### **APPENDIX B:**

#### PROJECT EMISSIONS INVENTORIES

#### **APPENDIX B**

The following is a list of the tables included within this appendix.

### **B.1.0 CONSTRUCTION EMISSION TABLES**

Emissions listed in the construction emission tables are for all construction scenarios unless otherwise specified.

- B.1.1 Well Pad Construction 1 Well per Pad
- B.1.2 Resource Road Construction
- B.1.3 Well Pad/Resource Road Traffic
- B.1.4 Well Pad/Resource Road Heavy Equipment Tailpipe
- B.1.5 Rig Move and Drilling Traffic Straight Drilling
- B.1.6 Rig Move and Drilling Haul Truck Tailpipe –Straight Drilling
- B.1.7 Drilling Emissions AP-42 Straight Drilling
- B.1.8 Drilling Emissions Tier 1 Straight Drilling
- B.1.9 Drilling Emissions Tier 2 Straight Drilling
- B.1.10 Completion/Testing Traffic
- B.1.11 Completion/Testing Heavy Equipment Tailpipe
- B.1.12 Completion Flaring
- B.1.13 Pipeline Construction
- B.1.14 Pipeline Construction Traffic
- B.1.15 Pipeline Heavy Equipment Tailpipe
- B.1.16 Construction Wind Erosion 1 Well per Pad

The following tables show construction emissions for the multiple well pad scenarios. Emissions are only shown if the multiple well pad scenario varies from the single well pad scenarios.

B.1.17 Well Pad/Resource Road Construction - 2 Wells per Pad

B.1.18 Well Pad/Resource Road Construction - 5 Wells per Pad

- B.1.19 Well Pad/Resource Road Construction 10 Wells per Pad
- B.1.20 Rig Move and Drilling Traffic Directional Drilling
- B.1.21 Rig Move and Drilling Haul Truck Tailpipe Directional Drilling
- B.1.22 Drilling Emission AP-42 Directional Drilling
- B.1.23 Drilling Emissions Tier 1 Directional Drilling
- B.1.24 Drilling Emissions Tier 2 Directional Drilling
- B.1.25 Wind Erosion 2 Wells per Pad
- B.1.26 Wind Erosion 5 Wells per Pad
- B.1.27 Wind Erosion 10 Wells per Pad

### **B.2.0 PRODUCTION EMISSION TABLES**

Emissions listed in the production emission tables are for all production scenarios unless otherwise specified.

- B.2.1 Production Traffic 1 Well per Pad
- B.2.2 Production Heavy Equipment Tailpipe 1 Well per Pad
- B.2.3 Indirect Heater
- B.2.4 Separator Heater
- B.2.5 Dehydrator Reboiler Heater
- B.2.6 Dehydrator Flashing
- B.2.7 Fugitive HAPs and VOC
- B.2.8 Condensate Storage Tank
- B.2.9 Jonah Water Disposal Well
- B.2.10 Bird Canyon Compressor Station
- B.2.11 Falcon Compressor Station
- B.2.12 Gobblers Knob Compressor Station
- B.2.13 Jonah Compressor Station
- B.2.14 Luman Compressor Station
- **B.2.15** Paradise Compressor Station
- B.2.16 Wind Erosion 1 Well per Pad

The following tables show production emissions for the multiple well pad scenarios. Emissions are only shown if the multiple well pad scenario varies from the single well pad scenarios.

- B.2.17 Production Traffic 2 Wells per Pad
- B.2.18 Production Traffic 5 Wells per Pad
- B.2.19 Production Traffic 10 Wells per Pad
- B.2.20 Wind Erosion 2 Wells per Pad
- B.2.21 Wind Erosion 5 Wells per Pad
- B.2.22 Wind Erosion 10 Wells per Pad

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# Table B.1.1Well Pad Construction - 1 Well per Pad

TRC Environ 605 Skyline E Laramie, WY Phone: (307) Fax: (307)	mental Corporation Drive 82070 ) 742-3843 ) 745-8317			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drillin 1 well per pad Well Pad Construc Fugitive Particula Well Pad Construc 3/24/2004	g Project ction te Emissions from ction
Well Pad Area	Construction Activity TSP Emission Factor <sup>1</sup>	Construction Activity Duration	Construction Activity Duration	Emission Control Efficiency	PM <sub>10</sub> Emissions (controlled) <sup>2</sup>	PM <sub>2.5</sub> Emissions (controlled) <sup>3</sup>
(acre)	(tons/acre-month)	(days/well pad)	(hours/day)	(%)	(lb/well)	(lb/well)
3.8	1.2	4	10	50	218.88	57.76
		Well Pac	d Construction Emis	sions (lb/day/well)	54.72	14.44
		Well Pa	ad Construction Emi	issions (lb/hr/well)	5.47	1.44
<ol> <li>AP-42 (EP/ <sup>2</sup> AP-42 (EP/ size range,</li> <li><sup>3</sup> AP-42 (EP/ size range,</li> </ol>	A 2004), Section 13.2.3, "H A 2004), Section 13.2.2 "Ur monthly emissions convert A 2004), Section 13.2.2 "Ur monthly emissions convert	eavy Construction Operat paved Roads", Backgrour ed to daily and hourly emi paved Roads", Backgrour ed to daily and hourly emi	ions"; TSP = total so nd Document. Assu ssions based on 30 nd Document. Assu ssions based on 30	uspended particulat ming that 36% of th -day month. ming that 9.5% of th -day month.	tes. le TSP is in the PM ne TSP is in the PM	10 2.5

### Table B.1.2Resource Road Construction

TRC Environment 605 Skyline Drive Laramie, WY 8207 Phone: (307) 742 Fax: (307) 745	al Corporation 70 2-3843 -8317			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drillin All Scenarios Resource Road C Fugitive Particula from Resource Ro 3/24/2004	g Project onstruction te Emissions oad Construction
Resource Road Area <sup>1</sup>	Construction Activity TSP Emission Factor <sup>2</sup>	Construction Activity Duration	Construction Activity Duration	Emission Control Efficiency	PM <sub>10</sub> Emissions (controlled) <sup>3</sup>	PM <sub>2.5</sub> Emissions (controlled) <sup>4</sup>
(acres)	(tons/acre-month)	(days/pad)	(hours/day)	(%)	(lb/pad)	(lb/pad)
1.3455	1.2	4	10	50	77.50	20.45
	Resource Road C	Construction Emissions	(lb/day/pad resou	rce road segment)	19.38	5.11
	Resource Road	Construction Emissior	ns (lb/hr/pad resou	rce road segment)	1.94	0.51
<ol> <li><sup>1</sup> Construction Are</li> <li><sup>2</sup> AP-42 (EPA 200 <sup>3</sup> AP-42 (EPA 200 size range, mont</li> <li><sup>4</sup> AP-42 (EPA 200 size range, mont</li> </ol>	ea = 0.15-mi x 74-ft ROW = 1 04), Section 13.2.3, "Heavy C 04), Section 13.2.2 "Unpaved thly emissions converted to c 04), Section 13.2.2 "Unpaved thly emissions converted to c	I.3455 acres; TSP = to Construction Operations I Roads", Background laily and hourly emissio Roads", Background I laily and hourly emissio	tal suspended par s". Document. Assum ons based on 30-d Document. Assumi ons based on 30-d	ticulates. ing that 36% of the ay month. ing that 9.5% of the ay month.	TSP is in the $PM_{10}$ TSP is in the $PM_{2,1}$	5

### Table B.1.3Well Pad/Resource Road Traffic

		605 Skyline Drive     Scenario: All S       Laramie, WY 82070     Activity: Well       Phone: (307) 742-3843     Emissions: Fugi       Fax: (307) 745-8317     from										
Dust Control Method	Average Vehicle Weight (lb)	Average Vehicle Speed (mph)	Silt Content <sup>1</sup>	Moisture Content <sup>2</sup>	Round Trips (RTs)	RT Distance (miles)	Vehicle Miles Traveled (VMT) <sup>3</sup> (VMT/pad)	Emission Control Efficiency (%)	PM <sub>10</sub> Emission Factor <sup>4</sup>	PM <sub>2.5</sub> Emission Factor <sup>4</sup>	PM <sub>10</sub> Emissions <sup>5</sup> (controlled) (lb/pad)	PM <sub>2.5</sub> Emissions <sup>5</sup> (controlled) (lb/pad)
	(12)	(p.i)	(70)	(70)	(itti)pad)	(111100)	(1111)pad)	(70)	(15, 1111)	(, )	(10) (10)	(10) poor
magnesium chloride	35,000	20	5.1	2.4	8	14	112	85	1.54	0.24	25.80	3.96
water	35,000	15	5.1	2.4	8	5	40	50	1.54	0.24	30.71	4.71
magnesium chloride	7,000	30	5.1	2.4	12	14	168	85	0.56	0.08	14.08	2.10
water	7,000	20	5.1	2.4	12	5	60	50	0.46	0.07	13.68	2.04
							Total Unpa	ved Road T	raffic Emiss	ions (lb/pad)	84.27	12.81
							Total Unpaved	Road Traff	c Emissions	s (lb/hr/pad) <sup>6</sup>	2.11	0.32
	magnesium chloride water magnesium chloride water -1, "Typical Silt Conter s, "Typical Values for C 'ehicle Type x Round T .2 "Unpaved Roads", e	magnesium chloride 35,000 water 35,000 magnesium chloride 7,000 water 7,000 water 7,000 -1, "Typical Silt Content Values of s, "Typical Values for Correction Fa 'ehicle Type x Round Trip Distance .2 "Unpaved Roads", equations 1a	<ul> <li>(ib) (inpin)</li> <li>magnesium chloride 35,000 20</li> <li>water 35,000 15</li> <li>magnesium chloride 7,000 30</li> <li>water 7,000 20</li> <li>-1, "Typical Silt Content Values of Surface Mater, "Typical Values for Correction Factors Applied (ehicle Type x Round Trip Distance.</li> <li>.2 "Unpaved Roads", equations 1a and 1b.</li> </ul>	<ul> <li>(iii) (inpri) (vo)</li> <li>magnesium chloride 35,000 20 5.1</li> <li>water 35,000 15 5.1</li> <li>magnesium chloride 7,000 30 5.1</li> <li>water 7,000 20 5.1</li> <li>-1, "Typical Silt Content Values of Surface Material on In s, "Typical Values for Correction Factors Applicable to the fehicle Type x Round Trip Distance.</li> <li>.2 "Unpaved Roads", equations 1a and 1b.</li> </ul>	<ul> <li>(ii) (iiipii) (20) (20)</li> <li>magnesium chloride 35,000 20 5.1 2.4</li> <li>water 35,000 15 5.1 2.4</li> <li>magnesium chloride 7,000 30 5.1 2.4</li> <li>water 7,000 20 5.1 2.4</li> <li>vater 7,000 20 5.1 2.4</li> <li>-1, "Typical Silt Content Values of Surface Material on Industrial an s, "Typical Values for Correction Factors Applicable to the Predictive (ehicle Type x Round Trip Distance.</li> <li>.2 "Unpaved Roads", equations 1a and 1b.</li> </ul>	<ul> <li>(iii) (iiipii) (76) (76) (76) (77) (77)</li> <li>magnesium chloride 35,000 20 5.1 2.4 8</li> <li>water 35,000 15 5.1 2.4 8</li> <li>magnesium chloride 7,000 30 5.1 2.4 12</li> <li>water 7,000 20 5.1 2.4 12</li> <li>-1, "Typical Silt Content Values of Surface Material on Industrial and Rural U t, "Typical Silt Content Values of Surface Material on Industrial and Rural U</li> <li>, "Typical Values for Correction Factors Applicable to the Predictive Emissio (ehicle Type x Round Trip Distance.</li> <li>.2 "Unpaved Roads", equations 1a and 1b.</li> </ul>	(iii) (iiiipi) (70) (70) (Rinpad) (iiiies) magnesium chloride 35,000 20 5.1 2.4 8 14 water 35,000 15 5.1 2.4 8 5 magnesium chloride 7,000 30 5.1 2.4 12 14 water 7,000 20 5.1 2.4 12 5 -1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved F b, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved F c, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor If (ehicle Type x Round Trip Distance.	(iii)       (iiii)       (iiiiii)       (iiii)       (iiii)	(b)         (mpn)         (7e)         (7e)         (Fripad)         (miles)         (miles) </td <td>(b)         (inplit)         (%</td> <td>(b)         (mpn)         (%)<!--</td--><td>(b)         (inpri)         (76)         (77)         (17)pady         (76)         (17)pady         (17)pady</td></td>	(b)         (inplit)         (%	(b)         (mpn)         (%) </td <td>(b)         (inpri)         (76)         (77)         (17)pady         (76)         (17)pady         (17)pady</td>	(b)         (inpri)         (76)         (77)         (17)pady         (76)         (17)pady         (17)pady

