

APPENDIX B2:
SEMINOLE ROAD EMISSIONS INVENTORY

Appendix B2 – Seminole Road Emissions Inventory

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Table B2.1.1
 Seminole Road Emissions Inventory
 Well Pad Construction



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
 Phase: Road Construction
 Activity: Fugitive Particulate Emissions from
 Well Pad Construction
 Engineer: Cassidy Marshall
 Date: 4/5/2004

Well Pad Area	Construction Activity TSP Emission Factor ¹	Construction Activity Duration ²	Construction Activity Duration	Construction Activity Duration	Construction Activity Duration ³	Emission Control Efficiency	PM ₁₀ Emissions (controlled) ⁴	PM-2.5 Emissions (controlled) ⁵	
(acre)	(tons/acre-month)	(days/well pad)	(hours/day)	(days/week)	(months/year)	(%)	(lb/well)	(lb/well)	
2.2	1.2	4	10	7	8	0	253.44	66.88	
							Well Pad Construction Emissions (lb/day/well)	63.36	16.72
							Well Pad Construction Emissions (lb/hr/well)	6.34	1.67

¹ AP-42 (EPA, 1995), Section 13.2.3, "Heavy Construction Operations".

² Days per well estimated by TRC.

³ Construction occurs 8 months per year, March -October.

⁴ AP-42 (EPA, 1998), Section 13.2.2 "Unpaved Roads", Background Document. Assuming that 36% of the TSP is in the PM₁₀

size range, monthly emissions converted to daily and hourly emissions based on 30-day month.

⁵ AP-42 (EPA, 1998), Section 13.2.2 "Unpaved Roads", Background Document. Assuming that 9.5% of the TSP is in the PM_{2.5}

size range, monthly emissions converted to daily and hourly emissions based on 30-day month.

Table B2.1.2
 Seminoe Road Emissions Inventory
 Resource Road Construction



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Road Construction
 Activity: Fugitive Particulate Emissions from
 Resource Road Construction
 Engineer: Cassidy Marshall
 Date: 4/5/2004

Resource Road Area ¹	Construction Activity TSP Emission Factor ²	Construction Activity Duration ³	Construction Activity Duration	Construction Activity Duration	Construction Activity Duration ⁴	Emission Control Efficiency	PM-10 Emissions (controlled) ⁵	PM-2.5 Emissions (controlled) ⁶	
(acres)	(tons/acre-month)	(days/pad)	(hours/day)	(day/week)	(months/year)	(%)	(lb/pad)	(lb/pad)	
2.4606	1.2	4	10	7	8	0	283.46	74.80	
							Resource Road Construction Emissions (lb/day/well)	70.87	18.70
							Resource Road Construction Emissions (lb/hr/well)	7.09	1.87

¹ Construction Area = 0.58 mi/well x 35-ft ROW = 2.4606 acres.

² AP-42 (EPA, 1995), Section 13.2.3, "Heavy Construction Operations".

³ Days per well estimated by TRC.

⁴ Construction occurs 8 months per year, March -October.

⁵ AP-42 (EPA, 1998), Section 13.2.2 "Unpaved Roads", Background Document. Assuming that 36% of the TSP is in the PM₁₀

⁶ size range, monthly emissions converted to daily and hourly emissions based on 30-day month.

AP-42 (EPA, 1998), Section 13.2.2 "Unpaved Roads", Background Document. Assuming that 9.5% of the TSP is in the PM_{2.5}

size range, monthly emissions converted to daily and hourly emissions based on 30-day month.

Table B2.1.3
 Seminoe Road Emissions Inventory
 Well Pad/Resource Road Traffic



605 Skyline Drive
 Laramie, WY 82070
 Phone: (307) 742-3843
 Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Well Pad/Resource Road
 Construction
 Activity: Fugitive Particulate Emissions
 from Traffic on Resource
 Roads
 Engineer: Cassady Marshall
 Date: 4/5/2004

Vehicle Type	Average Vehicle Weight (lb)	Average Vehicle Speed (mph)	Silt Content ¹ (%)	Moisture Content ² (%)	Vehicle Miles Traveled (VMT/well)	Construction Activity Duration (hours/day)	Construction Activity Duration (day/week)	Construction Activity Duration ³ (month/year)	Emission Control Efficiency (%)	PM-10 Emission Factor ⁴ (lb/VMT)	PM-2.5 Emission Factor ⁴ (lb/VMT)	PM-10 Emissions ⁵ (lb/pad)	PM-2.5 Emissions ⁵ (lb/pad)
Gravel/haul trucks	40,000	25	5.1	2.4	350	10	7	8	0	1.63	0.25	570.78	87.52
Fuel Trucks	40,000	25	5.1	2.4	8	10	7	8	0	1.63	0.25	13.05	2.00
Light trucks/pickups	7,000	25	5.1	2.4	108	10	7	8	0	0.51	0.08	55.06	8.23
Total Unpaved Road Traffic Emissions (lb/pad)												638.89	97.75
Total Unpaved Road Traffic Emissions (lb/hr/pad) ⁶												15.97	2.44

¹ AP-42 (EPA, 1998), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

² AP-42 (EPA, 1998), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

³ Construction occurs 8 months per year, March -October.

⁴ AP-42 (EPA, 2003), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

⁵ Calculated as lb/VMT x VMT/pad x control efficiency.

⁶ Calculated as lb/well / 4.0 days/well / 10 hours/day, and represents emissions for 4-mile segment of road.

