2.0 EMISSIONS INVENTORY - PINEDALE ANTICLINE PROJECT

The emissions inventory for sources directly associated with the PAP is developed based on emissions inventories developed for similar sources in Wyoming (e.g., Jonah Field II Natural Gas Project, Moxa Arch and Fontenelle Natural Gas Developments, etc.). Emissions inventories are developed for criteria pollutants (i.e., NO_x, SO_2, CO, PM_{10}, $PM_{2.5}$, and VOCs) and hazardous air pollutants (HAPs). For this analysis, the HAPs consist of xylene, benzene, toluene, ethylbenzene, n-hexane, and formaldehyde. Emissions sources expected to be a part of the PAP include:

- construction emissions, including well pad and resource road construction, drilling, and well completion and testing;
- production emissions, including well operation;
- wind erosion; and
- compression.

The types of new sources affiliated with the PAP are similar to the sources affiliated with other similar projects throughout southwest Wyoming. Emissions estimation methodologies for all construction sources and the production heaters are therefore modeled after those presented in the Jonah II EIS.[1]

The inventory presented herein is developed for both individual wells and the entire well field. The maximum required compression is expected to be 26,000 hp, which could support production of approximately 350 MMCFD for the entire field. Approximately nine barrels of condensate are produced for every MMCF of gas, resulting in total condensate production from the field of 3,150 barrels per day. (Full field development is expected to consist of 700 producing wells.) This inventory represents the "potential to emit," which assumes continuous operation of wells and compressors (i.e., 8,760 hours per year).

2.1 Well Construction Emissions

Air emissions result from three sequential construction activities: well pad and resource road construction, well drilling, and well completion. Each of the three activities consists of several different sources of air emissions and is discussed separately in the following sections. Emissions of both criteria pollutants and HAPs are estimated for each activity, when applicable.

[1] Final Environmental Impact Statement: Jonah Field II Natural Gas Project, U.S. Department of the Interior, Bureau of Land Management, Rock Springs District Office, February 1998.

The emission calculations for each of the emissions sources described below, along with any pertinent assumptions, are provided in Appendix A.

2.1.1 Well Pad and Resource Road Construction

Well pad and resource road construction consists of clearing, grading, and constructing the road and pad. The emission sources affiliated with this activity include fugitive dust emissions from travel on unpaved roads (haul trucks, pickup trucks, and heavy construction equipment)[2] and heavy construction operations,[3] and tailpipe emissions from mobile sources (haul trucks and heavy equipment, including a dozer, a grader, and a backhoe)[4] used in the construction process. Assumed controls for these sources include watering on the well pad service roads and during well pad and resource road construction to control emissions of particulate matter. The watering control efficiency is assumed to be 50 percent.

2.1.2 Well Drilling

Well drilling consists of rigging-up, drilling, and rigging-down. The emission sources affiliated with well drilling include fugitive dust emissions from travel on unpaved roads (18-wheeler semi-trailer trucks, support trucks, and pickup trucks),[2] and tailpipe emissions from mobile sources (heavy duty diesel engine powered trucks and drill rigs)[4] used in the construction process. (Note that although both gasoline- and diesel-burning trucks will be used, it is conservatively assumed that all trucks used in this process burn diesel fuel.) Particulate matter control is assumed to be watering on the unpaved roads, with a control efficiency of 50 percent.

2.1.3 Well Completion

Well completion also includes well testing. The emission sources affiliated with well completion include fugitive dust emissions from travel on unpaved roads (18-wheeler semi-trailer trucks, support trucks, and pickup trucks),[2] tailpipe emissions from mobile sources (heavy-duty diesel engine powered trucks),[5] and flaring of natural gas for well evaluation.[6] (Note that although both gasoline- and diesel-burning trucks will be used, it is conservatively assumed that all trucks used in this process burn

---

[2] Appendix A, Section I.C.

[3] Appendix A, Sections I.A.-I.B.

[4] Appendix A, Sections I.D-I.E.

[5] Appendix A, Section I.D.