Table B.1.4Well Pad/Resource Road Heavy Equipment Tailpipe

TRC Environmental Corporation 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317												P Sce A Emis	roject: enario: ctivity: sions: Date:	Jonah All Sce Well P Diesel from H 3/24/20	Infill Di enarios ad/Rese Combu leavy E 004	rilling ource Istion Equipn	Project Emissi nent Ta	ons ilpipe:	5	
Heavy Equipment	Engine Horsepower	Number Required	Operating Load Factor <sup>1</sup>	Р	ollutan	t Emissio	on Fact	or <sup>2</sup>	Construction Activity Duration	Construction Activity Duration		Pollutar	nt Emiss	sions		ľ	Pollutar	ıt Emis	sions⁴	ı
	(hp)					(g/hp-hr)	)		(days/	(hours/day)			(lb/well)		-		(Ib	)/hr/we	II)	-
				CO	NO <sub>x</sub>	SO <sub>2</sub>	VOC	$PM_{10}$	equipment type	)	CO	NO <sub>x</sub>	SO <sub>2</sub>	VOC	PM <sub>10</sub> °	CO	NOx	SO <sub>2</sub>	VOC	PM <sub>10</sub> <sup>5</sup>
Scraper	700	2	0.4	2.45	7.46	0.901	0.55	0.789	4	10	120.99	368.40	44.49	27.16	38.96	3.02	9.21	1.11	0.68	0.97
Motor Grader	250	1	0.4	1.54	7.14	0.874	0.36	0.625	4	10	13.58	62.96	7.71	3.17	5.51	0.34	1.57	0.19	0.08	0.14
D8 Dozer <sup>3</sup>	210	1	0.4	2.15	7.81	0.851	0.75	0.692	2	10	7.96	28.93	3.15	2.78	2.56	0.40	1.45	0.16	0.14	0.13
						٦	⊺otal He	eavy Eq	uipment Tailpip	e Emissions	142.53	460.28	55.35	33.11	47.04	3.76	12.23	1.46	0.90	1.24

<sup>1</sup> Taken from "Surface Mining" (Pfleider 1972) for average service duty.

<sup>2</sup> AP-42 (EPA 1985), Volume II Mobile Sources.

<sup>3</sup> Emission factor for track-type tractor.

<sup>4</sup> Calculated as lb/well; days/equipment type; 10 hours/day.

 $^{5}$  PM<sub>2.5</sub> assumed equivalent to PM<sub>10</sub> for combustion sources.

TRC Environmenta 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3 Fax: (307) 745-8	I Corporation 3843 3317	orporation Project: Jonah Infill Drilling Project Scenario: Straight Drilling Activity: Rig Move and Drilling 3 Emissions: Fugitive Particulate Emissions from Traffic 7 on Unpaved Roads Date: 3/24/2004												
Vehicle Type	Road Type	Dust Control Method	Average Vehicle Weight (lb)	Average Vehicle Speed (mph)	Silt Content <sup>2</sup> (%)	Moisture Content <sup>3</sup> (%)	RTs per Well	RT Distance (miles)	VMT <sup>4</sup> (VMT/pad)	Emission Control Efficiency (%)	PM <sub>10</sub> Emission Factor <sup>5</sup> (lb/VMT)	PM <sub>2.5</sub> Emission Factor <sup>5</sup> (lb/VMT)	PM <sub>10</sub> Emissions <sup>6</sup> (controlled) (lb/well)	PM <sub>2.5</sub> Emissions <sup>6</sup> (controlled) (lb/well)
Semis-tractor/	Primary Access	magnesium	44,000	20	5.1	2.4	140	14	1,960	85	1.70	0.26	500.47	76.74
trailer/mud/water/ fuel/cement trucks <sup>1</sup>	Resource	chloride water	44,000	15	5.1	2.4	140	5	700	50	1.70	0.26	595.79	91.35
Logging/mud trucks	Primary Access	magnesium	48,000	20	5.1	2.4	10	14	140	85	1.77	0.27	37.18	5.70
	Resource	water	48,000	15	5.1	2.4	10	5	50	50	1.77	0.27	44.26	6.79
Roustabouts/welders	s/ Primary Access	magnesium	20,000	30	5.1	2.4	20	14	280	85	1.19	0.18	50.14	7.69
labor	Resource	water	20,000	20	5.1	2.4	20	5	100	50	1.19	0.18	59.69	9.15
Vendors/marketers/	Primary Access	magnesium	7,000	30	5.1	2.4	30	14	420	85	0.56	0.083	35.19	5.26
vanous	Resource	water	7,000	20	5.1	2.4	30	5	150	50	0.46	0.068	34.20	5.11
									Total Unpa	ved Road Tr	affic Emissi	ons (lb/well)	1,356.90	207.79
								Т	otal Unpaved	I Road Traffi	c Emissions	(lb/hr/well)7	2.57	0.39

Table B.1.5Rig Move and Drilling Traffic - Straight Drilling

<sup>1</sup> Semi vehicle weight range is 28,000-60,000 lbs; average weight of 44,000 lbs used for calculations.

<sup>2</sup> AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

<sup>3</sup> AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

<sup>4</sup> Calculated as Round Trips per Vehicle Type x Round Trip Distance.

<sup>5</sup> AP-42 (EPA 2004), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

<sup>6</sup> Calculated as lb/VMT x VMT/pad x control efficiency.

<sup>7</sup> Calculated as (lb/well); 22 days/well; 24 hours/day, and represents emissions for 9.5-mile segment of road. Total duration is 22 days for a vertical well, including rig move duration of 3 days per well.

#### Table B.1.6 **Rig Move and Drilling Haul Truck Tailpipe - Straight Drilling**

TRC Environment 605 Skyline Drive Laramie, WY 8207 Phone: (307) 742 Fax: (307) 745	tal Corporation 70 2-3843 -8317					Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drilling Straight Drilling Rig Move and Drill Diesel Combustior from Heavy Equipr 3/24/2004	g Project ing n Emissions nent Tailpipes
Pollutant	Pollutant Emission Factor <sup>1</sup>	Total Haul Truck RTs	RT Distance	Total Haul Truck Miles Traveled	Haul Activity Duration	Haul Activity Duration	Emissions	Emissions <sup>3</sup>
	(g/mile)	(RTs/well)	(miles/RT)	(miles/well)	(days/well)	(hours/day)	(lb/well)	(lb/hr/well)
со	14.74	170	19	3230	22	24	104.96	0.20
NO <sub>x</sub>	11.44	170	19	3230	22	24	81.46	0.15
SO <sub>2</sub> <sup>2</sup>	0.32	170	19	3230	22	24	2.26	0.0043
VUC	5.69	170	19	3230	22	24	40.52	0.08

<sup>1</sup> 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.
 <sup>2</sup> The SO<sub>2</sub> 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.

<sup>3</sup> Calculated as lb/well; 22 days/well; 24 hours/day.

Table B.1.7Drilling Emissions AP-42 - Straight Drilling

TRC Environmental CorporationProject: Jonah Infill Drilling Project605 Skyline DriveScenario: Straight DrillingLaramie, WY 82070Activity: DrillingPhone: (307) 742-3843Emissions: Diesel Combustion EmissionsFax: (307) 745-8317from Drilling Engines - EPA AP-42Date: 3/24/2004										
Pollutant	Pollutant Emission Factor <sup>1</sup> (lb/hp-hr)	Total Horsepower (hp) All Engines <sup>2</sup> (hp)	Overall Load Factor <sup>3</sup>	Drilling Activity Duration (days/well)	Drilling Activity Duration (hours/day)	Emissions (Ib/well)	Emissions (lb/hr/well)			
СО	0.00668	2,100	0.42	19	24	2,702.63	5.93			
NOx	0.031	2,100	0.42	19	24	12,542.17	27.50			
SO24	0.00205	2,100	0.42	19	24	829.40	1.82			
VOC	0.0025	2,100	0.42	19	24	1,011.47	2.22			
PM <sub>10</sub> <sup>5</sup>	0.0022	2,100	0.42	19	24	890.09	1.95			
Stack Para Height Temperatu Diameter Velocity 5 x 5 x 5 m	ameters re structure used to de	5 m 700 Kelvin 0.2 m 25 m/s etermine downwash	parameters for t	he drilling rigs.						
<ol> <li>AP-42 (E and Diese</li> <li>Drilling e</li> <li>The over Therefor</li> <li>The SO<sub>2</sub> density c</li> <li>PM<sub>2.5</sub> as:</li> </ol>	PA 2004), Section 3 el Industrial Engines ngine horsepower b rall load factor is cal e, the overall load f emission factor is c of 7.001 lb/gal. Fuel sumed equivalent to	3.3, "Gasoline and D "; Ib/hp-hr = pounds ased on three engin culated based on av actor = 0.65 * 0.65 alculated assuming consumption rate ca . PM <sub>10</sub> for drilling eng	iesel Industrial E per horsepower es, two at 800 h erage throttle se = 0.42. 26.4 gal/hr fuel c alculated from C gines.	Engines. Table 3.3- -hour. p and one at 500 h tting of 65% and a consumption, with ( aterpillar's specific	1, "Emission Factors p. load factor of 65%. 0.05% sulfur content ation sheet for G341	s for Uncontrolled G of #2 diesel fuel, a 2, gas petroeleum	iasoline nd fuel drilling engine.			

Table B.1.8Drilling Emissions - Tier 1 - Straight Drilling

TRC Enviro 605 Skyline Laramie, W Phone: (30 Fax: (30	Jonah Infill Drillin Straight Drilling Drilling Diesel Combustio from Drilling Engi 3/24/2004	g Project n Emissions nes - EPA Tier 1										
Dellutent	Pollutant Emission	Total hpAll	Overall Load	Drilling Activity	Drilling Activity	Emissions	Emissions					
Pollularit	(lb/bp-br)	(hp)	racior	(days/well)	(bours/day)	(lb/well)	(lb/br/well)					
	(111-411/01)	(קיי)		(uays/weil)	(nouis/uay)							
СО	0.008219978	2,100	0.42	19	24	3,325.69	7.29					
NOx	0.01512476	2,100	0.42	19	24	6,119.27	13.42					
SO24	0.00034547	2,100	0.42	19	24	139.77	0.31					
voc	0.002137194	2,100	0.42	19	24	864.68	1.90					
PM <sub>10</sub> <sup>5</sup>	0.000887758	2,100	0.42	19	24	359.17	0.79					
Stack Paran Height Temperature Diameter Velocity 5 x 5 x 5 m s	PM10 <sup>-</sup> 0.000887758       2,100       0.42       19       24       359.17       0.79         Stack Parameters       Image: stack Parameters       I											
<ol> <li>Emission Available</li> <li>Drilling er</li> <li>The overa Therefore</li> <li>The SO<sub>2</sub> of density of</li> </ol>	factor for Tier 1 engine on-line at http://www.die agine horsepower based all load factor is calculate , the overall load factor emission factor is calculate 7.001 lb/gal. Fuel cons	taken from Diesel eselnet.com/stand on three engines, ed based on avera = $0.65 * 0.65 = 0$ ated assuming 26 sumption rate calc	Net, Revision 200 ards/eu/offroad.ht two at 800 hp an uge throttle setting .42. .4 gal/hr fuel cons ulated from Cater	03.10, Table 1, "EU ml. d one at 500 hp. of 65% and a load sumption, with 0.05 pillar's specification	J Emission Regulation d factor of 65%. 5% sulfur content of single for G4312,	ons for Nonroad Di #2 diesel fuel, and gas petroleum dril	esel Engines." fuel ling engine.					

Table B.1.9Drilling Emissions - Tier 2 - Straight Drilling

TRC Envir 605 Skylin Laramie, V Phone: (3 Fax: (3	onmental Corpora Drive /Y 82070 07) 742-3843 07) 745-8317	tion			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drillin Straight Drilling Drilling Diesel Combustio from Drilling Engi 3/24/2004	g Project n Emissions nes - EPA Tier 2					
Pollutant	Pollutant Emission Factor <sup>1</sup>	Total Horsepower All Engines <sup>2</sup>	Overall Load Factor <sup>3</sup>	Drilling Activity Duration	Drilling Activity Duration	Emissions	Emissions					
	(111-411/01)	(11)		(uays/well)	(110urs/uay)		(ID/III/Well)					
СО	0.0058	2,100	0.42	19	24	2,327.98	5.11					
NOx	0.0066	2,100	0.42	19	24	2,660.55	5.83					
SO24	0.00035	2,100	0.42	19	24	139.77	0.31					
VOC	0.0021	2,100	0.42	19	24	864.68	1.90					
PM <sub>10</sub> <sup>5</sup>	0.00033	2,100	0.42	19	24	133.03	0.29					
Stack Para Height Temperatur Diameter Velocity 5 x 5 x 5 m	Stack Parameters     5 m       Height     5 m       Temperature     700 Kelvin       Diameter     0.2 m       Velocity     25 m/s       5 x 5 x 5 m structure used to determine downwash parameters for the drilling rigs.											
<ol> <li>Emission Avaliabl</li> <li>Drilling e</li> <li>The over Therefor</li> <li>The SO<sub>2</sub> density c</li> <li>PM<sub>2.5</sub> as</li> </ol>	n factor for Tier 2 e e on-line at http://w ngine horsepower all load factor is ca e, the overall load emission factor is f 7.001 lb/gal. Fue sumed equivalent f	ngine taken from Die ww.dieselnet.com/st based on three engi lculated based on av factor = 0.65 * 0.65 calculated assuming cl consumption rate c to PM <sub>10</sub> for drilling er	esel Net, Revisio andards/eu/offro nes, two at 800 verage throttle so = 0.42. g 26.4 gal/hr fuel calculated from o ngines.	on 2003.10, Table bad.html. hp and one at 500 etting of 65% and I consumption, with Caterpillar's specifi	1, "EU Emission Re hp. a load factor of 65% h 0.05% sulfur conte cation sheets for G4	gulations for Nonro 5. ent of #2 diesel fuel 4312, gas petroleun	ad Diesel Engines." , and fuel n drilling engine.					