Table B2.1.4
Seminole Road Emissions Inventory
Well Pad/Resource Road Heavy Equipment



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
Phase: Well Pad/Road Construction
Activity: Diesel Combustion Emissions
from Heavy Equipment
Tailpipes
Engineer: Cassady Marshall
Date: 4/5/2004

Heavy Equipment	Engine Horsepower (hp)	Number Required	Operating Load Factor	Pollutant Emission Factor ¹					Construction Activity Duration (hours/well)	Construction Activity Duration ² (days/equipment type)	Construction Activity Duration (hours/day)	Construction Activity Duration (day/week)	Construction Activity Duration ⁶ (months/year)	Pollutant Emissions					Pollutant Emissions ⁷								
				CO	NO _x	SO ₂	VOC	PM ₁₀						CO	NO _x	SO ₂	VOC	PM ₁₀ ⁸	CO	NO _x	SO ₂	VOC	PM ₁₀ ⁸				
Gravel Trucks ³	325	--	0.4	6.68E-03	0.031	2.05E-03	2.47E-03	2.20E-03	34	--	--	7	8	6.51E-02	5.04E-03	1.55E-03	1.23E-04	1.32E-04	1.91E-03	1.48E-04	4.55E-05	3.63E-06	3.89E-06				
Motor Grader	135	1	0.4	1.54	7.14	0.874	0.36	0.625		1	10	7	8	1.83	8.50	1.04	0.43	0.74	0.18	0.85	0.10	0.04	0.07				
D8 Dozer ⁴	285	1	0.4	2.15	7.81	0.851	0.75	0.692		3	10	7	8	16.21	58.88	6.42	5.65	5.22	0.54	1.96	0.21	0.19	0.17				
Loader ⁵	200	1	0.4	2.71	8.81	0.857	0.97	0.805		1	10	7	8	4.78	15.54	1.51	1.71	1.42	0.48	1.55	0.15	0.17	0.14				
Total Heavy Equipment Tailpipe Emissions													22.82	82.92	8.97	7.79	7.38	1.20	4.37	0.47	0.40	0.39					

¹ AP-42 (EPA, 1985), Volume II Mobile Sources.

² Construction activity duration estimated by TRC.

³ Gravel Truck Pollutant Emission Factor taken from AP-42 (EPA 1996), "Table 3.3-1," "Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines."

⁴ Emission factor for track-type tractor.

⁵ Emission factor for wheeled loader.

⁶ Construction occurs 8 months per year, March -October.

⁷ Calculated as lb/well / days/equipment type / 10 hours/day.

⁸ PM-2.5 assumed equivalent to PM-10 for combustion sources.

Table B2.1.5
 Seminole Road Emissions Inventory
 Rig-up, Drilling, and Rig-down Traffic

TRC
 605 Skyline Drive
 Laramie, WY 82070
 Fax: (307) 745-8317

Project: Seminole Road
 Phase: Rig-up, Drilling, Rig-down
 Activity: Fugitive Particulate Emissions from
 Traffic on Unpaved Roads
 Engineer: Cassidy Marshall
 Date: 4/5/2004

Vehicle Type	Average Vehicle Weight (lb)	Average Vehicle Speed (mph)	Silt Content ¹ (%)	Moisture Content ² (%)	Construction Activity Duration (hours/day)	Construction Activity Duration (day/week)	Construction Activity Duration (days/year)	Vehicle Miles Traveled (VMT) (VMT/well)	Emission Control Efficiency (%)	PM-10 Emission Factor ³ (lb/VMT)	PM-2.5 Emission Factor ³ (lb/VMT)	PM-10 Emissions ⁴ (lb/well)	PM-2.5 Emissions ⁴ (lb/well)
Medium Wells ⁵													
Supply Trucks	40,000	25	5.1	2.4	24	7	350	42	0	1.63	0.25	68.49	10.50
Fuel Trucks	40,000	25	5.1	2.4	24	7	350	28	0	0.51	0.076	14.28	2.13
Light trucks/pickups	7,000	25	5.1	2.4	24	7	350	557	0	0.51	0.08	283.97	42.43
Total Resource Road Traffic Emissions (lb/pad)												366.74	55.07
Total Resource Road Emissions (lb/hr/well) ⁶												1.39	0.21
Deep Wells ⁵													
Supply Trucks	40,000	25	5.1	2.4	24	7	350	42	0	1.63	0.25	68.49	10.50
Fuel Trucks	40,000	25	5.1	2.4	24	7	350	28	0	0.51	0.076	14.28	2.13
Light trucks/pickups	7,000	25	5.1	2.4	24	7	350	557	0	0.51	0.08	283.97	42.43
Total Resource Road Traffic Emissions (lb/pad)												366.74	55.07
Total Resource Road Emissions (lb/hr/well) ⁶												0.90	0.13

¹ AP-42 (EPA, 1998), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

² AP-42 (EPA, 1998), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

³ AP-42 (EPA, 2003), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

⁴ Calculated as lb/VMT x VMT/pad x control efficiency.

⁵ Medium wells refer to a depth of 2,500' - 9,999' and deep wells refer to a depth of 10,000 and deeper, as defined by the proponent.

⁶ Calculated as (lb/well) / days/well / 24 hours/day, and represents emissions for 4-mile segment of road. Days per for medium wells = 11 days. Days per well for deep wells = 17 days.

Table B2.1.6
 Seminoe Road Emissions Inventory
 Rig-up, Drilling, and Rig-down Heavy Equipment



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Rig-up, Drilling, Rig-down
 Activity: Diesel Combustion Emissions
 from Haul Truck Tailpipes
 Engineer: Cassady Marshall
 Date: 4/5/2004

Pollutant	Pollutant Emission Factor ¹	Vehicle Miles Traveled (VMT)	Haul Activity Duration	Haul Activity Duration	Haul Activity Duration	Emissions	Emissions ⁴
	(grams/mile)	(VMT/well)	(days/well)	(hours/day)	(days/year)	(lb/well)	(lb/hr/well)
Medium Wells²							
CO	14.74	70	11	24	350	2.27	8.62E-03
NO _x	11.44	70	11	24	350	1.77	6.69E-03
SO ₂ ³	0.32	70	11	24	350	0.05	1.86E-04
VOC	5.69	70	11	24	350	0.88	3.33E-03
Deep Wells²							
CO	14.74	70	17	24	350	2.27	5.58E-03
NO _x	11.44	70	17	24	350	1.77	4.33E-03
SO ₂ ³	0.32	70	17	24	350	0.05	1.20E-04
VOC	5.69	70	17	24	350	0.88	2.15E-03

¹ AP-42 (EPA, 1985), Volume II Mobile Sources. Heavy duty diesel engine powered trucks, high altitude, 20 mph, "aged" with 50,000 miles, 1997+ model.