[6] Appendix A, Section I.F.

diesel fuel.) Particulate matter control is assumed to be watering on the unpaved roads, with a control efficiency of 50 percent.

2.1.4 Short-Term Maximum (Hourly) Emissions

The short-term maximum (hourly) emissions are estimated on both a per-well and a total well field basis. For calculation of short-term emissions, the consecutive nature of these activities is taken into account. During a one-hour period at a given well, only one of the three groups of activities (i.e., road construction, drilling, or completion) will be taking place. Therefore, short-term emissions are calculated as the maximum hourly emission rate from these three groups of activities. See Table 2.1 for a summary of the short-term emissions resulting from construction.

TABLE 2.1
SHORT-TERM CONSTRUCTION EMISSIONS - INDIVIDUAL WELL

Pollutant	Individual Well Emissions (lb/hour/well)			
	Construction	Drilling	Completion	Total
NO_x	2.59	10.29	14.28	14.28
CO	0.96	4.46	77.32	77.32
VOCs	0.21	0.99	13.19	13.19
SO_2	0.08	0.22	0.004	0.22
PM_{10}	29.90	10.25	17.40	29.90
$PM_{2.5}$	5.82	2.21	3.90	5.82
Benzene	-	-	4E-04	4E-04
Toluene	-	-	7E-04	7E-04
Xylenes	-	-	-	-
Ethylbenzene	-	-	-	-
n-Hexane	-	-	0.38	0.38
Formaldehyde	0.06	0.19	0.02	0.19

For calculating total well field short-term emissions, it is assumed that a maximum of eight wells will be under construction at any one time. The representative short-term emissions that could occur over the entire well field are the short-term emissions defined above multiplied by the total number of wells being constructed simultaneously (i.e., 8). See Table 2.2 for a summary of the total well field short-term emissions resulting from construction.

TABLE 2.2
SHORT-TERM CONSTRUCTION EMISSIONS - TOTAL WELL FIELD

Pollutant	Total Well Field Emissions (lb/hour)			
	Construction	Drilling	Completion	Total
NO_x	20.74	82.30	114.23	114.23
CO	7.72	35.64	618.55	618.55
VOCs	1.68	7.93	105.53	105.53
SO_2	0.60	1.76	0.04	1.76
PM_{10}	239.23	81.98	139.22	239.23
$PM_{2.5}$	46.59	17.69	31.16	46.59
Benzene	-	-	0.004	0.004
Toluene	-	-	0.006	0.006
Xylenes	-	-	-	-
Ethylbenzene	-	-	-	-
n-Hexane	-	-	3.00	3.00
Formaldehyde	0.46	1.50	0.13	1.50

2.1.5 Long-Term (Annual) Emissions

Long-term (annual) emissions are estimated for both the individual wells and the entire well field. Each constructed well undergoes all three activities over the course of a year. Therefore, long-term emissions for an individual well are calculated as the sum of the annual emissions from the three groups of activities, as shown in Table 2.3.

TABLE 2.3
LONG-TERM CONSTRUCTION EMISSIONS - INDIVIDUAL WELL

Pollutant	Individual Well Emissions (tons/yr/well)			
	Construction	Drilling	Completion	Total
NO_x	0.05	2.46	0.52	3.02
CO	0.02	1.04	2.79	3.85
VOCs	0.00	0.23	0.48	0.71
SO_2	0.00	0.05	0.00	0.05
PM_{10}	0.60	1.10	1.01	2.71
$PM_{2.5}$	0.12	0.33	0.20	0.64
Benzene	-	-	2E-05	2E-05
Toluene	-	-	3E-05	3E-05
Xylenes	-	-	-	-
Ethylbenzene	-	-	-	-
n-Hexane	-	-	0.01	0.01
Formaldehyde	0.001	0.05	0.001	0.05

A maximum of 90 wells will be constructed during any one year. Long-term emissions are calculated by multiplying the individual well emissions by the number of wells constructed per year (i.e., 90). See Table 2.4 for a summary of the long-term emissions resulting from construction over the entire well field.