605 Skyline Drive Laramie, WY 820 Phone: (307) 74 Fax: (307) 74	mie, WY 82070 ne: (307) 742-3843 (307) 745-8317 Average Average RTs Emission DM DIM DM													
Vehicle Type	Road Type	Dust Control Method	Average Vehicle Weight	Average Vehicle Speed	Silt Content <sup>2</sup>	Moisture Content <sup>3</sup>	RTs per Well	RT Distance	VMT <sup>4</sup>	Emission Control Efficiency	PM <sub>10</sub> Emissions <sup>5</sup>	PM <sub>2.5</sub> Emissions <sup>5</sup>	PM <sub>10</sub> Emissions <sup>6</sup> (controlled)	PM <sub>2.5</sub> Emissions <sup>6</sup> (controlled)
			(lb)	(mph)	(%)	(%)		(miles)	(VMT/well)	(%)	(lb/VMT)	(lb/VMT)	(lb/well)	(lb/well)
Semis/transport/ water/sand/frac	Primary Access	magnesium chloride	54,000	20	5.1	2.4	350	14	4,900	85	1.87	0.29	1,371.95	210.37
trucks <sup>1</sup>	Resource	water	54,000	15	5.1	2.4	350	5	1,750	50	1.87	0.29	1,633.27	250.44
Large Haul Trucks	Primary Access	magnesium chloride	48,000	20	5.1	2.4	50	14	700	85	1.77	0.27	185.88	28.50
	Resource	water	48,000	15	5.1	2.4	50	5	250	50	1.77	0.27	221.28	33.93
Small Haul Trucks	Primary Access	magnesium chloride	20,000	30	5.1	2.4	30	14	420	85	1.19	0.18	75.21	11.53
	Resource	water	20,000	20	5.1	2.4	30	5	150	50	1.19	0.18	89.54	13.73
Light trucks/ pick-	Primary Access	magnesium chloride	7,000	30	5.1	2.4	140	14	1,960	85	0.56	0.08	164.21	24.55
apo	Resource	water	7,000	20	5.1	2.4	140	5	700	50	0.46	0.07	159.58	23.84
									Total Un	paved Road	d Traffic Emiss	sions (lb/well)	3,900.91	596.87
									Total Unpav	ed Road Tr	affic Emission	s (lb/hr/well) <sup>7</sup>	6.56	1.00

Table B.1.10Completion/Testing Traffic

<sup>3</sup> AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

<sup>4</sup> Calculated as Round Trips per Vehicle Type x Round Trip Distance.

<sup>5</sup> AP-42 (EPA 2004), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

<sup>6</sup> Calculated as lb/VMT x VMT/pad x control efficiency.

<sup>7</sup> Calculated as lb/well; 35 days/well; 17 hours/day; and represents emissions for 9.5-mile segment of road.

# Table B.1.11Completion/Testing Heavy Equipment Tailpipe

TRC Environn 605 Skyline D Laramie, WY 8 Phone: (307) Fax: (307)	nental Corporation ive 2070 742-3843 745-8317					Project: Scenario: / Activity: ( Emissions: I f Date: :	Jonah Infill Drilling All Scenarios Completion/Testing Diesel Combustion From Heavy Equipm 3/24/2004	Project Emissions ient Tailpipes
Dellatent	Pollutant Emission	Total Haul Truck	DT Distance	Total Haul Truck	Haul Activity	Haul Activity	Emissions	Emissions <sup>3</sup>
Pollutant	(g/mile)	(PTs/well)	(miles/RT)		(days/well)	(bours/day)		(lb/br/well)
	(g/nile)	(ICTS/Well)	(IIIIes/KT)	(IIIIes/weil)	(uays/well)	(Tours/day)	(ID/WEII)	(ID/III/Well)
со	14.74	430	19	8170	35	17	265.49	0.45
NO <sub>x</sub>	11.44	430	19	8170	35	17	206.05	0.35
SO <sub>2</sub> <sup>2</sup>	0.32	430	19	8170	35	17	5.72	0.0096
VOC	5.69	430	19	8170	35	17	102.49	0.17
<sup>1</sup> AP-42 (EPA <sup>2</sup> The SO <sub>2</sub> e	. 1985), Volume II Mol nission factor is calcu	bile Sources. Heavy ilated assuming 10 r	<sup>,</sup> duty diesel engi mpg fuel consum	ne powered trucks, h iption, with 0.05% su	igh altitude, 20 mp Ifur content of #2 c	oh, "aged" with 50,00 diesel fuel, and fuel c	0 miles, 1997+ mod Jensity of 7.001 lb/ga	el. al.

<sup>3</sup> Calculated as lb/well; 35 days/well; 17 hours/day.

#### Table B.1.12 Completion Flaring

TRC Environmental Corporation 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317					Project Scenario Activity Emissions Date	: Jonah Infill Drilling Pr : All Scenarios : Completion/Testing F : Gas Flaring without H Flowback Separator U : 3/24/2004	roject 'laring ligh Pressure Jnits
Flaring Specifications:			Stack Param	eters			
Total Volume of Gas Emitted	35 000	mcf	Temperature	1 273 Kelvin			
Total Volume of Condensate Emitted	250	bbls	Diameter	1.0 m			
Average Heat Content	1,093	BTU/scf	Velocity	20 m/s			
Flaring/Flowback Activity Duration	120	hrs/well					
Flaring Duration	80	hrs/well					
Pre-ignition Flow-back Duration	40	hrs/well					
Pre-ignition Flow-back Time Involving a Gas Stream	10	%					
Actual Hours Gas is Vented	4	hrs					
Total Hours in which Gas is Vented or Flared <sup>1</sup>	84	hrs					
Average Flowrate of Gas <sup>2</sup>	416.67	mcf/hr					
Total Volume of Gas Vented <sup>3</sup>	1,666.67	mcf					
Total Volume of Flared Gas <sup>4</sup>	33,333.33	3 mcf					
Average Flowrate of Condensate	2.98	bbls/hr					
Pre-flare Volume of Condensate	11.90	bbls					
Volume of Condensate Flared	238.10	bbls					
		Volume	Emission	Emission		Total	Hourly

		Volume		Emission	Emission		Total		Hourly
Activity	Volume	Units	Pollutant	Factor	Factor Units	Emission Factor Source <sup>6</sup>	Emissions	Duration	Emissions
							(tons)	(hours)	(lb/hr)
Venting - Natural Gas <sup>5</sup>	1,666.67	mcf	VOC	4.70	lb / 1000 scf	Gas Constituent Analysis	3.91	4	1,956.87
			HAP (total)	0.17	lb / 1000 scf	Gas Constituent Analysis	0.14	4	71.37
			n-Hexane	0.08	lb / 1000 scf	Gas Constituent Analysis	0.070	4	35.13
			Benzene	0.026	lb / 1000 scf	Gas Constituent Analysis	0.022	4	10.75
			Toluene	0.041	lb / 1000 scf	Gas Constituent Analysis	0.034	4	17.02
			Ethylbenzene	0.0019	lb / 1000 scf	Gas Constituent Analysis	0.0016	4	0.80
			Xylenes	0.018	lb / 1000 scf	Gas Constituent Analysis	0.015	4	7.67
Flaring - Natural Gas	33,333.33	mcf	NOx	0.068	lb / 10^6 BTU	AP-42 Section 13.5	1.24	80	30.97
			CO	0.37	lb / 10^6 BTU	AP-42 Section 13.5	6.74	80	168.49
			VOC	2.35	lb / 1000 scf	Gas Constituent Analysis	39.14	80	978.43
			HAP (total)	0.09	lb / 1000 scf	Gas Constituent Analysis	1.43	80	35.69
			n-Hexane	0.042	lb / 1000 scf	Gas Constituent Analysis	0.70	80	17.57
			Benzene	0.013	lb / 1000 scf	Gas Constituent Analysis	0.22	80	5.38
			Toluene	0.020	lb / 1000 scf	Gas Constituent Analysis	0.34	80	8.51
			Ethylbenzene	0.001	lb / 1000 scf	Gas Constituent Analysis	0.016	80	0.40
			Xylenes	0.009	lb / 1000 scf	Gas Constituent Analysis	0.15	80	3.83

#### Table B.1.12 (Continued)

Activity	Volume	Volume Units	Pollutant	Emission Factor	Emission Factor Units	Emission Factor Source <sup>6</sup>	Total Emissions (tons)	Duration (hours)	Hourly Emissions (Ib/hr)
Flaring - Condensate	238.10	bbls	VOC	121.98	lb/bbl	Condensate Constituent Analysis	14.52	80	363.03
			HAP (total)	25.85	lb/bbl	Condensate Constituent Analysis	3.08	80	76.93
			n-hexane	4.59	lb/bbl	Condensate Constituent Analysis	0.55	80	13.67
			Benzene	1.42	lb/bbl	Condensate Constituent Analysis	0.17	80	4.22
			Toluene	6.11	lb/bbl	Condensate Constituent Analysis	0.73	80	18.19
			Ethylbenzene	0.74	lb/bbl	Condensate Constituent Analysis	0.09	80	2.19
			Xylenes	12.99	lb/bbl	Condensate Constituent Analysis	1.55	80	38.66

<sup>1</sup> Calculated as 10% \* 40 hrs of pre-ignition flowback + 80 hrs of flaring.

<sup>2</sup> Calculated as 3,500 mcf/84 hrs.

<sup>3</sup> Calculated as 416.67 mcf/hr \* 4 hrs.

<sup>4</sup> Calculated as 416.67 mcf/hr \* 80 hrs.

<sup>5</sup> An estimated 11.9 bbl of condensate are captured prior to flare ignition. Flashing from this condensate is not analyzed.

<sup>6</sup> For all emission factors that used the constituent analysis, a 50% destruction rate was assumed.

# Table B.1.13Pipeline Construction

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3 Fax: (307) 745-8	Corporation 8843 317	Project: Jonah Infill Drilling Project Scenario: All Scenarios Activity: Pipeline Construction Emissions: Fugitive Particulate Emissions from Pipeline Construction Date: 3/24/2004							
Pipeline Construction Area <sup>1</sup>	Construction Activity TSP Emission Factor <sup>2</sup>	Construction Activity Duration	Construction Activity Duration	PM <sub>10</sub> Emissions <sup>3</sup>	PM <sub>2.5</sub> Emissions <sup>4</sup>				
(acres)	(tons/acre-month)	(days/pad)	(hours/day)	(lb/pad)	(lb/pad)				
0.45	1.2	4	8	52.36	13.82				
		Pipeline Construction	Emissions (lb/day/pad)	13.09	3.45				
		Pipeline Construction	on Emissions (lb/hr/pad)	1.64	0.43				
<ul> <li><sup>1</sup> Pipeline constructi</li> <li><sup>2</sup> AP-42 (EPA 2004)</li> <li><sup>3</sup> AP-42 (EPA 2004)</li> <li>monthly emissions</li> </ul>	ion area = 0.15-mi x 25-ft RO ), Section 13.2.3, "Heavy Con ), Section 13.2.2 "Unpaved Ro s converted to daily and hourly	W = 0.45 acres. struction Operations". pads", Background Docu y emissions based on 30	ument. Assuming that 36%	6 of the TSP is in the F	PM <sub>2.5</sub> size range,				

### Table B.1.14

Pipeline	Construction	Traffic
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TRC Environmental Corporat 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317	tion										Project: Jonah Infill Drilling Project Scenario: All Scenarios Activity: Pipeline Construction Emissions: Fugitive Particulate Emissions from Unpaved Road Traffic Date: 3/24/2004						
Vehicle Type	Road Type	Dust Control Method	Average Vehicle Weight	Average Vehicle Speed	Silt Content <sup>2</sup>	Moisture Content <sup>3</sup>	RTs per pad	RT Distance	VMT <sup>4</sup>	Emission Control Efficiency	PM <sub>10</sub> Emission Factor <sup>5</sup>	PM <sub>2.5</sub> Emission Factor <sup>5</sup>	PM <sub>10</sub> Emissions <sup>6</sup> (controlled)	PM <sub>2.5</sub> Emissions <sup>6</sup> (controlled)			
			(lb)	(mph)	(%)	(%)		(miles)	(VMT/pad)	(%)	(lb/VMT)	(lb/VMT)	(lb/pad)	(lb/pad)			
Semis/transport, boom, equipment, water removal, sand, and gravel trucks <sup>1</sup>	Primary Access	magnesium chloride	54,000	20	5.1	2.4	8	14	112	85	1.87	0.29	31.36	4.81			
	Resource	water	54,000	15	5.1	2.4	8	5	40	50	1.87	0.29	37.33	5.72			
Light truck/pick-ups	Primary Access	magnesium chloride	7,000	30	5.1	2.4	12	14	168	85	0.23	0.03	5.80	0.86			
	Resource	water	7,000	20	5.1	2.4	12	5	60	50	0.23	0.03	6.90	1.03			
									Tot Total U	al Unpaved R Inpaved Road	oad Traffic Em I Traffic Emissi	issions (lb/pad) ons (lb/hr/pad) <sup>7</sup>	81.39 2.54	12.42 0.39			
												(, /					

<sup>1</sup> Semi vehicle weight range is 28,000-80,000 lbs, average weight of 54,000 lbs used for calculations.