² Medium wells refer to a depth of 2,500' - 9,999' and deep wells refer to a depth of 10,000 and deeper, as defined by the proponent.

³ The SO₂ emission factor is calculated assuming 10 mpg fuel consumption, with 0.05% sulfur content of #2 diesel fuel, and fuel density of 7.001 lb/gal.

⁴ Calculated as (lb/well) / days/well / 24 hours/day, and represents emissions for 4-mile segment of road.

Days per for medium wells = 11 days. Days per well for deep wells = 17 days.

Table B2.1.7
 Seminole Road Emissions Inventory
 Drilling Engines



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
 Phase: Drilling
 Activity: Diesel Combustion
 Emissions from Drilling
 Engines
 Engineer: Cassady Marshall
 Date: 4/5/2004

Pollutant	Pollutant Emission Factor ¹ (lb/hp-hr)	Total Horsepower All Engines ² (hp)	Overall Load Factor ³	Drilling Activity Duration (days/well)	Drilling Activity Duration (hours/day)	Drilling Activity Duration (days/year)	Emissions (lb/well)	Emissions (lb/hr/well)
Medium Drilling Engines⁴								
CO	0.00331	2,100	0.42	11	24	350	774.58	2.93
NOx	0.019	2,100	0.42	11	24	350	4,518.40	17.12
SO ₂ ⁵	0.00205	2,100	0.42	11	24	350	480.18	1.82
VOC	0.0006	2,100	0.42	11	24	350	129.10	0.49
PM ₁₀ ⁶	0.0022	2,100	0.42	11	24	350	515.31	1.95
Deep Drill Engines⁴								
CO	0.00331	2,100	0.42	17	24	350	1,197.08	2.93
NOx	0.019	2,100	0.42	17	24	350	6,982.99	17.12
SO ₂ ⁵	0.00205	2,100	0.42	17	24	350	742.10	1.82
VOC	0.0006	2,100	0.42	17	24	350	199.51	0.49
PM ₁₀ ⁶	0.0022	2,100	0.42	17	24	350	796.40	1.95

¹ Emission factors for NOx, CO, and VOC based on manufacturer's data. PM10 and SO2 emissions factors AP-42 (EPA, 1996), Section 3.3, "Gasoline and Diesel Industrial Engines. Table 3.3-1.

² Drilling engine horsepower based on two 800 hp engines.

³ The overall load factor is calculated based on average throttle setting of 65% and a load factor of 65%.
 Therefore, the overall load factor = 0.65 * 0.65 = 0.42.

⁴ Medium wells refer to a depth of 2,500' - 9,999' and deep wells refer to a depth of 10,000 and deeper, as defined by the proponent

⁵ The SO₂ emission factor is calculated assuming 26.4 gal/hr fuel consumption, with 0.05% sulfur content of #2 diesel fuel, and fuel density of 7.001 lb/gal. Fuel Consumption rate taken from "Caterpillar's Oilfield Mechanical Rig Power specification sheets".

⁶ PM2.5 assumed equivalent to PM10 for drilling engines.

Table B2.1.8
Seminole Road Emissions Inventory
Completion Traffic



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
Phase: Completion
Activity: Fugitive Particulate Emissions from
Traffic on Unpaved Roads
Engineer: Cassady Marshall
Date: 4/5/2004

Vehicle Type	Average Vehicle Weight	Average Vehicle Speed	Silt Content ¹	Moisture Content ²	Construction Activity Duration	Construction Activity Duration	Construction Activity Duration	Vehicle Miles Traveled (VMT)	Emission Control Efficiency	PM-10 Emission Factor ³	PM-2.5 Emission Factor ³	PM-10 Emissions ⁴ (controlled)	PM-2.5 Emissions ⁴ (controlled)
	(lb)	(mph)	(%)	(%)	(hours/day)	(day/week)	(days/year)	(VMT/well)	(%)	(lb/VMT)	(lb/VMT)	(lb/well)	(lb/well)
Medium Engines⁵													
Fuel Trucks	40,000	25	5.1	2.4	10	6	312	8	0	1.63	0.25	13.05	2.00
Light Pick-ups	7,000	25	5.1	2.4	10	6	312	200	0	0.51	0.076	101.97	15.24
Total Resource Road Emissions (lb/well)												115.01	17.24
Total Resource Road Emissions (lb/hr/well) ⁶												1.92	0.29
Deep Wells⁵													
Fuel Trucks	40,000	25	5.1	2.4	10	8	312	8	0	1.63	0.25	13.05	2.00
Light Pick-ups	7,000	25	5.1	2.4	10	8	312	200	0	0.51	0.076	101.97	15.24
Total Resource Road Emissions (lb/well)												115.01	17.24
Total Resource Road Emissions (lb/hr/well) ⁷												1.44	0.22

¹ AP-42 (EPA, 1998), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

² AP-42 (EPA, 1998), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

³ AP-42 (EPA, 2003), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

⁴ Calculated as lb/VMT x VMT/pad x control efficiency.

⁵ Medium wells refer to a depth of 2,500' - 9,999' and deep wells refer to a depth of 10,000 and deeper, as defined by the proponent.

