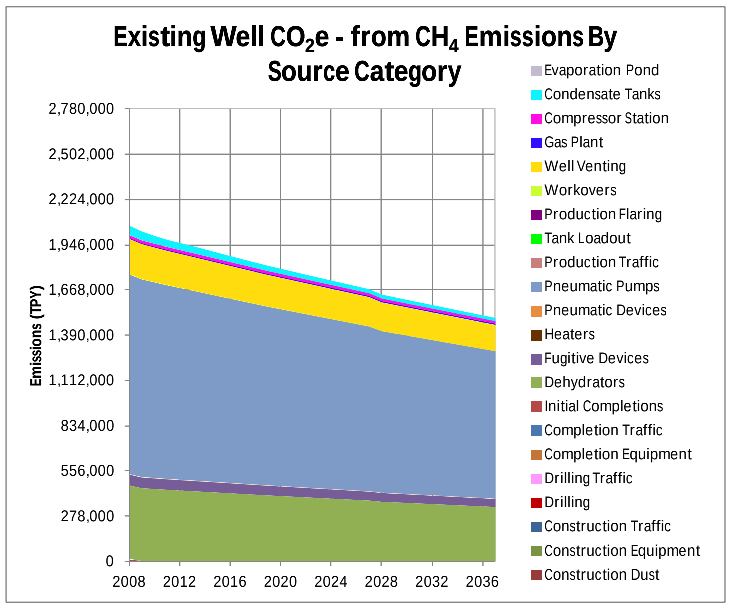

Figure 14. Existing Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

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

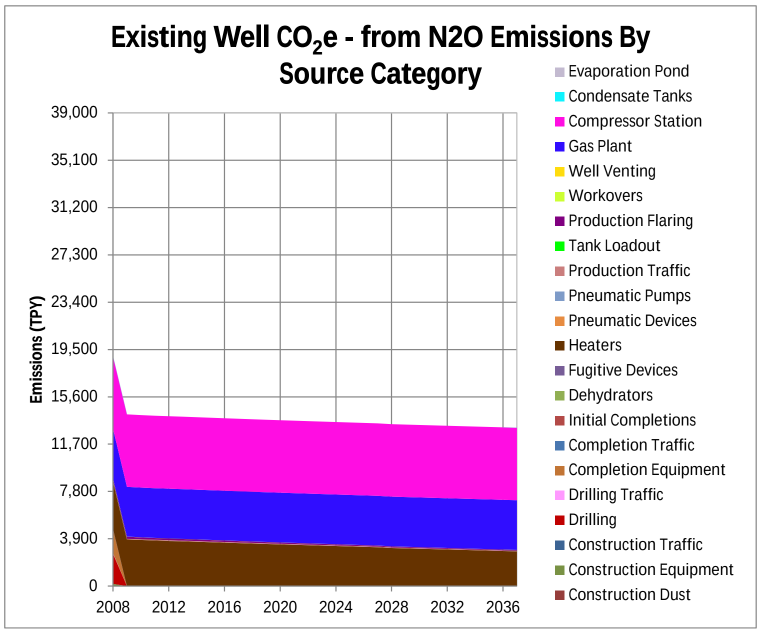

Figure 15. Existing Wells CO_2e - from N_2O Emissions (tons/year) Contribution by Source Category and by Project Year.

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

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	
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

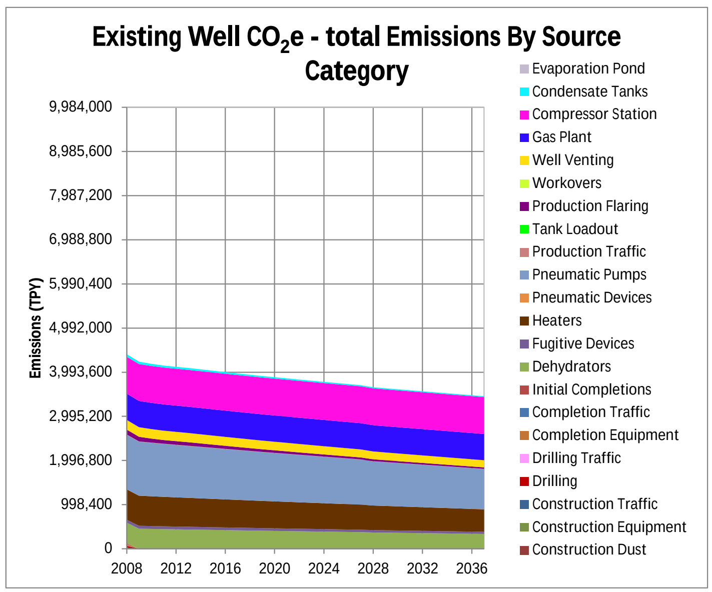

Figure 16. Existing Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.

Project Emissions Inventory for Future Wells

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

Year	Project Yr	Well Pads Constructed	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	278	480	480	845	42,879	278	480	845	43
2010	3	374	644	1,124	2,598	131,879	652	1,124	3,443	175
2011	4	371	640	1,764	3,910	198,498	1,023	1,764	7,353	373
2012	5	364	628	2,392	4,848	246,066	1,387	2,392	12,201	619
2013	6	371	640	3,032	5,729	290,834	1,759	3,032	17,930	910
2014	7	368	634	3,666	6,382	323,956	2,126	3,666	24,312	1,234
2015	8	379	654	4,320	6,966	353,579	2,506	4,320	31,278	1,588
2016	9	296	511	4,831	7,369	374,085	2,802	4,831	38,647	1,962
2017	10	389	671	5,502	7,816	396,752	3,191	5,502	46,463	2,359
2018	11	428	738	6,240	9,043	459,014	3,619	6,240	55,506	2,818
2019	12	345	594	6,834	9,510	482,764	3,964	6,834	65,016	3,300
2020	13	345	595	7,429	9,854	500,212	4,309	7,429	74,870	3,801
2021	14	389	671	8,100	10,120	513,728	4,698	8,100	84,991	4,314
2022	15	369	637	8,736	10,847	550,628	5,067	8,736	95,838	4,865
2023	16	124	214	8,950	10,487	532,345	5,191	8,950	106,325	5,397
2024	17	0	0	8,950	9,235	468,804	5,191	8,950	115,561	5,866
2025	18	0	0	8,950	8,418	427,312	5,191	8,950	123,979	6,293
2026	19	0	0	8,950	7,837	397,804	5,191	8,950	131,815	6,691
2027	20	0	0	8,950	7,366	373,908	5,191	8,950	139,181	7,065
2028	21	0	0	8,950	6,964	353,503	5,191	8,950	146,145	7,419
2029	22	0	0	8,950	6,612	335,618	5,191	8,950	152,757	7,754
2030	23	0	0	8,950	6,296	319,610	5,191	8,950	159,053	8,074
2031	24	0	0	8,950	6,011	305,143	5,191	8,950	165,065	8,379
2032	25	0	0	8,950	5,749	291,843	5,191	8,950	170,814	8,671
2033	26	0	0	8,950	5,508	279,574	5,191	8,950	176,322	8,950
2034	27	0	0	8,950	5,283	268,151	5,191	8,950	181,604	9,218
2035	28	0	0	8,950	5,070	257,382	5,191	8,950	186,675	9,476
2036	29	0	0	8,950	4,870	247,200	5,191	8,950	191,545	9,723
2037	30	0	0	8,950	4,680	237,559	5,191	8,950	196,224	9,961
Total		**5,191**	**8,950**							

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	278	480	480	42879	844710	0	559	844710	559	480	480	480	1
2010	374	1124	644	131879	2598025	0	1721	2598025	1721	1124	1189	1124	1
2011	371	1764	640	198498	3910403	0	2590	3910403	2590	1764	1849	1764	1
2012	364	2392	628	246066	4847507	1	3210	4847507	3210	2392	2459	2392	1
2013	371	3032	640	290834	5729425	1	3794	5729425	3794	3032	3074	3032	1
2014	368	3666	634	323956	6381932	1	4226	6381932	4226	3666	3659	3666	1
2015	379	4320	654	353579	6965513	1	4613	6965513	4613	4320	4253	4320	1
2016	296	4831	511	374085	7369471	1	4880	7369471	4880	4831	4712	4831	1
2017	389	5502	671	396752	7816018	1	5502	7816018	5502	5502	5305	5502	1
2018	428	6240	738	459014	9042569	1	6240	9042569	6240	6240	6035	6240	1
2019	345	6834	594	482764	9510444	1	6834	9510444	6834	6834	6569	6834	1
2020	345	7429	595	500212	9854172	1	7429	9854172	7429	7429	7089	7429	1
2021	389	8100	671	513728	10120451	1	8100	10120451	8100	8100	7663	8100	1
2022	369	8736	637	550628	10847380	1	8736	10847380	8736	8736	8258	8736	1
2023	124	8950	214	532345	10487190	1	8950	10487190	8950	8950	8394	8950	1
2024	0	8950	0	468804	9235443	1	8950	9235443	8950	8950	8262	8950	1
2025	0	8950	0	427312	8418050	1	8950	8418050	8950	8950	8176	8950	1
2026	0	8950	0	397804	7836739	1	8950	7836739	8950	8950	8115	8950	1
2027	0	8950	0	373908	7365979	1	8950	7365979	8950	8950	8065	8950	1
2028	0	8950	0	353503	6964003	1	8950	6964003	8950	8950	8023	8950	1
2029	0	8950	0	335618	6611673	1	8950	6611673	8950	8950	7986	8950	1
2030	0	8950	0	319610	6296321	1	8950	6296321	8950	8950	7952	8950	1
2031	0	8950	0	305143	6011315	1	8950	6011315	8950	8950	7922	8950	1
2032	0	8950	0	291843	5749315	1	8950	5749315	8950	8950	7895	8950	1
2033	0	8950	0	279574	5507609	1	8950	5507609	8950	8950	7869	8950	1
2034	0	8950	0	268151	5282566	1	8950	5282566	8950	8950	7845	8950	1
2035	0	8950	0	257382	5070431	1	8950	5070431	8950	8950	7823	8950	1
2036	0	8950	0	247200	4869849	1	8950	4869849	8950	8950	7802	8950	1
2037	0	8950	0	237559	4679907	1	8950	4679907	8950	8950	7782	8950	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 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	480	480	0.0%	0	480	0.0%	480	0	100%	480
New Project_2010	644	1,124	0.0%	0	644	0.0%	1124	0	100%	1124
New Project_2011	640	1,764	0.0%	0	640	0.0%	1764	0	100%	1764
New Project_2012	628	2,392	0.0%	0	628	0.0%	2392	0	100%	2392
New Project_2013	640	3,032	0.0%	0	640	0.0%	3032	0	100%	3032
New Project_2014	634	3,666	0.0%	0	634	0.0%	3666	0	100%	3666
New Project_2015	654	4,320	0.0%	0	654	0.0%	4320	0	100%	4320
New Project_2016	511	4,831	0.0%	0	511	0.0%	4831	0	100%	4831
New Project_2017	671	5,502	0.0%	0	671	0.0%	5502	0	100%	5502
New Project_2018	738	6,240	0.0%	0	738	0.0%	6240	0	100%	6240
New Project_2019	594	6,834	0.0%	0	594	0.0%	6834	0	100%	6834
New Project_2020	595	7,429	0.0%	0	595	0.0%	7429	0	100%	7429
New Project_2021	671	8,100	0.0%	0	671	0.0%	8100	0	100%	8100
New Project_2022	637	8,736	0.0%	0	637	0.0%	8736	0	100%	8736
New Project_2023	214	8,950	0.0%	0	214	0.0%	8950	0	100%	8950
New Project_2024	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2025	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2026	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2027	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2028	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2029	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2030	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2031	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2032	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2033	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2034	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2035	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2036	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2037	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
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	480	480	0.0%	0	480	0.0%	480	0	100%	480
New Project_2010	644	1,124	0.0%	0	644	0.0%	1124	0	100%	1124
New Project_2011	640	1,764	0.0%	0	640	0.0%	1764	0	100%	1764
New Project_2012	628	2,392	0.0%	0	628	0.0%	2392	0	100%	2392
New Project_2013	640	3,032	0.0%	0	640	0.0%	3032	0	100%	3032
New Project_2014	634	3,666	0.0%	0	634	0.0%	3666	0	100%	3666
New Project_2015	654	4,320	0.0%	0	654	0.0%	4320	0	100%	4320
New Project_2016	511	4,831	0.0%	0	511	0.0%	4831	0	100%	4831
New Project_2017	671	5,502	0.0%	0	671	0.0%	5502	0	100%	5502
New Project_2018	738	6,240	0.0%	0	738	0.0%	6240	0	100%	6240
New Project_2019	594	6,834	0.0%	0	594	0.0%	6834	0	100%	6834
New Project_2020	595	7,429	0.0%	0	595	0.0%	7429	0	100%	7429
New Project_2021	671	8,100	0.0%	0	671	0.0%	8100	0	100%	8100
New Project_2022	637	8,736	0.0%	0	637	0.0%	8736	0	100%	8736
New Project_2023	214	8,950	0.0%	0	214	0.0%	8950	0	100%	8950
New Project_2024	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2025	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2026	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2027	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2028	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2029	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2030	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2031	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2032	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2033	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2034	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2035	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2036	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2037	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
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	480	480	0.0%	0	480	0.0%	480	0	100%	480
New Project_2010	644	1,124	0.0%	0	644	0.0%	1124	0	100%	1124
New Project_2011	640	1,764	0.0%	0	640	0.0%	1764	0	100%	1764
New Project_2012	628	2,392	0.0%	0	628	0.0%	2392	0	100%	2392
New Project_2013	640	3,032	0.0%	0	640	0.0%	3032	0	100%	3032
New Project_2014	634	3,666	0.0%	0	634	0.0%	3666	0	100%	3666
New Project_2015	654	4,320	0.0%	0	654	0.0%	4320	0	100%	4320
New Project_2016	511	4,831	0.0%	0	511	0.0%	4831	0	100%	4831
New Project_2017	671	5,502	0.0%	0	671	0.0%	5502	0	100%	5502
New Project_2018	738	6,240	0.0%	0	738	0.0%	6240	0	100%	6240
New Project_2019	594	6,834	0.0%	0	594	0.0%	6834	0	100%	6834
New Project_2020	595	7,429	0.0%	0	595	0.0%	7429	0	100%	7429
New Project_2021	671	8,100	0.0%	0	671	0.0%	8100	0	100%	8100
New Project_2022	637	8,736	0.0%	0	637	0.0%	8736	0	100%	8736
New Project_2023	214	8,950	0.0%	0	214	0.0%	8950	0	100%	8950
New Project_2024	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2025	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2026	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2027	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2028	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2029	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2030	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2031	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2032	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2033	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2034	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2035	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2036	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
New Project_2037	0	8,950	0.0%	0	0	0.0%	8950	0	100%	8950
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)	
(green)	EPA NONROAD model Fully Deteriorated Tier Emission Factors	
(orange)	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	

Equipment			Activity & Emission Factors	Emissions (lb/well pad)
	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 (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	

Equipment			Activity & Emission Factors	Emissions (lb/well pad)
	Load Factor		0.4	
	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.

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

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

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 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:

Conservatively assumed that all equipment uses Tier 0 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)		
(green)	EPA NONROAD model Fully Deteriorated Tier Emission Factors		
(orange)	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 0	
	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	8.581	1021.56
		VOC	0.764	90.94
		CO	3.199	380.89
		PM10	0.512	60.96
		PM2.5	0.497	59.13
		SO2	0.115	13.69
		CO2	529	62943.91
		CH4	0.012	1.38
		PM_filt	0.184	21.88
		PM_cond	0.313	37.25
	(g/gal)	N2O	0.260	1.60
Engine 2	Engine Function		Hydraulic Triplex	
	Number of Engines		2	
	Fuel Type		Diesel	
	Engine Technology		Tier 0	
	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	8.581	158.91
		VOC	0.764	14.15
		CO	3.199	59.25
		PM10	0.512	9.48
		PM2.5	0.497	9.20
		SO2	0.115	2.13
		CO2	529	9791.27
		CH4	0.012	0.21
		PM_filt	0.184	3.40
		PM_cond	0.313	5.80
	(g/gal)	N2O	0.260	0.25
Engine 3	Engine Function		Blender	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 0	
	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	8.581	39.73
		VOC	0.764	3.54
		CO	3.200	14.81
		PM10	0.512	2.37
		PM2.5	0.497	2.30
		SO2	0.115	0.53
		CO2	529	2447.82
		CH4	0.012	0.05
		PM_filt	0.184	0.85
		PM_cond	0.313	1.45
	(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 0	
	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	8.581	28.38
		VOC	0.764	2.53
		CO	3.199	10.58
		PM10	0.512	1.69
		PM2.5	0.497	1.64
		SO2	0.115	0.38
		CO2	529	1748.44
		CH4	0.012	0.04
		PM_filt	0.184	0.61
		PM_cond	0.313	1.03
	(g/gal)	N2O	0.260	0.04
Engine 5	Engine Function		Frac Van	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 0	
	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	7.066	4.67
		VOC	1.112	0.74
		CO	4.136	2.74
		PM10	0.975	0.64
		PM2.5	0.946	0.63
		SO2	0.128	0.08
		CO2	587	388.23
		CH4	0.017	0.01
		PM_filt	0.350	0.23
		PM_cond	0.596	0.39
	(g/gal)	N2O	0.260	0.01
Engine 6	Engine Function		Acid Pump	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		Tier 0	
	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	7.066	4.67
		VOC	1.112	0.74
		CO	4.136	2.74
		PM10	0.975	0.64
		PM2.5	0.946	0.63
		SO2	0.128	0.08
		CO2	587	388.23
		CH4	0.017	0.01
		PM_filt	0.350	0.23
		PM_cond	0.596	0.39
	(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 0	
	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	7.066	4.67
		VOC	1.112	0.74
		CO	4.136	2.74
		PM10	0.975	0.64
		PM2.5	0.946	0.63
		SO2	0.128	0.08
		CO2	587	388.23
		CH4	0.017	0.01
		PM_filt	0.350	0.23
		PM_cond	0.596	0.39
	(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	1,263
	VOC	113
	CO	474
	PM10	76
	PM2.5	74
	SO2	17
	CO2	78,096
	CH4	2
	PM_filt	27
	PM_cond	47
	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)	0.6313	0.0567	0.2369	0.0382	0.0371	0.0085	39.0481	0.0009	0.0137	0.0234	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 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%

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

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

ASSUMPTIONS TO ESTIMATE 2009 FUGITIVE PARTICULATE EMISSIONS ASSOCIATED WITH 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.

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

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

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.

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 Drilling Emissions

ASSUMPTIONS

Activity data obtained from the operators

* Emission factors from EPA Federal Diesel Engine Tier 2 Standards and NONROAD fully deteriorated Tier 0 Efs 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:

Emissions (tons/year-well) = <u>Emission factor (g/hp-hr) * Horsepower * Time Used (hours) * Load</u>
453.6 (g/lb) * 2000 (lbs/ton)

Average of EPA NONROAD model Fully Deteriorated Tier 0 Emission Factors and 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	

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

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

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		1/2 Tier 0 + 1/2 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	6.557	4608.98
		VOC	0.510	358.21
		CO	2.905	2041.61
		PM10	0.331	232.37
		PM2.5	0.321	225.40
		SO2	0.105	73.73
		CO2	482	338921.62
		CH4	0.008	5.44
		PM_filt	0.119	83.40
		PM_cond	0.202	142.00
		N2O	0.260	8.62
Engine 2	Engine Function		Boiler	
	Number of Engines		1	
	Fuel Type		Diesel	
	Engine Technology		1/2 Tier 0 + 1/2 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	6.628	219.19
		VOC	0.514	16.99
		CO	3.464	114.55
		PM10	0.368	12.17
		PM2.5	0.357	11.80
		SO2	0.105	3.47
		CO2	482	15945.55
		CH4	0.008	0.26
		PM_filt	0.132	4.37
		PM_cond	0.225	7.43
		N2O	0.260	0.41

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

		Emissions (lb/spud) - Diesel ICE	
Equipment Type	Pollutant	Engine 1	Engine 2
Drilling Equipment	NOx	4,609	219
	VOC	358	17
	CO	2,042	115
	PM10	232	12
	PM2.5	225	12
	SO2	74	3
	CO2	338,922	15,946
	CH4	5	0
	PM_filt	83	4
	PM_cond	142	7
	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)	2.3045	0.1791	1.0208	0.1162	0.1127	0.0369	169.4608	0.0027	0.0417	0.0710	0.0043	total spuds
Drilling Equip (diesel ICE 125HP)	0.1096	0.0085	0.0573	0.0061	0.0059	0.0017	7.9728	0.0001	0.0022	0.0037	0.0002	total spuds

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

Year	Tier 0	Tier 2
2009	50%	50%
2010	50%	50%
2011	50%	50%
2012	50%	50%
2013	50%	50%
2014	50%	50%
2015	50%	50%
2016	50%	50%
2017	50%	50%
2018	50%	50%
2019	0%	100%
2020	0%	100%
2021	0%	100%
2022	0%	100%
2023	0%	100%
2024	0%	100%
2025	0%	100%
2026	0%	100%
2027	0%	100%
2028	0%	100%
2029	0%	100%
2030	0%	100%
2031	0%	100%
2032	0%	100%
2033	0%	100%
2034	0%	100%
2035	0%	100%
2036	0%	100%
2037	0%	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 0 and Tier 2	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2019	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2020	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2021	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2022	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2023	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2024	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2025	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2026	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2027	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2028	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2029	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2030	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2031	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2032	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2033	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2034	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2035	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2036	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	0%
Tier 2	2037	-31%	-97%	-10%	0%	-50%	-55%	-55%	-55%	-55%	-50%	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 0 and Tier 2	2009	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2010	0%	-53%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2011	0%	-91%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2012	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2013	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2014	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2015	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2016	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2017	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 0 and Tier 2	2018	0%	-97%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tier 2	2019	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2020	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2021	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2022	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2023	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2024	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2025	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2026	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2027	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2028	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2029	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2030	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2031	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2032	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2033	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2034	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2035	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2036	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	0%
Tier 2	2037	-29%	-97%	8%	0%	-49%	-39%	-39%	-39%	-39%	-49%	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.

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

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

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 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.

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 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

(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	N2O	
NOx	CO	THC	as CH4	(lb/MMSCF)[b]	VOC/THC[c]
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

ASSUMPTIONS

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

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) = $58(U^*-U_t^*)^2 + 25(U^*-U_t^*)$ 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

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		

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

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 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 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	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 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 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 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 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%

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.

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

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

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 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

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (lbs/MMscf)} * \text{Heater Size (Btu/hr)} * \text{Time On (Hours/Year)}}{\text{Fuel Heat Value (Btu/scf)} * 1x10^{6} \text{ (scf/MMscf)} * 2000 \text{ (lbs/ton)}}$$

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 >20º API	Heavy Oil <20º 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
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
100%	percentage of dehydrator emissions controlled
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

(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-Trimethylp	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		0.23	2	0.0003		5.79	2	0.0085	
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	0.0002	0.15	1	0.0002	0.0012	3.86	1	0.0053	0.0321
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

(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	°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)	THC component CO2 emissions potentials: lb emitted/well	THC component CO2 emissions potentials: Moles C in compound/Moles C in CO2	THC component CO2 emissions potentials: 2009 CO_2 Emissions (tons/well)	CO component 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.

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

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

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 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.

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 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		Turbine	Reciprocating
	EF (g/hp-hr)	source	EF (g/hp-hr)	source		
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 *	0.133%
Average VOC emissions per well (tpy)	0.01

**based on two existing evaporation facilities for 1500 CDC wells*

Table 251. VOC, CO_2 and CH_4 Weight Fractions.

Component	% Wt	Average per Well Emissions (TPY)
Methane	3.90%	0.0004
Carbon Dioxide	24.76%	0.0025
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	0.0070	0	0	0	0	0.0025	0.0004	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.