TABLE 2.4
LONG-TERM CONSTRUCTION EMISSIONS - TOTAL WELL FIELD

Pollutant	Total Well Field Emissions(tons/yr)			
	Construction	Drilling	Completion	Total
NO_x	4.67	221.01	46.50	272.18
CO	1.74	93.70	251.02	346.46
VOCs	0.38	20.68	42.88	63.94
SO_2	0.14	4.69	0.02	4.85
PM_{10}	53.83	99.36	90.55	243.74
$PM_{2.5}$	10.48	29.93	17.61	58.02
Benzene	-	-	1E-03	1E-03
Toluene	-	-	2E-03	2E-03
Xylenes	-	-	-	-
Ethylbenzene	-	-	-	-
n-Hexane	-	-	1.22	1.22
Formaldehyde	0.10	4.06	0.05	4.21

2.1.6 Distribution of Emissions for Modeling

Because the exact locations of the construction sources are not known, and the emissions sources are diffuse by nature, emissions from construction activities are treated as area sources in the CALPUFF modeling. For the short-term averaging periods (i.e., using short-term emission rates), emissions from well construction (assuming eight wells are under construction at any one time) are distributed into eight separate grid cells along the axis of the PAPA (approximately 7 kilometers apart), as shown in Figure 2.1.

For the long-term averaging periods, emissions from well construction (assuming 90 wells are constructed per year) are spread evenly over the PAPA except for a 2 kilometer by 2 kilometer region of maximum density (one well per square kilometer) placed adjacent to a region of maximum production (defined in Section 2.2.7). The purpose of the maximum density cells is to represent maximum possible emission density of and maximum impacts at locations within the PAPA. This distribution is also illustrated in Figure 2.1.