<sup>2</sup> AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

<sup>3</sup> AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

<sup>4</sup> Calculated as Round Trips per Vehicle Type x Round Trip Distance.

<sup>5</sup> AP-42 (EPA 2004), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

<sup>6</sup> Calculated as lb/VMT x VMT/pad x control efficiency.

<sup>7</sup> Calculated as Emissions (lb/pad); 4 (days/pad); 8 (hours/day); and represents emissions over 9.5-mile segment of road.

### Table B.1.15Pipeline Heavy Equipment Tailpipe

Г

TRC Environ 605 Skyline I Laramie, WY Phone: (307	mental Corp Drive 82070 7) 742-3843	Joration														S	Project: cenario: Activity: iissions: Date:	Jonah Ir All Scen Pipeline Diesel C Emissio Equipm 3/24/200	nfill Drillin Narios Construc Combustic Ons from F ent Tailpi O4	ng Project ction on Heavy pes
	<b>F</b> acine	Number	Operating						Ormation	Construction										
Equipment	Engine Horsepowe	r Required	Factor		Polluta	nt Emiss	sion Facto	or <sup>1</sup>	Activity Duration	Duration		Pollu	tant Emi	ssions			Poll	utant Em	issions <sup>3</sup>	
	(hp)	· · ·	_			(a/hp-hr	)		(days/equip type)	(hours/day)		-	(lb/well)	)	-			(lb/hr/well	I)	
			·	CO	NOx	SO <sub>2</sub>	VOC	PM <sub>10</sub>			со	NOx	SO <sub>2</sub>	VOC	PM <sub>10</sub> <sup>7</sup>	со	NOx	SO <sub>2</sub>	VOC	PM <sub>10</sub> <sup>6</sup>
Grader	200	1	0.4	1.54	7.14	0.874	0.36	0.625	2	8	4.35	20.15	2.47	1.02	1.76	0.27	1.26	0.15	0.06	0.11
Excavator <sup>2</sup>	300	1	0.4	2.15	7.81	0.851	0.75	0.692	4	8	18.20	66.12	7.20	6.35	5.86	0.57	2.07	0.23	0.20	0.18
Trencher <sup>3</sup>	300	1	0.4	4.6	11.01	0.932	1.01	0.902	1	8	9.74	23.30	1.97	2.14	1.91	1.22	2.91	0.25	0.27	0.24
Tractor <sup>4</sup>	150	1	0.4	7.34	11.91	0.851	1.76	1.27	2	8	15.53	25.21	1.80	3.72	2.69	0.97	1.58	0.11	0.23	0.17
							Total Err	hissions fr	om Heavy Equipme	nt Tailpipes	47.82	134.77	13.44	13.23	12.22	3.03	7.81	0.74	0.76	0.70
<ol> <li>AP-42 (EP/</li> <li>Emission fa</li> <li>Emission fi</li> <li>Emissions fi</li> <li>Calculated</li> <li>PM<sub>2.5</sub> assur</li> </ol>	A 1985), Volu actor for trac actor for mis factor for wh as lb/well; da med equivala	ume II Mobile k-type tracto cellaneous. eeled tractor ays/equipme ent to PM <sub>10</sub> f	e Sources; or. r. ent type; 8 h for combus <sup>1</sup>	g/hp-hr nours/da tion sou	= grams y. rces.	per hors	sepower-l	hour.												

### Table B.1.16Construction Wind Erosion - 1 Well Per Pad

TRC Environmental Corporatio 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317	Project: Jonah Infill Drilling Project Scenario: 1 well per pad Activity: Well Pad, Resource Road, Pipel Construction Emissions: Wind Erosion Date: 3/24/2004							
Emission Factor :	0.3733	lb/hr/100m <sup>2</sup>		Based on AF	-42 Chapter 13	3.2.5 (EPA 200	)4), Industrial V	Vind Erosion
Control Efficiency:	50	%		using Jonah	Field, Wyoming	g meteorologic	al data.	
<b>Disturbed Area:</b> Well Pad Construction:	3.8	acres	15,378.60	m²				
Access Road Construction:	1.3455	acres	5,445.24	m²	(based on 74-	ft ROW width,	0.15-mile leng	gth)
Pipeline Construction	0.45	acres	1,821.15	m²	(based on 25-	ft ROW width,	0.15-mile lenç	gth)
<b>Source Parameters</b> 148 1-km area sources sigma z = 2.33 m								
PM <sub>10</sub> Emissions Calculations:								
	PM <sub>10</sub>	PM <sub>2.5</sub>		Control	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	Emission Factor	Emission Factor	Area	Efficiency	Emissions	Emissions	Emissions	Emissions
	(lb/hr/100 m <sup>2</sup> )	(lb/hr/100 m <sup>2</sup> )	(100 m <sup>2</sup> )	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)
Well Pad Construction:	0.3733	0.1493	153.79	50	28.70	11.48	3.62	1.45
Resource Road Construction	0.3733	0.1493	54.45	50	10.16	4.07	1.28	0.51
Pipeline Construction	0.3733	0.1493	18.21	50	3.40	1.36	0.43	0.17

TRC Environ 605 Skyline I Laramie, WY Phone: (307 Fax: (307	mental Corporation Drive 82070 7) 742-3843 ) 745-8317			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drillin 2 wells per pad Well Pad Construc Fugitive Particular from Well Pad Con 3/24/2004	g Project ction te Emissions nstruction
Well Pad Area	Construction Activity TSP Emission Factor <sup>1</sup>	Construction Activity Duration	Construction Activity Duration	Emission Control Efficiency	PM <sub>10</sub> Emissions (controlled) <sup>2</sup>	PM <sub>2.5</sub> Emissions (controlled) <sup>3</sup>
(acre)	(tons/acre-month)	(days/well pad)	(hours/day)	(%)	(lb/well)	(lb/well)
7.0	1.2	4	10	50	403.20	106.40
		Well Pad (	Construction Emis	sions (lb/day/well)	100.80	26.60
		Well Pad	Construction Emi	ssions (lb/hr/well)	10.08	2.66
<ol> <li>AP-42 (EP</li> <li>AP-42 (EP</li> <li>size range</li> <li>AP-42 (EP</li> <li>size range</li> </ol>	PA 2004), Section 13.2 PA 2004), Section 13.2 , monthly emissions c PA 2004), Section 13.2 , monthly emissions c	2.3, "Heavy Construction 2.2 "Unpaved Roads", E onverted to daily and he 2.2 "Unpaved Roads", E onverted to daily and he	n Operations". Background Docur ourly emissions ba Background Docur ourly emissions ba	nent. Assuming tha ased on 30-day mo nent. Assuming tha ased on 30-day mo	nt 36% of the TSP is nth. at 9.5% of the TSP i nth.	s in the $PM_{10}$ s in the $PM_{2.5}$

Table B.1.17Well Pad/Resource Road Construction - 2 Wells per Pad

# Table B.1.18Well Pad/Resource Road Construction - 5 Wells per Pad

TRC Environ 605 Skyline I Laramie, WY Phone: (307 Fax: (307	mental Corporation Drive 82070 7) 742-3843 1) 745-8317			Jonah Infill Drillin 5 wells per pad Well Pad Construc Fugitive Particula from Well Pad Con 3/24/2004	illing Project d struction :ulate Emissions Construction		
Well Pad Area	Construction Activity TSP Emission Factor <sup>1</sup>	Construction Activity Duration	Construction Activity Duration	Emission Control Efficiency	PM <sub>10</sub> Emissions (controlled) <sup>2</sup>	PM <sub>2.5</sub> Emissions (controlled) <sup>3</sup>	
(acre)	(tons/acre-month)	(days/well pad)	(hrs/day)	(%)	(lb/well)	(lb/well)	
10.0	1.2	4	10	50	576.00	152.00	
		Well Pac	Construction Emis	sions (lb/day/well)	144.00	38.00	
		Well Pa	d Construction Em	issions (lb/hr/well)	14.40	3.80	
<ol> <li>AP-42 (EF</li> <li>AP-42 (EF</li> <li>size range</li> <li>AP-42 (EF</li> <li>size range</li> </ol>	PA 2004), Section 13.2 PA 2004), Section 13.2 A 2004), Section 13.2 A 2004), Section 13.2 A 2004), Section 13.2	2.3, "Heavy Construction 2.2 "Unpaved Roads", B onverted to daily and ho 2.2 "Unpaved Roads", B onverted to daily and ho	n Operations". ackground Docume burly emissions bas ackground Docume burly emissions bas	ent. Assuming that a led on 30-day mont ent. Assuming that led on 30-day mont	36% of the TSP is in h. 9.5% of the TSP is i h.	n the PM <sub>10</sub> in the PM <sub>2.5</sub>	

# Table B.1.19Well Pad/Resource Road Construction - 10 Wells per Pad

TRC Environ 605 Skyline I Laramie, WY Phone: (307 Fax: (307	mental Corporation Drive 82070 7) 742-3843 1) 745-8317			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drillin 10 wells per pad Well Pad Construc Fugitive Particula Well Pad Construc 3/24/2004	g Project ction te Emissions from ction
Well Pad Area	Construction Activity TSP Emission Factor <sup>1</sup>	Construction Activity Duration	Construction Activity Duration	Emission Control Efficiency	PM <sub>10</sub> Emissions (controlled) <sup>2</sup>	PM <sub>2.5</sub> Emissions (controlled) <sup>3</sup>
(acre)	(tons/acre-month)	(days/well pad)	(hrs/day)	(%)	(lb/well)	(lb/well)
10.0	1.2	4	10	50	576.00	152.00
		Well Pac	Construction Emis	ssions (lb/day/well)	144.00	38.00
		Well Pa	d Construction Em	issions (lb/hr/well)	14.40	3.80
<ol> <li>AP-42 (EF</li> <li>AP-42 (EF</li> <li>size range</li> <li>AP-42 (EF</li> <li>size range,</li> </ol>	PA 2004), Section 13.2 PA 2004), Section 13.2 e, monthly emissions c PA 2004), Section 13.2 monthly emissions co	2.3, "Heavy Construction 2.2 "Unpaved Roads", B onverted to daily and ho 2.2 "Unpaved Roads", B onverted to daily and ho	n Operations". ackground Docume ourly emissions bas ackground Docume urly emissions base	ent. Assuming that a sed on 30-day mont ent. Assuming that ed on 30-day month	36% of the TSP is in h. 9.5% of the TSP is i 1.	n the PM <sub>10</sub> in the PM <sub>2.5</sub>

 Table B.1.20

 Rig Move and Drilling Traffic – Directional Drilling

TRC Environmental Co 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-384 Fax: (307) 745-8317	orporation 3 7										Project: Scenario: Activity: Emissions: Date:	Jonah Infill I Directional I Rig Move an Fugitive Part from Traffic 3/24/2004	Drilling Projec Drilling d Drilling ticulate Emiss on Unpaved F	sions Roads
Vehicle Type	Road Type	Dust Control Method	Average Vehicle Weight	Average Vehicle Speed	Silt Content <sup>2</sup>	Moisture Content <sup>3</sup>	RTs per Well	RT Distance	VMT <sup>4</sup>	Emission Control Efficiency	PM <sub>10</sub> Emission Factor <sup>5</sup>	PM <sub>2.5</sub> Emission Factor <sup>5</sup>	PM <sub>10</sub> Emissions <sup>6</sup> (controlled)	PM <sub>2.5</sub> Emissions <sup>6</sup> (controlled)
			(lb)	(mph)	(%)	(%)		(miles)	(VMT/pad)	(%)	(lb/VMT)	(lb/VMT)	(lb/well)	(lb/well)
Semis-tractor/ trailer/mud/water/fuel/	Primary Access	magnesium chloride	44,000	20	5.1	2.4	168	14	2,352	85	1.70	0.26	600.56	92.09
cement trucks <sup>1</sup>	Resource	water	44,000	15	5.1	2.4	168	5	840	50	1.70	0.26	714.95	109.63
Logging/mud trucks	Primary Access	magnesium chloride	48,000	20	5.1	2.4	12	14	168	85	1.77	0.27	44.61	6.84
	Resource	water	48,000	15	5.1	2.4	12	5	60	50	1.77	0.27	53.11	8.14
Roustabouts/welders/ hot-shot/contract labor	Primary Access	magnesium chloride	20,000	30	5.1	2.4	24	14	336	85	1.19	0.18	60.17	9.23
	Resource	water	20,000	20	5.1	2.4	24	5	120	50	1.19	0.18	71.63	10.98
Vendors/marketers/ various	Primary Access	magnesium chloride	7,000	30	5.1	2.4	36	14	504	85	0.56	0.083	42.23	6.31
	Resource	water	7,000	20	5.1	2.4	36	5	180	50	0.46	0.068	41.04	6.13
									Total Un	paved Road	Traffic Emiss	sions (lb/well)	1,628.28	249.34
									Total Unpav	ed Road Tra	ffic Emission	s (lb/hr/well)7	2.61	0.40

<sup>1</sup> Semi vehicle weight range is 28,000-60,000 lbs; average weight of 44,000 lbs used for calculations.