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	
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	177	3	1,159	51	303	31	3	0	0	96	0	0	5	0	61	3	0	0	0	0	0	1,892
	2010	0	237	3	1,555	61	407	38	4	0	0	225	0	0	10	0	163	8	0	0	0	0	0	2,711
	2011	0	236	3	1,545	55	404	34	4	0	0	353	0	0	14	0	251	12	0	0	0	0	0	2,911
	2012	0	231	3	1,516	48	396	30	4	0	0	478	0	0	17	0	326	17	0	383	55	0	0	3,504
	2013	0	236	2	1,545	43	404	27	4	0	0	606	0	0	19	0	399	21	0	383	55	0	0	3,746
	2014	0	234	2	1,531	38	400	23	4	0	0	733	0	0	21	0	466	26	0	383	55	0	0	3,915
	2015	0	241	2	1,579	35	413	21	5	0	0	863	0	0	22	0	531	30	0	383	55	0	0	4,180
	2016	0	188	1	1,234	24	323	15	4	0	0	965	0	0	22	0	580	34	0	383	55	0	0	3,827
	2017	0	247	2	1,620	28	424	17	5	0	0	1,100	0	0	23	0	642	39	0	383	55	0	0	4,583
	2018	0	272	2	1,782	27	466	16	5	0	0	1,247	0	0	23	0	734	44	0	383	55	0	0	5,055
	2019	0	219	1	992	19	375	12	4	0	0	1,366	0	0	23	0	792	48	0	383	55	0	0	4,288
	2020	0	219	1	993	17	375	10	4	0	0	1,484	0	0	22	0	845	52	0	383	55	0	0	4,462
	2021	0	247	1	1,121	17	424	11	5	0	0	1,619	0	0	22	0	901	57	0	383	55	0	0	4,862
	2022	0	235	1	1,063	12	402	8	4	0	0	1,746	0	0	19	0	970	62	0	383	55	0	0	4,959
	2023	0	79	0	357	5	135	3	1	0	0	1,788	0	0	23	0	974	63	0	383	55	0	0	3,865
	2024	0	0	0	0	0	0	0	0	0	0	1,788	0	0	21	0	934	63	0	383	55	0	0	3,244
	2025	0	0	0	0	0	0	0	0	0	0	1,788	0	0	18	0	908	63	0	383	55	0	0	3,215
	2026	0	0	0	0	0	0	0	0	0	0	1,788	0	0	17	0	889	63	0	383	55	0	0	3,195
	2027	0	0	0	0	0	0	0	0	0	0	1,788	0	0	16	0	874	63	0	383	55	0	0	3,180
	2028	0	0	0	0	0	0	0	0	0	0	1,788	0	0	15	0	861	63	0	383	55	0	0	3,166
	2029	0	0	0	0	0	0	0	0	0	0	1,788	0	0	15	0	850	63	0	383	55	0	0	3,154
	2030	0	0	0	0	0	0	0	0	0	0	1,788	0	0	14	0	840	63	0	383	55	0	0	3,143
	2031	0	0	0	0	0	0	0	0	0	0	1,788	0	0	14	0	831	63	0	383	55	0	0	3,134
	2032	0	0	0	0	0	0	0	0	0	0	1,788	0	0	13	0	823	63	0	383	55	0	0	3,125
	2033	0	0	0	0	0	0	0	0	0	0	1,788	0	0	13	0	815	63	0	383	55	0	0	3,117
	2034	0	0	0	0	0	0	0	0	0	0	1,788	0	0	13	0	808	63	0	383	55	0	0	3,110
	2035	0	0	0	0	0	0	0	0	0	0	1,788	0	0	13	0	801	63	0	383	55	0	0	3,103
	2036	0	0	0	0	0	0	0	0	0	0	1,788	0	0	13	0	794	63	0	383	55	0	0	3,096
	2037	0	0	0	0	0	0	0	0	0	0	1,788	0	0	12	0	788	63	0	383	55	0	0	3,090
	TOTAL	0	3,297	27	19,590	479	5,650	297	62	0	0	39,706	0	0	492	0	20,452	1,403	0	9,959	1,420	0	0	102,833

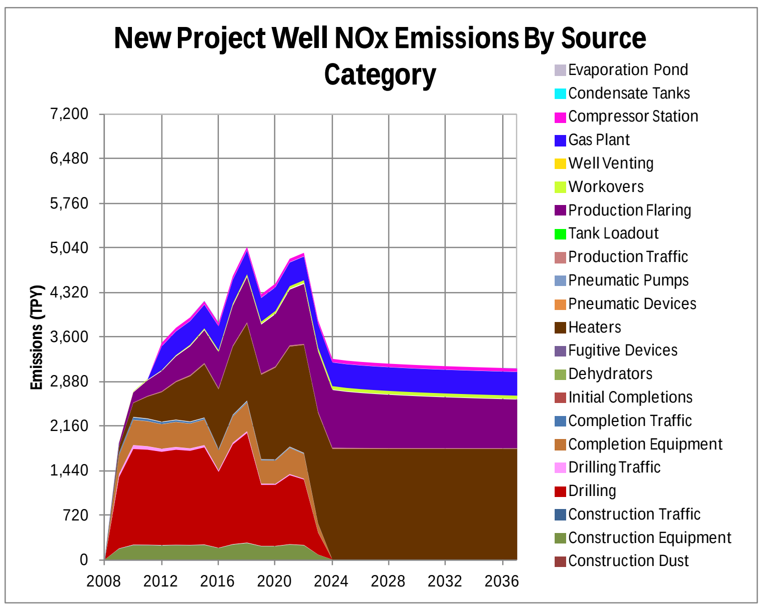

Figure 17. New Project Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 255. New Project Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	26	0	90	6	27	4	4	0	321	5	0	0	1	61	79	0	359	0	0	0	3	988
	2010	0	35	0	121	8	37	5	6	0	751	12	0	0	2	187	210	1	841	0	0	0	8	2,225
	2011	0	35	0	120	7	36	4	6	0	1,179	19	0	0	4	282	323	1	1,320	0	0	0	12	3,349
	2012	0	35	0	118	6	36	4	6	0	1,598	26	0	0	5	350	419	2	1,790	72	3	0	17	4,486
	2013	0	35	0	120	6	36	4	6	0	2,026	33	0	0	5	413	514	2	2,269	72	3	0	21	5,566
	2014	0	35	0	119	5	36	3	6	0	2,450	40	0	0	6	460	599	3	2,743	72	3	0	26	6,606
	2015	0	36	0	123	5	37	3	6	0	2,887	47	0	0	7	502	683	3	3,232	72	3	0	30	7,677
	2016	0	28	0	96	4	29	2	5	0	3,228	53	0	0	7	531	747	4	3,615	72	3	0	34	8,457
	2017	0	37	0	126	4	38	3	6	0	3,676	60	0	0	7	564	827	4	4,117	72	3	0	39	9,583
	2018	0	41	0	138	4	42	3	7	0	4,169	69	0	0	7	652	945	5	4,669	72	3	0	44	10,870
	2019	0	33	0	56	3	34	2	5	0	4,566	75	0	0	8	686	1,019	5	5,114	72	3	0	48	11,728
	2020	0	33	0	56	3	34	2	5	0	4,964	82	0	0	8	711	1,087	6	5,558	72	3	0	52	12,674
	2021	0	37	0	63	3	38	2	6	0	5,412	89	0	0	8	730	1,160	6	6,061	72	3	0	57	13,746
	2022	0	35	0	60	2	36	1	6	0	5,837	96	0	0	7	782	1,248	7	6,537	72	3	0	61	14,791
VOC [tpy]	2023	0	12	0	20	1	12	1	2	0	5,980	98	0	0	8	756	1,253	7	6,697	72	3	0	63	14,984
	2024	0	0	0	0	0	0	0	0	0	5,980	98	0	0	8	666	1,202	7	6,697	72	3	0	63	14,794
	2025	0	0	0	0	0	0	0	0	0	5,980	98	0	0	7	607	1,168	7	6,697	72	3	0	63	14,701
	2026	0	0	0	0	0	0	0	0	0	5,980	98	0	0	6	565	1,144	7	6,697	72	3	0	63	14,635
	2027	0	0	0	0	0	0	0	0	0	5,980	98	0	0	6	531	1,125	7	6,697	72	3	0	63	14,581
	2028	0	0	0	0	0	0	0	0	0	5,980	98	0	0	6	502	1,108	7	6,697	72	3	0	63	14,535
	2029	0	0	0	0	0	0	0	0	0	5,980	98	0	0	5	477	1,094	7	6,697	72	3	0	63	14,495
	2030	0	0	0	0	0	0	0	0	0	5,980	98	0	0	5	454	1,081	7	6,697	72	3	0	63	14,459
	2031	0	0	0	0	0	0	0	0	0	5,980	98	0	0	5	433	1,069	7	6,697	72	3	0	63	14,427
	2032	0	0	0	0	0	0	0	0	0	5,980	98	0	0	5	415	1,058	7	6,697	72	3	0	63	14,397
	2033	0	0	0	0	0	0	0	0	0	5,980	98	0	0	4	397	1,049	7	6,697	72	3	0	63	14,369
	2034	0	0	0	0	0	0	0	0	0	5,980	98	0	0	4	381	1,039	7	6,697	72	3	0	63	14,344
	2035	0	0	0	0	0	0	0	0	0	5,980	98	0	0	4	366	1,031	7	6,697	72	3	0	63	14,320
	2036	0	0	0	0	0	0	0	0	0	5,980	98	0	0	4	351	1,022	7	6,697	72	3	0	63	14,297
	2037	0	0	0	0	0	0	0	0	0	5,980	98	0	0	4	337	1,015	7	6,697	72	3	0	63	14,275
	TOTAL	0	493	4	1,426	69	507	43	80	0	132,762	2,184	0	0	162	14,148	26,316	148	148,672	1,876	71	0	1,393	330,356

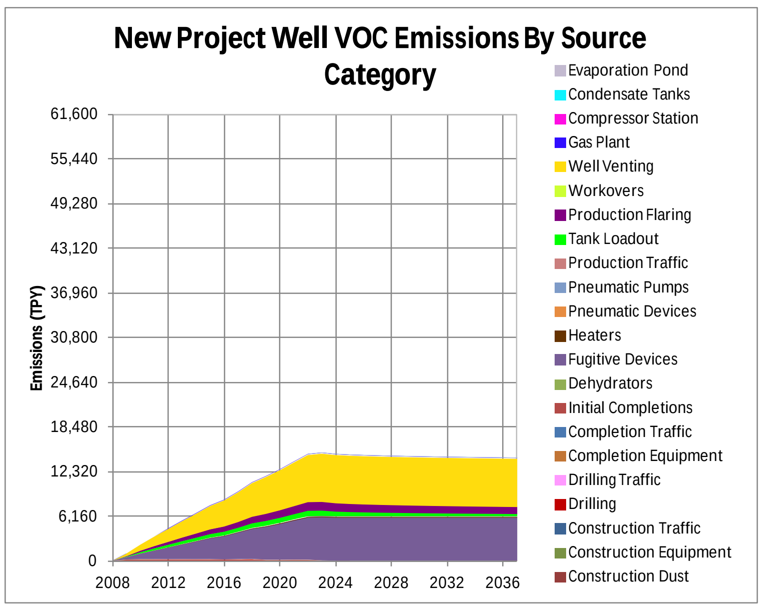

Figure 18. New Project Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 256. New Project Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	3	0	19	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
	2010	0	2	0	12	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
	2011	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	2012	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2013	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2014	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2015	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2016	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2017	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2018	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2019	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2020	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2021	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	2022	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
SO2 [tpy]	2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2037	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	TOTAL	0	7	0	41	1	9	1	0	0	0	0	0	0	3	0	0	1	0	18	0	0	0	81

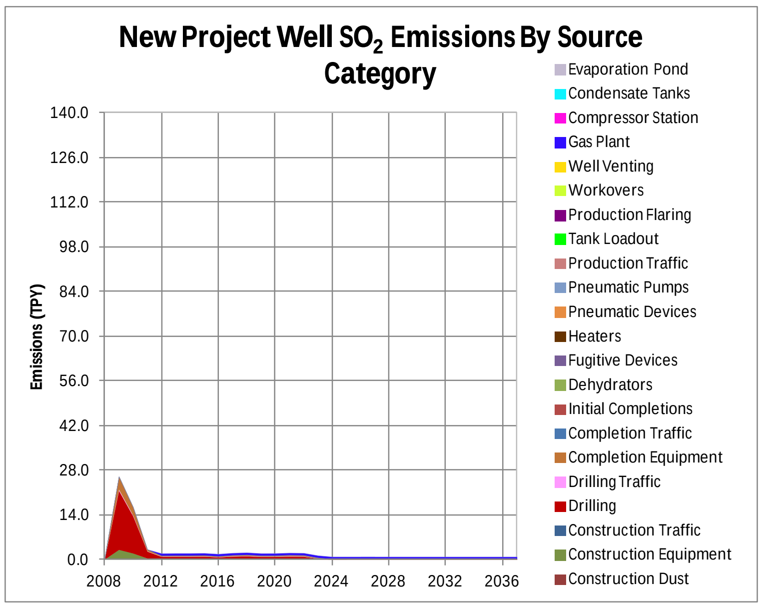

Figure 19. New Project Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 257. New Project Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

Pollutant	Year	Construction: Construction Dust	Construction: Construction Equipment	Construction: Construction Traffic	Drilling: Drilling	Drilling: Drilling Traffic	Completion: Completion Equipment	Completion: Completion Traffic	Completion: Initial Completions	Production: Dehydrators	Production: Fugitive Devices	Production: Heaters	Production: Pneumatic Devices	Production: Pneumatic Pumps	Production: Production Traffic	Production: Tank Loadout	Production: Production Flaring	Production: Workovers	Production: Well Venting	Production: Gas Plant	Production: Compressor Station	Production: Condensate Tanks	Production: Evaporation Pond	Total (Costruction + Drilling + Completion + Production)
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	117	11	19	59	309	18	196	0	0	0	7	0	0	64	0	0	0	0	0	0	0	0	800
	2010	157	14	26	79	414	25	262	0	0	0	17	0	0	149	0	0	1	0	0	0	0	0	1,144
	2011	156	14	26	78	411	24	261	0	0	0	27	0	0	234	0	0	1	0	0	0	0	0	1,232
	2012	153	14	25	77	403	24	255	0	0	0	36	0	0	318	0	0	1	0	35	6	0	0	1,348
	2013	156	14	26	78	411	24	260	0	0	0	46	0	0	403	0	0	1	0	35	6	0	0	1,461
	2014	154	14	26	78	406	24	257	0	0	0	56	0	0	487	0	0	2	0	35	6	0	0	1,545
	2015	159	15	26	80	419	25	265	0	0	0	66	0	0	574	0	0	2	0	35	6	0	0	1,672
	2016	124	11	21	62	327	20	207	0	0	0	73	0	0	641	0	0	2	0	35	6	0	0	1,531
	2017	163	15	27	82	429	26	272	0	0	0	84	0	0	730	0	0	3	0	35	6	0	0	1,872
	2018	179	16	30	90	472	28	299	0	0	0	95	0	0	828	0	0	3	0	35	6	0	0	2,082
	2019	144	13	24	33	380	23	241	0	0	0	104	0	0	907	0	0	3	0	35	6	0	0	1,913
	2020	144	13	24	33	380	23	241	0	0	0	113	0	0	985	0	0	4	0	35	6	0	0	2,001
	2021	163	15	27	38	429	26	272	0	0	0	123	0	0	1,074	0	0	4	0	35	6	0	0	2,211
	2022	155	14	26	36	406	24	257	0	0	0	133	0	0	1,158	0	0	4	0	35	6	0	0	2,255
	2023	52	5	9	12	136	8	86	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,677
	2024	0	0	0	0	0	0	0	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,369
	2025	0	0	0	0	0	0	0	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,368
	2026	0	0	0	0	0	0	0	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,368
	2027	0	0	0	0	0	0	0	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,368
	2028	0	0	0	0	0	0	0	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,368
	2029	0	0	0	0	0	0	0	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,368
	2030	0	0	0	0	0	0	0	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,368
	2031	0	0	0	0	0	0	0	0	0	0	136	0	0	1,187	0	0	4	0	35	6	0	0	1,368
	2032	0	0	0	0	0	0	0	0	0	0	136	0	0	1,186	0	0	4	0	35	6	0	0	1,368
	2033	0	0	0	0	0	0	0	0	0	0	136	0	0	1,186	0	0	4	0	35	6	0	0	1,368
	2034	0	0	0	0	0	0	0	0	0	0	136	0	0	1,186	0	0	4	0	35	6	0	0	1,368
	2035	0	0	0	0	0	0	0	0	0	0	136	0	0	1,186	0	0	4	0	35	6	0	0	1,368
	2036	0	0	0	0	0	0	0	0	0	0	136	0	0	1,186	0	0	4	0	35	6	0	0	1,368
	2037	0	0	0	0	0	0	0	0	0	0	136	0	0	1,186	0	0	4	0	35	6	0	0	1,368
	TOTAL	2,175	199	361	915	5,732	342	3,631	0	0	0	3,018	0	0	26,352	0	0	95	0	922	158	0	0	43,900

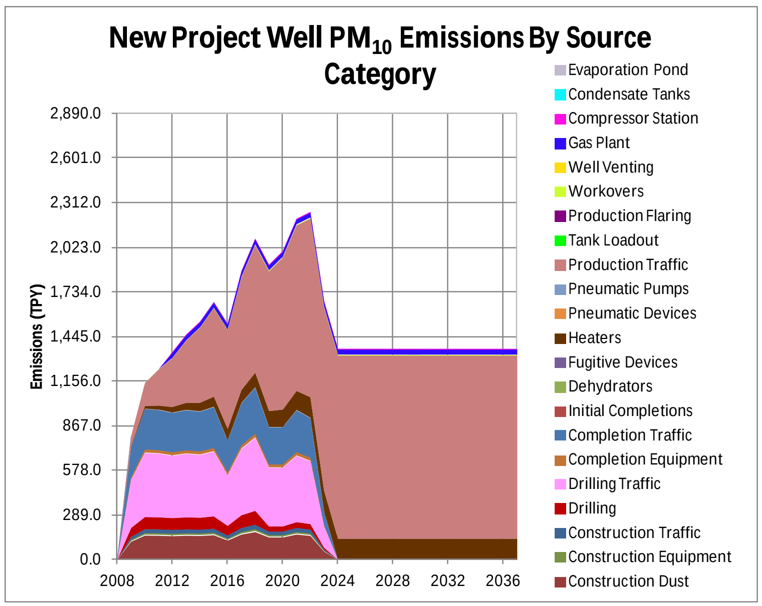

Figure 20. New Project Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 258. New Project Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	30	10	2	57	33	18	21	0	0	0	7	0	0	7	0	0	0	0	0	0	0	0	186
	2010	40	14	3	76	44	24	28	0	0	0	17	0	0	15	0	0	1	0	0	0	0	0	262
	2011	40	14	3	76	44	24	28	0	0	0	27	0	0	24	0	0	1	0	0	0	0	0	279
	2012	39	14	3	74	42	23	27	0	0	0	36	0	0	32	0	0	1	0	35	6	0	0	334
	2013	40	14	3	76	43	24	27	0	0	0	46	0	0	41	0	0	1	0	35	6	0	0	356
	2014	40	14	3	75	42	24	27	0	0	0	56	0	0	49	0	0	2	0	35	6	0	0	372
	2015	41	14	3	78	43	24	27	0	0	0	66	0	0	58	0	0	2	0	35	6	0	0	397
	2016	32	11	2	61	34	19	21	0	0	0	73	0	0	65	0	0	2	0	35	6	0	0	361
	2017	42	14	3	80	44	25	28	0	0	0	84	0	0	73	0	0	3	0	35	6	0	0	436
	2018	46	16	3	88	48	27	30	0	0	0	95	0	0	83	0	0	3	0	35	6	0	0	481
	2019	37	13	2	32	39	22	24	0	0	0	104	0	0	91	0	0	3	0	35	6	0	0	409
	2020	37	13	2	32	38	22	24	0	0	0	113	0	0	99	0	0	3	0	35	6	0	0	426
	2021	42	14	3	37	43	25	27	0	0	0	123	0	0	107	0	0	4	0	35	6	0	0	467
	2022	40	14	3	35	41	24	26	0	0	0	133	0	0	116	0	0	4	0	35	6	0	0	475
PM2.5 [tpy]	2023	13	5	1	12	14	8	9	0	0	0	136	0	0	119	0	0	4	0	35	6	0	0	361
	2024	0	0	0	0	0	0	0	0	0	0	136	0	0	119	0	0	4	0	35	6	0	0	300
	2025	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2026	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2027	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2028	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2029	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2030	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2031	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2032	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2033	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2034	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2035	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2036	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	2037	0	0	0	0	0	0	0	0	0	0	136	0	0	118	0	0	4	0	35	6	0	0	300
	TOTAL	560	193	37	888	592	332	375	0	0	0	3,018	0	0	2,634	0	0	92	0	922	158	0	0	9,801

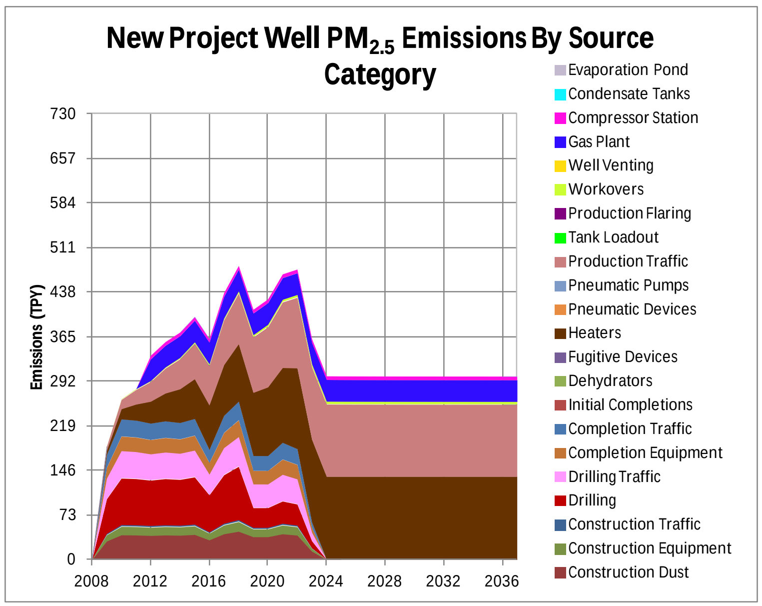

Figure 21. New Project Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 259. New Project Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	218	4	517	55	114	35	18	0	0	81	0	0	12	0	333	1	0	0	0	0	0	1,388
	2010	0	293	5	694	71	153	45	24	0	0	189	0	0	28	0	888	3	0	0	0	0	0	2,392
	2011	0	291	4	690	67	152	43	24	0	0	296	0	0	42	0	1,365	5	0	0	0	0	0	2,979
	2012	0	286	4	677	62	149	40	24	0	0	402	0	0	55	0	1,772	7	0	504	62	0	0	4,043
	2013	0	291	4	690	60	152	38	24	0	0	509	0	0	66	0	2,174	9	0	504	62	0	0	4,583
	2014	0	288	4	684	56	150	36	24	0	0	615	0	0	76	0	2,533	11	0	504	62	0	0	5,043
	2015	0	297	4	705	55	155	35	25	0	0	725	0	0	86	0	2,888	13	0	504	62	0	0	5,554
	2016	0	232	3	551	40	121	26	19	0	0	811	0	0	91	0	3,157	14	0	504	62	0	0	5,632
	2017	0	305	3	723	51	159	32	25	0	0	924	0	0	100	0	3,495	16	0	504	62	0	0	6,400
	2018	0	336	3	796	53	175	34	28	0	0	1,047	0	0	109	0	3,995	18	0	504	62	0	0	7,161
	2019	0	270	3	581	41	141	26	22	0	0	1,147	0	0	116	0	4,307	20	0	504	62	0	0	7,241
	2020	0	270	3	582	40	141	26	23	0	0	1,247	0	0	123	0	4,598	22	0	504	62	0	0	7,639
	2021	0	305	3	657	44	159	28	25	0	0	1,360	0	0	130	0	4,905	24	0	504	62	0	0	8,205
	2022	0	289	3	623	39	151	25	24	0	0	1,466	0	0	132	0	5,278	25	0	504	62	0	0	8,621
CO [tpy]	2023	0	97	1	209	14	51	9	8	0	0	1,502	0	0	141	0	5,299	26	0	504	62	0	0	7,921
	2024	0	0	0	0	0	0	0	0	0	0	1,502	0	0	138	0	5,081	26	0	504	62	0	0	7,313
	2025	0	0	0	0	0	0	0	0	0	0	1,502	0	0	132	0	4,939	26	0	504	62	0	0	7,165
	2026	0	0	0	0	0	0	0	0	0	0	1,502	0	0	129	0	4,838	26	0	504	62	0	0	7,061
	2027	0	0	0	0	0	0	0	0	0	0	1,502	0	0	127	0	4,756	26	0	504	62	0	0	6,977
	2028	0	0	0	0	0	0	0	0	0	0	1,502	0	0	125	0	4,687	26	0	504	62	0	0	6,906
	2029	0	0	0	0	0	0	0	0	0	0	1,502	0	0	123	0	4,625	26	0	504	62	0	0	6,843
	2030	0	0	0	0	0	0	0	0	0	0	1,502	0	0	121	0	4,571	26	0	504	62	0	0	6,786
	2031	0	0	0	0	0	0	0	0	0	0	1,502	0	0	119	0	4,521	26	0	504	62	0	0	6,735
	2032	0	0	0	0	0	0	0	0	0	0	1,502	0	0	118	0	4,476	26	0	504	62	0	0	6,688
	2033	0	0	0	0	0	0	0	0	0	0	1,502	0	0	116	0	4,434	26	0	504	62	0	0	6,644
	2034	0	0	0	0	0	0	0	0	0	0	1,502	0	0	115	0	4,395	26	0	504	62	0	0	6,604
	2035	0	0	0	0	0	0	0	0	0	0	1,502	0	0	113	0	4,358	26	0	504	62	0	0	6,566
	2036	0	0	0	0	0	0	0	0	0	0	1,502	0	0	113	0	4,323	26	0	504	62	0	0	6,530
	2037	0	0	0	0	0	0	0	0	0	0	1,502	0	0	111	0	4,290	26	0	504	62	0	0	6,495
	TOTAL	0	4,069	48	9,379	748	2,120	476	339	0	0	33,353	0	0	3,008	0	111,280	577	0	13,095	1,622	0	0	180,115