⁶ Calculated as (lb/well) / 6 days/well / 10 hours/day, and represents emissions for 4-mile segment of road.

⁷ Calculated as (lb/well) / 8 days/well / 10 hours/day, and represents emissions for 4-mile segment of road.

Table B2.1.9
 Seminoe Road Emissions Inventory
 Completion Heavy Equipment



605 Skyline Drive
 Laramie, WY 82070
 Phone: (307) 742-3843
 Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Completion
 Activity: Diesel Combustion
 Emissions from Haul
 Truck Tailpipes
 Engineer: Cassady Marshall
 Date: 4/5/2004

Pollutant	Pollutant Emission Factor ¹	Vehicle Miles Traveled (VMT)	Haul Activity Duration	Haul Activity Duration	Haul Activity Duration	Haul Activity Duration	Emissions	Emissions ²
	(grams/mile)	(VMT/well)	(days/well)	(hours/day)	(days/week)	(days/year)	(lb/well)	(lb/hr/well)
Medium Engines³								
CO	14.74	8	6	10	6	312	0.26	4.33E-03
NO _x	11.44	8	6	10	6	312	0.20	3.36E-03
SO ₂ ⁴	0.32	8	6	10	6	312	0.01	9.33E-05
VOC	5.69	8	6	10	6	312	0.10	1.67E-03
Deep Wells³								
CO	14.74	8	8	10	6	312	0.26	3.25E-03
NO _x	11.44	8	8	10	6	312	0.20	2.52E-03
SO ₂ ⁴	0.32	8	8	10	6	312	0.01	7.00E-05
VOC	5.69	8	8	10	6	312	0.10	1.25E-03

¹ AP-42 (EPA, 1985), Volume II Mobile Sources. Heavy duty diesel engine powered trucks, high altitude, 20 mph, "aged" with 50,000 miles, 1997+ model.

² For medium wells calculated as lb/well / 6 days/well / 10 hours/day. For deep wells calculated as lb/well / 8 days/well / 10 hours/day.

³ Medium wells refer to a depth of 2,500' - 9,999' and deep wells refer to a depth of 10,000 and deeper, as defined by the proponent.

⁴ The SO₂ emission factor is calculated assuming 10 mpg fuel consumption, with 0.05% sulfur content of #2 diesel fuel, and fuel density of 7.001 lb/gal.

Table 2.1.10
 Seminole Road Emissions Inventory
 Completion Engines



605 Skyline Drive
 Laramie, WY 82070
 Phone: (307) 742-3843
 Fax: (307) 745-8317

Project: Seminole Road
 Phase: Completion
 Activity: Diesel Combustion Emissions
 from Completion Engines
 Engineer: Cassidy Marshall
 Date: 4/5/2004

Pollutant	Pollutant Emission Factor ¹	Total Horsepower All Engines	Overall Load Factor ²	Drilling Activity Duration	Drilling Activity Duration	Drilling Activity Duration	Drilling Activity Duration	Emissions	Emissions
	(lb/hp-hr)	(hp)		(days/well)	(hours/day)	(days/week)	(days/year)	(lb/well)	(lb/hr/well)
Medium Engines³									
CO	0.00668	350	0.42	6	10	6	312	59.27	0.99
NOx	0.031	350	0.42	6	10	6	312	275.05	4.58
SO ₂ ⁴	0.00205	350	0.42	6	10	6	312	18.19	0.30
VOC	0.0025	350	0.42	6	10	6	312	22.18	0.37
PM ₁₀ ⁵	0.0022	350	0.42	6	10	6	312	19.52	0.33
Deep Engines³									
CO	0.00668	350	0.42	8	10	6	312	79.02	0.99
NOx	0.031	350	0.42	8	10	6	312	366.73	4.58
SO ₂ ⁴	0.00205	350	0.42	8	10	6	312	24.25	0.30
VOC	0.0025	350	0.42	8	10	6	312	29.58	0.37
PM ₁₀ ⁵	0.0022	350	0.42	8	10	6	312	26.03	0.33

¹ AP-42 (EPA, 1996), Section 3.3, "Gasoline and Diesel Industrial Engines. Table 3.3-1, "Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines."

² The overall load factor is calculated based on average throttle setting of 65% and a load factor of 65%.
 Therefore, the overall load factor = 0.65 * 0.65 = 0.42.

³ Medium wells refer to a depth of 2,500' - 9,999' and deep wells refer to a depth of 10,000 and deeper, as defined by the proponent.

⁴ The SO₂ emission factor is calculated assuming 26.4 gal/hr fuel consumption, with 0.05% sulfur content of #2 diesel fuel, and fuel density of 7.001 lb/gal. Fuel Consumption rate taken from "Caterpillar's Oilfield Mechanical Rig Power specification sheets".

⁵ PM2.5 assumed equivalent to PM10 for drilling engines.

Table B2.1.11
 Seminoe Road Emissions Inventory
 Utility Installation



605 Skyline Drive
 Laramie, WY 82070
 Phone: (307) 742-3843
 Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Utility Installation
 Activity: Fugitive Particulate Emissions from
 Utility Installation
 Engineer: Cassady Marshall
 Date: 4/5/2004

Utility Area ¹	Construction Activity TSP Emission Factor ²	Installation Activity Duration ³	Installation Activity Duration	Installation Activity Duration	Installation Activity Duration ⁴	Emission Control Efficiency	PM-10 Emissions (controlled) ⁵	PM-2.5 Emissions (controlled) ⁵
(acres)	(tons/acre-month)	(days/pad)	(hours/day)	(day/week)	(months/year)	(%)	(lb/pad)	(lb/pad)
1.7576	1.2	4	10	7	8	0	202.47	53.43
Utility Installation Construction Emissions (lb/day/well)							50.62	13.36
Utility Installation Construction Emissions (lb/hr/well)							5.06	1.34

¹ Utility Area = 0.58 mi/well x 25-ft ROW = 1.1212 acres. Includes pipeline and electricity installation.
² AP-42 (EPA, 1995), Section 13.2.3, "Heavy Construction Operations".
³ Days per well estimated by TRC.
⁴ Construction occurs 8 months per year, March -October.
⁵ AP-42 (EPA, 1998), Section 13.2.2 "Unpaved Roads", Background Document. Assuming that 36% of the TSP is in the PM₁₀
 size range, monthly emissions converted to daily and hourly emissions based on 30-day month.
 AP-42 (EPA, 1998), Section 13.2.2 "Unpaved Roads", Background Document. Assuming that 9.5% of the TSP is in the PM_{2.5}
 size range, monthly emissions converted to daily and hourly emissions based on 30-day month.