<sup>2</sup> AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

<sup>3</sup> AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

<sup>4</sup> Calculated as Round Trips per Vehicle Type x Round Trip Distance.

<sup>5</sup> AP-42 (EPA 2004), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

<sup>6</sup> Calculated as lb/VMT x VMT/pad x control efficiency.

<sup>7</sup> Calculated as (lb/well); 26 days/well; 24 hours/day; and represents emissions for 9.5-mile segment of road. Total duration is 26 days for a directional well, including rig move duration of 3 days per well.

### Table B.1.21Rig Move and Drilling Haul Truck Tailpipe - Directional Drilling

TRC Environment 605 Skyline Drive Laramie, WY 8207 Phone: (307) 742 Fax: (307) 745	tal Corporation 70 2-3843 8317					Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drilling Directional Drilling Rig Move and Drill Diesel Combustior from Heavy Equip 3/24/2004	g Project ing n Emissions nent Tailpipes
Pollutant	Pollutant Emission Factor <sup>1</sup>	Total Haul Truck RTs	RT Distance	Total Haul Truck Miles Traveled	Haul Activity Duration	Haul Activity Duration	Emissions	Emissions <sup>3</sup>
	(g/mile)	(RTs/well)	(miles/RT)	(miles/well)	(days/well)	(hrs/day)	(lb/well)	(lb/hr/well)
со	14.74	216	19	4,104	26	24	133.36	0.21
NO <sub>x</sub>	11.44	216	19	4,104	26	24	103.50	0.17
SO2 <sup>2</sup> VOC	0.32 5.69	216 216	19 19	4,104 4,104	26 26	24 24	2.87 51.48	0.0046

<sup>1</sup> 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.

<sup>2</sup> The SO<sub>2</sub> 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.

<sup>3</sup> Calculated as lb/well; 26 days/well; 24 hours/day.

Table B.1.22Drilling Emission AP-42 - Directional Drilling

605 Skyli Laramie, Phone: Fax: (	ne Drive WY 82070 (307) 742-3843 (307) 745-8317				Scenario: Activity: Emissions: Date:	Directional Drilling Drilling Diesel Combustion from Drilling Engin 3/24/2004	es - EPA AP-42
	Pollutant Emission	Total Horsepower All	Overall Load	Drilling Activity	Drilling Activity		
Pollutant	Factor	Engines <sup>∠</sup>	Factor <sup>3</sup>	Duration	Duration	Emissions	Emissions
	(lb/hp-hr)	(hp)		(days/well)	(hours/day)	(lb/well)	(lb/hr/well)
со	0.00668	2.600	0.42	23	24	4.050.56	7.34
NOv	0.03100	2.600	0.42	23	24	18,797,53	34.05
SO24	0.00205	2,600	0.42	23	24	1,243.06	2.25
voc	0.00250	2,600	0.42	23	24	1,515.93	2.75
PM <sub>10</sub> <sup>5</sup>	0.00220	2,600	0.42	23	24	1,334.02	2.42
Stack Pa	rameters						
Heiaht	5 m						
Temperat	675 Kelvin						
Diameter	0.2 m						
Velocitv	30 m/s						
5 x 5 x 5 i	m structure used to de	termine downwash nara	meters for drillin	na rias			

<sup>1</sup> Emission factor for Tier 1 engine taken from Diesel Net, Revision 2003.10, Table 1, "EU Emission Regulations for Nonroad Diesel Engines." Available on-line at http://www.dieselnet.com/standards/eu/offroad.html.

<sup>2</sup> Drilling engine horsepower based on four engines, two at 800 hp and two at 500 hp.

<sup>3</sup> 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.

<sup>4</sup> The SO<sub>2</sub> 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 calculated from Caterpillar's specification sheets for G4312, gas petroleum drilling engine.

<sup>5</sup>  $PM_{2.5}$  assumed equivalent to  $PM_{10}$  for drilling engines.

Table B.1.23Drilling Emissions – Tier 1- Directional Drilling

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TRC Environ 605 Skyline D Laramie, WY Phone: (307 Fax: (307)	mental Corporation rive 82070 ) 742-3843 ) 745-8317			Project: Jonah Infill Drilling Project Scenario: Directional Drilling Activity: Drilling Emissions: Diesel Combustion Emissions f Drilling Engines - EPA Tier 1 Date: 3/24/2004						
Dellutent	Pollutant Emission	Total Horsepower All	Overall Load	Drilling Activity	Drilling Activity	Emissions	Emissions			
Pollutant	(lb/bp-br)	Engines (bp)	Facior	(days/well)	(bours/day)					
	(111-411/01)	(קיי)		(days/weil)	(nouis/uay)					
со	0.00822	2,600	0.42	23	24	4,984.36	9.03			
NO <sub>x</sub>	0.01512	2,600	0.42	23	24	9,171.23	16.61			
SO24	0.00035	2,600	0.42	23	24	209.48	0.38			
VOC	0.00214	2,600	0.42	23	24	1,295.93	2.35			
$PM_{10}^{5}$	0.00089	2,600	0.42	23	24	538.31	0.98			
Stack Parameters       Height     5 m       Temperature     675 Kelvin       Diameter     0.2 m       Velocity     30 m/s       5 x 5 x 5 m structure used to determine downwash parameters for drilling rigs										
<ol> <li>Emission fa Available or</li> <li>Drilling eng</li> <li>The overall Therefore,</li> <li>The SO<sub>2</sub> end density of 7</li> <li>PM<sub>2.5</sub> assure</li> </ol>	actor for Tier 1 engine f n-line at http://www.die ine horsepower based load factor is calculate the overall load factor nission factor is calcula .001 lb/gal. Fuel cons med equivalent to PM <sub>1</sub>	taken from Diesel Net, selnet.com/standards/ on four engines, two a d based on average th = $0.65 * 0.65 = 0.42$ . ated assuming 26.4 gal umption rate calculated <sub>0</sub> for drilling engines.	Revision 2003. eu/offroad.html. t 800 hp and tw rottle setting of /hr fuel consum d from Caterpilla	10, Table 1, "EU E to at 500 hp. 65% and a load fa ption, with 0.05% s ar's specification sh	mission Regulations f ctor of 65%. sulfur content of #2 di neets for G4312, gas	for Nonroad Diesel E esel fuel, and fuel petroleum drilling er	Engines." ngine.			

Table B.1.24Drilling Emissions - Tier 2 - Directional Drilling

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TRC Enviror 605 Skyline Laramie, WY Phone: (30 Fax: (307	nmental Corporation Drive 7 82070 7) 742-3843 7) 745-8317				Project: J Scenario: D Activity: D Emissions: D Date: 3	Ionah Infill Drilling Directional Drilling Drilling Diesel Combustion Drilling Engines - E 5/24/2004	Project Emissions from PA Tier 2			
	Pollutant Emission	Total Horsepower	Overall Load	Drilling Activity	Drilling Activity					
Pollutant	Factor	All Engines <sup>2</sup>	Factor <sup>3</sup>	Duration	Duration	Emissions	Emissions			
	(lb/hp-hr)	(hp)		(days/well)	(hrs/day)	(lb/well)	(lb/hr/well)			
<u> </u>	0.00575	2 600	0.42	22	24	2 490 06	6.22			
NO	0.00575	2,000	0.42	23	24	3,409.00	7.22			
$SO_2^4$	0.00035	2,600	0.42	23	24	209.48	0.38			
VOC	0.00214	2,600	0.42	23	24	1.295.93	2.35			
PM <sub>10</sub> <sup>5</sup>	0.00033	2,600	0.42	23	24	199.37	0.36			
Stack Param Height Temperature Diameter Velocity 5 x 5 x 5 m st	Stack ParametersHeight5 mTemperature675 KelvinDiameter0.2 mVelocity30 m/s5 x 5 x 5 m structure used to determine downwash parameters for drilling rigs									
<ol> <li>Emission Available</li> <li>Drilling er</li> <li>The overa Therefore</li> </ol>	<ul> <li>Emission factor for Tier 2 engine taken from Diesel Net, Revision 2003.10, Table 1, "EU Emission Regulations for Nonroad Diesel Engines." Available on-line at http://www.dieselnet.com/standards/eu/offroad.html.</li> <li>Drilling engine horsepower based on four engines, two at 800 hp and two at 500 hp.</li> <li>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</li> </ul>									
<sup>4</sup> The SO <sub>2</sub> e density of	emission factor is calculate 7.001 lb/gal. Fuel consum	ed assuming 26.4 gal/ aption rate calculated	/hr fuel consump from Caterpillar	otion, with 0.05% s s specification she	ulfur content of #2 di eets for G4312, gas p	esel fuel, and fuel petroleum drilling en	gine.			
<sup>5</sup> PM <sub>2.5</sub> ass	umed equivalent to PM <sub>10</sub> f	or drilling engines.								

# Table B.1.25Wind Erosion – 2 Wells per Pad

TRC Environmental Corporatio 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317	n				Project: Scenario: Activity: Emissions: Date:	Jonah Infill Dr 2 wells per pa Well Pad, Res Construction Wind Erosion 3/24/2004	illing Project d ource Road, F	Pipeline
Emission Factor :	0.3733	lb/hr/100m <sup>2</sup>		Based on AF	P-42 Chapter 13	.2.5 (EPA 2004	), Industrial Wi	nd Erosion
Control Efficiency:	50	%		using Jonah	Field, Wyoming	meteorological	data.	
Disturbed Area								
Well Pad Construction:	7	acres	28,329.00	m²				
Access Road Construction:	1.3455	acres	5,445.24	m <sup>2</sup>	(based on 74-	ft ROW width, (	).15-mile length	ו)
Pipeline Construction	0.45	acres	1,821.15	i m²	(based on 25-	ft ROW width, (	).15-mile length	ו)
PM <sub>10</sub> Emissions Calculations:								
	PM <sub>10</sub>	PM <sub>2.5</sub>		Control	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	Emission Factor	Emission Factor	Area	Efficiency	Emissions	Emissions	Emissions	Emissions
	(lb/hr/100 m <sup>2</sup> )	(lb/hr/100 m <sup>2</sup> )	(100 m <sup>2</sup> )	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)
Well Pad Construction	0.3733	0.1493	283.29	50	52.87	21.15	6.66	2.66
Resource Road Construction	0.3733	0.1493	54.45	50	10.16	4.07	1.28	0.51
Pipeline Construction	0.3733	0.1493	18.21	50	3.40	1.36	0.43	0.17