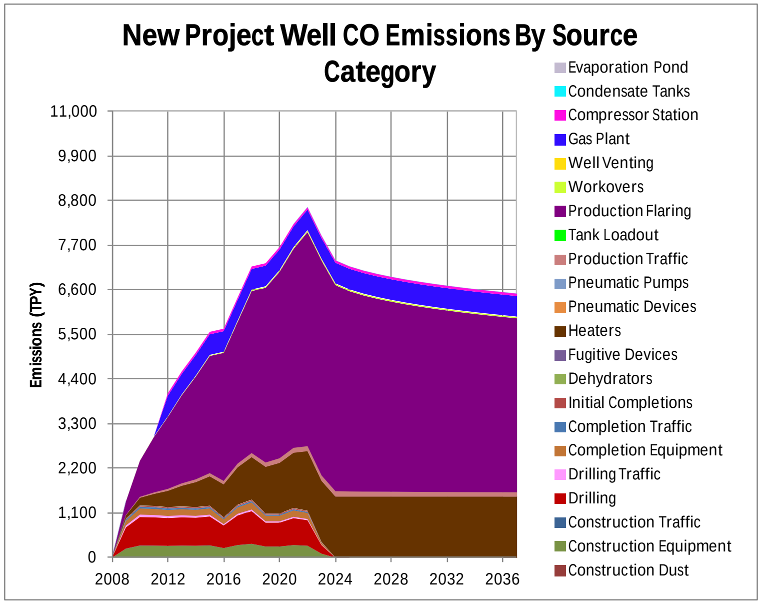

Figure 22. New Project Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

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	2	0	8	0	2	0	2	0	0	0	0	0	0	0	32	0	0	0	0	0	0	47
	2010	0	3	0	10	1	3	0	2	0	0	1	0	0	0	0	84	0	0	0	0	0	0	105
	2011	0	3	0	10	0	3	0	2	0	0	2	0	0	0	0	129	0	0	0	0	0	0	150
	2012	0	3	0	10	0	3	0	2	0	0	2	0	0	0	0	168	0	0	25	2	0	0	216
	2013	0	3	0	10	0	3	0	2	0	0	3	0	0	0	0	206	0	0	25	2	0	0	255
	2014	0	3	0	10	0	3	0	2	0	0	3	0	0	0	0	240	0	0	25	2	0	0	289
	2015	0	3	0	10	0	3	0	2	0	0	4	0	0	0	0	273	0	0	25	2	0	0	324
	2016	0	2	0	8	0	2	0	2	0	0	4	0	0	0	0	299	0	0	25	2	0	0	346
	2017	0	3	0	11	0	3	0	2	0	0	5	0	0	0	0	331	0	0	25	2	0	0	383
	2018	0	3	0	12	0	4	0	3	0	0	5	0	0	0	0	378	0	0	25	2	0	0	433
	2019	0	3	0	5	0	3	0	2	0	0	6	0	0	0	0	407	0	0	25	2	0	0	454
	2020	0	3	0	5	0	3	0	2	0	0	7	0	0	0	0	435	0	0	25	2	0	0	482
	2021	0	3	0	5	0	3	0	2	0	0	7	0	0	0	0	464	1	0	25	2	0	0	513
	2022	0	3	0	5	0	3	0	2	0	0	8	0	0	0	0	499	1	0	25	2	0	0	549
	2023	0	1	0	2	0	1	0	1	0	0	8	0	0	0	0	501	1	0	25	2	0	0	542
	2024	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	481	1	0	25	2	0	0	516
	2025	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	467	1	0	25	2	0	0	503
	2026	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	458	1	0	25	2	0	0	493
	2027	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	450	1	0	25	2	0	0	486
	2028	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	443	1	0	25	2	0	0	479
	2029	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	438	1	0	25	2	0	0	473
	2030	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	432	1	0	25	2	0	0	468
	2031	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	428	1	0	25	2	0	0	463
	2032	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	423	1	0	25	2	0	0	459
	2033	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	419	1	0	25	2	0	0	455
	2034	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	416	1	0	25	2	0	0	451
	2035	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	412	1	0	25	2	0	0	448
	2036	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	409	1	0	25	2	0	0	445
	2037	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	406	1	0	25	2	0	0	441
	TOTAL	0	42	0	121	4	43	3	32	0	0	175	0	0	6	0	10,527	13	0	648	56	0	0	11,669

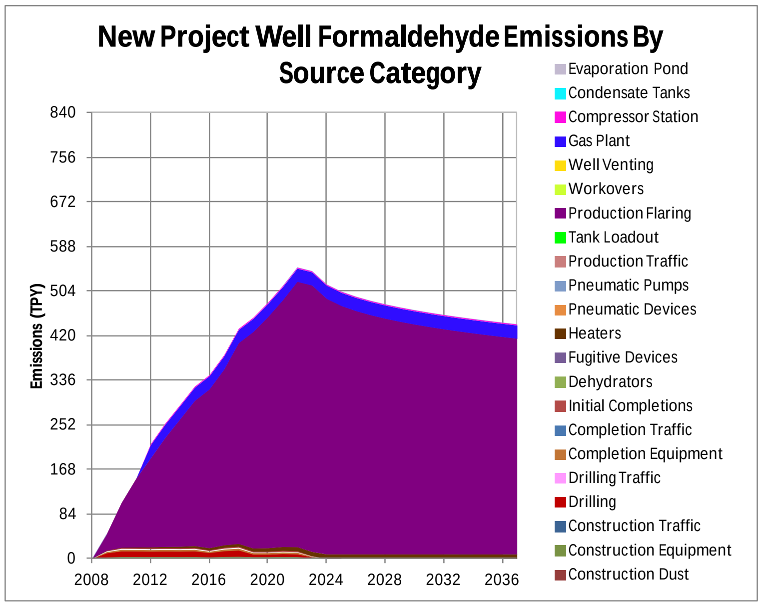

Figure 23. New Project Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 261. New Project Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	14	0	0	0	0	2	0	0	7	0	0	0	0	23
	2010	0	0	0	0	0	0	0	0	0	32	0	0	0	0	6	0	0	17	0	0	0	0	55
	2011	0	0	0	0	0	0	0	0	0	50	0	0	0	0	10	0	0	26	0	0	0	0	86
	2012	0	0	0	0	0	0	0	0	0	67	0	0	0	0	12	0	0	36	0	0	0	0	115
	2013	0	0	0	0	0	0	0	0	0	85	0	0	0	0	14	0	0	45	0	0	0	0	145
	2014	0	0	0	0	0	0	0	0	0	103	0	0	0	0	16	0	0	54	0	0	0	0	174
	2015	0	0	0	0	0	0	0	0	0	122	0	0	0	0	17	0	0	64	0	0	0	0	203
	2016	0	0	0	0	0	0	0	0	0	136	0	0	0	0	18	0	0	72	0	0	0	0	226
	2017	0	0	0	0	0	0	0	0	0	155	0	0	0	0	19	0	0	82	0	0	0	0	256
	2018	0	0	0	0	0	0	0	0	0	176	0	0	0	0	22	0	0	93	0	0	0	0	291
	2019	0	0	0	0	0	0	0	0	0	193	0	0	0	0	23	0	0	101	0	0	0	0	318
	2020	0	0	0	0	0	0	0	0	0	209	0	0	0	0	24	0	0	110	0	0	0	0	344
	2021	0	0	0	0	0	0	0	0	0	228	0	0	0	0	25	0	0	120	0	0	0	0	374
	2022	0	0	0	0	0	0	0	0	0	246	0	0	0	0	27	0	0	130	0	0	0	0	403
	2023	0	0	0	0	0	0	0	0	0	252	0	0	0	0	26	0	0	133	0	0	0	0	411
	2024	0	0	0	0	0	0	0	0	0	252	0	0	0	0	23	0	0	133	0	0	0	0	408
	2025	0	0	0	0	0	0	0	0	0	252	0	0	0	0	21	0	0	133	0	0	0	0	406
	2026	0	0	0	0	0	0	0	0	0	252	0	0	0	0	19	0	0	133	0	0	0	0	405
	2027	0	0	0	0	0	0	0	0	0	252	0	0	0	0	18	0	0	133	0	0	0	0	403
	2028	0	0	0	0	0	0	0	0	0	252	0	0	0	0	17	0	0	133	0	0	0	0	402
	2029	0	0	0	0	0	0	0	0	0	252	0	0	0	0	16	0	0	133	0	0	0	0	402
	2030	0	0	0	0	0	0	0	0	0	252	0	0	0	0	15	0	0	133	0	0	0	0	401
	2031	0	0	0	0	0	0	0	0	0	252	0	0	0	0	15	0	0	133	0	0	0	0	400
	2032	0	0	0	0	0	0	0	0	0	252	0	0	0	0	14	0	0	133	0	0	0	0	399
	2033	0	0	0	0	0	0	0	0	0	252	0	0	0	0	13	0	0	133	0	0	0	0	399
	2034	0	0	0	0	0	0	0	0	0	252	0	0	0	0	13	0	0	133	0	0	0	0	398
	2035	0	0	0	0	0	0	0	0	0	252	0	0	0	0	12	0	0	133	0	0	0	0	398
	2036	0	0	0	0	0	0	0	0	0	252	0	0	0	0	12	0	0	133	0	0	0	0	397
	2037	0	0	0	0	0	0	0	0	0	252	0	0	0	0	11	0	0	133	0	0	0	0	397
	TOTAL	0	0	0	0	0	0	0	0	0	5,599	0	0	0	1	481	0	0	2,950	5	0	0	2	9,039

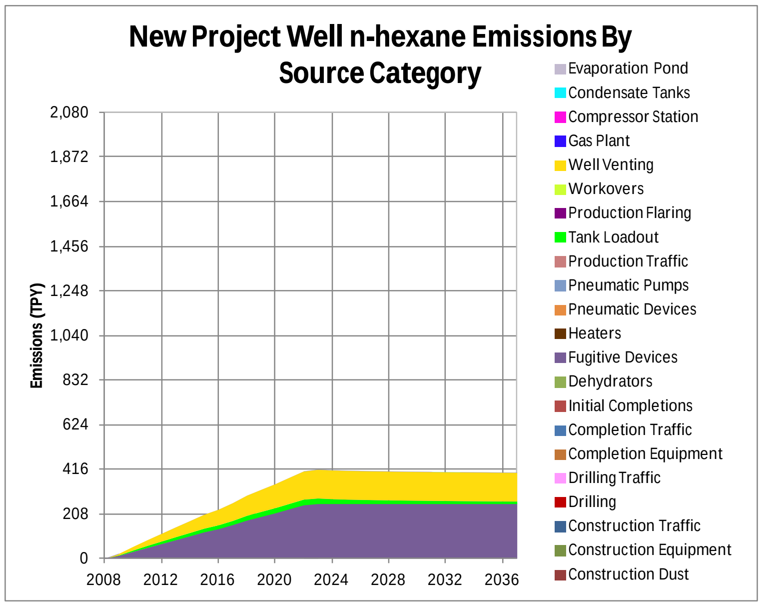

Figure 24. New Project Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 262. New Project Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	1	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	6
	2010	0	0	0	1	0	0	0	0	0	5	0	0	0	0	1	0	0	3	0	0	0	1	13
	2011	0	0	0	1	0	0	0	0	0	8	1	0	0	0	1	0	0	5	0	0	0	2	20
	2012	0	0	0	1	0	0	0	0	0	11	1	0	0	0	2	0	0	7	1	0	0	2	27
	2013	0	0	0	1	0	0	0	0	0	14	1	0	0	0	2	0	0	9	1	0	0	3	33
	2014	0	0	0	1	0	0	0	0	0	17	2	0	0	0	2	0	0	11	1	0	0	4	39
	2015	0	0	0	1	0	0	0	0	0	20	2	0	0	0	2	0	0	13	1	0	0	4	45
	2016	0	0	0	1	0	0	0	0	0	22	2	0	0	0	3	0	0	15	1	0	0	5	49
	2017	0	0	0	1	0	0	0	0	0	25	2	0	0	0	3	0	0	17	1	0	0	5	56
	2018	0	0	0	1	0	0	0	0	0	29	3	0	0	0	3	0	0	19	1	0	0	6	64
	2019	0	0	0	1	0	0	0	0	0	32	3	0	0	0	3	0	0	21	1	0	0	7	68
	2020	0	0	0	1	0	0	0	0	0	34	3	0	0	0	3	0	0	23	1	0	0	7	74
	2021	0	0	0	1	0	0	0	0	0	37	4	0	0	0	3	0	0	25	1	0	0	8	80
	2022	0	0	0	1	0	0	0	0	0	40	4	0	0	0	4	0	0	27	1	0	0	8	86
benzene [tpy]	2023	0	0	0	0	0	0	0	0	0	41	4	0	0	0	4	0	0	28	1	0	0	9	87
	2024	0	0	0	0	0	0	0	0	0	41	4	0	0	0	3	0	0	28	1	0	0	9	86
	2025	0	0	0	0	0	0	0	0	0	41	4	0	0	0	3	0	0	28	1	0	0	9	86
	2026	0	0	0	0	0	0	0	0	0	41	4	0	0	0	3	0	0	28	1	0	0	9	85
	2027	0	0	0	0	0	0	0	0	0	41	4	0	0	0	3	0	0	28	1	0	0	9	85
	2028	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	85
	2029	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	85
	2030	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	85
	2031	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	85
	2032	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	85
	2033	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	85
	2034	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	84
	2035	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	84
	2036	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	84
	2037	0	0	0	0	0	0	0	0	0	41	4	0	0	0	2	0	0	28	1	0	0	9	84
	TOTAL	0	5	0	15	1	5	1	0	0	918	87	0	0	5	68	0	2	615	21	0	0	193	1,936

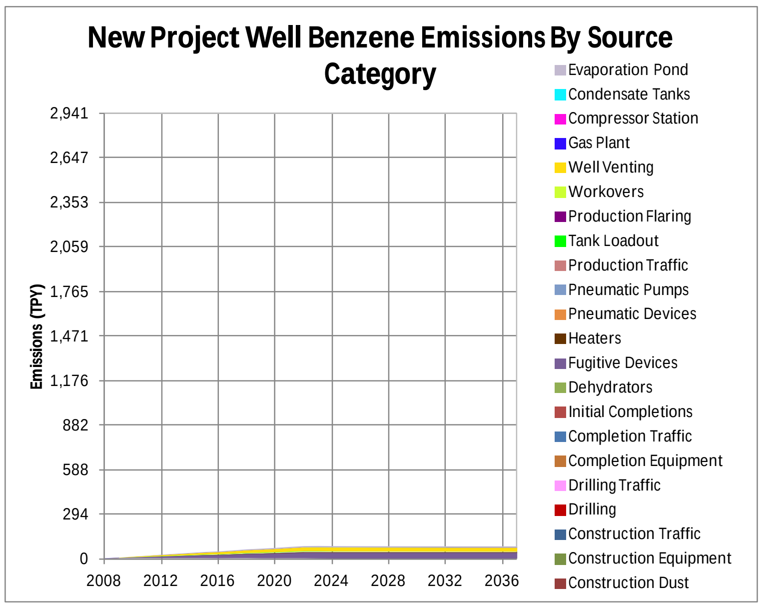

Figure 25. New Project Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

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	1
	2011	0	0	0	0	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	2
	2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
	2016	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2
	2017	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2
	2018	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2019	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2020	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2021	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2022	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	4
	2023	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2024	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2025	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2026	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2027	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2028	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2029	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2030	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2031	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2032	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2033	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2034	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2035	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2036	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	2037	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	3
	TOTAL	0	1	0	3	0	1	0	0	0	21	0	0	0	2	1	0	0	28	0	0	0	21	79

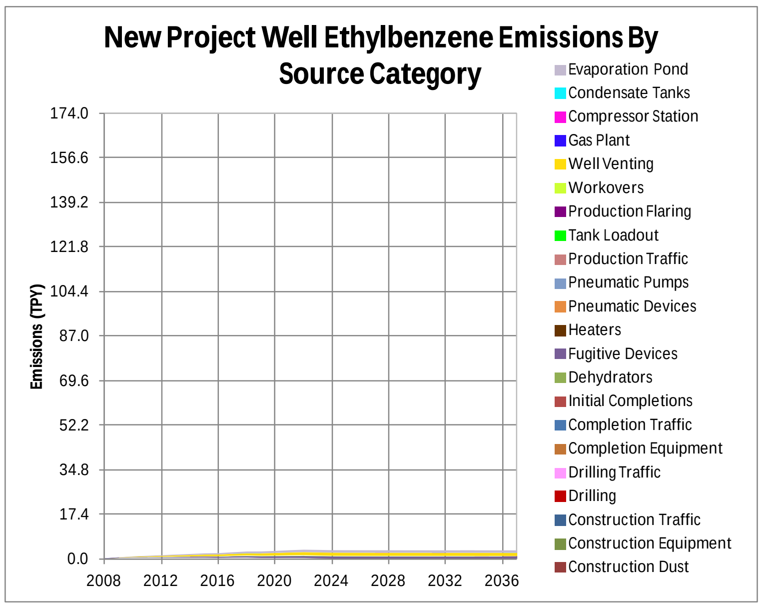

Figure 26. New Project Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

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	1	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	1	9
	2010	0	1	0	2	0	1	0	0	0	7	0	0	0	0	1	0	0	5	0	0	0	1	18
	2011	0	1	0	2	0	1	0	0	0	11	0	0	0	0	2	0	0	8	0	0	0	2	27
	2012	0	1	0	2	0	1	0	0	0	16	1	0	0	0	2	0	0	10	0	0	0	3	35
	2013	0	1	0	2	0	1	0	0	0	20	1	0	0	0	3	0	0	13	0	0	0	4	44
	2014	0	1	0	2	0	1	0	0	0	24	1	0	0	0	3	0	0	16	0	0	0	5	52
	2015	0	1	0	2	0	1	0	0	0	28	1	0	0	1	3	0	0	18	0	0	0	5	60
	2016	0	0	0	1	0	0	0	0	0	31	1	0	0	1	3	0	0	21	0	0	0	6	66
	2017	0	1	0	2	0	1	0	0	0	36	1	0	0	1	4	0	0	23	0	0	0	7	75
	2018	0	1	0	2	0	1	0	0	0	40	1	0	0	1	4	0	0	27	0	0	0	8	85
	2019	0	0	0	1	0	1	0	0	0	44	2	0	0	1	4	0	0	29	0	0	0	9	91
	2020	0	0	0	1	0	1	0	0	0	48	2	0	0	1	4	0	0	32	0	0	0	9	98
	2021	0	1	0	1	0	1	0	0	0	52	2	0	0	1	5	0	0	35	0	0	0	10	107
	2022	0	1	0	1	0	1	0	0	0	57	2	0	0	1	5	0	0	37	0	0	0	11	115
	2023	0	0	0	0	0	0	0	0	0	58	2	0	0	1	5	0	0	38	0	0	0	11	116
	2024	0	0	0	0	0	0	0	0	0	58	2	0	0	1	4	0	0	38	0	0	0	11	115
	2025	0	0	0	0	0	0	0	0	0	58	2	0	0	1	4	0	0	38	0	0	0	11	114
	2026	0	0	0	0	0	0	0	0	0	58	2	0	0	1	4	0	0	38	0	0	0	11	114
	2027	0	0	0	0	0	0	0	0	0	58	2	0	0	0	3	0	0	38	0	0	0	11	114
	2028	0	0	0	0	0	0	0	0	0	58	2	0	0	0	3	0	0	38	0	0	0	11	114
	2029	0	0	0	0	0	0	0	0	0	58	2	0	0	0	3	0	0	38	0	0	0	11	113
	2030	0	0	0	0	0	0	0	0	0	58	2	0	0	0	3	0	0	38	0	0	0	11	113
	2031	0	0	0	0	0	0	0	0	0	58	2	0	0	0	3	0	0	38	0	0	0	11	113
	2032	0	0	0	0	0	0	0	0	0	58	2	0	0	0	3	0	0	38	0	0	0	11	113
	2033	0	0	0	0	0	0	0	0	0	58	2	0	0	0	2	0	0	38	0	0	0	11	113
	2034	0	0	0	0	0	0	0	0	0	58	2	0	0	0	2	0	0	38	0	0	0	11	113
	2035	0	0	0	0	0	0	0	0	0	58	2	0	0	0	2	0	0	38	0	0	0	11	113
	2036	0	0	0	0	0	0	0	0	0	58	2	0	0	0	2	0	0	38	0	0	0	11	112
	2037	0	0	0	0	0	0	0	0	0	58	2	0	0	0	2	0	0	38	0	0	0	11	112
	TOTAL	0	7	0	22	2	8	1	0	0	1,288	44	0	0	13	89	0	2	847	10	0	0	251	2,585