Table B2.1.12
Seminole Road Emissions Inventory
Utility Installation Traffic



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
Phase: Utility Installation
Activity: Fugitive Particulate Emissions from
Traffic on Resource Roads
Engineer: Cassidy Marshall
Date: 4/5/2004

Vehicle Type	Average Vehicle Weight	Average Vehicle Speed	Silt Content ¹	Moisture Content ²	Vehicle Miles Traveled (VMT)	Construction Activity Duration	Construction Activity Duration	Construction Activity Duration ³	Emission Control Efficiency	PM-10 Emission Factor ⁴	PM-2.5 Emission Factor ⁴	PM-10 Emissions ⁵ (controlled)	PM-2.5 Emissions ⁵ (controlled)
	(lb)	(mph)	(%)	(%)	(VMT/well)	(hours/day)	(day/week)	(months/year)	(%)	(lb/VMT)	(lb/VMT)	(lb/well)	(lb/well)
Fuel Trucks	40,000	25	5.1	2.4	8	10	7	8	0	1.63	0.25	13.05	2.00
Supply Trucks	40,000	25	5.1	2.4	8	10	7	8	0	1.63	0.25	13.05	2.00
Light trucks/pickups	7,000	25	5.1	2.4	108	10	7	8	0	0.51	0.08	55.06	8.23
Utility Installation Construction Emissions (lb/well)												81.15	12.23
Utility Installation Construction Emissions (lb/hr/well) ⁶												2.03	0.31

¹ AP-42 (EPA, 1998), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

² AP-42 (EPA, 1998), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

³ Construction occurs 8 months per year, March -October.

⁴ AP-42 (EPA, 2003), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

⁵ Calculated as lb/VMT x VMT/pad x control efficiency.

⁶ Calculated as lb/well / 4 days/well / 10 hours/day, and represents emissions for 4-mile segment of road.

Table B2.1.13
Seminole Road Emissions Inventory
Utility Installation Heavy Equipment



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
Phase: Utility Installation
Activity: Diesel Combustion
Emissions from Heavy
Equipment Tailpipes
Engineer: Cassidy Marshall
Date: 4/5/2004

Heavy Equipment	Engine Horsepower (hp)	Number Required	Operating Load Factor	Pollutant Emission Factor ¹					Construction Activity Duration ² (days/ equipment type)	Construction Activity Duration (hours/day)	Construction Activity Duration (day/week)	Construction Activity Duration ³ (months/year)	Pollutant Emissions					Pollutant Emissions ⁴				
				CO	NO _x	SO ₂	VOC	PM ₁₀					CO	NO _x	SO ₂	VOC	PM ₁₀ ⁵	CO	NO _x	SO ₂	VOC	PM ₁₀ ⁵
Motor Grader	135	1	0.4	1.54	7.14	0.874	0.36	0.625	1	10	7	8	1.83	8.50	1.04	0.43	0.74	0.18	0.85	0.10	0.04	0.07
D8 Dozer ⁶	285	1	0.4	2.15	7.81	0.851	0.75	0.692	2	10	7	8	10.81	39.26	4.28	3.77	3.48	0.54	1.96	0.21	0.19	0.17
Backhoe	128	1	0.4	7.34	11.91	0.851	1.76	1.27	1	10	7	8	8.29	13.44	0.96	1.99	1.43	0.83	1.34	0.10	0.20	0.14
Total Heavy Equipment Tailpipe Emissions													20.93	61.20	6.28	6.19	5.66	1.55	4.16	0.41	0.43	0.39

¹ AP-42 (EPA, 1985), Volume II Mobile Sources.

² Construction activity duration estimated by TRC.

³ Construction occurs 8 months per year, March -October.

⁴ Calculated as lb/well / days/equipment type / 10 hours/day.

⁵ PM-2.5 assumed equivalent to PM-10 for combustion sources.

⁶ Emission factor for track-type tractor.

Table B2.1.14
 Seminole Road Emissions Inventory
 Wind Erosion



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
 Phase: Well Pad, Resource Road,
 Utility Construction
 Activity: Wind Erosion
 Engineer: Cassidy Marshall
 Date: 4/5/2004

Emission Factor : 0.3534 lb/hr/100m² Based on AP-42 Chapter 13.2.5, Industrial Wind Erosion
 using Rawlins, Wyoming meteorological data.