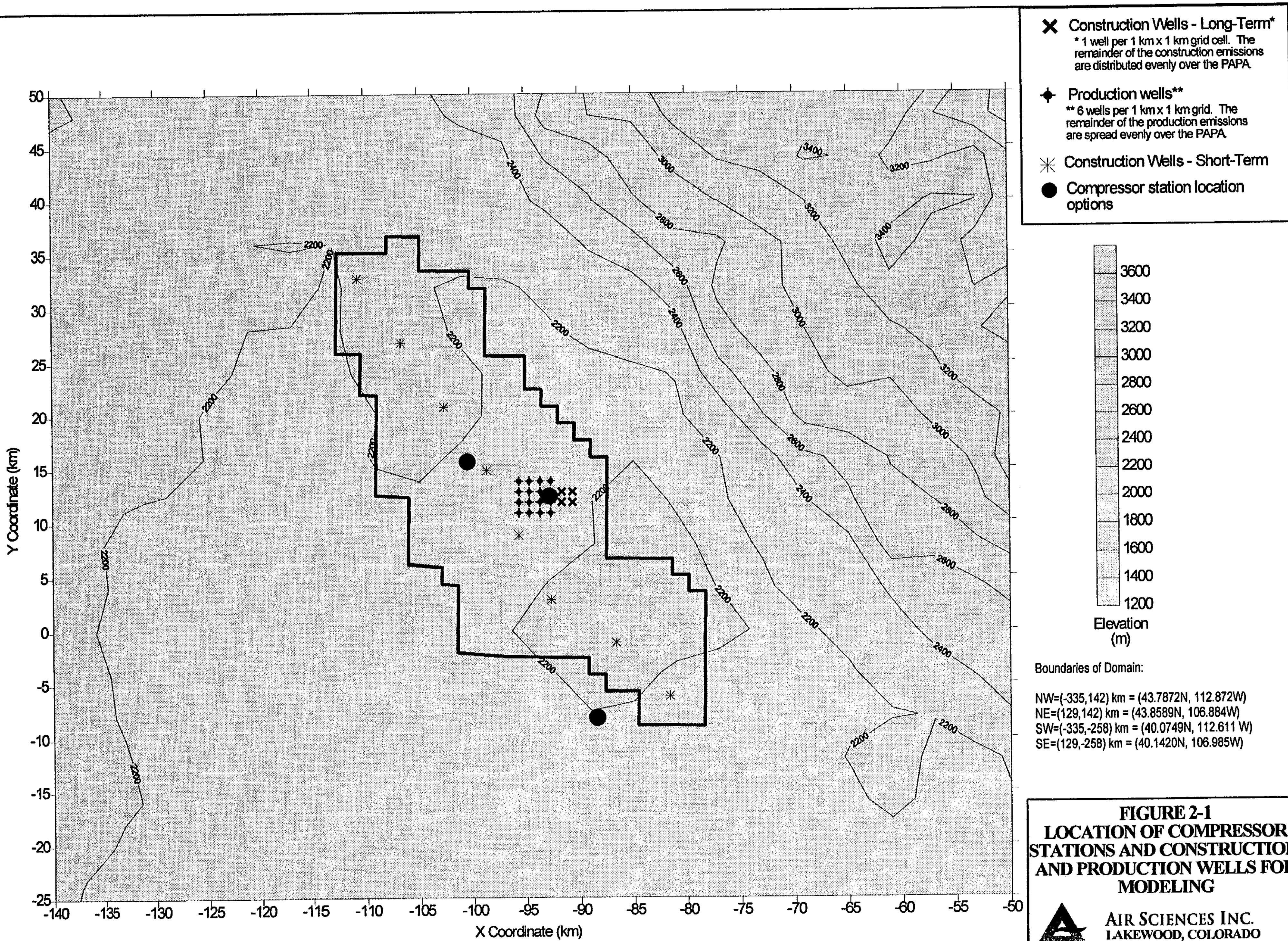

FIGURE 2-1
LOCATION OF COMPRESSOR STATIONS AND CONSTRUCTION AND PRODUCTION WELLS FOR MODELING

2.2 Well Production Emissions

Air emissions result from several aspects of gas production: three-phase separation, triethylene glycol (TEG) dehydration, and condensate storage. Each of these processes are discussed separately in this section. Emissions of both criteria pollutants and HAPs are estimated from each process, when applicable.

The emission calculations for each of the emissions sources described below, along with any pertinent assumptions, are provided in Appendix A.

2.2.1 Three-Phase Separator and Glycol Regeneration Heaters

A natural gas-fired three-phase separator heater will operate for a maximum of 15 minutes per hour and only during the winter months (October 1 - April 30).[7] The glycol heater is assumed to operate year-round for a maximum of 15 minutes per hour.[8]

Note that the three-phase separator also results in VOC and HAPs emissions from flashing, which are discussed in Section 2.2.3. Also, note that the TEG dehydration system results in emissions of VOCs and HAPs that were stripped from the gas during dehydration. These emissions, discussed in Section 2.2.2, are released through a separate stack during regeneration of the glycol (i.e., evaporation of adsorbed water).

2.2.2 Glycol Dehydration System - VOCs/HAPs Emissions

VOCs and HAPs emissions from the glycol dehydration system are estimated using the Gas Research Institute's (GRI's) GLYCALC emissions estimation program. Emissions are based on gas composition and throughput. For this study, predicted emissions from a typical Jonah II well (provided by McMurry Oil Company) were adjusted by the ratio of the desired PAP gas production rate per well to the Jonah II production rate.[9] VOCs and HAPs emissions from dehydration are calculated based on the total well field production rates (i.e., individual well emissions are not calculated for these sources). It is assumed that no controls will be required on these emissions sources.

---

[7] Appendix A, Section II.A.

[8] Appendix A, Section II.B.

[9] Appendix A, Section II.C.

2.2.3 Flashing

Flashing emissions occur as a result of pressure differentials between the well and the separator, and the separator and the storage tank. For the purposes of this analysis, all flashing emissions are assumed to occur at the separator, where the largest pressure difference is realized. These flashing emissions of VOCs and HAPs from the PAP condensate storage tanks are estimated based on HYSYS simulations of a typical Jonah II well. Predicted flashing emissions from a typical Jonah II well (provided by McMurry Oil Company) are adjusted by the ratio of the desired PAP gas production rate per well to the Jonah II production rate.[10] VOCs and HAPs emissions from flashing are calculated based on the total well field production rates (i.e., individual well emissions are not calculated for these sources).