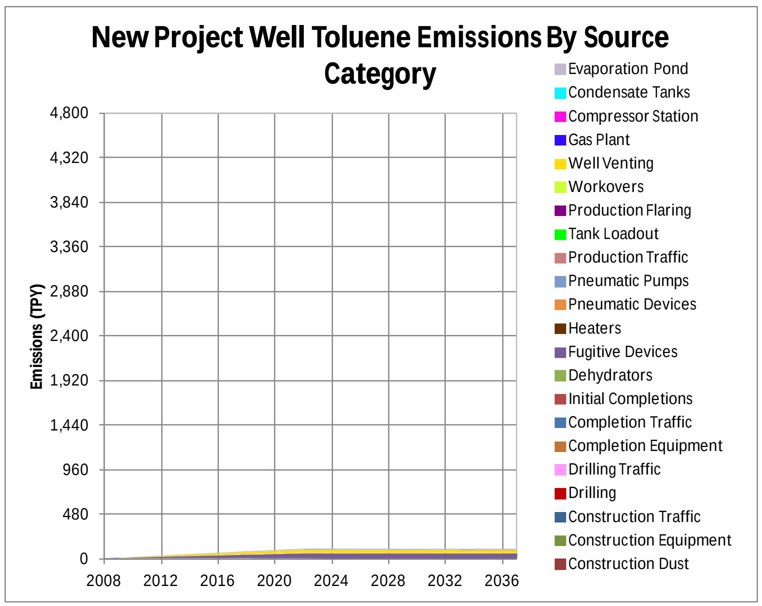

Figure 27. New Project Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 265. New Project Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	1	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	1	5
	2010	0	0	0	1	0	0	0	0	0	4	0	0	0	0	1	0	0	1	0	0	0	2	11
	2011	0	0	0	1	0	0	0	0	0	6	0	0	0	0	1	0	0	2	0	0	0	3	15
	2012	0	0	0	1	0	0	0	0	0	8	0	0	0	0	1	0	0	3	0	0	0	4	20
	2013	0	0	0	1	0	0	0	0	0	11	0	0	0	0	1	0	0	4	0	0	0	5	24
	2014	0	0	0	1	0	0	0	0	0	13	0	0	0	0	2	0	0	5	0	0	0	6	28
	2015	0	0	0	1	0	0	0	0	0	15	0	0	0	0	2	0	0	6	0	0	0	7	33
	2016	0	0	0	1	0	0	0	0	0	17	0	0	0	0	2	0	0	6	0	0	0	8	36
	2017	0	0	0	2	0	0	0	0	0	19	0	0	0	0	2	0	0	7	0	0	0	9	41
	2018	0	0	0	2	0	1	0	0	0	22	0	0	0	0	2	0	0	8	0	0	0	11	46
	2019	0	0	0	1	0	0	0	0	0	24	0	0	0	0	2	0	0	9	0	0	0	12	49
	2020	0	0	0	1	0	0	0	0	0	26	0	0	0	0	2	0	0	10	0	0	0	13	53
	2021	0	0	0	1	0	0	0	0	0	29	0	0	0	0	3	0	0	11	0	0	0	14	58
	2022	0	0	0	1	0	0	0	0	0	31	0	0	0	0	3	0	0	12	0	0	0	15	62
	2023	0	0	0	0	0	0	0	0	0	32	0	0	0	0	3	0	0	12	0	0	0	15	62
	2024	0	0	0	0	0	0	0	0	0	32	0	0	0	0	2	0	0	12	0	0	0	15	61
	2025	0	0	0	0	0	0	0	0	0	32	0	0	0	0	2	0	0	12	0	0	0	15	61
	2026	0	0	0	0	0	0	0	0	0	32	0	0	0	0	2	0	0	12	0	0	0	15	61
	2027	0	0	0	0	0	0	0	0	0	32	0	0	0	0	2	0	0	12	0	0	0	15	61
	2028	0	0	0	0	0	0	0	0	0	32	0	0	0	0	2	0	0	12	0	0	0	15	61
	2029	0	0	0	0	0	0	0	0	0	32	0	0	0	0	2	0	0	12	0	0	0	15	61
	2030	0	0	0	0	0	0	0	0	0	32	0	0	0	0	2	0	0	12	0	0	0	15	61
	2031	0	0	0	0	0	0	0	0	0	32	0	0	0	0	2	0	0	12	0	0	0	15	61
	2032	0	0	0	0	0	0	0	0	0	32	0	0	0	0	1	0	0	12	0	0	0	15	60
	2033	0	0	0	0	0	0	0	0	0	32	0	0	0	0	1	0	0	12	0	0	0	15	60
	2034	0	0	0	0	0	0	0	0	0	32	0	0	0	0	1	0	0	12	0	0	0	15	60
	2035	0	0	0	0	0	0	0	0	0	32	0	0	0	0	1	0	0	12	0	0	0	15	60
	2036	0	0	0	0	0	0	0	0	0	32	0	0	0	0	1	0	0	12	0	0	0	15	60
	2037	0	0	0	0	0	0	0	0	0	32	0	0	0	0	1	0	0	12	0	0	0	15	60
	TOTAL	0	6	0	17	1	6	1	0	0	699	0	0	0	8	49	0	2	264	1	0	0	340	1,394

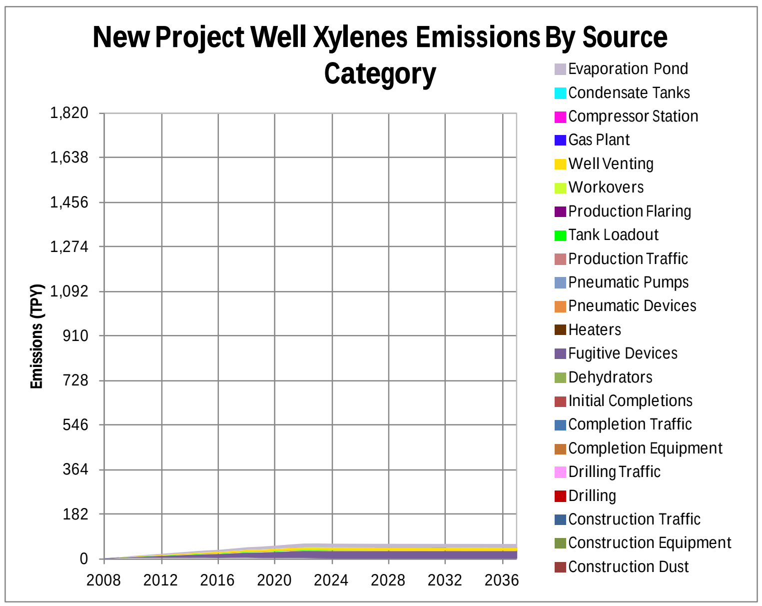

Figure 28. New Project Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	13,961	395	85,168	6,893	18,743	4,287	5,795	0	52	115,106	0	0	776	0	113,731	215	153	0	0	0	1	365,276
	2010	0	18,731	529	114,267	9,243	25,147	5,748	7,775	0	122	269,541	0	0	1,814	0	306,150	503	359	0	0	0	3	759,931
	2011	0	18,614	525	113,557	9,175	24,991	5,706	7,727	0	192	423,016	0	0	2,834	0	469,747	789	564	0	0	0	4	1,077,441
	2012	0	18,265	514	111,428	8,992	24,522	5,591	7,582	0	260	573,614	0	0	3,821	0	607,749	1,070	765	601,322	96,112	0	6	2,061,614
	2013	0	18,614	523	113,557	9,149	24,991	5,688	7,727	0	329	727,089	0	0	4,810	0	743,693	1,356	970	601,322	96,112	0	8	2,355,937
	2014	0	18,440	517	112,493	9,049	24,756	5,625	7,654	0	398	879,125	0	0	5,776	0	864,155	1,640	1,172	601,322	96,112	0	9	2,628,243
	2015	0	19,021	532	116,042	9,317	25,537	5,791	7,896	0	469	1,035,958	0	0	6,752	0	982,666	1,932	1,381	601,322	96,112	0	11	2,910,740
	2016	0	14,862	415	90,669	7,266	19,954	4,516	6,169	0	525	1,158,498	0	0	7,490	0	1,071,923	2,161	1,545	601,322	96,112	0	12	3,083,439
	2017	0	19,516	543	119,058	9,524	26,201	5,918	8,101	0	598	1,319,407	0	0	8,463	0	1,183,750	2,461	1,759	601,322	96,112	0	14	3,402,747
	2018	0	21,465	596	130,946	10,457	28,817	6,497	8,910	0	678	1,496,383	0	0	9,523	0	1,353,971	2,791	1,995	601,322	96,112	0	16	3,770,477
	2019	0	17,276	478	105,396	8,403	23,195	5,220	7,171	0	742	1,638,827	0	0	10,356	0	1,457,627	3,057	2,185	601,322	96,112	0	17	3,977,385
	2020	0	17,291	478	105,484	8,397	23,214	5,216	7,177	0	807	1,781,391	0	0	11,179	0	1,553,372	3,323	2,375	601,322	96,112	0	19	4,217,157
	2021	0	19,516	538	119,058	9,464	26,201	5,878	8,101	0	880	1,942,301	0	0	12,113	0	1,653,623	3,623	2,590	601,322	96,112	0	20	4,501,341
	2022	0	18,512	508	112,936	8,945	24,854	5,555	7,684	0	949	2,094,936	0	0	12,855	0	1,779,182	3,908	2,793	601,322	96,112	0	22	4,771,074
CO2 [tpy]	2023	0	6,210	171	37,882	3,007	8,337	1,868	2,578	0	972	2,146,135	0	0	13,303	0	1,782,508	4,003	2,862	601,322	96,112	0	22	4,707,292
	2024	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	13,235	0	1,702,123	4,003	2,862	601,322	96,112	0	22	4,566,787
	2025	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	13,111	0	1,649,632	4,003	2,862	601,322	96,112	0	22	4,514,171
	2026	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	13,054	0	1,612,301	4,003	2,862	601,322	96,112	0	22	4,476,784
	2027	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	13,010	0	1,582,070	4,003	2,862	601,322	96,112	0	22	4,446,508
	2028	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,967	0	1,556,255	4,003	2,862	601,322	96,112	0	22	4,420,650
	2029	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,930	0	1,533,629	4,003	2,862	601,322	96,112	0	22	4,397,988
	2030	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,896	0	1,513,378	4,003	2,862	601,322	96,112	0	22	4,377,702
	2031	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,866	0	1,495,075	4,003	2,862	601,322	96,112	0	22	4,359,369
	2032	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,837	0	1,478,250	4,003	2,862	601,322	96,112	0	22	4,342,516
	2033	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,812	0	1,462,728	4,003	2,862	601,322	96,112	0	22	4,326,968
	2034	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,788	0	1,448,276	4,003	2,862	601,322	96,112	0	22	4,312,492
	2035	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,768	0	1,434,654	4,003	2,862	601,322	96,112	0	22	4,298,850
	2036	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,750	0	1,421,772	4,003	2,862	601,322	96,112	0	22	4,285,951
	2037	0	0	0	0	0	0	0	0	0	972	2,146,135	0	0	12,734	0	1,409,575	4,003	2,862	601,322	96,112	0	22	4,273,737
	TOTAL	0	260,294	7,262	1,587,942	127,280	349,461	79,101	108,046	0	21,585	47,647,215	0	0	292,622	0	37,223,568	88,881	63,534	15,634,373	2,498,906	0	496	105,990,567

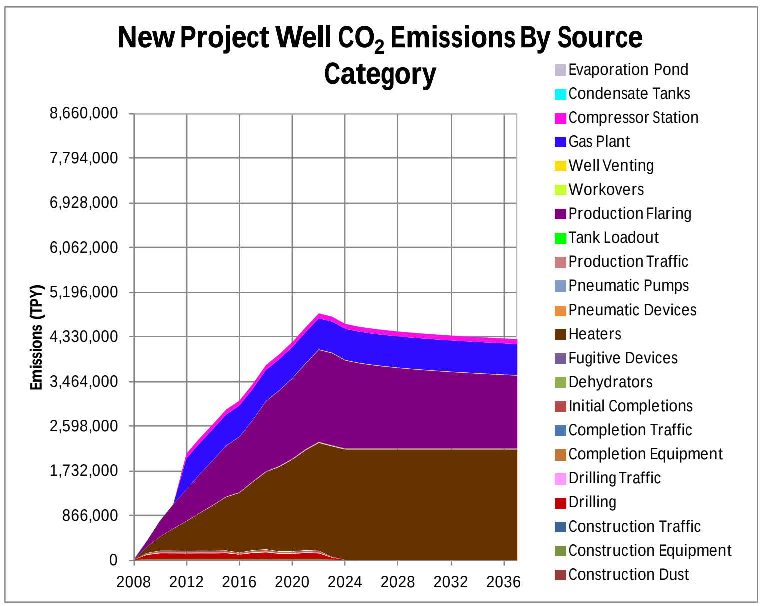

Figure 29. New Project Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 267. New Project Wells CO_2e - from CH4 Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	8	0	29	6	9	4	36	0	11,134	46	0	0	1	409	662	0	36,530	0	0	0	4	48,880
	2010	0	11	1	39	9	12	5	48	0	26,072	108	0	0	3	1,259	1,765	0	85,541	0	0	0	9	114,883
	2011	0	11	1	38	9	12	6	48	0	40,918	170	0	0	5	1,895	2,712	0	134,248	0	0	0	15	180,087
	2012	0	11	1	38	9	11	6	47	0	55,485	231	0	0	6	2,349	3,520	1	182,041	1,908	210	0	20	245,892
	2013	0	11	1	38	10	12	6	48	0	70,330	293	0	0	8	2,777	4,318	1	230,748	1,908	210	0	25	310,741
	2014	0	11	1	38	10	11	6	48	0	85,036	354	0	0	9	3,093	5,032	1	278,998	1,908	210	0	30	374,795
	2015	0	11	1	39	10	12	6	49	0	100,206	417	0	0	10	3,376	5,738	1	328,770	1,908	210	0	36	440,799
	2016	0	9	0	31	8	9	5	38	0	112,059	466	0	0	11	3,572	6,271	1	367,659	1,908	210	0	40	492,297
	2017	0	12	1	40	10	12	6	50	0	127,624	531	0	0	13	3,788	6,943	1	418,725	1,908	210	0	45	559,919
	2018	0	13	1	44	11	13	7	56	0	144,743	602	0	0	14	4,382	7,936	1	474,889	1,908	210	0	51	634,882
	2019	0	10	1	18	9	11	6	45	0	158,521	660	0	0	15	4,609	8,556	2	520,095	1,908	210	0	56	694,730
	2020	0	10	1	18	9	11	6	45	0	172,311	717	0	0	16	4,776	9,133	2	565,339	1,908	210	0	61	754,571
	2021	0	12	1	20	10	12	6	50	0	187,875	782	0	0	17	4,905	9,743	2	616,405	1,908	210	0	67	822,025
	2022	0	11	1	19	10	12	6	48	0	202,640	843	0	0	18	5,257	10,485	2	664,845	1,908	210	0	72	886,385
	2023	0	4	0	6	3	4	2	16	0	207,592	864	0	0	19	5,083	10,525	2	681,093	1,908	210	0	74	907,405
	2024	0	0	0	0	0	0	0	0	0	207,592	864	0	0	19	4,476	10,094	2	681,093	1,908	210	0	74	906,331
	2025	0	0	0	0	0	0	0	0	0	207,592	864	0	0	19	4,080	9,812	2	681,093	1,908	210	0	74	905,652
	2026	0	0	0	0	0	0	0	0	0	207,592	864	0	0	19	3,798	9,611	2	681,093	1,908	210	0	74	905,170
	2027	0	0	0	0	0	0	0	0	0	207,592	864	0	0	19	3,570	9,449	2	681,093	1,908	210	0	74	904,780
	2028	0	0	0	0	0	0	0	0	0	207,592	864	0	0	19	3,375	9,310	2	681,093	1,908	210	0	74	904,446
	2029	0	0	0	0	0	0	0	0	0	207,592	864	0	0	19	3,204	9,188	2	681,093	1,908	210	0	74	904,154
	2030	0	0	0	0	0	0	0	0	0	207,592	864	0	0	18	3,051	9,080	2	681,093	1,908	210	0	74	903,892
	2031	0	0	0	0	0	0	0	0	0	207,592	864	0	0	18	2,913	8,981	2	681,093	1,908	210	0	74	903,655
	2032	0	0	0	0	0	0	0	0	0	207,592	864	0	0	18	2,786	8,891	2	681,093	1,908	210	0	74	903,438
	2033	0	0	0	0	0	0	0	0	0	207,592	864	0	0	18	2,669	8,808	2	681,093	1,908	210	0	74	903,237
	2034	0	0	0	0	0	0	0	0	0	207,592	864	0	0	18	2,560	8,730	2	681,093	1,908	210	0	74	903,050
	2035	0	0	0	0	0	0	0	0	0	207,592	864	0	0	18	2,457	8,657	2	681,093	1,908	210	0	74	902,874
	2036	0	0	0	0	0	0	0	0	0	207,592	864	0	0	17	2,360	8,588	2	681,093	1,908	210	0	74	902,708
	2037	0	0	0	0	0	0	0	0	0	207,592	864	0	0	17	2,268	8,522	2	681,093	1,908	210	0	74	902,550
	TOTAL	0	157	8	455	132	162	83	673	0	4,608,832	19,178	0	0	420	95,098	221,057	47	15,121,233	49,600	5,451	0	1,640	20,124,226

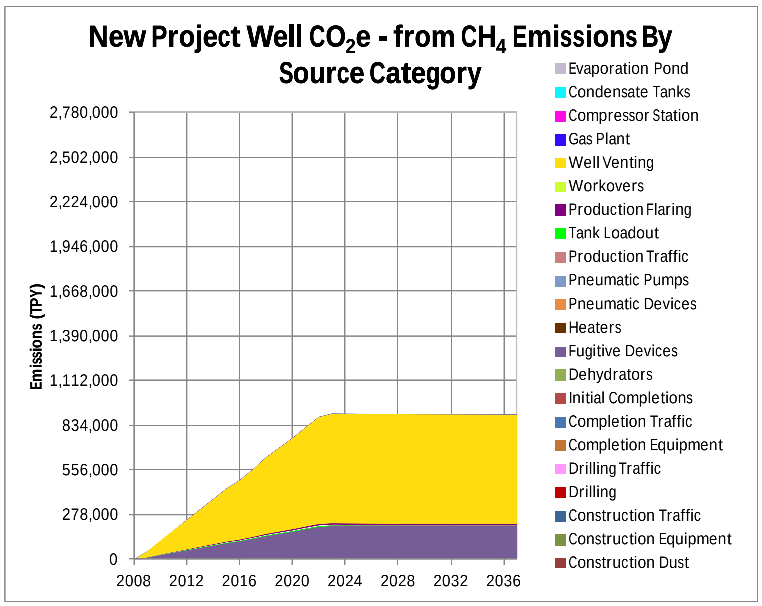

Figure 30. New Project Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

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	110	3	671	41	148	26	19	0	0	654	0	0	10	0	271	2	0	0	0	0	0	1,954
	2010	0	148	3	901	52	198	33	26	0	0	1,532	0	0	21	0	696	4	0	0	0	0	0	3,613
	2011	0	147	3	895	48	197	30	26	0	0	2,404	0	0	30	0	1,075	6	0	0	0	0	0	4,862
	2012	0	144	3	878	43	194	28	25	0	0	3,260	0	0	38	0	1,413	8	0	4,209	792	0	0	11,035
	2013	0	147	3	895	41	197	26	26	0	0	4,132	0	0	44	0	1,749	11	0	4,209	792	0	0	12,272
	2014	0	146	2	887	38	195	24	25	0	0	4,996	0	0	49	0	2,061	13	0	4,209	792	0	0	13,437
	2015	0	150	2	915	36	202	23	26	0	0	5,888	0	0	53	0	2,373	15	0	4,209	792	0	0	14,685
	2016	0	117	2	715	26	157	17	20	0	0	6,584	0	0	55	0	2,612	17	0	4,209	792	0	0	15,324
	2017	0	154	2	938	32	207	20	27	0	0	7,499	0	0	58	0	2,917	19	0	4,209	792	0	0	16,875
	2018	0	170	2	1,032	33	227	21	30	0	0	8,504	0	0	61	0	3,326	22	0	4,209	792	0	0	18,429
	2019	0	137	2	831	25	183	16	24	0	0	9,314	0	0	62	0	3,604	24	0	4,209	792	0	0	19,221
	2020	0	137	1	831	23	183	15	24	0	0	10,124	0	0	63	0	3,869	26	0	4,209	792	0	0	20,298
	2021	0	154	2	938	25	207	16	27	0	0	11,039	0	0	64	0	4,156	29	0	4,209	792	0	0	21,657
	2022	0	146	1	890	20	196	13	25	0	0	11,906	0	0	57	0	4,476	31	0	4,209	792	0	0	22,764
	2023	0	49	0	299	7	66	5	9	0	0	12,197	0	0	66	0	4,523	32	0	4,209	792	0	0	22,254
	2024	0	0	0	0	0	0	0	0	0	0	12,197	0	0	62	0	4,399	32	0	4,209	792	0	0	21,691
	2025	0	0	0	0	0	0	0	0	0	0	12,197	0	0	55	0	4,317	32	0	4,209	792	0	0	21,603
	2026	0	0	0	0	0	0	0	0	0	0	12,197	0	0	52	0	4,260	32	0	4,209	792	0	0	21,542
	2027	0	0	0	0	0	0	0	0	0	0	12,197	0	0	50	0	4,213	32	0	4,209	792	0	0	21,493
	2028	0	0	0	0	0	0	0	0	0	0	12,197	0	0	48	0	4,173	32	0	4,209	792	0	0	21,450
	2029	0	0	0	0	0	0	0	0	0	0	12,197	0	0	45	0	4,138	32	0	4,209	792	0	0	21,413
	2030	0	0	0	0	0	0	0	0	0	0	12,197	0	0	44	0	4,106	32	0	4,209	792	0	0	21,380
	2031	0	0	0	0	0	0	0	0	0	0	12,197	0	0	42	0	4,078	32	0	4,209	792	0	0	21,350
	2032	0	0	0	0	0	0	0	0	0	0	12,197	0	0	41	0	4,052	32	0	4,209	792	0	0	21,323
	2033	0	0	0	0	0	0	0	0	0	0	12,197	0	0	40	0	4,028	32	0	4,209	792	0	0	21,298
	2034	0	0	0	0	0	0	0	0	0	0	12,197	0	0	40	0	4,005	32	0	4,209	792	0	0	21,275
	2035	0	0	0	0	0	0	0	0	0	0	12,197	0	0	39	0	3,984	32	0	4,209	792	0	0	21,254
	2036	0	0	0	0	0	0	0	0	0	0	12,197	0	0	39	0	3,964	32	0	4,209	792	0	0	21,233
	2037	0	0	0	0	0	0	0	0	0	0	12,197	0	0	38	0	3,946	32	0	4,209	792	0	0	21,214
	TOTAL	0	2,057	31	12,516	491	2,758	312	358	0	0	270,795	0	0	1,367	0	96,783	702	0	109,443	20,588	0	0	518,201

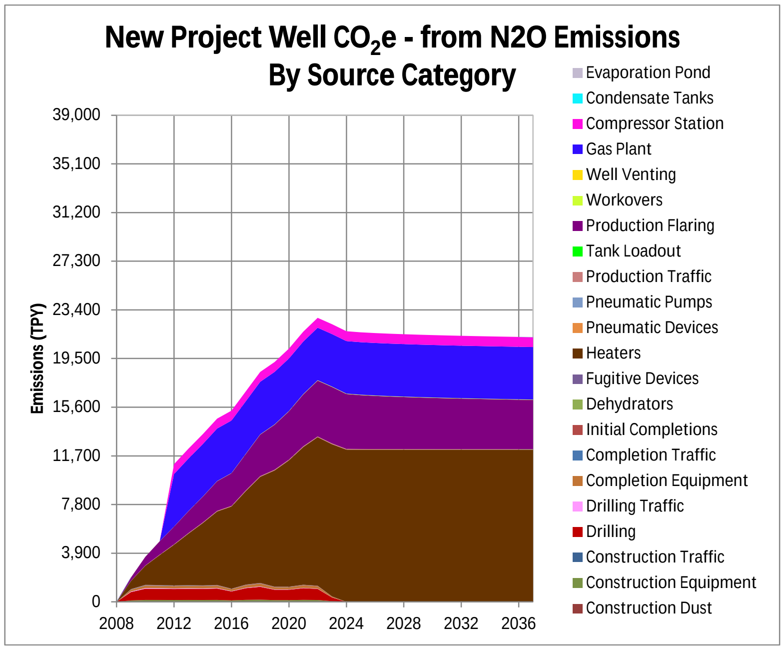

Figure 31. New Project Wells CO_2e - from N_2O Emissions (tons/year) Contribution by Source Category and by Project Year.