Control Efficiency: 0 %

Disturbed Area:

Well Pad Construction: 2.20 acres 8903.40 m²
 Resource Road Construction: 2.46 acres 9958.07 m² (based on 35' ROW road width, 0.58 mile section per well)
 Utility Installation 1.76 acres 7112.91 m² (based on 25' ROW road width, 0.58 mile section per well)

PM-10 Emissions Calculations:

	PM-10 Emission Factor (lb/hr/100 m ²)	PM-2.5 Emission Factor (lb/hr/100 m ²)	Area/100 (100 m ²)	Control Efficiency (%)	PM-10 Emissions (lb/hr)	PM-2.5 Emissions (lb/hr)	PM-10 Emissions (g/sec)	PM-2.5 Emissions (g/sec)
Well Pad Construction	0.3534	0.1414	89.03	0	31.47	12.59	3.96	1.59
Resource Road Construction	0.3534	0.1414	99.58	0	35.19	14.08	4.43	1.77
Utility	0.3534	0.1414	71.13	0	25.14	10.05	3.17	1.27

Table B2.1.15
 Seminole Road Emissions Inventory
 Wind Erosion Output

rawl2003

COMPUTATION OF WIND EROSION EMISSIONS (version 93037)
 BASED ON AP-42 SECTION 13.2.5 INDUSTRIAL WIND EROSION

EXAMINE COMPUTED EMISSIONS FOR DISTURBANCE FREQUENCY --
 COMPUTATION ASSUMES DISTURBANCE EVERY HOUR

Particle Size (1=TSP, 2=PM10): 2
 Anemometer Ht (m): 10.00
 Threshold Friction Velocity (m/sec): 1.02
 Stockpile or Exposed Surface Area (m2): 100.
 Surface Type (1=Flat, 2=Stockpile): 1
 Correction Factor: 1.000

YR	MO	DAY	HR	ANEM WIND SPEED (m/sec)	THRESHOLD FRICTION VELOCITY (m/sec)	FRICTION VELOCITY @SURFACE (m/sec)	POTENTIAL EMISSION (lb)	POTENTIAL EMISSIONS (g/sec)	
3	2	10	6	6	17	1.02	1.0812	0.1926	0.0243
3	2	16	19	19	19	1.02	1.2084	0.7461	0.094
3	3	5	18	17.5	17.5	1.02	1.113	0.3116	0.0393
3	3	5	19	17	17	1.02	1.0812	0.1926	0.0243
3	3	5	20	17	17	1.02	1.0812	0.1926	0.0243
3	3	5	21	17.5	17.5	1.02	1.113	0.3116	0.0393
3	3	5	22	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	6	4	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	6	5	17.5	17.5	1.02	1.113	0.3116	0.0393
3	3	6	14	18.5	18.5	1.02	1.1766	0.5883	0.0741
3	3	6	15	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	6	16	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	8	13	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	8	14	17	17	1.02	1.0812	0.1926	0.0243
3	3	8	17	17.5	17.5	1.02	1.113	0.3116	0.0393
3	3	10	18	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	4	1	12	18.5	18.5	1.02	1.1766	0.5883	0.0741
3	4	1	13	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	4	1	16	17.5	17.5	1.02	1.113	0.3116	0.0393
3	4	2	12	18	18	1.02	1.1448	0.4435	0.0559
3	4	2	16	17	17	1.02	1.0812	0.1926	0.0243
3	9	12	16	17	17	1.02	1.0812	0.1926	0.0243
3	9	16	14	17.5	17.5	1.02	1.113	0.3116	0.0393
3	10	27	10	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	10	28	18	17	17	1.02	1.0812	0.1926	0.0243
3	10	28	19	20.6	20.6	1.02	1.3102	1.3379	0.1686
3	10	28	21	20.6	20.6	1.02	1.3102	1.3379	0.1686
3	10	28	22	18	18	1.02	1.1448	0.4435	0.0559
3	10	28	23	20.1	20.1	1.02	1.2784	1.1387	0.1435
3	10	28	24	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	10	29	2	18.5	18.5	1.02	1.1766	0.5883	0.0741
3	10	29	9	17.5	17.5	1.02	1.113	0.3116	0.0393
3	10	29	11	18.5	18.5	1.02	1.1766	0.5883	0.0741
3	11	11	10	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	11	11	11	18	18	1.02	1.1448	0.4435	0.0559

Table B2.1.15
 Seminole Road Emissions Inventory
 Wind Erosion Output

3	11	11	12	18.5	1.02	1.1766	0.5883	0.0741
3	11	18	12	18.5	1.02	1.1766	0.5883	0.0741
3	11	18	13	17	1.02	1.0812	0.1926	0.0243
3	12	13	20	16.5	1.02	1.0494	0.0865	0.0109
3	12	17	8	16.5	1.02	1.0494	0.0865	0.0109
3	12	17	9	18	1.02	1.1448	0.4435	0.0559
3	12	26	20	17	1.02	1.0812	0.1926	0.0243
3	12	30	1	18	1.02	1.1448	0.4435	0.0559
3	12	30	2	18.5	1.02	1.1766	0.5883	0.0741
3	12	30	3	18.5	1.02	1.1766	0.5883	0.0741
3	12	30	4	16.5	1.02	1.0494	0.0865	0.0109
3	12	30	5	16.5	1.02	1.0494	0.0865	0.0109

16.5

16.6101 total/hr
 0.353406 average lb/hr

when ws>16.5 mph

Table B2.2.1
 Seminoe Road Emissions Inventory
 Production Traffic



605 Skyline Drive
 Laramie, WY 82070
 Phone: (307) 742-3843
 Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Production Traffic
 Activity: Fugitive Particulate Emissions
 from Production Traffic
 Engineer: Cassady Marshall
 Date: 4/5/2004

Vehicle Type	Average Vehicle Weight (lb)	Average Vehicle Speed (mph)	Silt Content ¹ (%)	Moisture Content ² (%)	Vehicle Miles Traveled (VMT/well)	Emission Control Efficiency (%)	PM-10 Emission Factor ³ (lb/VMT)	PM-2.5 Emission Factor ³ (lb/VMT)	PM-10 Emissions ⁴ (lb/well/yr)	PM-2.5 Emissions ⁴ (lb/well/yr)
Supply Trucks	40,000	25	5.1	2.4	25	0	1.63	0.25	40.77	6.25
Light trucks/ pickups	7,000	25	5.1	2.4	1,035	0	0.51	0.08	527.67	78.85
Total Resource Road Emissions (lb/well/yr)									568.44	85.10

¹ AP-42 (EPA, 1998), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."
² AP-42 (EPA, 1998), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."
³ AP-42 (EPA, 2003), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.
⁴ Calculated as lb/VMT x VMT/well x control efficiency.