# Table B.1.26Wind Erosion – 5 Wells per Pad

TRC Environmental Corporation 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317	n				Project: Scenario: Activity: Emissions: Date:	Jonah Infill Dr 5 wells per pa Well Pad, Res Construction Wind Erosion 3/24/2004	illing Project d ource Road, F	Pipeline
Emission Factor :	0.3733	lb/hr/100m <sup>2</sup>		Based on AF	P-42 Chapter 13. Field, Wyoming	2.5 (EPA 2004 meteorological	), Industrial Wi	nd Erosion
Control Efficiency:	50	%		doing contain	r loid, tryoning	meteorological		
Disturbed Area:								
Well Pad Construction:	10	acres	40,470.00	m²				
Access Road Construction:	1.3455	acres	5,445.24	m²	(based on 74-f	t ROW width, 0	).15-mile length	ר)
Pipeline Construction	0.45	acres	1,821.15	m²	(based on 25-f	t ROW width, (	).15-mile length	ר)
PM <sub>10</sub> Emissions Calculations:								
	PM <sub>10</sub>	PM <sub>2.5</sub>		Control	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	Emission Factor	Emission Factor	Area	Efficiency	Emissions	Emissions	Emissions	Emissions
	(lb/hr/100 m <sup>2</sup> )	(lb/hr/100 m <sup>2</sup> )	(100 m <sup>2</sup> )	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)
Well Pad Construction	0.3733	0.1493	404.70	50	75.53	30.21	9.52	3.81
Resource Road Construction	0.3733	0.1493	54.45	50	10.16	4.07	1.28	0.51
Pipeline Construction	0.3733	0.1493	18.21	50	3.40	1.36	0.43	0.17

# Table B.1.27Wind Erosion – 10 Wells per Pad

TRC Environmental Corporatio 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317	n				Project: Scenario: Activity: Emissions: Date:	Jonah Infill Dr 10 wells per p Well Pad, Res Construction Wind Erosion 3/24/2004	illing Project ad ource Road, F	Pipeline
Emission Factor :	0.3733	lb/hr/100m <sup>2</sup>		Based on AF	P-42 Chapter 13	.2.5 (EPA 2004	), Industrial Wi	nd Erosion
Control Efficiency:	50	%		using bonan	ricid, wyonning	meteorological	udid.	
<b>Disturbed Area:</b> Well Pad Construction:	10	acres	40,470.00	m²				
Access Road Construction:	1.3455	acres	5,445.24	m²	(based on 74-	ft ROW width, (	).15-mile length	ו)
Pipeline Construction	0.45	acres	1,821.15	m²	(based on 25-	ft ROW width, (	).15-mile length	ו)
PM <sub>10</sub> Emissions Calculations:								
	PM <sub>10</sub>	PM <sub>2.5</sub>		Control	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	Emission Factor	Emission Factor	Area	Efficiency	Emissions	Emissions	Emissions	Emissions
	(lb/hr/100 m <sup>2</sup> )	(lb/hr/100 m <sup>2</sup> )	(100 m <sup>2</sup> )	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)
Well Pad Construction	0.3733	0.1493	404.70	50	75.53	30.21	9.52	3.81
Resource Road Construction	0.3733	0.1493	54.45	50	10.16	4.07	1.28	0.51
Pipeline Construction	0.3733	0.1493	18.21	50	3.40	1.36	0.43	0.17

Table B.2.1Production Traffic – 1 Well per Pad

605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3 Fax: (307) 745-8	843 3317											Scenario: Activity: Emissions: Date:	1 well per pad Production Tra Fugitive Partice from Traffic on 3/24/2004	ffic ulate Emissions Unpaved Road
Vehicle Type	Road Type	Dust Control Method	Average Vehicle Weight	Average Vehicle Speed	Silt Content <sup>2</sup>	Moisture Content <sup>3</sup>	RTs per Well⁴	RT Distance	VMT <sup>5</sup>	Emission Control Efficiency	PM <sub>10</sub> Emission Factor <sup>6</sup>	PM <sub>2.5</sub> Emission Factor <sup>6</sup>	PM <sub>10</sub> Emissions <sup>7</sup> (controlled)	PM <sub>2.5</sub> Emissions <sup>7</sup> (controlled)
			(lb)	(mph)	(%)	(%)	(RTs/yr)	(miles)	(VMT/well/yr)	(%)	(lb/VMT)	(Ib/VMT)	(lb/well/yr)	(lb/well/yr)
Workover Rig	Primary Access	magnesium chloride	90,000	20	5.1	2.4	1	14	14	85	2.35	0.36	4.93	0.76
	Resource	water	90,000	15	5.1	2.4	1	5	5	50	2.35	0.36	5.87	0.90
Haul trucks (water/condensate) <sup>1</sup>	Primary Access	magnesium chloride	54,000	20	5.1	2.4	35	14	490	85	1.87	0.29	137.19	21.04
	Resource	water	54,000	15	5.1	2.4	35	5	175	50	1.87	0.29	163.33	25.04
Light trucks/	Primary Access	magnesium chloride	7,000	30	5.1	2.4	122	14	1,708	85	0.56	0.08	143.10	21.39
F	Resource	water	7,000	20	5.1	2.4	122	5	610	50	0.46	0.07	139.07	20.77
								Total /	Access and Uni	mproved Ro	ad Emissior	s (lb/well/yr)	593.49	89.90

<sup>1</sup> Haul trucks weight range is 28,000-80,000 lbs. Average weight of 54,000 lbs used for calculations.

<sup>2</sup> AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

<sup>3</sup> AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

<sup>4</sup> Includes Supervisory Control and Data Acquisitions system (SCADA). SCADA is being installed at wells to increase production efficiency by providing real-time operating data to field staff including well flow rates and pressures, processing equipment operating conditions, tank levels, and emissions control equipment status. SCADA implementation is expected to reduce well site visits by 30-40%b and reduce potential for spills.

<sup>5</sup> Calculated as Round Trips per Vehicle Type x Round Trip Distance

<sup>6</sup> AP-42 (EPA 2004), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

<sup>7</sup> Calculated as lb/VMT x VMT/well x control efficiency.

## Table B.2.2Production Heavy Equipment Tailpipe – 1 Well per Pad

TRC Environmen 605 Skyline Drive Laramie, WY 820 Phone: (307) 74 Fax: (307) 74	ntal e )70 12-3843 5-8317			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drilling All Scenarios Production Traffic Diesel Combustion from Heavy Equip 3/24/2004	Project Emissions ment Tailpipes
Pollutant	Pollutant Emission Factor <sup>1</sup>	Annual RTs per Well	Single Well Round Trip Distance	Single Well Annual VMT	Hourly Emissions Single Well	Annual Emissions Single Well
	(g/mi)	(RTs/well/yr)	(mi/RT)	(mi/well/yr)	(lb/hr)	(tpy)
со	14.74	35	19	665.00	0.002467	0.01080
NO <sub>x</sub>	11.44	35	19	665.00	0.001915	0.00839
SO <sub>2</sub> <sup>2</sup>	0.32	35	19	665.00	0.000054	0.00024
VOC	5.69	35	19	665.00	0.000952	0.00417

The SO<sub>2</sub> 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 B.2.3 Indirect Heater

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317 Fuel Combustion Source:			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drillin 1 well per pad Production Emissions from Ir 1/26/04	g Project ndirect Heater	
Unit Description	Indirect Heater					
Design Firing Rate (MMBTU/hr)	0.75					
Operating Parameters:						
Operating cycle	15	min/hr Septe	ember to April			
Operating hours	24	hr/day,	7	days/wk,	213	days/yr.
Annual Operating Hours	1,277.5					
Capacity (%)	100					
Annual Load (%):	Winter	43.75	Spring	12.5		
	Summer	0	Fall	43.75		
Actual Fuel Combustion for the Yea	r per Unit:					
Volume of Natural Gas Combusted	0.96	MMSCF				
Heat Content	1,000.00	Btu/scf				
Building Size (approximate):						
Width	8.00	ft				
Length	15.00	ft				
Height	7	ft				
Potential Emission Data:						
	From Stack Testing	Actual <sup>2</sup>	Actual	Method of	Emission	
	(lb/hr)	(lb/hr)	(tpy)	Determination	Factors	Units
Filterable Particulate		0.0034	0.002	AP-42	4.5	lb/MMscf
Condensable Particulate		0.0056	0.004	AP-42	7.5	lb/MMscf
Total PM		0.0090	0.006			
VOC		0.0060	0.004	AP-42	8.0	lb/MMscf
СО	0.291	0.073	0.19	Stack Testing <sup>1</sup>		
NO <sub>x</sub>	0.034	0.0085	0.022	Stack Testing <sup>1</sup>		
SO <sub>2</sub>		0.0	0.0	Fuel Analysis	0.0	lb/MMscf

<sup>1</sup> Stack testing data for this heater was provided by EnCana and included five separate tests of  $NO_x$  and CO emissions. NOx and CO were the only pollutants for which stack testing emission were provided. The maximum of the stack test

emissions was used for calculations.

<sup>2</sup> Actual lb/hr calculated using stack testing lb/hr \* 15 min/hr \* 60 min/hr.

#### Table B.2.4

#### Separator Heater

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317				Project: Scenario: Activity: Emissions: Date:	Jonah Infill Dril 1 well per pad Production Low-pressure S Heater 1/26/04	ling Project Separator
Fuel Combustion Source:						
Unit Description	Low-pressure Separa	tor Burner				
Design Firing Rate (MMBTU/hr)	0.085					
Operating Parameters:						
Operating cycle	7.5	min/hr Septer	mber to April			
Operating hours	24	hr/day,	7	days/wk,	213	days/yr.
Annual Operating hours	638.75					
Capacity (%)	100					
Annual Load (%):	Winter	43.75	Spring	12.5		
	Summer	0	Fall	43.75		
Actual Fuel Combustion for the	Year for Unit:					
Volume of Natural Gas Combusted	0.05	MMSCF	1000			
Heat Content	1,000	Btu/scf				
Building Size:						
Width	8.00	ft				
Length	15.00	ft				
Height	7.00	ft				
Potential Emission Data:						
	From Stack Testing	Actual <sup>2</sup>	Actual	Method of	Emission	
	lb/hr	lb/hr	tpy	Determination	Factors	Units
Filterable Particulate		0.00038	0.00012	AP-42	4.5	lb/MMscf
Condensable Particulate		0.00064	0.00020	AP-42	7.5	lb/MMscf
Total PM		0.0010	0.00033			
SO <sub>2</sub>		0.0	0.0	Fuel Analysis	0.0	lb/MMscf
NO <sub>x</sub>	0.0100	0.0013	0.0032	Stack Testing <sup>1</sup>		
со	0.138	0.0173	0.044	Stack Testing <sup>1</sup>		
VOC		0.00068	0.00022	AP-42	8.0	lb/MMscf

<sup>1</sup> Stack testing data for this heater was provided by EnCana and included five separate tests of NO<sub>x</sub> and CO emissions. NOx and CO were the only pollutants for which stack testing emission were provided. The maximum of the stack test emissions was used for calculations.

<sup>2</sup> Actual lb/hr calculated using stack testing lb/hr \* 7.5 min/hr \* 60 min/hr.

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317				Project: Scenario: Activity: Emissions: Date:	Jonah Infill 1 well per pa Production Dehy Reboil 1/26/04	Drilling Project ad er Heater
Fuel Combustion Source:						
Unit Description	Reboiler Heater					
Design Firing Rate (MMBTU/hr)	0.085					
Operating Parameters:						
Operating cycle	35	min/hr year round	ł			
Operating hours	24	hr/day,	7	days/wk,	365	days/yr.
Annual Operating hours	5,110					
Capacity (%)	100					
Annual Load (%):	Winter	25	Spring	25		
	Summer	25	Fall	25		
Actual Fuel Combustion for the Ye	ear for Unit:					
Volume of Natural Gas Combusted	0.43	MMSCF				
Heat Content	1,000	Btu/scf				
Building Size						
Width	8.00	ft				
Length	15.00	ft				
Height	7.00	ft				
lioight	1100					
Potential Emission Data:						
	From Stack Testing	Actual <sup>2</sup>	Actual	Method of	Emission	
	lb/hr	lb/hr	tpy	Determination	Factors	Units
Filterable Particulate		0.00038	0.0010	AP-42	4.5	lb/MMscf
Condensable Particulate		0.00064	0.0016	AP-42	7.5	lb/MMscf
Total PM		0.00102	0.0026			
SO <sub>2</sub>		0.0	0.0	Fuel Analysis	0.0	lb/MMscf
NO <sub>x</sub>	0.0080	0.0047	0.020	Stack Testing <sup>1</sup>		
со	0.080	0.047	0.20	Stack Testing <sup>1</sup>		
VOC		0.00068	0.0017	AP-42	8.0	lb/MMscf

### Table B.2.5Dehydrator Reboiler Heater

 $^{1}$  Stack testing data for this heater was provided by EnCana and included five separate tests of NO<sub>x</sub> and CO emissions.

NOx and CO were the only pollutants for which stack testing emission were provided. The maximum of the stack test

emissions was used for calculations.

 $^{2}\;$  Actual lb/hr calculated by using stack testing lb/hr \* 35 min/hr \* 60 min/hr.

Table B.2.6Dehydrator Flashing

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317		Project: Jonah Infill Drilling Project Scenario: All Scenarios Activity: Production Emissions: TEG Dehydrator Flashing Date: 10/30/2003
	Uncontrolled	Controlled
Pollutant	(tpy) <sup>1</sup>	(tpy) <sup>1</sup>
VOC	12.78	1.20
HAP	6.75	0.68
Benzene	1.55	0.15
Toluene	3.18	0.35
Ethylbenzene	0.15	0.01
Xylene	1.70	0.15
n-Hexane	0.16	0.02
<sup>1</sup> Data provided by EnCana. Ass	umes 75% of the wells have a pu	mp limit and 25% of the wells have BTEX control.