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	14,079	398	85,868	6,940	18,900	4,317	5,850	0	11,186	115,807	0	0	787	409	114,664	217	36,683	0	0	0	5	416,110
	2010	0	18,890	533	115,206	9,303	25,357	5,786	7,849	0	26,194	271,181	0	0	1,838	1,259	308,611	507	85,900	0	0	0	12	878,427
	2011	0	18,773	529	114,491	9,232	25,200	5,742	7,800	0	41,109	425,590	0	0	2,869	1,895	473,535	796	134,812	0	0	0	19	1,262,390
	2012	0	18,421	518	112,344	9,045	24,727	5,624	7,654	0	55,744	577,104	0	0	3,865	2,349	612,682	1,079	182,806	607,439	97,113	0	26	2,318,541
	2013	0	18,773	526	114,491	9,199	25,200	5,720	7,800	0	70,659	731,514	0	0	4,862	2,777	749,760	1,368	231,717	607,439	97,113	0	33	2,678,950
	2014	0	18,597	520	113,417	9,096	24,963	5,655	7,727	0	85,435	884,475	0	0	5,835	3,093	871,247	1,654	280,170	607,439	97,113	0	39	3,016,475
	2015	0	19,183	535	116,995	9,363	25,751	5,820	7,971	0	100,676	1,042,262	0	0	6,816	3,376	990,777	1,949	330,151	607,439	97,113	0	46	3,366,224
	2016	0	14,989	417	91,414	7,301	20,120	4,537	6,228	0	112,584	1,165,548	0	0	7,557	3,572	1,080,806	2,179	369,204	607,439	97,113	0	52	3,591,060
	2017	0	19,682	546	120,036	9,566	26,420	5,945	8,178	0	128,222	1,327,437	0	0	8,534	3,788	1,193,610	2,482	420,484	607,439	97,113	0	59	3,979,541
	2018	0	21,647	598	132,022	10,501	29,058	6,525	8,995	0	145,420	1,505,490	0	0	9,597	4,382	1,365,233	2,815	476,885	607,439	97,113	0	67	4,423,788
	2019	0	17,423	481	106,244	8,437	23,388	5,242	7,240	0	159,263	1,648,801	0	0	10,433	4,609	1,469,786	3,083	522,280	607,439	97,113	0	73	4,691,336
	2020	0	17,438	480	106,333	8,430	23,408	5,237	7,246	0	173,118	1,792,233	0	0	11,258	4,776	1,566,374	3,351	567,714	607,439	97,113	0	80	4,992,027
	2021	0	19,682	540	120,016	9,499	26,420	5,900	8,178	0	188,755	1,954,121	0	0	12,194	4,905	1,667,523	3,654	618,995	607,439	97,113	0	87	5,345,023
	2022	0	18,670	510	113,846	8,975	25,062	5,573	7,758	0	203,589	2,107,686	0	0	12,930	5,257	1,794,143	3,941	667,639	607,439	97,113	0	94	5,680,223
	2023	0	6,262	172	38,187	3,018	8,406	1,874	2,602	0	208,564	2,159,196	0	0	13,388	5,083	1,797,557	4,037	683,955	607,439	97,113	0	96	5,636,951
	2024	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	13,316	4,476	1,716,616	4,037	683,955	607,439	97,113	0	96	5,494,808
	2025	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	13,184	4,080	1,663,761	4,037	683,955	607,439	97,113	0	96	5,441,426
	2026	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	13,125	3,798	1,626,172	4,037	683,955	607,439	97,113	0	96	5,403,496
	2027	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	13,078	3,570	1,595,731	4,037	683,955	607,439	97,113	0	96	5,372,780
	2028	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	13,033	3,375	1,569,738	4,037	683,955	607,439	97,113	0	96	5,346,547
	2029	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,994	3,204	1,546,956	4,037	683,955	607,439	97,113	0	96	5,323,555
	2030	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,958	3,051	1,526,564	4,037	683,955	607,439	97,113	0	96	5,302,974
	2031	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,926	2,913	1,508,135	4,037	683,955	607,439	97,113	0	96	5,284,374
	2032	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,896	2,786	1,491,193	4,037	683,955	607,439	97,113	0	96	5,267,276
	2033	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,870	2,669	1,475,564	4,037	683,955	607,439	97,113	0	96	5,251,504
	2034	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,845	2,560	1,461,012	4,037	683,955	607,439	97,113	0	96	5,236,818
	2035	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,825	2,457	1,447,295	4,037	683,955	607,439	97,113	0	96	5,222,978
	2036	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,806	2,360	1,434,324	4,037	683,955	607,439	97,113	0	96	5,209,892
	2037	0	0	0	0	0	0	0	0	0	208,564	2,159,196	0	0	12,789	2,268	1,422,042	4,037	683,955	607,439	97,113	0	96	5,197,500
	TOTAL	0	262,508	7,301	1,600,912	127,903	352,380	79,496	109,078	0	4,630,417	47,937,188	0	0	294,409	95,098	37,541,408	89,630	15,184,767	15,793,416	2,524,945	0	2,136	126,632,994

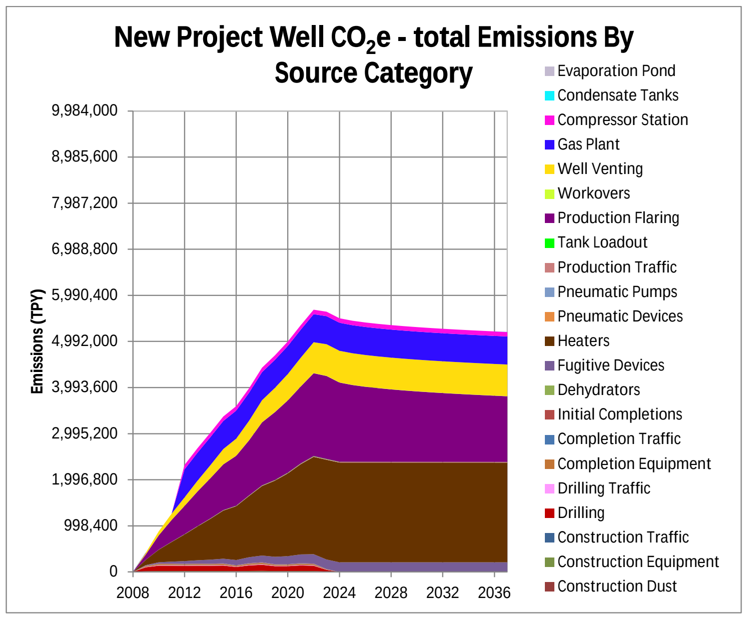

Figure 32. New Project Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.

Total Project Emissions Summary

Table 270. Total New and Existing Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	177	3	1,159	51	303	31	3	0	0	660	0	0	33	0	120	23	0	568	621	0	0	3,751
	2010	0	237	3	1,555	61	407	38	4	0	0	783	0	0	38	0	214	28	0	568	621	0	0	4,557
	2011	0	236	3	1,545	55	404	34	4	0	0	905	0	0	42	0	298	32	0	568	621	0	0	4,746
	2012	0	231	3	1,516	48	396	30	4	0	0	1,025	0	0	44	0	372	36	0	951	675	0	0	5,332
	2013	0	236	2	1,545	43	404	27	4	0	0	1,147	0	0	46	0	445	41	0	951	675	0	0	5,568
	2014	0	234	2	1,531	38	400	23	4	0	0	1,269	0	0	48	0	509	45	0	951	675	0	0	5,729
	2015	0	241	2	1,579	35	413	21	5	0	0	1,394	0	0	49	0	572	49	0	951	675	0	0	5,986
	2016	0	188	1	1,234	24	323	15	4	0	0	1,491	0	0	48	0	620	53	0	951	675	0	0	5,626
	2017	0	247	2	1,620	28	424	17	5	0	0	1,619	0	0	49	0	680	57	0	951	675	0	0	6,374
	2018	0	272	2	1,782	27	466	16	5	0	0	1,762	0	0	49	0	771	62	0	951	675	0	0	6,839
	2019	0	219	1	992	19	375	12	4	0	0	1,875	0	0	48	0	827	66	0	951	675	0	0	6,065
	2020	0	219	1	993	17	375	10	4	0	0	1,989	0	0	47	0	879	70	0	951	675	0	0	6,232
	2021	0	247	1	1,121	17	424	11	5	0	0	2,118	0	0	47	0	934	75	0	951	675	0	0	6,626
	2022	0	235	1	1,063	12	402	8	4	0	0	2,240	0	0	43	0	1,002	79	0	951	675	0	0	6,715
NOx [tpy]	2023	0	79	0	357	5	135	3	1	0	0	2,278	0	0	47	0	1,004	80	0	951	675	0	0	5,616
	2024	0	0	0	0	0	0	0	0	0	0	2,273	0	0	45	0	964	80	0	951	675	0	0	4,988
	2025	0	0	0	0	0	0	0	0	0	0	2,268	0	0	42	0	937	80	0	951	675	0	0	4,953
	2026	0	0	0	0	0	0	0	0	0	0	2,263	0	0	40	0	917	80	0	951	675	0	0	4,927
	2027	0	0	0	0	0	0	0	0	0	0	2,258	0	0	39	0	902	80	0	951	675	0	0	4,906
	2028	0	0	0	0	0	0	0	0	0	0	2,249	0	0	38	0	888	79	0	951	675	0	0	4,881
	2029	0	0	0	0	0	0	0	0	0	0	2,245	0	0	37	0	876	79	0	951	675	0	0	4,863
	2030	0	0	0	0	0	0	0	0	0	0	2,240	0	0	37	0	865	79	0	951	675	0	0	4,847
	2031	0	0	0	0	0	0	0	0	0	0	2,236	0	0	36	0	855	79	0	951	675	0	0	4,832
	2032	0	0	0	0	0	0	0	0	0	0	2,231	0	0	35	0	847	79	0	951	675	0	0	4,818
	2033	0	0	0	0	0	0	0	0	0	0	2,227	0	0	35	0	838	79	0	951	675	0	0	4,805
	2034	0	0	0	0	0	0	0	0	0	0	2,222	0	0	34	0	831	78	0	951	675	0	0	4,792
	2035	0	0	0	0	0	0	0	0	0	0	2,218	0	0	34	0	823	78	0	951	675	0	0	4,780
	2036	0	0	0	0	0	0	0	0	0	0	2,213	0	0	33	0	817	78	0	951	675	0	0	4,768
	2037	0	0	0	0	0	0	0	0	0	0	2,209	0	0	33	0	810	78	0	951	675	0	0	4,756
	TOTAL	0	3,591	32	20,757	531	5,819	329	62	0	0	54,476	0	0	1,225	0	21,480	1,924	0	27,002	20,035	0	0	157,263

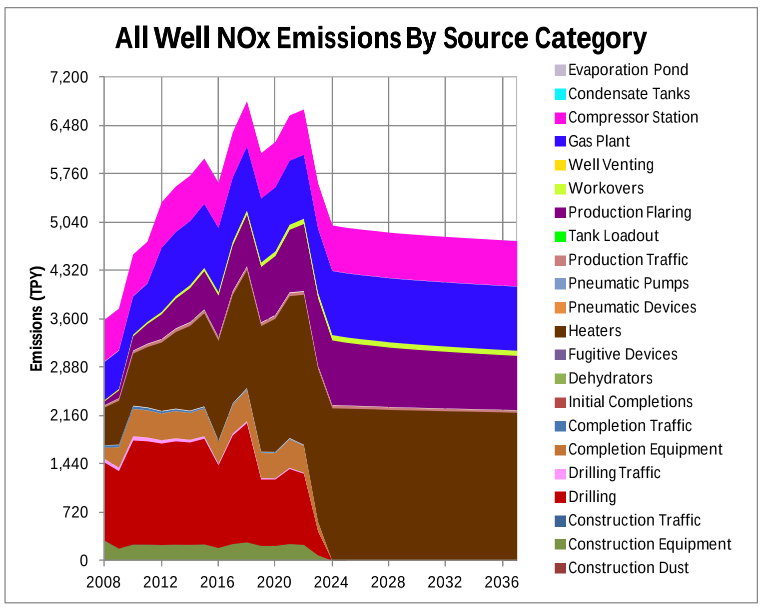

Figure 33. Total New and Existing Wells NOx Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 271. Total New and Existing Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	26	0	90	6	27	4	4	26,548	2,206	36	0	12,295	8	246	154	2	2,470	198	221	13,311	23	57,877
	2010	0	35	0	121	8	37	5	6	25,484	2,617	43	0	12,169	9	347	276	3	2,930	198	221	11,585	27	56,121
	2011	0	35	0	120	7	36	4	6	24,751	3,025	50	0	12,042	10	427	384	3	3,387	198	221	10,624	32	55,363
	2012	0	35	0	118	6	36	4	6	24,463	3,427	56	0	11,925	11	492	479	4	3,837	271	224	10,438	36	55,866
	2013	0	35	0	120	6	36	4	6	24,206	3,836	63	0	11,808	12	554	573	4	4,296	271	224	10,307	40	56,401
	2014	0	35	0	119	5	36	3	6	23,736	4,242	70	0	11,692	13	594	655	5	4,750	271	224	9,821	45	56,320
	2015	0	36	0	123	5	37	3	6	23,244	4,661	77	0	11,575	13	628	737	5	5,220	271	224	9,316	49	56,229
	2016	0	28	0	96	4	29	2	5	22,781	4,985	82	0	11,458	13	651	798	6	5,582	271	224	8,875	52	55,940
	2017	0	37	0	126	4	38	3	6	22,347	5,415	89	0	11,341	13	677	876	6	6,064	271	224	8,490	57	56,084
	2018	0	41	0	138	4	42	3	7	21,938	5,890	97	0	11,224	14	761	992	7	6,596	271	224	8,150	62	56,459
	2019	0	33	0	56	3	34	2	5	21,545	6,269	103	0	11,108	14	790	1,064	7	7,020	271	224	7,840	66	56,453
	2020	0	33	0	56	3	34	2	5	21,179	6,650	109	0	11,000	14	811	1,131	7	7,447	271	224	7,555	70	56,600
	2021	0	37	0	63	3	38	2	6	20,830	7,082	116	0	10,893	14	826	1,202	8	7,931	271	224	7,298	74	56,919
	2022	0	35	0	60	2	36	1	6	20,403	7,491	123	0	10,786	13	873	1,289	8	8,389	271	224	6,951	79	57,039
	2023	0	12	0	20	1	12	1	2	20,072	7,617	125	0	10,679	14	844	1,293	8	8,530	271	224	6,729	80	56,533
	2024	0	0	0	0	0	0	0	0	19,751	7,601	125	0	10,572	13	751	1,240	8	8,512	271	224	6,521	80	55,668
	2025	0	0	0	0	0	0	0	0	19,449	7,584	125	0	10,465	12	690	1,205	8	8,493	271	224	6,340	80	54,946
	2026	0	0	0	0	0	0	0	0	19,149	7,568	124	0	10,358	12	645	1,181	8	8,475	271	224	6,162	79	54,255
	2027	0	0	0	0	0	0	0	0	18,858	7,551	124	0	10,251	12	609	1,160	8	8,456	271	224	5,996	79	53,599
	2028	0	0	0	0	0	0	0	0	18,445	7,520	124	0	10,046	11	578	1,143	8	8,421	271	224	5,837	79	52,706
	2029	0	0	0	0	0	0	0	0	18,076	7,505	123	0	9,949	11	548	1,127	8	8,405	271	224	5,580	79	51,905
	2030	0	0	0	0	0	0	0	0	17,816	7,490	123	0	9,852	10	524	1,113	8	8,388	271	224	5,440	79	51,338
	2031	0	0	0	0	0	0	0	0	17,564	7,475	123	0	9,754	10	501	1,101	8	8,371	271	224	5,310	78	50,791
	2032	0	0	0	0	0	0	0	0	17,314	7,460	123	0	9,657	10	481	1,089	8	8,354	271	224	5,184	78	50,253
	2033	0	0	0	0	0	0	0	0	17,066	7,445	122	0	9,560	10	462	1,079	8	8,338	271	224	5,060	78	49,722
	2034	0	0	0	0	0	0	0	0	16,826	7,431	122	0	9,462	10	444	1,069	8	8,321	271	224	4,945	78	49,209
	2035	0	0	0	0	0	0	0	0	16,591	7,416	122	0	9,365	9	427	1,060	8	8,304	271	224	4,836	78	48,710
	2036	0	0	0	0	0	0	0	0	16,367	7,401	122	0	9,268	9	411	1,051	8	8,288	271	224	4,738	78	48,234
	2037	0	0	0	0	0	0	0	0	16,146	7,386	121	0	9,170	9	396	1,042	8	8,271	271	224	4,643	78	47,765
	TOTAL	0	537	5	1,531	75	507	47	210	620,038	182,149	2,996	0	322,148	341	17,184	27,640	203	203,978	7,828	6,695	227,956	1,912	1,623,979

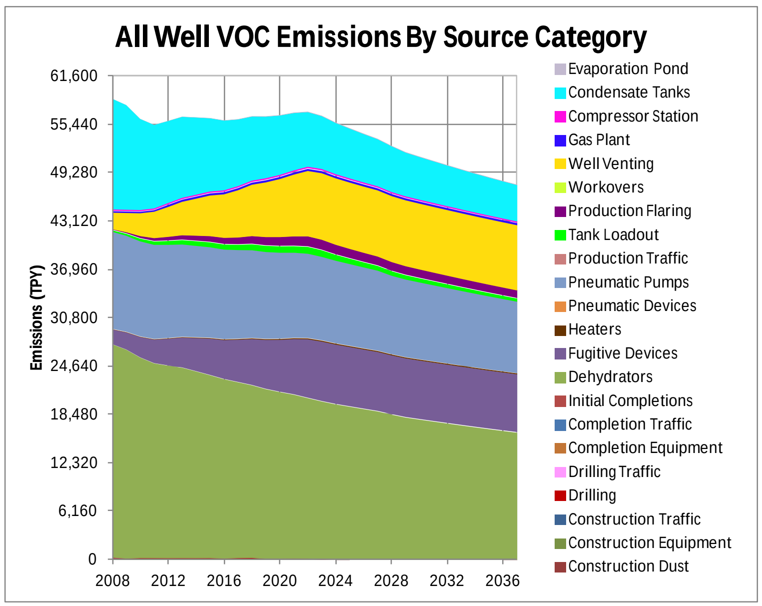

Figure 34. Total New and Existing Wells VOC Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 272. Total New and Existing Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	278

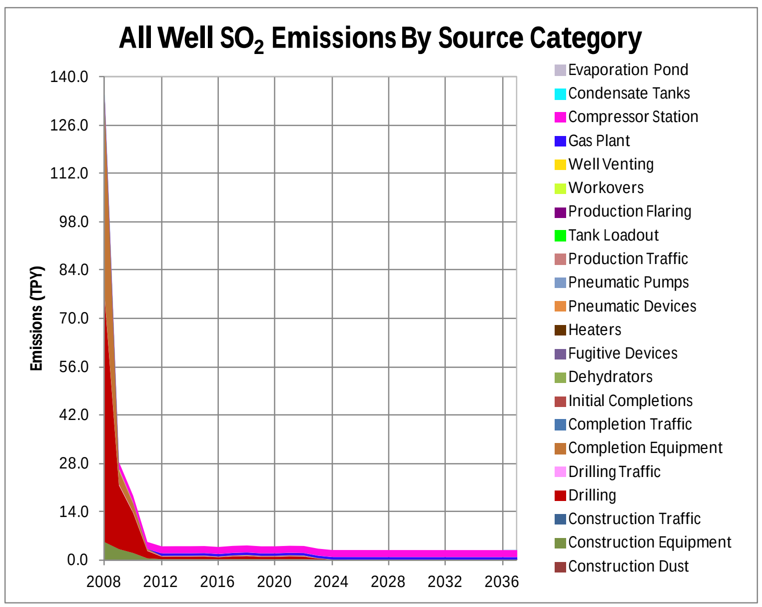

Figure 35. Total New and Existing Wells SO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 273. Total New and Existing Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	117	11	19	59	309	18	196	0	0	0	50	0	0	439	0	0	2	0	32	49	0	0	1,300
	2010	157	14	26	79	414	25	262	0	0	0	59	0	0	521	0	0	2	0	32	49	0	0	1,640
	2011	156	14	26	78	411	24	261	0	0	0	69	0	0	602	0	0	2	0	32	49	0	0	1,724
	2012	153	14	25	77	403	24	255	0	0	0	78	0	0	682	0	0	2	0	67	55	0	0	1,836
	2013	156	14	26	78	411	24	260	0	0	0	87	0	0	763	0	0	3	0	67	55	0	0	1,944
	2014	154	14	26	78	406	24	257	0	0	0	96	0	0	844	0	0	3	0	67	55	0	0	2,025
	2015	159	15	26	80	419	25	265	0	0	0	106	0	0	927	0	0	3	0	67	55	0	0	2,147
	2016	124	11	21	62	327	20	207	0	0	0	113	0	0	991	0	0	4	0	67	55	0	0	2,002
	2017	163	15	27	82	429	26	272	0	0	0	123	0	0	1,076	0	0	4	0	67	55	0	0	2,339
	2018	179	16	30	90	472	28	299	0	0	0	134	0	0	1,171	0	0	4	0	67	55	0	0	2,546
	2019	144	13	24	33	380	23	241	0	0	0	142	0	0	1,246	0	0	4	0	67	55	0	0	2,372
	2020	144	13	24	33	380	23	241	0	0	0	151	0	0	1,321	0	0	5	0	67	55	0	0	2,457
	2021	163	15	27	38	429	26	272	0	0	0	161	0	0	1,407	0	0	5	0	67	55	0	0	2,663
	2022	155	14	26	36	406	24	257	0	0	0	170	0	0	1,488	0	0	5	0	67	55	0	0	2,704
PM10 [tpy]	2023	52	5	9	12	136	8	86	0	0	0	173	0	0	1,513	0	0	5	0	67	55	0	0	2,122
	2024	0	0	0	0	0	0	0	0	0	0	173	0	0	1,510	0	0	5	0	67	55	0	0	1,810
	2025	0	0	0	0	0	0	0	0	0	0	172	0	0	1,506	0	0	5	0	67	55	0	0	1,806
	2026	0	0	0	0	0	0	0	0	0	0	172	0	0	1,503	0	0	5	0	67	55	0	0	1,802
	2027	0	0	0	0	0	0	0	0	0	0	172	0	0	1,499	0	0	5	0	67	55	0	0	1,799
	2028	0	0	0	0	0	0	0	0	0	0	171	0	0	1,493	0	0	5	0	67	55	0	0	1,792
	2029	0	0	0	0	0	0	0	0	0	0	171	0	0	1,490	0	0	5	0	67	55	0	0	1,788
	2030	0	0	0	0	0	0	0	0	0	0	170	0	0	1,487	0	0	5	0	67	55	0	0	1,785
	2031	0	0	0	0	0	0	0	0	0	0	170	0	0	1,484	0	0	5	0	67	55	0	0	1,782
	2032	0	0	0	0	0	0	0	0	0	0	170	0	0	1,481	0	0	5	0	67	55	0	0	1,778
	2033	0	0	0	0	0	0	0	0	0	0	169	0	0	1,478	0	0	5	0	67	55	0	0	1,775
	2034	0	0	0	0	0	0	0	0	0	0	169	0	0	1,475	0	0	5	0	67	55	0	0	1,772
	2035	0	0	0	0	0	0	0	0	0	0	169	0	0	1,472	0	0	5	0	67	55	0	0	1,768
	2036	0	0	0	0	0	0	0	0	0	0	168	0	0	1,469	0	0	5	0	67	55	0	0	1,765
	2037	0	0	0	0	0	0	0	0	0	0	168	0	0	1,466	0	0	5	0	67	55	0	0	1,762
	TOTAL	2,369	217	393	971	6,030	354	3,820	0	0	0	4,140	0	0	36,185	0	0	130	0	1,883	1,615	0	0	58,106