Table B2.2.2
 Seminoe Road Emissions Inventory
 Production Traffic Heavy Equipment



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Production Traffic
 Activity: Diesel Combustion
 Emissions from Haul
 Truck Tailpipes
 Engineer: Cassady Marshall
 Date: 4/5/2004

Pollutant	Pollutant Emission Factor ¹ (grams/mi)	Annual Well VMT (mi/well/yr)	Hourly Emissions Single Well (lb/hr)	Annual Emissions Single Well (tpy)
CO	14.74	25.00	9.27E-05	4.06E-04
NO _x	11.44	25.00	7.20E-05	3.15E-04
SO ₂ ²	0.32	25.00	2.02E-06	8.85E-06
VOC	5.69	25.00	3.58E-05	1.57E-04

¹AP-42 (EPA, 1985), Table 2.7.1 "Volume II Mobile Sources." Heavy duty diesel engine powered trucks, high altitude, 20 mph, "aged" with 50,000 miles, 1997+ model.

² The SO₂ emission factor is calculated assuming 10 mpg fuel consumption, with 0.05% sulfur content of #2 diesel fuel, and fuel density of 7.08 lb/gal.

Table B2.2.3
 Seminole Road Emissions Inventory
 Down-hole Pumps



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
 Phase: Production
 Activity: Water Pumps
 Engineer: Cassady Marshall
 Date: 4/5//2004

Fuel Combustion Source

Unit Description Downhole de-watering pump engine
 Engine design (hp) 100

Emission Data

	(lb/hr)	(tpy)	Emission Factor	Units
Nitrogen oxides	0.2	1.0	1.0	g/hp-hr
Carbon monoxide	0.7	3.0	3.0	g/hp-hr
VOC	0.2	1.0	1.0	g/hp-hr
Formaldehyde	0.0010	0.0500	0.05	g/hp-hr

Downhole pumps installed during completion for CBM wells and remain for life of well.
 Natural gas fired.

Table B2.2.4
Seminoe Road Emissions Inventory
Wells Outside of Electrification Boundary by Year



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminoe Road
Phase: Production
Activity: Well outside Electrification
Boundary
Engineer: Cassidy Marshall
Date: 4/5/2004

Wells outside of electrification Boundary

Year	Number of Wells
2004	--
2005	16
2006	13
2007	11
2008	26
2009	9
2010	3
2011	15
2012	0
2013	0
2014	0

Table B2.2.5
 Seminole Road Emissions Inventory
 Seminole Road Compressor Station #1



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
 Phase: Production
 Activity: Emissions from C.S.
 Engineer: Cassidy Marshall
 Date: 4/5/2004

Fuel Combustion Source

Unit Description	Seminole Road Compressor Station 1
Engine design (hp)	2,680

Stack Parameters

Height	24	ft
Temperature	750	F
Diameter	1.3	ft
Velocity	89.6	ft/s

Emission Data

	(lb/hr)	(tpy)	Data Source	Emission Factor	Units
PM10	0.0	0.0	Permit CT-2833	--	
PM2.5	0.0	0.00	Permit CT-2833	--	
Sulfur dioxide	0.0	0.0	Permit CT-2833	--	
Nitrogen oxides	8.8	38.6	Permit CT-2833	1.5	g/hp-hr
Carbon monoxide	3.0	13.2	Permit CT-2833	0.5	g/hp-hr
VOC	6.0	26.2	Permit CT-2833	1	g/hp-hr
Formaldehyde	0.4	1.8	Permit CT-2833	0.07	g/hp-hr

Table B2.2.6
 Seminole Road Emissions Inventory
 Seminole Road Compressor Station #2



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminole Road
 Phase: Production
 Activity: Emissions from C.S.
 Engineer: Cassady Marshall
 Date: 4/5/2004

Fuel Combustion Source

Unit Description Seminole Road Compressor Station 2
 Engine design (hp) 2,680

Stack Parameters

Height 24 ft
 Temperature 750 F
 Diameter 1.3 ft
 Velocity 89.6 ft/s

Emission Data

	(lb/hr)	(tpy)	Data Source	Emission Factor	Units
PM10	0.0	0.0	Permit CT-2833	--	
PM2.5	0.0	0.00	Permit CT-2833	--	
Sulfur dioxide	0.0	0.0	Permit CT-2833	--	
Nitrogen oxides	8.8	38.6	Permit CT-2833	1.5	g/hp-hr
Carbon monoxide	3.0	13.2	Permit CT-2833	0.5	g/hp-hr
VOC	6.0	26.2	Permit CT-2833	1	g/hp-hr
Formaldehyde	0.4	1.8	Permit CT-2833	0.07	g/hp-hr

Table B2.2.7
 Seminoe Road Emissions Inventory
 Seminoe Road Compressor Station #3



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Production
 Activity: Emissions from C.S.
 Engineer: Cassady Marshall
 Date: 4/5/2004

Fuel Combustion Source

Unit Description Seminoe Road Compressor Station 3
 Engine design (hp) 2,680

Stack Parameters

Height 24 ft
 Temperature 750 F
 Diameter 1.3 ft
 Velocity 89.6 ft/s

Emission Data

	(lb/hr)	(tpy)	Data Source	Emission Factor	Units
PM10	0.0	0.0	Permit CT-2833	--	
PM2.5	0.0	0.00	Permit CT-2833	--	
Sulfur dioxide	0.0	0.0	Permit CT-2833	--	
Nitrogen oxides	8.8	38.6	Permit CT-2833	1.5	g/hp-hr
Carbon monoxide	3.0	13.2	Permit CT-2833	0.5	g/hp-hr
VOC	6.0	26.2	Permit CT-2833	1	g/hp-hr
Formaldehyde	0.4	1.8	Permit CT-2833	0.07	g/hp-hr

Table B2.2.8
 Seminoe Road Emissions Inventory
 Wind Erosion



605 Skyline Drive
Laramie, WY 82070
Phone: (307) 742-3843
Fax: (307) 745-8317

Project: Seminoe Road
 Phase: Production
 Activity: Wind Erosion
 Engineer: Cassady Marshall
 Date: 4/5/2004

Emission Factor : 0.3534 lb/hr/100m² Based on AP-42 Chapter 13.2.5, Industrial Wind Erosion
 Rawlins, Wyoming meteorological data.