A percentage of the wells will be required to apply state-regulated Best Available Control Technology (BACT) on their condensate tanks. Typically for condensate tanks requiring BACT, controls for flashing are assumed to be flaring with 98 percent control efficiency. To calculate the VOCs and HAPs emissions from flashing and the combustion emissions associated with flaring, it is assumed that twenty percent of the total condensate will be produced from wells requiring BACT.[11] The quantity of gas flared at those wells requiring BACT is calculated based on the assumption that 302.74 standard cubic feet of gas is flared for each barrel of condensate produced. Appendix A contains the emissions calculations.

2.2.4 Process Fugitives

Note that because VOC emissions from process fugitives are difficult to accurately estimate, but account for less than one percent of the PAP inventory, they are assumed to be negligible for the Pinedale Anticline Project.

2.2.5 Short-Term Maximum (Hourly) Emissions

Short-term emissions are estimated for all the production source categories. However, production emissions from the individual well sites are estimated only for the two process heaters (the three-phase separator and the glycol regeneration heater), as shown in Table 2.5. The maximum

[10] Appendix A, Section II.D.

[11] Appendix A, Section II.E.

short-term emissions for the heaters are based on the assumption that the heaters only operate 15 minutes per hour.

Production emissions for the entire well field are calculated for all source categories, as shown in Table 2.6. Total well field emissions from combustion sources are estimated by multiplying the short-term emissions by the number of concurrently operating wells (estimated to be 700). Emissions from the remaining source categories are estimated based on the overall gas and oil production rates, as described in the corresponding sections above.

TABLE 2.5
SHORT-TERM PRODUCTION EMISSIONS - INDIVIDUAL WELL

Pollutant	Individual Well Emissions (lb/hour/well)					
	Three-Phase Separator	Dehydrator Heater	Dehydration System (VOCs)*	Condensate Tank - Flashing*	Flare*	Total
NO_x	0.02	0.003	N/A	N/A	N/A	0.02
CO	0.02	0.001	N/A	N/A	N/A	0.02
VOCs	0.001	1.72E-04	N/A	N/A	N/A	0.001
SO_2	1.13E-04	1.88E-05	N/A	N/A	N/A	1.31E-04
PM_{10}	0.001	2.38E-04	N/A	N/A	N/A	0.002
$PM_{2.5}$	0.001	2.38E-04	N/A	N/A	N/A	0.002
Benzene	3.94E-07	6.56E-08	N/A	N/A	N/A	4.59E-07
Toluene	6.38E-07	1.06E-07	N/A	N/A	N/A	7.44E-07
Xylenes	-	-	N/A	N/A	N/A	-
Ethylbenzene	-	-	N/A	N/A	N/A	-
n-Hexane	3.38E-04	5.63E-05	N/A	N/A	N/A	3.94E-04
Formaldehyde	1.41E-05	2.34E-06	N/A	N/A	N/A	1.64E-05

*Per well emissions not calculated.

TABLE 2.6
SHORT-TERM PRODUCTION EMISSIONS - TOTAL WELL FIELD

Pollutant	Total Well Field Emissions (lb/hour)					
	Three-Phase Separator	Dehydrator Heater	Dehydration System (VOCs)	Condensate Tank-Flashing	Flare	Total (lb/hour)
NO_x	13.13	2.06	-	-	0.54	15.72
CO	11.03	0.88	-	-	2.94	14.84
VOCs	0.72	0.12	433.50	1,193.76	-	1,628.10
SO_2	0.08	0.01	-	-	-	0.09
PM_{10}	1.00	0.17	-	-	0.06	1.22
$PM_{2.5}$	1.00	0.17	-	-	0.06	1.22
Benzene	2.76E-04	4.59E-05	53.28	1.39	-	54.67
Toluene	4.46E-04	7.44E-05	132.49	0.01	-	132.50
Xylenes	-	-	113.02	0.10	-	113.12
Ethylbenzene	-	-	8.79	0.27	-	9.06
n-Hexane	0.24	0.04	4.13	56.86	-	61.27
Formaldehyde	0.01	0.002	-	-	-	0.01

2.2.6 Long-Term (Annual) Emissions

Long-term emissions are estimated for all the production emissions. As described in Section 2.2.5, production emissions from the individual well sites are estimated only for the two process heaters (the three-phase separator and the glycol regeneration heater).