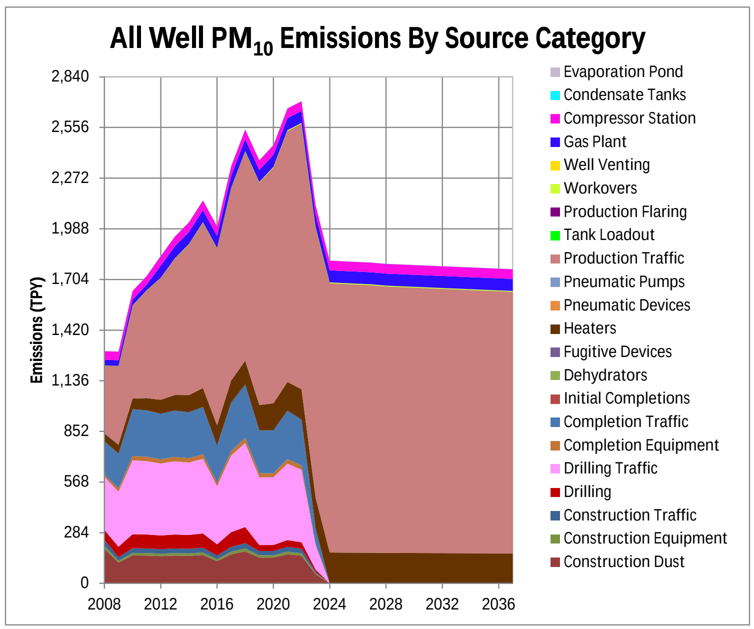

Figure 36. Total New and Existing Wells PM_{10} Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 274. Total New and Existing Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	30	10	2	57	33	18	21	0	0	0	50	0	0	45	0	0	2	0	32	49	0	0	349
	2010	40	14	3	76	44	24	28	0	0	0	59	0	0	53	0	0	2	0	32	49	0	0	425
	2011	40	14	3	76	44	24	28	0	0	0	69	0	0	62	0	0	2	0	32	49	0	0	441
	2012	39	14	3	74	42	23	27	0	0	0	78	0	0	70	0	0	2	0	67	55	0	0	495
	2013	40	14	3	76	43	24	27	0	0	0	87	0	0	78	0	0	3	0	67	55	0	0	516
	2014	40	14	3	75	42	24	27	0	0	0	96	0	0	86	0	0	3	0	67	55	0	0	531
	2015	41	14	3	78	43	24	27	0	0	0	106	0	0	94	0	0	3	0	67	55	0	0	556
	2016	32	11	2	61	34	19	21	0	0	0	113	0	0	100	0	0	3	0	67	55	0	0	519
	2017	42	14	3	80	44	25	28	0	0	0	123	0	0	109	0	0	4	0	67	55	0	0	593
	2018	46	16	3	88	48	27	30	0	0	0	134	0	0	118	0	0	4	0	67	55	0	0	637
	2019	37	13	2	32	39	22	24	0	0	0	142	0	0	126	0	0	4	0	67	55	0	0	564
	2020	37	13	2	32	38	22	24	0	0	0	151	0	0	133	0	0	5	0	67	55	0	0	581
	2021	42	14	3	37	43	25	27	0	0	0	161	0	0	142	0	0	5	0	67	55	0	0	621
	2022	40	14	3	35	41	24	26	0	0	0	170	0	0	149	0	0	5	0	67	55	0	0	628
PM2.5 [tpy]	2023	13	5	1	12	14	8	9	0	0	0	173	0	0	152	0	0	5	0	67	55	0	0	513
	2024	0	0	0	0	0	0	0	0	0	0	173	0	0	152	0	0	5	0	67	55	0	0	452
	2025	0	0	0	0	0	0	0	0	0	0	172	0	0	151	0	0	5	0	67	55	0	0	451
	2026	0	0	0	0	0	0	0	0	0	0	172	0	0	151	0	0	5	0	67	55	0	0	450
	2027	0	0	0	0	0	0	0	0	0	0	172	0	0	150	0	0	5	0	67	55	0	0	449
	2028	0	0	0	0	0	0	0	0	0	0	171	0	0	150	0	0	5	0	67	55	0	0	448
	2029	0	0	0	0	0	0	0	0	0	0	171	0	0	149	0	0	5	0	67	55	0	0	447
	2030	0	0	0	0	0	0	0	0	0	0	170	0	0	149	0	0	5	0	67	55	0	0	447
	2031	0	0	0	0	0	0	0	0	0	0	170	0	0	149	0	0	5	0	67	55	0	0	446
	2032	0	0	0	0	0	0	0	0	0	0	170	0	0	148	0	0	5	0	67	55	0	0	445
	2033	0	0	0	0	0	0	0	0	0	0	169	0	0	148	0	0	5	0	67	55	0	0	445
	2034	0	0	0	0	0	0	0	0	0	0	169	0	0	148	0	0	5	0	67	55	0	0	444
	2035	0	0	0	0	0	0	0	0	0	0	169	0	0	148	0	0	5	0	67	55	0	0	443
	2036	0	0	0	0	0	0	0	0	0	0	168	0	0	147	0	0	5	0	67	55	0	0	443
	2037	0	0	0	0	0	0	0	0	0	0	168	0	0	147	0	0	5	0	67	55	0	0	442
	TOTAL	610	210	41	942	625	344	395	0	0	0	4,140	0	0	3,644	0	0	126	0	1,883	1,615	0	0	14,574

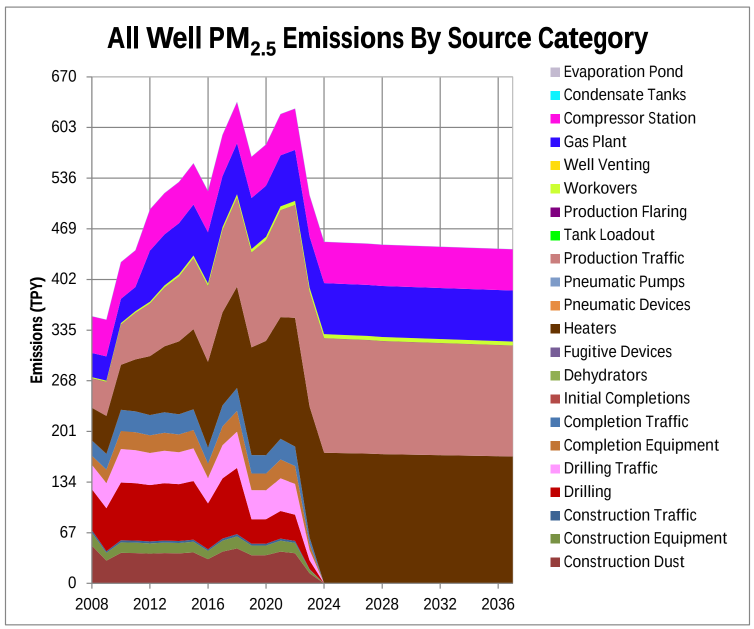

Figure 37. Total New and Existing Wells $PM_{2.5}$ Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	218	4	517	55	114	35	18	0	0	554	0	0	90	0	651	10	0	741	449	0	0	3,454
	2010	0	293	5	694	71	153	45	24	0	0	657	0	0	105	0	1,167	11	0	741	449	0	0	4,414
	2011	0	291	4	690	67	152	43	24	0	0	760	0	0	118	0	1,622	13	0	741	449	0	0	4,973
	2012	0	286	4	677	62	149	40	24	0	0	861	0	0	130	0	2,024	15	0	1,244	511	0	0	6,027
	2013	0	291	4	690	60	152	38	24	0	0	964	0	0	141	0	2,423	17	0	1,244	511	0	0	6,558
	2014	0	288	4	684	56	150	36	24	0	0	1,066	0	0	150	0	2,771	18	0	1,244	511	0	0	7,003
	2015	0	297	4	705	55	155	35	25	0	0	1,171	0	0	159	0	3,115	20	0	1,244	511	0	0	7,496
	2016	0	232	3	551	40	121	26	19	0	0	1,252	0	0	163	0	3,373	22	0	1,244	511	0	0	7,559
	2017	0	305	3	723	51	159	32	25	0	0	1,360	0	0	171	0	3,703	24	0	1,244	511	0	0	8,313
	2018	0	336	3	796	53	175	34	28	0	0	1,480	0	0	180	0	4,195	26	0	1,244	511	0	0	9,060
	2019	0	270	3	581	41	141	26	22	0	0	1,575	0	0	186	0	4,500	27	0	1,244	511	0	0	9,129
	2020	0	270	3	582	40	141	26	23	0	0	1,671	0	0	192	0	4,784	29	0	1,244	511	0	0	9,515
	2021	0	305	3	657	44	159	28	25	0	0	1,779	0	0	199	0	5,085	31	0	1,244	511	0	0	10,070
	2022	0	289	3	623	39	151	25	24	0	0	1,882	0	0	200	0	5,450	33	0	1,244	511	0	0	10,473
CO [tpy]	2023	0	97	1	209	14	51	9	8	0	0	1,914	0	0	208	0	5,465	33	0	1,244	511	0	0	9,763
	2024	0	0	0	0	0	0	0	0	0	0	1,909	0	0	204	0	5,243	33	0	1,244	511	0	0	9,145
	2025	0	0	0	0	0	0	0	0	0	0	1,905	0	0	197	0	5,097	33	0	1,244	511	0	0	8,988
	2026	0	0	0	0	0	0	0	0	0	0	1,901	0	0	194	0	4,992	33	0	1,244	511	0	0	8,875
	2027	0	0	0	0	0	0	0	0	0	0	1,897	0	0	191	0	4,906	33	0	1,244	511	0	0	8,783
	2028	0	0	0	0	0	0	0	0	0	0	1,889	0	0	188	0	4,833	33	0	1,244	511	0	0	8,698
	2029	0	0	0	0	0	0	0	0	0	0	1,885	0	0	185	0	4,766	33	0	1,244	511	0	0	8,625
	2030	0	0	0	0	0	0	0	0	0	0	1,882	0	0	183	0	4,707	33	0	1,244	511	0	0	8,561
	2031	0	0	0	0	0	0	0	0	0	0	1,878	0	0	181	0	4,655	33	0	1,244	511	0	0	8,502
	2032	0	0	0	0	0	0	0	0	0	0	1,874	0	0	179	0	4,606	32	0	1,244	511	0	0	8,448
	2033	0	0	0	0	0	0	0	0	0	0	1,870	0	0	176	0	4,562	32	0	1,244	511	0	0	8,396
	2034	0	0	0	0	0	0	0	0	0	0	1,867	0	0	174	0	4,520	32	0	1,244	511	0	0	8,349
	2035	0	0	0	0	0	0	0	0	0	0	1,863	0	0	172	0	4,480	32	0	1,244	511	0	0	8,303
	2036	0	0	0	0	0	0	0	0	0	0	1,859	0	0	171	0	4,443	32	0	1,244	511	0	0	8,261
	2037	0	0	0	0	0	0	0	0	0	0	1,855	0	0	169	0	4,408	32	0	1,244	511	0	0	8,220
	TOTAL	0	4,431	55	9,883	804	2,252	512	339	0	0	45,760	0	0	5,036	0	116,879	792	0	35,313	15,092	0	0	237,147

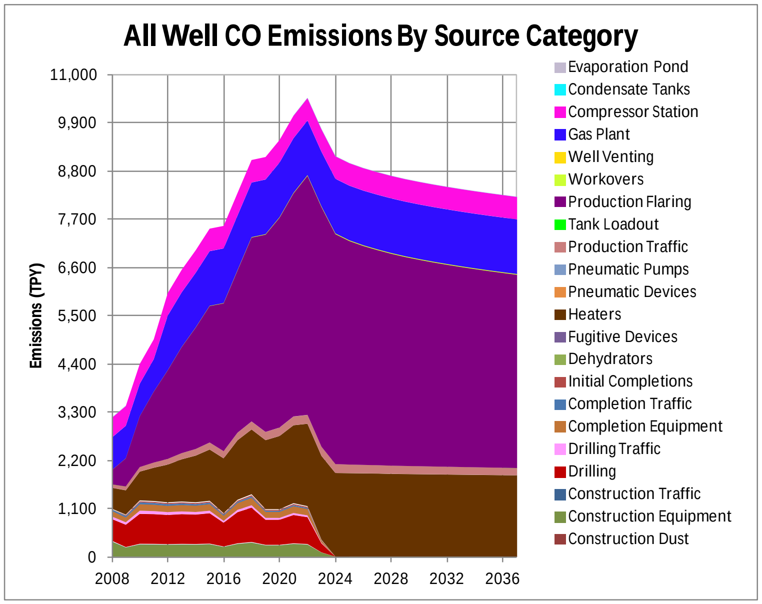

Figure 38. Total New and Existing Wells CO Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 276. Total New and Existing Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	2	0	8	0	2	0	2	0	0	3	0	0	0	0	62	0	0	85	148	0	0	313
	2010	0	3	0	10	1	3	0	2	0	0	3	0	0	0	0	110	0	0	85	148	0	0	368
	2011	0	3	0	10	0	3	0	2	0	0	4	0	0	0	0	153	0	0	85	148	0	0	411
	2012	0	3	0	10	0	3	0	2	0	0	5	0	0	0	0	191	0	0	110	151	0	0	476
	2013	0	3	0	10	0	3	0	2	0	0	5	0	0	0	0	229	0	0	110	151	0	0	515
	2014	0	3	0	10	0	3	0	2	0	0	6	0	0	0	0	262	0	0	110	151	0	0	548
	2015	0	3	0	10	0	3	0	2	0	0	6	0	0	0	0	295	0	0	110	151	0	0	582
	2016	0	2	0	8	0	2	0	2	0	0	7	0	0	0	0	319	0	0	110	151	0	0	603
	2017	0	3	0	11	0	3	0	2	0	0	7	0	0	1	0	350	1	0	110	151	0	0	639
	2018	0	3	0	12	0	4	0	3	0	0	8	0	0	1	0	397	1	0	110	151	0	0	688
	2019	0	3	0	5	0	3	0	2	0	0	8	0	0	1	0	426	1	0	110	151	0	0	709
	2020	0	3	0	5	0	3	0	2	0	0	9	0	0	1	0	453	1	0	110	151	0	0	736
	2021	0	3	0	5	0	3	0	2	0	0	9	0	0	1	0	481	1	0	110	151	0	0	767
	2022	0	3	0	5	0	3	0	2	0	0	10	0	0	0	0	516	1	0	110	151	0	0	801
	2023	0	1	0	2	0	1	0	1	0	0	10	0	0	1	0	517	1	0	110	151	0	0	794
	2024	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	496	1	0	110	151	0	0	768
	2025	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	482	1	0	110	151	0	0	754
	2026	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	472	1	0	110	151	0	0	744
	2027	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	464	1	0	110	151	0	0	736
	2028	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	457	1	0	110	151	0	0	729
	2029	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	451	1	0	110	151	0	0	722
	2030	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	445	1	0	110	151	0	0	717
	2031	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	440	1	0	110	151	0	0	712
	2032	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	436	1	0	110	151	0	0	707
	2033	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	431	1	0	110	151	0	0	703
	2034	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	428	1	0	110	151	0	0	699
	2035	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	424	1	0	110	151	0	0	695
	2036	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	420	1	0	110	151	0	0	692
	2037	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	417	1	0	110	151	0	0	688
	TOTAL	0	46	0	130	5	43	3	32	0	0	240	0	0	13	0	11,056	17	0	3,200	4,511	0	0	19,296

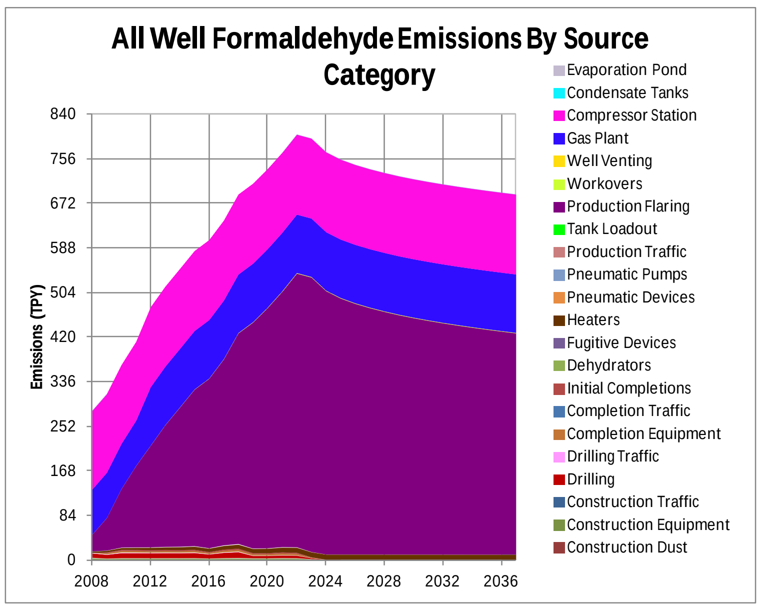

Figure 39. Total New and Existing Wells Formaldehyde Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 277. Total New and Existing Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	93	0	0	583	0	8	0	0	49	0	1	517	0	1,947
	2010	0	0	0	0	0	0	0	0	666	110	0	0	577	0	12	0	0	58	0	1	450	0	1,875
	2011	0	0	0	0	0	0	0	0	647	128	0	0	571	0	15	0	0	67	0	1	412	0	1,841
	2012	0	0	0	0	0	0	0	0	639	145	0	0	566	0	17	0	0	76	1	1	405	0	1,849
	2013	0	0	0	0	0	0	0	0	633	162	0	0	560	0	19	0	0	85	1	1	400	0	1,860
	2014	0	0	0	0	0	0	0	0	620	179	0	0	555	0	20	0	0	94	1	1	381	0	1,851
	2015	0	0	0	0	0	0	0	0	607	197	0	0	549	0	21	0	0	104	1	1	361	0	1,841
	2016	0	0	0	0	0	0	0	0	595	210	0	0	544	0	22	0	0	111	1	1	344	0	1,828
	2017	0	0	0	0	0	0	0	0	584	228	0	0	538	0	23	0	0	120	1	1	328	0	1,824
	2018	0	0	0	0	0	0	0	0	573	248	0	0	532	0	26	0	0	131	1	1	315	0	1,828
	2019	0	0	0	0	0	0	0	0	563	264	0	0	527	0	27	0	0	139	1	1	303	0	1,826
	2020	0	0	0	0	0	0	0	0	553	280	0	0	522	0	28	0	0	148	1	1	292	0	1,825
	2021	0	0	0	0	0	0	0	0	544	299	0	0	517	0	28	0	0	157	1	1	282	0	1,829
	2022	0	0	0	0	0	0	0	0	533	316	0	0	512	0	30	0	0	166	1	1	268	0	1,827
	2023	0	0	0	0	0	0	0	0	525	321	0	0	507	0	29	0	0	169	1	1	260	0	1,812
	2024	0	0	0	0	0	0	0	0	516	321	0	0	502	0	26	0	0	169	1	1	252	0	1,786
	2025	0	0	0	0	0	0	0	0	508	320	0	0	496	0	23	0	0	169	1	1	244	0	1,763
	2026	0	0	0	0	0	0	0	0	500	319	0	0	491	0	22	0	0	168	1	1	237	0	1,741
	2027	0	0	0	0	0	0	0	0	493	318	0	0	486	0	21	0	0	168	1	1	231	0	1,719
	2028	0	0	0	0	0	0	0	0	482	317	0	0	477	0	20	0	0	167	1	1	225	0	1,689
	2029	0	0	0	0	0	0	0	0	472	317	0	0	472	0	19	0	0	167	1	1	215	0	1,663
	2030	0	0	0	0	0	0	0	0	466	316	0	0	467	0	18	0	0	166	1	1	209	0	1,645
	2031	0	0	0	0	0	0	0	0	459	315	0	0	463	0	17	0	0	166	1	1	204	0	1,627
	2032	0	0	0	0	0	0	0	0	452	315	0	0	458	0	16	0	0	166	1	1	199	0	1,609
	2033	0	0	0	0	0	0	0	0	446	314	0	0	453	0	16	0	0	165	1	1	195	0	1,591
	2034	0	0	0	0	0	0	0	0	440	313	0	0	449	0	15	0	0	165	1	1	190	0	1,574
	2035	0	0	0	0	0	0	0	0	434	313	0	0	444	0	15	0	0	165	1	1	186	0	1,558
	2036	0	0	0	0	0	0	0	0	428	312	0	0	440	0	14	0	0	164	1	1	182	0	1,542
	2037	0	0	0	0	0	0	0	0	422	312	0	0	435	0	13	0	0	164	1	1	178	0	1,527
	TOTAL	0	0	0	0	0	0	0	3	16,202	7,682	0	0	15,282	2	584	0	0	4,047	14	43	8,812	3	52,676

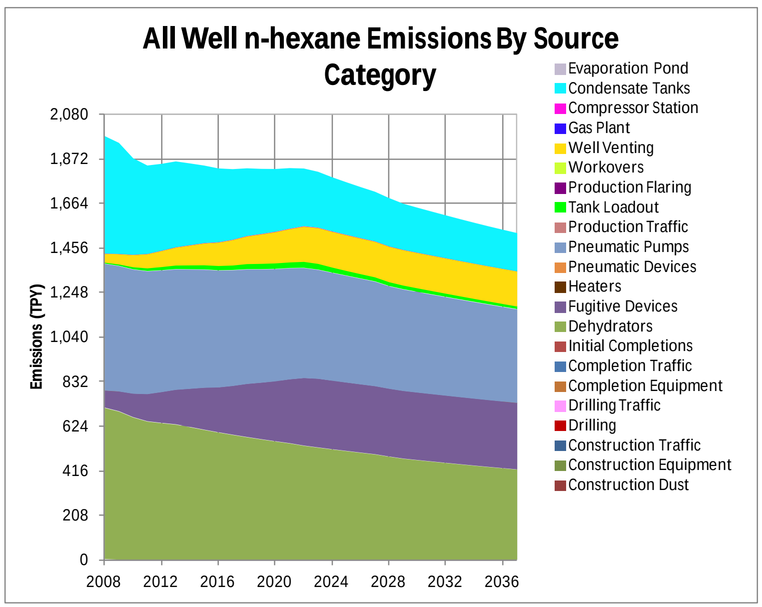

Figure 40. Total New and Existing Wells n-hexane Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 278. Total New and Existing Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	1	0	0	0	0	2,557	15	1	0	50	0	1	0	0	10	2	1	106	3	2,748
	2010	0	0	0	1	0	0	0	0	2,454	18	2	0	49	0	2	0	0	12	2	1	92	4	2,638
	2011	0	0	0	1	0	0	0	0	2,384	21	2	0	49	0	2	0	0	14	2	1	84	4	2,565
	2012	0	0	0	1	0	0	0	0	2,356	24	2	0	48	0	2	0	0	16	3	1	82	5	2,542
	2013	0	0	0	1	0	0	0	0	2,331	27	3	0	48	0	3	0	0	18	3	1	81	6	2,521
	2014	0	0	0	1	0	0	0	0	2,286	29	3	0	47	0	3	0	0	20	3	1	77	6	2,477
	2015	0	0	0	1	0	0	0	0	2,239	32	3	0	47	0	3	0	0	22	3	1	73	7	2,431
	2016	0	0	0	1	0	0	0	0	2,194	34	3	0	46	0	3	0	0	23	3	1	70	7	2,387
	2017	0	0	0	1	0	0	0	0	2,152	37	4	0	46	0	3	0	0	25	3	1	67	8	2,348
	2018	0	0	0	1	0	0	0	0	2,113	41	4	0	45	0	4	0	0	27	3	1	64	9	2,312
	2019	0	0	0	1	0	0	0	0	2,075	43	4	0	45	0	4	0	0	29	3	1	61	9	2,276
	2020	0	0	0	1	0	0	0	0	2,040	46	4	0	44	0	4	0	0	31	3	1	59	10	2,243
	2021	0	0	0	1	0	0	0	0	2,006	49	5	0	44	0	4	0	0	33	3	1	57	10	2,213
	2022	0	0	0	1	0	0	0	0	1,965	52	5	0	43	0	4	0	0	35	3	1	54	11	2,174
	2023	0	0	0	0	0	0	0	0	1,933	53	5	0	43	0	4	0	0	35	3	1	52	11	2,141
	2024	0	0	0	0	0	0	0	0	1,902	53	5	0	43	0	4	0	0	35	3	1	51	11	2,107
	2025	0	0	0	0	0	0	0	0	1,873	52	5	0	42	0	3	0	0	35	3	1	49	11	2,075
	2026	0	0	0	0	0	0	0	0	1,844	52	5	0	42	0	3	0	0	35	3	1	48	11	2,044
	2027	0	0	0	0	0	0	0	0	1,816	52	5	0	41	0	3	0	0	35	3	1	46	11	2,014
	2028	0	0	0	0	0	0	0	0	1,776	52	5	0	40	0	3	0	0	35	3	1	45	11	1,971
	2029	0	0	0	0	0	0	0	0	1,741	52	5	0	40	0	3	0	0	35	3	1	43	11	1,933
	2030	0	0	0	0	0	0	0	0	1,716	52	5	0	40	0	3	0	0	35	3	1	42	11	1,906
	2031	0	0	0	0	0	0	0	0	1,691	52	5	0	39	0	2	0	0	35	3	1	41	11	1,880
	2032	0	0	0	0	0	0	0	0	1,667	52	5	0	39	0	2	0	0	35	3	1	40	11	1,854
	2033	0	0	0	0	0	0	0	0	1,644	51	5	0	39	0	2	0	0	34	3	1	39	11	1,829
	2034	0	0	0	0	0	0	0	0	1,620	51	5	0	38	0	2	0	0	34	3	1	38	11	1,804
	2035	0	0	0	0	0	0	0	0	1,598	51	5	0	38	0	2	0	0	34	3	1	37	11	1,780
	2036	0	0	0	0	0	0	0	0	1,576	51	5	0	37	0	2	0	0	34	3	1	36	11	1,757
	2037	0	0	0	0	0	0	0	0	1,555	51	5	0	37	0	2	0	0	34	3	1	36	11	1,734
	TOTAL	0	6	0	16	1	5	1	1	59,713	1,259	120	0	1,299	11	82	0	2	843	84	21	1,783	265	65,511

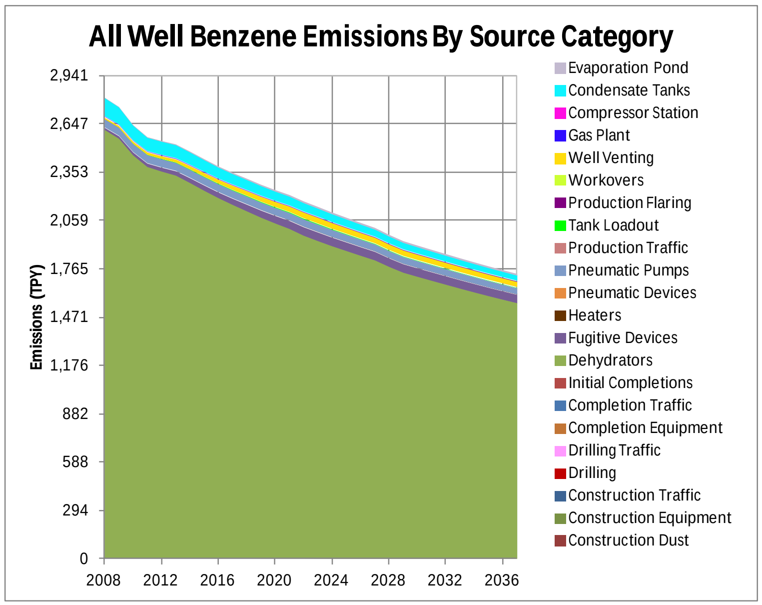

Figure 41. Total New and Existing Wells Benzene Emissions (tons/year) Contribution by Source Category and by Project Year.