### Table B.2.7Fugitive HAPs and VOC

TRC Environmen 605 Skyline Drive Laramie, WY 820' Phone: (307) 74 Fax: (307) 745	tal 70 2-3843 5-8317								Project: Jonah Infill Drilling Project Scenario: All Scenarios Activity: Production Emissions: Fugitive VOC/HAP Emissions Date: 10/30/2003					
Gas Analysis We	Gas Analysis Weight Fraction													
VOC	0 18378													
Benzene	0.00054													
Toluene	0.00085													
Ethlybenzene	0.00004													
Xylene	0.00038													
n-hexane	0.00176													
		Emission Factor <sup>1</sup>	Non-methane Hydrocarbons <sup>2</sup>	Non-methane Hydrocarbons	Benzene <sup>2</sup>	Benzene	Toluene <sup>2</sup>	Toluene	Ethlybenzene <sup>2</sup>	Ethlybenzene	Xylene <sup>2</sup>	Xylene	n-Hexane <sup>2</sup>	n-Hexane
Source	Quantity	(lb/hr/component)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Valves	16	0.00992	0.0292	0.128	0.00009	0.00038	0.00014	0.00059	0.000006	0.000028	0.00006	0.00027	0.00028	0.0012
Flanges	38	0.00086	0.0060	0.026	0.00002	0.00008	0.00003	0.00012	0.000001	0.000006	0.00001	0.00006	0.00006	0.0003
Connections	94	0.00044	0.0076	0.033	0.00002	0.00010	0.00004	0.00015	0.000002	0.000007	0.00002	0.00007	0.00007	0.0003
Pump seals	8	0.00529	0.0078	0.034	0.00002	0.00010	0.00004	0.00016	0.000002	0.000007	0.00002	0.00007	0.00007	0.0003
Open ended lines	6	0.00441	0.0049	0.021	0.00001	0.00006	0.00002	0.00010	0.000001	0.000005	0.00001	0.00004	0.00005	0.0002
		Total Emissions/Well	0.0554	0.243	0.00016	0.00071	0.00026	0.00113	0.000012	0.000053	0.00012	0.00051	0.00053	0.0023
<sup>1</sup> Taken from the <sup>2</sup> Calculated as w	WDEQ (2001	) "Oil and Gas Producti	on Facilities Chapter 6, Section :	2 Permitting Guidance".										

#### Table B.2.8 **Condensate Storage Tank**

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

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Project: Jonah Infill Drilling Project Scenario: All Scenarios Activity: Production Emissions: Condensate Storage Tank Date: 10/30/2003

			NO <sub>x</sub> and CO Emission	ons from Smoke	less Flare			
VOC a	and HAP Em	issions	Combustion					
VOC	1	tpy/tank	NO <sub>x</sub> Emission Factor <sup>2</sup>	0.068	Ib/MMBTU			
HAP	0.1	tpy/tank	CO Emission Factor <sup>2</sup>	0.37	Ib/MMBTU			
Benzene	0.0024	tpy/tank	Heat Content	1,000	Btu/scf			
Toluene	0.0001	tpy/tank	Condensate Production	25.30	bbl/day			
Ethylbenzene	0.0014	tpy/tank	Gas to Oil Ratio <sup>3</sup>	957.37	scf/bbl			
Xylene	0.0018	tpy/tank	Gas Production	24,221.46	SCFD			
n-Hexane	0.0443	tpy/tank						
			Combustion Emissions from Storage Tanks					
These wells ave	rage 25.3 bb	ls	NO <sub>x</sub>	0.30	tpy/tank			
of condensate p	er day.		CO	tpy/tank				

VOC	15.9	tpy/tank
HAP	0.8	tpy/tank
Benzene	0.0367	tpy/tank
Toluene	0.0021	tpy/tank
Ethylbenzene	0.022	tpy/tank
Xylene	0.0279	tpy/tank
n-Hexane	0.6891	tpy/tank
These wells avera	age 7.9 bbls of	f condensate per day.

<sup>1</sup> Provided by EnCana.

<sup>2</sup> AP-42 (EPA 2004), Table 13.5-1, "Emission Factors for Flare Operations."

<sup>3</sup> Taken from Tank Oil Analysis Global Properties.

Table B.2.9 Jonah Water Disposal Well

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317				Project: Scenario: Activity: Emissions: Date:	Jonah Infill I All Scenarios Production Jonah Water 3/31/2004	Drilling Project s <sup>.</sup> Disposal Well
Unit Description	Jonah Wa	ter Disposal Well				
Engine Design (hp)	400					
Operating Parameters:						
Operated	24	hr/day	7	davs/wk	365	davs/vr
Operating hours	8.760	,,		aayo,,		
Capacity (%)	100	(while operating)				
Annual Load (%)	Winter	25	Spring	25		
/	Summer	25	Fall	25		
Stack Parameters						
Height	6.1 m					
Temperature	832 Kelvin					
Diameter	0.2 m					
Velocity	16.7 m/s					
Emissions Data:	lb/hr	tpy				
NO <sub>x</sub>	0.90	3.9				
со	0.90	3.9				
VOC	0.90	3.9				
Formaldehyde	0.10	0.2				

#### **Table B.2.10 Bird Canyon Compressor Station**

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317				Project: Scenario: Activity: Emissions: Date:	Jonah Infill D All Scenarios Projected Jor Duke Field Se 3/24/2004	rilling Project nah Field Compression ervices Bird Canyon C.S.
Fuel Combustion Source:						
Unit Description	Bird Canyon Co	ompressor Station				
Engine design (hp)	11,004	•				
Operating Parameters:						
Operated	24	hr/dav	7	davs/wk	365	days/vr
Operating hours	8 760	in, acy,	·	aayo, mq		
Capacity (%)	100	(while operating	(r			
Annual Load (%)	Winter	25	Sprina	25		
	Summer	25	Fall	25		
Potential Fuel Combustion for the	Year for Unit:					
Volume of Natural Gas Combusted	636.30	MMSCF				
Assumes gas consumed at rate of	6601	Btu/hp-hr				
Heat Content	1000	Btu/scf				
Emission Data:			Method of	Emission		
	lb/hr	tpy	Determination	Factor <sup>1</sup>	Units	_
PM <sub>10</sub>	0.0	0.0	AP-42	0.00008	lb/MMscf	
PM <sub>2.5</sub>	0.0	0.00	AP-43	0.00008	lb/MMscf	
SO <sub>2</sub>	0.0	0.0	Fuel Analysis	0.00	lb/MMscf	
NO <sub>x</sub>	17.0	74.4	BACT	0.7	g/hp-hr	
CO	7.3	31.9	Permitted Emissions <sup>2</sup>	0.300	g/hp-hr	
VOC	12.1	53.1	Permitted Emissions <sup>2</sup>	0.500	g/hp-hr	
Formaldehyde	1.9	8.5	Permitted Emissions <sup>2</sup>	0.080	g/hp-hr	
<sup>1</sup> Based on a 4-stroke lean burn engi	ine, taken from AP	-42 Table 3.2-3 (E	PA 2004).			

Table B.2.11Falcon Compressor Station

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317				Project: . Scenario: / Activity: I Emissions: I Date: :	Jonah Infill Dı All Scenarios Projected Pin Duke Field Se 3/24/2004	rilling Project edale Anticline Compression rvices Falcon C.S.
Fuel Combustion Source:						
Unit Description	Falcon Compre	essor Station				
Engine design (hp/hr)	7,336					
Operating Parameters:						
Operated	24	hr/day,	7	days/wk,	365	days/yr
Operating hours	8,760					
Capacity (%)	100	(while operating)				
Annual Load (%)	Winter	25	Spring	25		
	Summer	25	Fall	25		
Potential Fuel Combustion for the	e Year for Unit:					
Volume of Natural Gas Combusted	424.20	MMSCF				
Assumes gas consumed at rate of	6,601	Btu/hp-hr				
Heat Content	1,000	Btu/scf				
Emission Data:			Method of	Emission		
	lb/hr	tpy	Determination	Factor <sup>1</sup>	Units	
PM <sub>10</sub>	0.0	0.0	AP-42	0.0000771	lb/MMscf	
PM <sub>2.5</sub>	0.0	0.00	AP-43	0.0000771	lb/MMscf	
SO <sub>2</sub>	0.0	0.0	Fuel Analysis	0.00	lb/MMscf	
NO <sub>x</sub>	11.3	49.6	BACT	0.7	g/hp-hr	
СО	4.9	21.3	Permitted Emissions <sup>2</sup>	0.300	g/hp-hr	
VOC	8.1	35.4	Permitted Emissions <sup>2</sup>	0.500	g/hp-hr	
Formaldehyde	1.3	5.7	Permitted Emissions <sup>2</sup>	0.080	g/hp-hr	
<ul> <li><sup>1</sup> Based on a 4-stroke lean burn er</li> <li><sup>2</sup> Emission rates taken from a Pine</li> </ul>	ngine, taken from edale Anticline Pe	AP-42 Table 3.2-3 rmit for an engine v	(EPA 2004). vith 0.7g/hphr NO <sub>x</sub> .			

Table B.2.12Gobblers Knob Compressor Station

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317				Project: Scenario: Activity: Emissions: Date:	Jonah Infill I All Scenarios Projected Pir Questar Gob 3/24/2004	Drilling Project S nedale Anticline Compression blers Knob C.S.
Fuel Combustion Source:						
Unit Description	Gobblers Knob	Compressor Static	on (Comprised of Pinedale	e, Mesa 1, and	Mesa 2)	
Engine design (hp/hr)	10,000					
Operating Parameters:			_			
Operated	24	hr/day,	7	days/wk,	365	days/yr
Operating hours	8,760					
Capacity (%)	100	(while operating	)			
Annual Load (%)	Winter	25	Spring	25		
	Summer	25	Fall	25		
Potential Fuel Combustion for the	Year for Unit:					
Volume of Natural Gas Combusted	578.25	MMSCF				
Assumes gas consumed at rate of	6,601	Btu/hp-hr				
Heat Content	1,000	Btu/scf				
Emission Data:			Method of	Emission		
DM	lb/hr	tpy	Determination	Factor	Units	_
PM <sub>10</sub>	0.0	0.0	AP-42	0.0000771	ID/IVINISCT	
PM <sub>2.5</sub>	0.0	0.00	AP-43	0.0000771	ID/IVINISCT	
	0.0	0.0	Fuel Analysis	0.00	ID/IVIIVISCT	
NO <sub>x</sub>	15.4	67.6	BACI Dermitted Emissions <sup>2</sup>	0.7	g/np-nr	
	6.6	29.0	Permitted Emissions	0.300	g/np-nr	
	11.0	48.3		0.500	g/np-nr	
Formaidenyde	1.8	1.1	Permitted Emissions	0.080	g/np-nr	
<sup>1</sup> Based on a 4-stroke lean burn eng	ine, taken from AF	P-42 Table 3.2-3 (E	PA 2004).			

<sup>2</sup> Emission rates taken from a Pinedale Anticline WDEQ permit for an engine with 0.7g/hp-hr NO<sub>x</sub>.