Because the three-phase separator heater only operates during October through April, these emissions are defined separately from emissions during May through September. The long-term emissions from an individual well site during the period between October 1 and April 30 are shown in Table 2.7. The long-term emissions from an individual well site during the remainder of the year are shown in Table 2.8.

TABLE 2.7
LONG-TERM PRODUCTION EMISSIONS - INDIVIDUAL WELL
(OCTOBER - APRIL)

Pollutant	Individual Well Emissions (lb/hr/well)					
	Three-Phase Separator	Dehydrator Heater	Dehydration System (VOCs)*	Condensate Tank - Flashing*	Flare*	Total
NO_x	0.02	2.94E-03	N/A	N/A	N/A	0.02
CO	0.02	1.25E-03	N/A	N/A	N/A	0.02
VOCs	0.001	1.72E-04	N/A	N/A	N/A	0.001
SO_2	1.13E-04	1.88E-05	N/A	N/A	N/A	1.31E-04
PM_{10}	0.001	2.38E-04	N/A	N/A	N/A	0.002
$PM_{2.5}$	0.001	2.38E-04	N/A	N/A	N/A	0.002
Benzene	3.94E-07	6.56E-08	N/A	N/A	N/A	4.59E-07
Toluene	6.38E-07	1.06E-07	N/A	N/A	N/A	7.44E-07
Xylenes	-	-	N/A	N/A	N/A	-
Ethylbenzene	-	-	N/A	N/A	N/A	-
n-Hexane	3.38E-04	5.63E-05	N/A	N/A	N/A	3.94E-04
Formaldehyde	1.41E-05	2.34E-06	N/A	N/A	N/A	1.64E-05

*Per well emissions not calculated.

TABLE 2.8
LONG-TERM PRODUCTION EMISSIONS - INDIVIDUAL WELL
(MAY - SEPTEMBER)

Pollutant	Individual Well Emissions (lb/hr/well)					
	Three-Phase Separator	Dehydrator Heater	Dehydration System (VOCs)*	Condensate Tank - Flashing*	Flare*	Total
NO_x	-	2.94E-03	N/A	N/A	N/A	2.94E-03
CO	-	1.25E-03	N/A	N/A	N/A	1.25E-03
VOCs	-	1.72E-04	N/A	N/A	N/A	1.72E-04
SO_2	-	1.88E-05	N/A	N/A	N/A	1.88E-05
PM_{10}	-	2.38E-04	N/A	N/A	N/A	2.38E-04
$PM_{2.5}$	-	2.38E-04	N/A	N/A	N/A	2.38E-04
Benzene	-	6.56E-08	N/A	N/A	N/A	6.56E-08
Toluene	-	1.06E-07	N/A	N/A	N/A	1.06E-07
Xylenes	-	-	N/A	N/A	N/A	-
Ethylbenzene	-	-	N/A	N/A	N/A	-
n-Hexane	-	5.63E-05	N/A	N/A	N/A	5.63E-05
Formaldehyde	-	2.34E-06	N/A	N/A	N/A	2.34E-06

*Per well emissions not calculated.

Production emissions for the entire well field are calculated for each source category. As described above, the emissions between October 1 and April 30 differ from those between May 1 and September 30; therefore, these emissions are presented separately in Tables 2.9 and 2.10. Total well field emissions from combustion sources are calculated by multiplying the long-term per-well emissions by the total number of concurrently operating wells (estimated to be 700). The well field emissions from the remaining sources are calculated based on the overall gas and oil production rates, as described in the corresponding sections above.