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	163
	2010	0	0	0	0	0	0	0	0	151	0	0	0	2	0	0	0	0	1	0	0	2	0	157
	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	1	0	0	2	0	0	0	0	1	0	0	2	1	151
	2013	0	0	0	0	0	0	0	0	143	1	0	0	2	0	0	0	0	1	0	0	2	1	149
	2014	0	0	0	0	0	0	0	0	140	1	0	0	2	0	0	0	0	1	0	0	1	1	147
	2015	0	0	0	0	0	0	0	0	137	1	0	0	2	0	0	0	0	1	0	0	1	1	144
	2016	0	0	0	0	0	0	0	0	135	1	0	0	2	0	0	0	0	1	0	0	1	1	141
	2017	0	0	0	0	0	0	0	0	132	1	0	0	2	0	0	0	0	1	0	0	1	1	139
	2018	0	0	0	0	0	0	0	0	130	1	0	0	2	0	0	0	0	1	0	0	1	1	137
	2019	0	0	0	0	0	0	0	0	127	1	0	0	2	0	0	0	0	1	0	0	1	1	134
	2020	0	0	0	0	0	0	0	0	125	1	0	0	2	0	0	0	0	1	0	0	1	1	132
	2021	0	0	0	0	0	0	0	0	123	1	0	0	2	0	0	0	0	1	0	0	1	1	131
	2022	0	0	0	0	0	0	0	0	121	1	0	0	2	0	0	0	0	2	0	0	1	1	128
	2023	0	0	0	0	0	0	0	0	119	1	0	0	2	0	0	0	0	2	0	0	1	1	126
	2024	0	0	0	0	0	0	0	0	117	1	0	0	2	0	0	0	0	2	0	0	1	1	124
	2025	0	0	0	0	0	0	0	0	115	1	0	0	2	0	0	0	0	2	0	0	1	1	122
	2026	0	0	0	0	0	0	0	0	113	1	0	0	2	0	0	0	0	2	0	0	1	1	120
	2027	0	0	0	0	0	0	0	0	112	1	0	0	2	0	0	0	0	2	0	0	1	1	118
	2028	0	0	0	0	0	0	0	0	109	1	0	0	2	0	0	0	0	2	0	0	1	1	116
	2029	0	0	0	0	0	0	0	0	107	1	0	0	2	0	0	0	0	2	0	0	1	1	114
	2030	0	0	0	0	0	0	0	0	105	1	0	0	2	0	0	0	0	2	0	0	1	1	112
	2031	0	0	0	0	0	0	0	0	104	1	0	0	2	0	0	0	0	2	0	0	1	1	111
	2032	0	0	0	0	0	0	0	0	102	1	0	0	2	0	0	0	0	2	0	0	1	1	109
	2033	0	0	0	0	0	0	0	0	101	1	0	0	2	0	0	0	0	2	0	0	1	1	108
	2034	0	0	0	0	0	0	0	0	100	1	0	0	2	0	0	0	0	2	0	0	1	1	106
	2035	0	0	0	0	0	0	0	0	98	1	0	0	2	0	0	0	0	2	0	0	1	1	105
	2036	0	0	0	0	0	0	0	0	97	1	0	0	2	0	0	0	0	2	0	0	1	1	103
	2037	0	0	0	0	0	0	0	0	96	1	0	0	2	0	0	0	0	2	0	0	1	1	102
	TOTAL	0	1	0	3	0	1	0	0	3,667	29	0	0	54	4	1	0	0	38	2	2	34	29	3,867

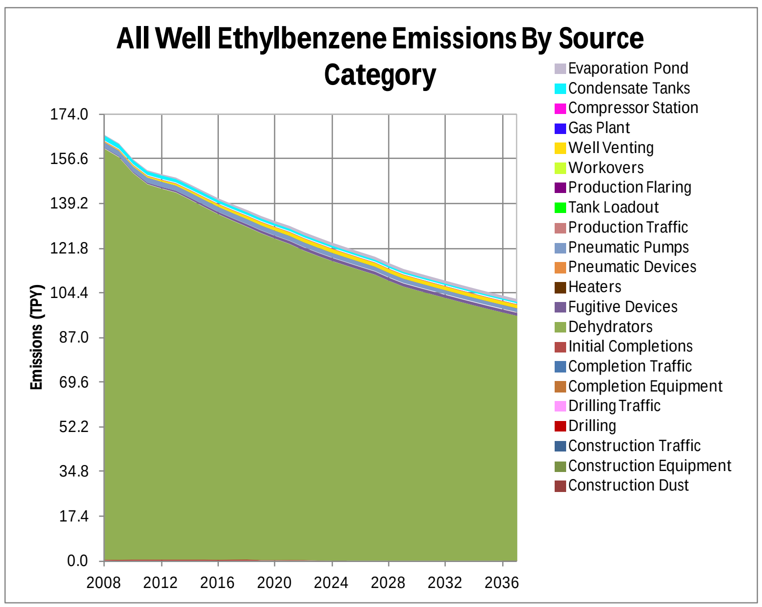

Figure 42. Total New and Existing Wells Ethylbenzene Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	1	0	0	0	0	4,222	21	1	0	68	1	2	0	0	14	1	0	151	4	4,488
	2010	0	1	0	2	0	1	0	0	4,053	25	1	0	68	1	2	0	0	17	1	0	130	5	4,307
	2011	0	1	0	2	0	1	0	0	3,937	29	1	0	67	1	3	0	0	19	1	0	119	6	4,186
	2012	0	1	0	2	0	1	0	0	3,891	33	1	0	66	1	3	0	0	22	1	0	117	6	4,146
	2013	0	1	0	2	0	1	0	0	3,850	37	1	0	66	1	3	0	0	24	1	0	116	7	4,111
	2014	0	1	0	2	0	1	0	0	3,775	41	1	0	65	1	4	0	0	27	1	0	110	8	4,037
	2015	0	1	0	2	0	1	0	0	3,697	45	2	0	64	1	4	0	0	30	1	0	104	9	3,961
	2016	0	0	0	1	0	0	0	0	3,623	48	2	0	64	1	4	0	0	32	1	0	99	9	3,887
	2017	0	1	0	2	0	1	0	0	3,554	53	2	0	63	1	4	0	0	35	1	0	95	10	3,821
	2018	0	1	0	2	0	1	0	0	3,489	57	2	0	62	1	5	0	0	38	1	0	91	11	3,761
	2019	0	0	0	1	0	1	0	0	3,427	61	2	0	62	1	5	0	0	40	1	0	87	12	3,700
	2020	0	0	0	1	0	1	0	0	3,368	65	2	0	61	1	5	0	0	42	1	0	84	13	3,645
	2021	0	1	0	1	0	1	0	0	3,313	69	2	0	60	1	5	0	0	45	1	0	81	13	3,594
	2022	0	1	0	1	0	1	0	0	3,245	73	2	0	60	1	5	0	0	48	1	0	77	14	3,529
toluene [tpy]	2023	0	0	0	0	0	0	0	0	3,192	74	3	0	59	1	5	0	0	49	1	0	74	14	3,474
	2024	0	0	0	0	0	0	0	0	3,141	74	3	0	59	1	5	0	0	48	1	0	72	14	3,418
	2025	0	0	0	0	0	0	0	0	3,093	74	2	0	58	1	4	0	0	48	1	0	70	14	3,367
	2026	0	0	0	0	0	0	0	0	3,046	73	2	0	58	1	4	0	0	48	1	0	68	14	3,316
	2027	0	0	0	0	0	0	0	0	2,999	73	2	0	57	1	4	0	0	48	1	0	66	14	3,267
	2028	0	0	0	0	0	0	0	0	2,934	73	2	0	56	1	4	0	0	48	1	0	64	14	3,197
	2029	0	0	0	0	0	0	0	0	2,875	73	2	0	55	1	3	0	0	48	1	0	61	14	3,135
	2030	0	0	0	0	0	0	0	0	2,833	73	2	0	55	1	3	0	0	48	1	0	59	14	3,091
	2031	0	0	0	0	0	0	0	0	2,793	73	2	0	54	1	3	0	0	48	1	0	58	14	3,048
	2032	0	0	0	0	0	0	0	0	2,754	72	2	0	54	1	3	0	0	48	1	0	56	14	3,006
	2033	0	0	0	0	0	0	0	0	2,714	72	2	0	53	1	3	0	0	47	1	0	55	14	2,964
	2034	0	0	0	0	0	0	0	0	2,676	72	2	0	53	1	3	0	0	47	1	0	54	14	2,924
	2035	0	0	0	0	0	0	0	0	2,639	72	2	0	52	1	3	0	0	47	1	0	53	14	2,884
	2036	0	0	0	0	0	0	0	0	2,603	72	2	0	51	1	3	0	0	47	1	0	51	14	2,847
	2037	0	0	0	0	0	0	0	0	2,568	72	2	0	51	1	2	0	0	47	1	0	50	14	2,810
	TOTAL	0	8	0	23	2	8	2	1	98,614	1,767	60	0	1,789	27	108	0	3	1,162	39	11	2,530	345	106,499

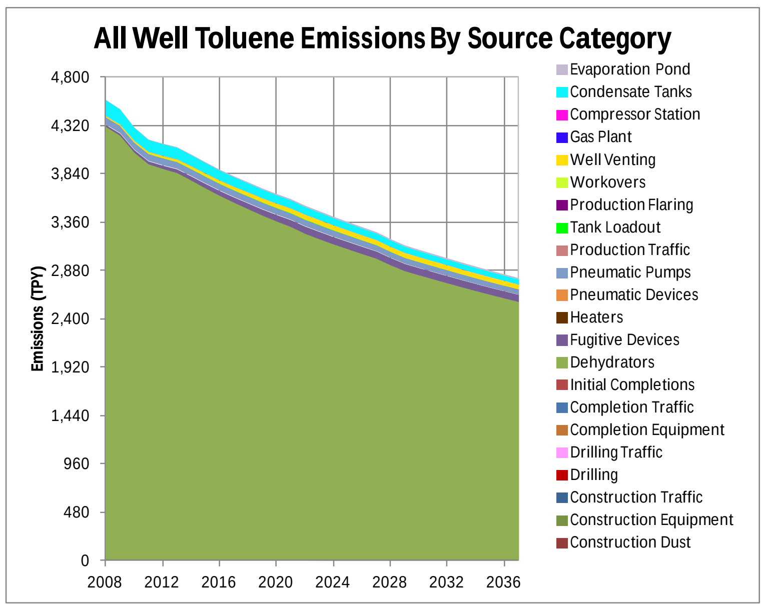

Figure 43. Total New and Existing Wells Toluene Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 281. Total New and Existing Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
	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	1	0	0	0	0	1,555	12	0	0	39	0	1	0	0	4	0	0	81	6	1,701
	2010	0	0	0	1	0	0	0	0	1,493	14	0	0	39	0	1	0	0	5	0	0	70	7	1,632
	2011	0	0	0	1	0	0	0	0	1,450	16	0	0	39	0	1	0	0	6	0	0	64	8	1,587
	2012	0	0	0	1	0	0	0	0	1,433	18	0	0	38	1	2	0	0	7	0	0	63	9	1,573
	2013	0	0	0	1	0	0	0	0	1,418	20	0	0	38	1	2	0	0	8	0	0	62	10	1,561
	2014	0	0	0	1	0	0	0	0	1,390	22	0	0	37	1	2	0	0	8	0	0	59	11	1,534
	2015	0	0	0	1	0	0	0	0	1,361	25	0	0	37	1	2	0	0	9	0	0	56	12	1,506
	2016	0	0	0	1	0	0	0	0	1,334	26	0	0	37	1	2	0	0	10	0	0	53	13	1,479
	2017	0	0	0	2	0	0	0	0	1,309	29	0	0	36	1	2	0	0	11	0	0	51	14	1,456
	2018	0	0	0	2	0	1	0	0	1,285	31	0	0	36	1	3	0	0	12	0	0	49	15	1,434
	2019	0	0	0	1	0	0	0	0	1,262	33	0	0	36	1	3	0	0	12	0	0	47	16	1,412
	2020	0	0	0	1	0	0	0	0	1,240	35	0	0	35	1	3	0	0	13	0	0	45	17	1,392
	2021	0	0	0	1	0	0	0	0	1,220	37	0	0	35	1	3	0	0	14	0	0	44	18	1,374
	2022	0	0	0	1	0	0	0	0	1,195	39	0	0	35	1	3	0	0	15	0	0	41	19	1,350
xylenes [tpy]	2023	0	0	0	0	0	0	0	0	1,176	40	0	0	34	1	3	0	0	15	0	0	40	20	1,329
	2024	0	0	0	0	0	0	0	0	1,157	40	0	0	34	1	3	0	0	15	0	0	39	19	1,308
	2025	0	0	0	0	0	0	0	0	1,139	40	0	0	34	1	2	0	0	15	0	0	38	19	1,288
	2026	0	0	0	0	0	0	0	0	1,121	40	0	0	33	1	2	0	0	15	0	0	37	19	1,269
	2027	0	0	0	0	0	0	0	0	1,104	40	0	0	33	1	2	0	0	15	0	0	36	19	1,250
	2028	0	0	0	0	0	0	0	0	1,080	40	0	0	32	1	2	0	0	15	0	0	35	19	1,224
	2029	0	0	0	0	0	0	0	0	1,059	40	0	0	32	1	2	0	0	15	0	0	33	19	1,200
	2030	0	0	0	0	0	0	0	0	1,043	39	0	0	32	0	2	0	0	15	0	0	32	19	1,184
	2031	0	0	0	0	0	0	0	0	1,029	39	0	0	31	0	2	0	0	15	0	0	31	19	1,167
	2032	0	0	0	0	0	0	0	0	1,014	39	0	0	31	0	2	0	0	15	0	0	31	19	1,152
	2033	0	0	0	0	0	0	0	0	999	39	0	0	31	0	2	0	0	15	0	0	30	19	1,136
	2034	0	0	0	0	0	0	0	0	985	39	0	0	30	0	2	0	0	15	0	0	29	19	1,120
	2035	0	0	0	0	0	0	0	0	972	39	0	0	30	0	1	0	0	15	0	0	28	19	1,105
	2036	0	0	0	0	0	0	0	0	959	39	0	0	30	0	1	0	0	15	0	0	28	19	1,091
	2037	0	0	0	0	0	0	0	0	946	39	0	0	29	0	1	0	0	15	0	0	27	19	1,077
	TOTAL	0	6	0	18	2	6	1	0	36,314	960	0	0	1,032	16	60	0	2	362	9	9	1,367	466	40,630

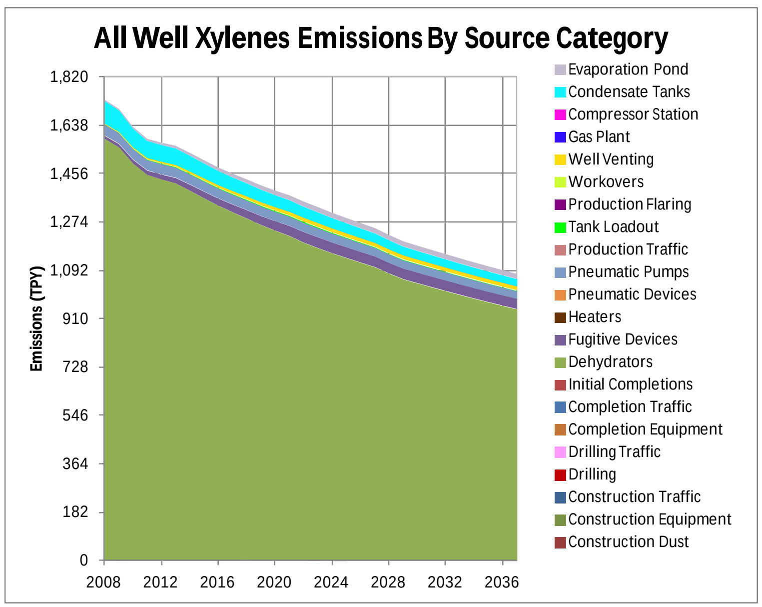

Figure 44. Total New and Existing Wells Xylenes Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 282. Total New and Existing Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Pollutant	Year	Construction			Drilling		Completion		
		Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions
CO2 [tpy]	2008	0	23,168	655	44,407	6,637	35,396	4,128	54
	2009	0	13,961	395	85,168	6,893	18,743	4,287	5,795
	2010	0	18,731	529	114,267	9,243	25,147	5,748	7,775
	2011	0	18,614	525	113,557	9,175	24,991	5,706	7,727
	2012	0	18,265	514	111,428	8,992	24,522	5,591	7,582
	2013	0	18,614	523	113,557	9,149	24,991	5,688	7,727
	2014	0	18,440	517	112,493	9,049	24,756	5,625	7,654
	2015	0	19,021	532	116,042	9,317	25,537	5,791	7,896
	2016	0	14,862	415	90,669	7,266	19,954	4,516	6,169
	2017	0	19,516	543	119,058	9,524	26,201	5,918	8,101
	2018	0	21,465	596	130,946	10,457	28,817	6,497	8,910
	2019	0	17,276	478	105,396	8,403	23,195	5,220	7,171
	2020	0	17,291	478	105,484	8,397	23,214	5,216	7,177
	2021	0	19,516	538	119,058	9,464	26,201	5,878	8,101
	2022	0	18,512	508	112,936	8,945	24,854	5,555	7,684
	2023	0	6,210	171	37,882	3,007	8,337	1,868	2,578
	2024	0	0	0	0	0	0	0	0
	2025	0	0	0	0	0	0	0	0
	2026	0	0	0	0	0	0	0	0
	2027	0	0	0	0	0	0	0	0
	2028	0	0	0	0	0	0	0	0
	2029	0	0	0	0	0	0	0	0
	2030	0	0	0	0	0	0	0	0
	2031	0	0	0	0	0	0	0	0
	2032	0	0	0	0	0	0	0	0
	2033	0	0	0	0	0	0	0	0
	2034	0	0	0	0	0	0	0	0
	2035	0	0	0	0	0	0	0	0
	2036	0	0	0	0	0	0	0	0
	2037	0	0	0	0	0	0	0	0
	TOTAL	0	283,462	7,917	1,632,349	133,917	384,857	83,229	108,100

Year	Production														Total (Costruction + Drilling + Completion + Production)
	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	
2008	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	5,143	359	791,588	0	5,108	5,345	0	217,975	1,477	1,056	582,056	809,692	509	8	2,555,556
2010	4,996	425	939,059	0	5,055	6,335	0	396,100	1,752	1,252	582,056	809,692	438	10	2,928,610
2011	4,894	492	1,085,571	0	5,003	7,308	0	551,763	2,025	1,448	582,056	809,692	399	11	3,230,956
2012	4,842	557	1,229,741	0	4,954	8,252	0	688,281	2,294	1,640	1,183,378	905,804	391	13	4,207,043
2013	4,793	624	1,376,789	0	4,905	9,198	0	823,193	2,568	1,836	1,183,378	905,804	386	14	4,493,738
2014	4,722	690	1,522,398	0	4,857	10,120	0	939,673	2,840	2,030	1,183,378	905,804	367	16	4,755,428
2015	4,651	758	1,672,803	0	4,808	11,052	0	1,054,049	3,120	2,231	1,183,378	905,804	346	17	5,027,155
2016	4,584	810	1,788,916	0	4,760	11,746	0	1,139,698	3,337	2,385	1,183,378	905,804	328	19	5,189,616
2017	4,519	880	1,943,398	0	4,711	12,675	0	1,248,379	3,625	2,591	1,183,378	905,804	313	20	5,499,157
2018	4,458	958	2,113,947	0	4,663	13,691	0	1,415,831	3,943	2,819	1,183,378	905,804	299	22	5,857,500
2019	4,398	1,019	2,249,964	0	4,614	14,481	0	1,516,971	4,197	3,000	1,183,378	905,804	287	23	6,055,276
2020	4,343	1,081	2,386,636	0	4,570	15,264	0	1,610,399	4,452	3,182	1,183,378	905,804	275	25	6,286,668
2021	4,290	1,151	2,541,653	0	4,525	16,158	0	1,708,574	4,741	3,389	1,183,378	905,804	265	26	6,562,713
2022	4,232	1,218	2,688,397	0	4,481	16,860	0	1,831,299	5,015	3,585	1,183,378	905,804	251	28	6,823,543
2023	4,181	1,238	2,733,704	0	4,436	17,269	0	1,832,835	5,099	3,645	1,183,378	905,804	242	28	6,751,913
2024	4,130	1,236	2,727,812	0	4,392	17,161	0	1,750,780	5,088	3,637	1,183,378	905,804	234	28	6,603,682
2025	4,082	1,233	2,721,921	0	4,347	16,996	0	1,696,837	5,077	3,629	1,183,378	905,804	227	28	6,543,560
2026	4,033	1,230	2,716,029	0	4,303	16,900	0	1,658,081	5,066	3,622	1,183,378	905,804	220	28	6,498,695
2027	3,986	1,228	2,710,137	0	4,258	16,816	0	1,626,527	5,055	3,614	1,183,378	905,804	213	28	6,461,045
2028	3,904	1,223	2,698,889	0	4,173	16,697	0	1,599,498	5,035	3,599	1,183,378	905,804	207	28	6,422,435
2029	3,854	1,220	2,693,533	0	4,133	16,624	0	1,574,784	5,025	3,592	1,183,378	905,804	197	28	6,392,172
2030	3,811	1,218	2,688,177	0	4,093	16,553	0	1,553,423	5,015	3,584	1,183,378	905,804	192	28	6,365,276
2031	3,769	1,215	2,682,821	0	4,052	16,487	0	1,534,089	5,005	3,577	1,183,378	905,804	187	28	6,340,412
2032	3,727	1,213	2,677,465	0	4,012	16,422	0	1,516,264	4,995	3,570	1,183,378	905,804	182	28	6,317,059
2033	3,685	1,211	2,672,108	0	3,971	16,360	0	1,499,764	4,985	3,563	1,183,378	905,804	177	28	6,295,035
2034	3,644	1,208	2,666,752	0	3,931	16,300	0	1,484,406	4,975	3,556	1,183,378	905,804	173	28	6,274,155
2035	3,603	1,206	2,661,396	0	3,890	16,245	0	1,469,929	4,965	3,549	1,183,378	905,804	168	28	6,254,161
2036	3,563	1,203	2,656,040	0	3,850	16,191	0	1,456,286	4,955	3,542	1,183,378	905,804	165	28	6,235,003
2037	3,523	1,201	2,650,684	0	3,810	16,138	0	1,443,349	4,945	3,534	1,183,378	905,804	161	28	6,216,554
TOTAL	127,593	29,615	65,371,774	0	133,827	412,260	0	38,949,545	121,944	87,168	33,096,054	26,789,679	8,340	680	167,762,311