Control Efficiency: 0 %

Disturbed Area:

Well Pad Production: 1.2 acres 4856.40 m²

PM-10 Emissions Calculations:

	PM-10	PM-2.5	Area/100	Control	PM-10	PM-2.5	PM-10	PM-2.5
	Emission Factor	Emission Factor		Efficiency	Emissions	Emissions	Emissions	Emissions
	(lb/hr/100 m ²)	(lb/hr/100 m ²)	(100 m ²)	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)
Well Pad Production	0.3534	0.1414	48.56	0	17.16	6.87	2.16	0.87

Table B2.2.9
 Seminole Road Emissions Inventory
 Wind Erosion Output

rawl2003

COMPUTATION OF WIND EROSION EMISSIONS (version 93037)
 BASED ON AP-42 SECTION 13.2.5 INDUSTRIAL WIND EROSION

EXAMINE COMPUTED EMISSIONS FOR DISTURBANCE FREQUENCY --
 COMPUTATION ASSUMES DISTURBANCE EVERY HOUR

Particle Size (1=TSP, 2=PM10): 2
 Anemometer Ht (m): 10.00
 Threshold Friction Velocity (m/sec): 1.02
 Stockpile or Exposed Surface Area (m2): 100.
 Surface Type (1=Flat, 2=Stockpile): 1
 Correction Factor: 1.000

YR	MO	DAY	HR	ANEM WIND SPEED (m/sec)	THRESHOLD FRICTION VELOCITY (m/sec)	FRICTION VELOCITY @SURFACE (m/sec)	POTENTIAL EMISSION (lb)	POTENTIAL EMISSIONS (g/sec)	
3	2	10	6	6	17	1.02	1.0812	0.1926	0.0243
3	2	16	19	19	19	1.02	1.2084	0.7461	0.094
3	3	5	18	17.5	17.5	1.02	1.113	0.3116	0.0393
3	3	5	19	17	17	1.02	1.0812	0.1926	0.0243
3	3	5	20	17	17	1.02	1.0812	0.1926	0.0243
3	3	5	21	17.5	17.5	1.02	1.113	0.3116	0.0393
3	3	5	22	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	6	4	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	6	5	17.5	17.5	1.02	1.113	0.3116	0.0393
3	3	6	14	18.5	18.5	1.02	1.1766	0.5883	0.0741
3	3	6	15	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	6	16	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	8	13	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	3	8	14	17	17	1.02	1.0812	0.1926	0.0243
3	3	8	17	17.5	17.5	1.02	1.113	0.3116	0.0393
3	3	10	18	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	4	1	12	18.5	18.5	1.02	1.1766	0.5883	0.0741
3	4	1	13	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	4	1	16	17.5	17.5	1.02	1.113	0.3116	0.0393
3	4	2	12	18	18	1.02	1.1448	0.4435	0.0559
3	4	2	16	17	17	1.02	1.0812	0.1926	0.0243
3	9	12	16	17	17	1.02	1.0812	0.1926	0.0243
3	9	16	14	17.5	17.5	1.02	1.113	0.3116	0.0393
3	10	27	10	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	10	28	18	17	17	1.02	1.0812	0.1926	0.0243
3	10	28	19	20.6	20.6	1.02	1.3102	1.3379	0.1686
3	10	28	21	20.6	20.6	1.02	1.3102	1.3379	0.1686
3	10	28	22	18	18	1.02	1.1448	0.4435	0.0559
3	10	28	23	20.1	20.1	1.02	1.2784	1.1387	0.1435
3	10	28	24	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	10	29	2	18.5	18.5	1.02	1.1766	0.5883	0.0741
3	10	29	9	17.5	17.5	1.02	1.113	0.3116	0.0393
3	10	29	11	18.5	18.5	1.02	1.1766	0.5883	0.0741
3	11	11	10	16.5	16.5	1.02	1.0494	0.0865	0.0109
3	11	11	11	18	18	1.02	1.1448	0.4435	0.0559

Table B2.2.9
 Seminole Road Emissions Inventory
 Wind Erosion Output

3	11	11	12	18.5	1.02	1.1766	0.5883	0.0741
3	11	18	12	18.5	1.02	1.1766	0.5883	0.0741
3	11	18	13	17	1.02	1.0812	0.1926	0.0243
3	12	13	20	16.5	1.02	1.0494	0.0865	0.0109
3	12	17	8	16.5	1.02	1.0494	0.0865	0.0109
3	12	17	9	18	1.02	1.1448	0.4435	0.0559
3	12	26	20	17	1.02	1.0812	0.1926	0.0243
3	12	30	1	18	1.02	1.1448	0.4435	0.0559
3	12	30	2	18.5	1.02	1.1766	0.5883	0.0741
3	12	30	3	18.5	1.02	1.1766	0.5883	0.0741
3	12	30	4	16.5	1.02	1.0494	0.0865	0.0109
3	12	30	5	16.5	1.02	1.0494	0.0865	0.0109

16.5

16.6101 total/hr
 0.353406 average lb/hr

when ws>16.5 mph