TABLE 2.9
LONG-TERM PRODUCTION EMISSIONS - TOTAL WELL FIELD
(OCTOBER - APRIL)

Pollutant	Total Well Field Emissions lb/hr)					
	Three-Phase Separator	Dehydrator Heater	Dehydration System - VOCs	Condensate Tank-Flashing	Flare	Total Well Field (lb/hr)
NO_x	13.13	2.06	-	-	0.54	15.72
CO	11.03	0.88	-	-	2.94	14.84
VOCs	0.72	0.12	433.50	1,193.76	-	1,628.10
SO_2	0.08	0.01	-	-	-	0.09
PM_{10}	1.00	0.17	-	-	0.06	1.22
$PM_{2.5}$	1.00	0.17	-	-	0.06	1.22
Benzene	2.76E-04	4.59E-05	53.28	1.39	-	54.67
Toluene	4.46E-04	7.44E-05	132.49	0.01	-	132.50
Xylenes	-	-	113.02	0.10	-	113.12
Ethylbenzene	-	-	8.79	0.27	-	9.06
n-Hexane	0.24	0.04	4.13	56.86	-	61.27
Formaldehyde	0.01	0.002	-	-	-	0.01

TABLE 2.10
LONG-TERM PRODUCTION EMISSIONS - TOTAL WELL FIELD
(MAY - SEPTEMBER)

Pollutant	Total Well Field Emissions (lb/hr)					Total (lb/hr)
	Three-Phase Separator	Dehydrator Heater	Dehydration System - VOCs	Condensate Tank-Flashing	Flare	
NO_x	-	2.06	-	-	0.54	2.60
CO	-	0.88	-	-	2.94	3.82
VOCs	-	0.12	433.50	1,193.76	-	1,627.38
SO_2	-	0.01	-	-	-	0.01
PM_{10}	-	0.17	-	-	0.06	0.23
$PM_{2.5}$	-	0.17	-	-	0.06	0.23
Benzene	-	4.59E-05	53.28	1.39	-	54.67
Toluene	-	7.44E-05	132.49	0.01	-	132.50
Xylenes	-	-	113.02	0.10	-	113.12
Ethylbenzene	-	-	8.79	0.27	-	9.06
n-Hexane	-	0.04	4.13	56.86	-	61.03
Formaldehyde	-	0.002	-	-	-	0.002

2.2.7 Distribution of Emissions for Modeling

Because the exact locations of the well heads are not known, and the emissions sources are diffuse by nature, emissions from production are treated as area sources in the CALPUFF modeling. Emissions from the producing wells are distributed evenly over the PAPA as 1 kilometer by 1 kilometer area sources for both the short-term and the long-term averaging periods, except for a 4 kilometer by 4 kilometer region of maximum density (six producing wells per square kilometer). Combustion emissions from the heaters, as well as erosion emissions, are calculated, and therefore distributed, on a per-well basis (see Section 2.2.5 and 2.2.6). Emissions from dehydration and flashing, and associated flaring, are calculated on a field-wide basis only. To calculate emissions from these sources in this region of maximum density, the well production rate is assumed to be an average of 12.7 barrels per day of condensate and 1.4 MMCFD of gas, for a total of 1,219.2 barrels per day of condensate and 134.4 MMCFD of gas in this region. The remainder of the total production is spread evenly over the PAPA. Figure 2.1 illustrates the assumed locations of the production emissions for both short-term and long-term averaging periods.

2.3 Wind Erosion Emissions During Production

Wind erosion emissions are calculated for disturbed areas, such as the well pads and access roads. The wind erosion emission calculation is taken from the Jonah II EIS,[12] and the emissions are summarized in Table 2.11. The wind erosion emissions are distributed in the same manner as the production emissions (see Section 2.2.7).

TABLE 2.11
SHORT-TERM AND LONG-TERM WIND EROSION EMISSIONS

Pollutant	Individual Well Emissions		Total Well Field Emissions	
	(lb/hour/well)	(tons/yr/well)	(lb/hour)	(tons/year)
PM_{10}	0.03	0.12	19.35	84.77
$PM_{2.5}$	0.01	0.05	7.74	33.91

2.4 Compression Emissions

The emissions from compression were calculated for two scenarios; 26,000 horsepower and 16,000 horsepower. Application of state-regulated Best Available Control Technology (BACT) will be required on the compressors. Current control technology reduces NO_x emissions to 1.5 grams per horsepower-hour (g/hp-hr) or below, as shown in previous EIS's in the state. NO_x emissions are quantified for the alternatives of 1.5, 1.0 and 0.7 g/hp-hr, and CO emissions are quantified at 3.0 g/hp-hr. The remaining pollutants are estimated based on AP-42 emission factors.[13] The compression emissions are summarized in Table 2.12.