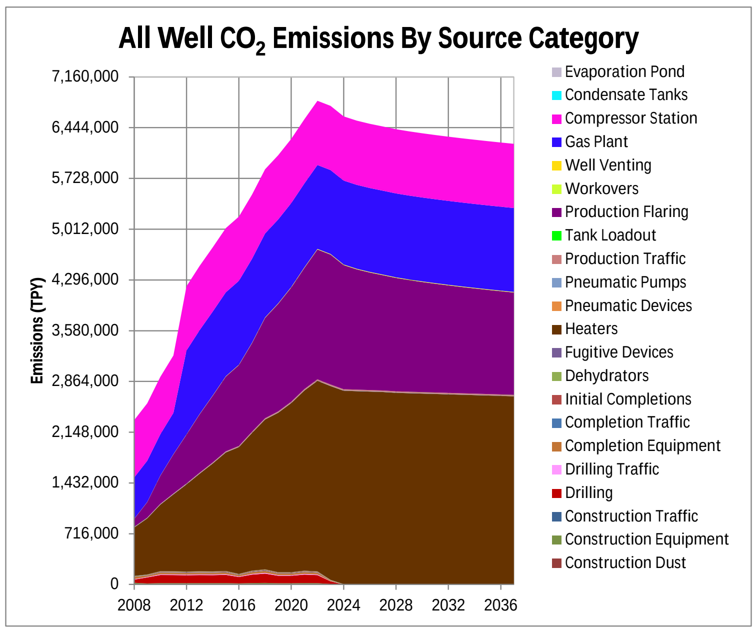

Figure 45. Total New and Existing Wells CO_2 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 283. Total New and Existing Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	8	0	29	6	9	4	36	449,981	76,569	319	0	1,215,630	9	1,655	1,292	1	251,217	7,391	18,182	54,394	27	2,076,758
	2010	0	11	1	39	9	12	5	48	444,904	90,834	378	0	1,203,117	11	2,331	2,318	1	298,018	7,391	18,182	47,684	32	2,115,324
	2011	0	11	1	38	9	12	6	48	440,014	105,005	437	0	1,190,605	12	2,871	3,221	1	344,515	7,391	18,182	43,932	37	2,156,348
	2012	0	11	1	38	9	11	6	47	435,718	118,951	495	0	1,179,055	14	3,307	4,021	1	390,268	9,298	18,391	43,186	42	2,202,871
	2013	0	11	1	38	10	12	6	48	431,440	133,174	554	0	1,167,505	15	3,722	4,813	1	436,935	9,298	18,391	42,650	47	2,248,673
	2014	0	11	1	38	10	11	6	48	427,042	147,259	613	0	1,155,955	17	3,990	5,505	2	483,146	9,298	18,391	40,741	52	2,292,135
	2015	0	11	1	39	10	12	6	49	422,632	161,807	673	0	1,144,405	18	4,223	6,188	2	530,878	9,298	18,391	38,762	58	2,337,463
	2016	0	9	0	31	8	9	5	38	418,238	173,039	720	0	1,132,855	19	4,375	6,701	2	567,727	9,298	18,391	37,027	62	2,368,554
	2017	0	12	1	40	10	12	6	50	413,861	187,982	782	0	1,121,305	20	4,553	7,355	2	616,753	9,298	18,391	35,508	67	2,416,009
	2018	0	13	1	44	11	13	7	56	409,497	204,478	851	0	1,109,756	21	5,114	8,333	2	670,878	9,298	18,391	34,164	73	2,471,001
	2019	0	10	1	18	9	11	6	45	405,142	217,635	906	0	1,098,206	22	5,311	8,938	2	714,044	9,298	18,391	32,937	77	2,511,009
	2020	0	10	1	18	9	11	6	45	401,147	230,855	961	0	1,087,618	23	5,449	9,503	2	757,418	9,298	18,391	31,808	82	2,552,655
	2021	0	12	1	20	10	12	6	50	397,162	245,850	1,023	0	1,077,031	25	5,553	10,101	3	806,614	9,298	18,391	30,790	87	2,602,039
	2022	0	11	1	19	10	12	6	48	393,132	260,044	1,082	0	1,066,443	25	5,871	10,827	3	853,185	9,298	18,391	29,421	93	2,647,921
	2023	0	4	0	6	3	4	2	16	389,157	264,426	1,100	0	1,055,856	26	5,675	10,857	3	867,563	9,298	18,391	28,537	94	2,651,020
	2024	0	0	0	0	0	0	0	0	385,187	263,857	1,098	0	1,045,268	26	5,048	10,416	3	865,694	9,298	18,391	27,709	94	2,632,088
	2025	0	0	0	0	0	0	0	0	381,229	263,287	1,096	0	1,034,681	25	4,635	10,125	3	863,824	9,298	18,391	26,982	94	2,613,669
	2026	0	0	0	0	0	0	0	0	377,271	262,717	1,093	0	1,024,094	26	4,336	9,916	3	861,954	9,298	18,391	26,267	93	2,595,459
	2027	0	0	0	0	0	0	0	0	373,318	262,147	1,091	0	1,013,506	25	4,092	9,746	3	860,084	9,298	18,391	25,601	93	2,577,396
	2028	0	0	0	0	0	0	0	0	365,852	261,059	1,086	0	993,294	25	3,883	9,600	3	856,514	9,298	18,391	24,937	93	2,544,036
	2029	0	0	0	0	0	0	0	0	362,200	260,541	1,084	0	983,669	25	3,687	9,467	3	854,815	9,298	18,391	23,919	93	2,527,191
	2030	0	0	0	0	0	0	0	0	358,609	260,023	1,082	0	974,044	25	3,520	9,351	3	853,115	9,298	18,391	23,357	93	2,510,910
	2031	0	0	0	0	0	0	0	0	355,023	259,505	1,080	0	964,419	24	3,370	9,247	3	851,415	9,298	18,391	22,830	92	2,494,697
	2032	0	0	0	0	0	0	0	0	351,438	258,986	1,078	0	954,794	24	3,231	9,151	3	849,715	9,298	18,391	22,318	92	2,478,519
	2033	0	0	0	0	0	0	0	0	347,854	258,468	1,076	0	945,169	24	3,102	9,061	3	848,015	9,298	18,391	21,817	92	2,462,370
	2034	0	0	0	0	0	0	0	0	344,274	257,950	1,073	0	935,544	24	2,982	8,978	3	846,316	9,298	18,391	21,349	92	2,446,274
	2035	0	0	0	0	0	0	0	0	340,697	257,432	1,071	0	925,919	24	2,869	8,900	3	844,616	9,298	18,391	20,905	92	2,430,217
	2036	0	0	0	0	0	0	0	0	337,127	256,914	1,069	0	916,294	24	2,763	8,826	3	842,916	9,298	18,391	20,503	91	2,414,219
	2037	0	0	0	0	0	0	0	0	333,558	256,396	1,067	0	906,669	23	2,662	8,756	3	841,216	9,298	18,391	20,113	91	2,398,244
	TOTAL	0	171	9	489	138	162	87	13,504	11,747,471	6,323,298	26,312	0	31,850,850	632	115,499	232,178	65	20,746,266	271,315	550,896	957,515	2,250	72,839,106

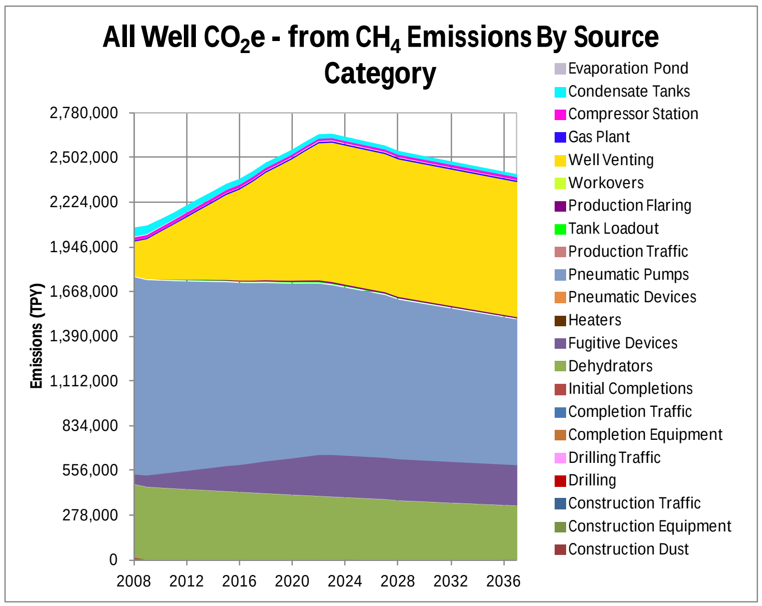

Figure 46. Total New and Existing Wells CO_2e - from CH_4 Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 284. Total New and Existing Wells CO_2e - from N2O Emissions (tons/year) Contribution by Source Category and by Project Year.

Pollutant	Year	Construction			Drilling		Completion			Production	
		Construction Dust	Construction Equipment	Construction Traffic	Drilling	Drilling Traffic	Completion Equipment	Completion Traffic	Initial Completions	Dehydrators	Fugitive Devices
CO2e-from N2O [tpy]	2008	0	183	5	2,490	41	1,984	26	0	0	0
	2009	0	110	3	671	41	148	26	19	0	0
	2010	0	148	3	901	52	198	33	26	0	0
	2011	0	147	3	895	48	197	30	26	0	0
	2012	0	144	3	878	43	194	28	25	0	0
	2013	0	147	3	895	41	197	26	26	0	0
	2014	0	146	2	887	38	195	24	25	0	0
	2015	0	150	2	915	36	202	23	26	0	0
	2016	0	117	2	715	26	157	17	20	0	0
	2017	0	154	2	938	32	207	20	27	0	0
	2018	0	170	2	1,032	33	227	21	30	0	0
	2019	0	137	2	831	25	183	16	24	0	0
	2020	0	137	1	831	23	183	15	24	0	0
	2021	0	154	2	938	25	207	16	27	0	0
	2022	0	146	1	890	20	196	13	25	0	0
	2023	0	49	0	299	7	66	5	9	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
	TOTAL	0	2,240	36	15,005	533	4,742	338	358	0	0

Year	Production												Total (Costruction + Drilling + Completion + Production)
	Heaters	Pneumatic Devices	Pneumatic Pumps	Production Traffic	Tank Loadout	Production Flaring	Workovers	Well Venting	Gas Plant	Compressor Station	Condensate Tanks	Evaporation Pond	
2008	3,884	0	0	60	0	182	10	0	4,096	5,974	0	0	18,935
2009	4,499	0	0	69	0	443	12	0	4,096	5,974	0	0	16,110
2010	5,337	0	0	80	0	847	14	0	4,096	5,974	0	0	17,708
2011	6,170	0	0	88	0	1,215	16	0	4,096	5,974	0	0	18,905
2012	6,989	0	0	95	0	1,550	18	0	8,305	6,766	0	0	25,039
2013	7,825	0	0	101	0	1,885	20	0	8,305	6,766	0	0	26,237
2014	8,652	0	0	105	0	2,190	22	0	8,305	6,766	0	0	27,359
2015	9,507	0	0	109	0	2,497	25	0	8,305	6,766	0	0	28,562
2016	10,167	0	0	110	0	2,730	26	0	8,305	6,766	0	0	29,159
2017	11,045	0	0	113	0	3,030	29	0	8,305	6,766	0	0	30,668
2018	12,014	0	0	115	0	3,435	31	0	8,305	6,766	0	0	32,181
2019	12,787	0	0	115	0	3,709	33	0	8,305	6,766	0	0	32,932
2020	13,564	0	0	116	0	3,971	35	0	8,305	6,766	0	0	33,971
2021	14,445	0	0	116	0	4,255	37	0	8,305	6,766	0	0	35,293
2022	15,279	0	0	109	0	4,570	40	0	8,305	6,766	0	0	36,361
2023	15,537	0	0	117	0	4,615	40	0	8,305	6,766	0	0	35,815
2024	15,503	0	0	113	0	4,488	40	0	8,305	6,766	0	0	35,215
2025	15,470	0	0	105	0	4,404	40	0	8,305	6,766	0	0	35,090
2026	15,436	0	0	102	0	4,344	40	0	8,305	6,766	0	0	34,993
2027	15,403	0	0	99	0	4,295	40	0	8,305	6,766	0	0	34,907
2028	15,339	0	0	96	0	4,253	40	0	8,305	6,766	0	0	34,798
2029	15,308	0	0	93	0	4,215	40	0	8,305	6,766	0	0	34,727
2030	15,278	0	0	91	0	4,182	40	0	8,305	6,766	0	0	34,661
2031	15,247	0	0	89	0	4,152	40	0	8,305	6,766	0	0	34,598
2032	15,217	0	0	87	0	4,124	39	0	8,305	6,766	0	0	34,538
2033	15,186	0	0	86	0	4,098	39	0	8,305	6,766	0	0	34,481
2034	15,156	0	0	85	0	4,074	39	0	8,305	6,766	0	0	34,426
2035	15,126	0	0	84	0	4,052	39	0	8,305	6,766	0	0	34,372
2036	15,095	0	0	83	0	4,031	39	0	8,305	6,766	0	0	34,319
2037	15,065	0	0	82	0	4,011	39	0	8,305	6,766	0	0	34,267
TOTAL	371,530	0	0	2,914	0	99,846	963	0	232,314	199,806	0	0	930,626

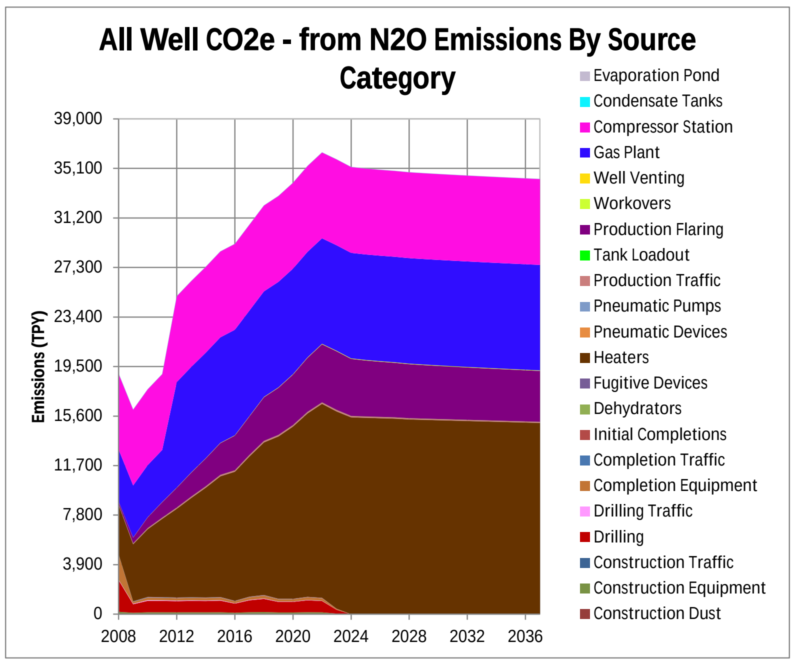

Figure 47. Total New and Existing Wells CO_2e - from N_2O Emissions (tons/year) Contribution by Source Category and by Project Year.

Table 285. Total New and Existing Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.

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	
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	14,079	398	85,868	6,940	18,900	4,317	5,850	455,124	76,928	796,405	0	1,220,738	5,423	1,655	219,711	1,489	252,272	593,542	833,848	54,903	35	4,648,425
	2010	0	18,890	533	115,206	9,303	25,357	5,786	7,849	449,900	91,259	944,774	0	1,208,173	6,426	2,331	399,265	1,766	299,270	593,542	833,848	48,122	42	5,061,642
	2011	0	18,773	529	114,491	9,232	25,200	5,742	7,800	444,908	105,497	1,092,178	0	1,195,608	7,409	2,871	556,199	2,042	345,962	593,542	833,848	44,331	49	5,406,209
	2012	0	18,421	518	112,344	9,045	24,727	5,624	7,654	440,560	119,508	1,237,225	0	1,184,009	8,362	3,307	693,852	2,313	391,908	1,200,981	930,961	43,577	55	6,434,952
	2013	0	18,773	526	114,491	9,199	25,200	5,720	7,800	436,233	133,798	1,385,168	0	1,172,411	9,314	3,722	829,891	2,590	438,771	1,200,981	930,961	43,037	62	6,768,647
	2014	0	18,597	520	113,417	9,096	24,963	5,655	7,727	431,765	147,949	1,531,663	0	1,160,812	10,242	3,990	947,368	2,864	485,176	1,200,981	930,961	41,108	68	7,074,922
	2015	0	19,183	535	116,995	9,363	25,751	5,820	7,971	427,283	162,565	1,682,984	0	1,149,214	11,179	4,223	1,062,733	3,147	533,108	1,200,981	930,961	39,108	75	7,393,179
	2016	0	14,989	417	91,414	7,301	20,120	4,537	6,228	422,822	173,849	1,799,803	0	1,137,615	11,875	4,375	1,149,128	3,365	570,113	1,200,981	930,961	37,355	80	7,587,330
	2017	0	19,682	546	120,036	9,566	26,420	5,945	8,178	418,380	188,862	1,955,225	0	1,126,017	12,808	4,553	1,258,765	3,656	619,345	1,200,981	930,961	35,821	87	7,945,835
	2018	0	21,647	598	132,022	10,501	29,058	6,525	8,995	413,955	205,436	2,126,812	0	1,114,418	13,828	5,114	1,427,599	3,977	673,697	1,200,981	930,961	34,463	95	8,360,682
	2019	0	17,423	481	106,244	8,437	23,388	5,242	7,240	409,540	218,654	2,263,657	0	1,102,820	14,619	5,311	1,529,618	4,232	717,044	1,200,981	930,961	33,224	101	8,599,217
	2020	0	17,438	480	106,333	8,430	23,408	5,237	7,246	405,490	231,936	2,401,161	0	1,092,188	15,403	5,449	1,623,872	4,490	760,601	1,200,981	930,961	32,083	107	8,873,294
	2021	0	19,682	540	120,016	9,499	26,420	5,900	8,178	401,452	247,001	2,557,121	0	1,081,556	16,299	5,553	1,722,929	4,781	810,004	1,200,981	930,961	31,055	114	9,200,045
	2022	0	18,670	510	113,846	8,975	25,062	5,573	7,758	397,364	261,262	2,704,759	0	1,070,924	16,994	5,871	1,846,696	5,057	856,770	1,200,981	930,961	29,672	120	9,507,825
	2023	0	6,262	172	38,187	3,018	8,406	1,874	2,602	393,338	265,665	2,750,341	0	1,060,292	17,412	5,675	1,848,307	5,142	871,208	1,200,981	930,961	28,779	123	9,438,747
	2024	0	0	0	0	0	0	0	0	389,318	265,092	2,744,413	0	1,049,660	17,299	5,048	1,765,684	5,131	869,331	1,200,981	930,961	27,943	122	9,270,984
	2025	0	0	0	0	0	0	0	0	385,311	264,520	2,738,486	0	1,039,028	17,127	4,635	1,711,366	5,120	867,453	1,200,981	930,961	27,209	122	9,192,319
	2026	0	0	0	0	0	0	0	0	381,304	263,947	2,732,558	0	1,028,396	17,028	4,336	1,672,341	5,109	865,576	1,200,981	930,961	26,487	122	9,129,146
	2027	0	0	0	0	0	0	0	0	377,304	263,375	2,726,630	0	1,017,765	16,940	4,092	1,640,569	5,098	863,698	1,200,981	930,961	25,814	121	9,073,348
	2028	0	0	0	0	0	0	0	0	369,756	262,281	2,715,314	0	997,467	16,818	3,883	1,613,351	5,077	860,113	1,200,981	930,961	25,145	121	9,001,268
	2029	0	0	0	0	0	0	0	0	366,054	261,761	2,709,925	0	987,802	16,742	3,687	1,588,465	5,067	858,406	1,200,981	930,961	24,117	121	8,954,089
	2030	0	0	0	0	0	0	0	0	362,420	261,240	2,704,537	0	978,137	16,669	3,520	1,566,956	5,057	856,699	1,200,981	930,961	23,548	120	8,910,847
	2031	0	0	0	0	0	0	0	0	358,792	260,720	2,699,148	0	968,471	16,600	3,370	1,547,487	5,047	854,992	1,200,981	930,961	23,017	120	8,869,707
	2032	0	0	0	0	0	0	0	0	355,165	260,199	2,693,759	0	958,806	16,534	3,231	1,529,539	5,037	853,285	1,200,981	930,961	22,500	120	8,830,117
	2033	0	0	0	0	0	0	0	0	351,539	259,679	2,688,370	0	949,140	16,471	3,102	1,512,924	5,027	851,578	1,200,981	930,961	21,994	120	8,791,886
	2034	0	0	0	0	0	0	0	0	347,918	259,158	2,682,982	0	939,475	16,409	2,982	1,497,459	5,016	849,872	1,200,981	930,961	21,521	120	8,754,855
	2035	0	0	0	0	0	0	0	0	344,300	258,638	2,677,593	0	929,810	16,353	2,869	1,482,881	5,006	848,165	1,200,981	930,961	21,073	119	8,718,749
	2036	0	0	0	0	0	0	0	0	340,690	258,117	2,672,204	0	920,144	16,297	2,763	1,469,143	4,996	846,458	1,200,981	930,961	20,668	119	8,683,541
	2037	0	0	0	0	0	0	0	0	337,081	257,597	2,666,815	0	910,479	16,243	2,662	1,456,116	4,986	844,751	1,200,981	930,961	20,274	119	8,649,065
	TOTAL	0	285,873	7,962	1,647,843	134,588	389,761	83,654	121,962	11,875,065	6,352,913	65,769,616	0	31,984,677	415,806	115,499	39,281,569	122,972	20,833,434	33,599,683	27,540,381	965,855	2,930	241,532,043

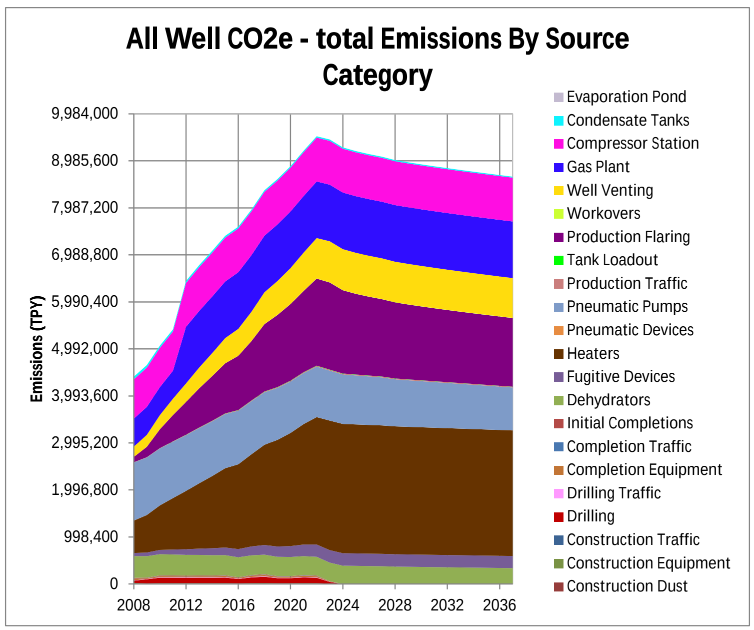

Figure 48. Total New and Existing Wells CO_2e - total Emissions (tons/year) Contribution by Source Category and by Project Year.