Compressor sources are treated as point sources in the CALPUFF modeling. The three location options for these compressor stations are shown in Figure 2.1, and stack parameters are included in Appendix B. For the modeling, it is assumed that the compressors are located along the north side of a 30 foot tall (to roof peak) compressor building, measuring 300 feet in length and 50 feet in width.

[12] Appendix A, Section III.

[13] Appendix A, Section IV.

TABLE 2.12
SHORT-TERM AND LONG-TERM COMPRESSION EMISSIONS

Pollutant		Compression Emissions (lb/hr)		Compression Emissions (tons/yr)	
		16,000 hp	26,000 hp	16,000 hp	26,000 hp
NO_x	1.5 g/hp-hr	52.91	85.98	231.75	376.59
	1 g/hp-hr	35.27	57.32	154.50	251.06
	0.7 g/hp-hr	24.69	40.12	108.15	175.74
CO		105.82	171.96	463.50	753.19
VOCs		11.04	17.94	48.36	78.58
SO_2		3.52	5.72	15.42	25.05
PM_{10}		0.07	0.11	0.29	0.48
$PM_{2.5}$		3.52	5.72	15.42	25.05
Benzene		0.11	0.17	0.47	0.76
Toluene		0.03	0.05	0.13	0.22
Xylenes		0.01	0.01	0.03	0.05
Ethylbenzene		0.01	0.01	0.03	0.04
n-Hexane		0.10	0.16	0.42	0.68
Formaldehyde		5.28	8.58	23.13	37.58

2.5 Total Emissions Summary

Total well field short-term maximum and long-term average emissions are summarized in Tables 2.13 and 2.14.

TABLE 2.13
SHORT-TERM EMISSIONS - TOTAL PAP

Pollutant	Total Well Field Emissions (lb/hour)				
	Construction	Production	Erosion	Compression (26,000 hp)	Total
NO_x	114.23	15.72	-	57.32	187.3
CO	618.55	14.84	-	171.96	805.4
VOCs	105.53	1,628.10	-	17.94	1,751.6
SO_2	1.76	0.09	-	0.11	2.0
PM_{10}	239.23	1.22	19.35	5.72	265.5
$PM_{2.5}$	46.59	1.22	7.74	5.72	61.3
Benzene	0.004	54.67	-	0.17	54.9
Toluene	0.006	132.50	-	0.05	132.6
Xylenes	-	113.12	-	0.01	113.1
Ethylbenzene	-	9.06	-	0.01	9.1
n-Hexane	3.00	61.27	-	0.16	64.4
Formaldehyde	1.50	0.01	-	8.58	10.1

TABLE 2.14
LONG-TERM EMISSIONS - TOTAL PAP

Pollutant	Total Well Field Emissions (tons/year)				
	Construction	Production	Erosion	Compression (26,000 hp)	Total
NO_x	272.18	44.76	-	251.06	568.0
CO	346.46	44.76	-	753.19	1,144.4
VOCs	63.94	7,129.76	-	78.58	7,272.3
SO_2	4.85	0.26	-	0.48	5.6
PM_{10}	243.74	3.53	84.77	25.05	357.1
$PM_{2.5}$	58.02	3.53	33.91	25.05	120.5
Benzene	0.001	239.45	-	0.76	240.2
Toluene	0.002	580.37	-	0.22	580.6
Xylenes	-	495.47	-	0.05	495.5
Ethylbenzene	-	39.68	-	0.04	39.7
n-Hexane	1.22	267.92	-	0.68	269.8
Formaldehyde	4.21	0.03	-	37.58	41.8