### Table B.2.13Jonah Compressor Station

Fuel Combustion Source: Unit DescriptionUnit DescriptionJonah Compressor StationEngine design (hp/hr)3,900Operating Parameters: Operating hoursOperating hours8,760Capacity (%)100Annual Load (%)Winter25FallSummer25Fotential Fuel Combustion for the Year for Unit: Volume of Natural Gas Combusted225.52MMSCF Assumes gas consumed at rate of 1,0006,601Btu/hp-hr Heat ContentMethod of Emission Data:PMt100.0PMt250.00.00.0AP-420.0000771Ib/MMscf SO20.00.00.0AP-430.0000771Ib/MMscf SO20.0NQ,6.02.611.3Permitted Emissions20.300g/hp-hr CO2.6VOC4.38.8Permitted Emissions2VOC4.30.73.0Permitted Emissions20.73.0Operating functionFormaldehyde0.73.0Permitted Emissions20.0800.0711.50.60.70.70.800.70.70.800.70.800.810.810.810.810.820.820.830.84	TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317				Project: Scenario: Activity: Emissions: Date:	Jonah Infill D All Scenarios Projected Jor Mountain Gas 3/24/2004	rilling Project s nah Field Compression s Resources Jonah C.S.	
Unit DescriptionJonah Compressor StationEngine design (hp/hr)3,900Operating Parameters:Operated24hr/day,7days/wk,365days/yrOperating hours8,760Capacity (%)100(while operating)Annual Load (%)100(while operating)Munuel Load (%)100(while operating)Summer25Spring25Summer25Fall25Potential Fuel Combustion for the Year for Unit:Volume of Natural Gas Combusted225.52MMSCFAssumes gas consumed at rate of6,601Btu/hp-hrHeat Content1,000Btu/scfEmission Data:PMt_00.00.0AP-42PMt_00.00.0AP-43PMt_00.00.0AP-43PMt_250.00.0AP-43SO20.00.0Fuel AnalysisNO_k6.026.4BACTNO_k2.611.3Permitted Emissions20.300g/hp-hrVOC4.318.8Permitted Emissions20.080g/hp-hr	Fuel Combustion Source:							
Engine design (hp/hr)3,900Operating Parameters:Operated24hr/day,7days/wk,365days/yrOperating hours8,760Capacity (%)100(while operating)Annual Load (%)Winter25Spring25Summer25Fall25Potential Fuel Combustion for the Year for Unit:Volume of Natural Gas Combusted225.52MMSCFAssumes gas consumed at rate of6,601Btu/hp-hrHeat Content1,000Btu/scfEmission Data:PMt_00.00.0AP-420.0000771PMt_2.50.00.00AP-430.0000771lb/MMscfSQ_20.00.0Fuel Analysis0.00lb/MMscfNO_k6.026.4BACT0.7g/hp-hrCO2.611.3Permitted Emissions²0.300g/hp-hrYOC4.318.8Permitted Emissions²0.000g/hp-hrYOC4.30.73.0Permitted Emissions²0.000g/hp-hr	Unit Description	Jonah Compre	ssor Station					
Operating Parameters:Operated24hr/day,7days/wk,365days/yrOperating hours8,760Capacity (%)100(while operating)Annual Load (%)Winter25Spring25Summer25Fall25Potential Fuel Combustion for the Year for Unit:Volume of Natural Gas Combusted225.52MMSCFAssumes gas consumed at rate of6,601Btu/hp-hrHeat Content1,000Btu/scfEmission Data:PM100.00.0AP-420.0000771PM250.00.00AP-430.0000771Ib/MMscfSQ20.00.0Fuel Analysis0.00Ib/MMscfNQk6.026.4BACT0.7g/hp-hrCO2.611.3Permitted Emissions <sup>2</sup> 0.300g/hp-hrVOC4.318.8Permitted Emissions <sup>2</sup> 0.080g/hp-hr	Engine design (hp/hr)	3,900						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Operating Parameters:							
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Operated	24	hr/day,	7	days/wk,	365	days/yr	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Operating hours	8,760						
Annual Load (%)Winter Summer25Spring 2525Potential Fuel Combustion for the Year for Unit:Volume of Natural Gas Combusted225.52MMSCFAssumes gas consumed at rate of 1,000 $6,601$ Btu/hp-hrHeat Content1,000Btu/scfMethod of DeterminationFailsionPM10Do.00.0PM100.00.0PM10PM2.5SO20.00O.0AP-420.0000771Ib/MMscfPM2.50.0SO20.00.0AP-430.000771Ib/MMscf0.0NOx6.026.4BACT0.7YOC4.34.318.8Permitted Emissions20.5009.0809/hp-hr	Capacity (%)	100	(while operatir	ng)				
Summer25Fall25Potential Fuel Combustion for the Year for Unit:Volume of Natural Gas Combusted225.52MMSCFAssumes gas consumed at rate of6,601Btu/hp-hrHeat Content1,000Btu/scfEmission Data:Method ofEmission Data:PM100.00.0PM2.50.00.00Q20.00.0AP-420.0000771Ib/MScfSO2NOx6.026.11.3Permitted Emissions²0.300Q102.611.3Permitted Emissions²VOC4.34.318.8Permitted Emissions²0.080g/hp-hr	Annual Load (%)	Winter	25	Spring	25			
Potential Fuel Combustion for the Year for Unit:Volume of Natural Gas Combusted225.52MMSCFAssumes gas consumed at rate of6,601Btu/hp-hrHeat Content1,000Btu/scfEmission Data:Method ofEmissionPM <sub>10</sub> 0.00.0AP-420.0000771Ib/MMscfPM <sub>25</sub> 0.00.00AP-430.0000771Ib/MMscfSO20.00.0Fuel Analysis0.00Ib/MMscfNOx6.026.4BACT0.7g/hp-hrCO2.611.3Permitted Emissions²0.300g/hp-hrVOC4.318.8Permitted Emissions²0.500g/hp-hrFormaldehyde0.73.0Permitted Emissions²0.080g/hp-hr		Summer	25	Fall	25			
Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content $225.52$ $6,601$ Btu/hp-hr $1,000$ MMSCFEmission Data:Method of Ib/hrEmission Factor1UnitsPM100.00.0AP-420.0000771Ib/MMscfPM250.00.00AP-430.0000771Ib/MMscfSO20.00.0Fuel Analysis0.00Ib/MMscfNOx6.026.4BACT0.7g/hp-hrCO2.611.3Permitted Emissions²0.300g/hp-hrVOC4.318.8Permitted Emissions²0.300g/hp-hrFormaldehyde0.73.0Permitted Emissions²0.080g/hp-hr	Potential Fuel Combustion for the	/ear for Unit:						
Assumes gas consumed at rate of Heat Content         6,601 1,000         Btu/scf           Emission Data:         Method of Ib/hr         Emission type         Emission Determination         Factor <sup>1</sup> Units           PM <sub>10</sub> 0.0         0.0         AP-42         0.0000771         Ib/MMscf           PM <sub>25</sub> 0.0         0.00         AP-43         0.0000771         Ib/MMscf           SO <sub>2</sub> 0.0         0.0         Fuel Analysis         0.00         Ib/MMscf           NO <sub>x</sub> 6.0         26.4         BACT         0.7         g/hp-hr           VOC         2.6         11.3         Permitted Emissions <sup>2</sup> 0.300         g/hp-hr           VOC         4.3         18.8         Permitted Emissions <sup>2</sup> 0.500         g/hp-hr           Formaldehyde         0.7         3.0         Permitted Emissions <sup>2</sup> 0.800         g/hp-hr	Volume of Natural Gas Combusted	225.52	MMSCF					
Heat Content         1,000         Btu/scf           Emission Data:         Method of         Emission           Ib/hr         tpy         Determination         Factor <sup>1</sup> Units           PM <sub>10</sub> 0.0         0.0         AP-42         0.0000771         Ib/MMscf           PM <sub>2.5</sub> 0.0         0.00         AP-43         0.0000771         Ib/MMscf           SO <sub>2</sub> 0.0         0.0         Fuel Analysis         0.00         Ib/MMscf           NO <sub>x</sub> 6.0         26.4         BACT         0.7         g/hp-hr           CO         2.6         11.3         Permitted Emissions <sup>2</sup> 0.300         g/hp-hr           VOC         4.3         18.8         Permitted Emissions <sup>2</sup> 0.500         g/hp-hr           Formaldehyde         0.7         3.0         Permitted Emissions <sup>2</sup> 0.800         g/hp-hr	Assumes gas consumed at rate of	6,601	Btu/hp-hr					
Emission Data:         Method of         Emission           Ib/hr         tpy         Determination         Factor <sup>1</sup> Units           PM <sub>10</sub> 0.0         0.0         AP-42         0.0000771         Ib/MMscf           PM <sub>2.5</sub> 0.0         0.00         AP-43         0.0000771         Ib/MMscf           SO <sub>2</sub> 0.0         0.0         Fuel Analysis         0.00         Ib/MMscf           NO <sub>x</sub> 6.0         26.4         BACT         0.7         g/hp-hr           CO         2.6         11.3         Permitted Emissions <sup>2</sup> 0.300         g/hp-hr           VOC         4.3         18.8         Permitted Emissions <sup>2</sup> 0.500         g/hp-hr           Formaldehyde         0.7         3.0         Permitted Emissions <sup>2</sup> 0.800         g/hp-hr	Heat Content	1,000	Btu/scf					
Method of         Emission           Ib/hr         tpy         Determination         Factor <sup>1</sup> Units           PM <sub>10</sub> 0.0         0.0         AP-42         0.000771         Ib/MMscf           PM <sub>2.5</sub> 0.0         0.00         AP-43         0.000771         Ib/MMscf           SO <sub>2</sub> 0.0         0.0         Fuel Analysis         0.00         Ib/MMscf           NO <sub>x</sub> 6.0         26.4         BACT         0.7         g/np-hr           CO         2.6         11.3         Permitted Emissions <sup>2</sup> 0.300         g/np-hr           VOC         4.3         18.8         Permitted Emissions <sup>2</sup> 0.500         g/np-hr           Formaldehyde         0.7         3.0         Permitted Emissions <sup>2</sup> 0.080         g/np-hr	Emission Data:							
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$				Method of	Emission			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		lb/hr	tpy	Determination	Factor <sup>1</sup>	Units		
PM2.5         0.0         0.00         AP-43         0.000771         lb/MMscf           SO2         0.0         0.0         Fuel Analysis         0.00         lb/MMscf           NOx         6.0         26.4         BACT         0.7         g/hp-hr           CO         2.6         11.3         Permitted Emissions <sup>2</sup> 0.300         g/hp-hr           VOC         4.3         18.8         Permitted Emissions <sup>2</sup> 0.500         g/hp-hr           Formaldehyde         0.7         3.0         Permitted Emissions <sup>2</sup> 0.080         g/hp-hr	PM <sub>10</sub>	0.0	0.0	AP-42	0.0000771	lb/MMscf		
SO2         0.0         0.0         Fuel Analysis         0.00         Ib/MMscf           NOx         6.0         26.4         BACT         0.7         g/hp-hr           CO         2.6         11.3         Permitted Emissions <sup>2</sup> 0.300         g/hp-hr           VOC         4.3         18.8         Permitted Emissions <sup>2</sup> 0.500         g/hp-hr           Formaldehyde         0.7         3.0         Permitted Emissions <sup>2</sup> 0.080         g/hp-hr	PM <sub>2.5</sub>	0.0	0.00	AP-43	0.0000771	lb/MMscf		
NO <sub>x</sub> 6.0         26.4         BACT         0.7         g/hp-hr           CO         2.6         11.3         Permitted Emissions <sup>2</sup> 0.300         g/hp-hr           VOC         4.3         18.8         Permitted Emissions <sup>2</sup> 0.500         g/hp-hr           Formaldehyde         0.7         3.0         Permitted Emissions <sup>2</sup> 0.080         g/hp-hr	SO <sub>2</sub>	0.0	0.0	Fuel Analysis	0.00	lb/MMscf		
CO         2.6         11.3         Permitted Emissions <sup>2</sup> 0.300         g/hp-hr           VOC         4.3         18.8         Permitted Emissions <sup>2</sup> 0.500         g/hp-hr           Formaldehyde         0.7         3.0         Permitted Emissions <sup>2</sup> 0.080         g/hp-hr	NO <sub>x</sub>	6.0	26.4	BACT	0.7	g/hp-hr		
VOC4.318.8Permitted Emissions20.500g/hp-hrFormaldehyde0.73.0Permitted Emissions20.080g/hp-hr	СО	2.6	11.3	Permitted Emissions <sup>2</sup>	0.300	g/hp-hr		
Formaldehyde 0.7 3.0 Permitted Emissions <sup>2</sup> 0.080 g/hp-hr	VOC	4.3	18.8	Permitted Emissions <sup>2</sup>	0.500	g/hp-hr		
	Formaldehyde	0.7	3.0	Permitted Emissions <sup>2</sup>	0.080	g/hp-hr		
<sup>1</sup> Based on a 4-stroke lean burn engine, taken from AP-42 Table 3.2-3 (EPA 2004). <sup>2</sup> Emission rates taken from a Pinadale Anticline Permit for an engine with 0 Tableshr NO.	<sup>1</sup> Based on a 4-stroke lean burn eng	ine, taken from Al	P-42 Table 3.2-3	(EPA 2004).				

#### Table B.2.14 Luman Compressor Station

Fuel Combustion Source:         Unit Description       Li         Engine design (hp/hr)       Dperating Parameters:         Operated       Operating hours         Capacity (%)       Annual Load (%)         Potential Fuel Combustion for the Year       Volume of Natural Gas Combusted         Assumes gas consumed at rate of       Heat Content	uman Compre 11,604 24 8,760 100 Winter Summer ar for Unit: 671.00 6,601 1,000	hr/day, hr/day, (while operatir 25 25 MMSCF Btu/ho-hr	7 ng) Spring Fall	days/wk, 25 25	365	days/yr
Unit Description Li Engine design (hp/hr) Operating Parameters: Operated Operating hours Capacity (%) Annual Load (%) Potential Fuel Combustion for the Year Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	uman Compre 11,604 24 8,760 100 Winter Summer ar for Unit: 671.00 6,601 1,000	hr/day, (while operatir 25 25 MMSCF Btu/ho-hr	7 ng) Spring Fall	days/wk, 25 25	365	days/yr
Engine design (hp/hr) <b>Operating Parameters:</b> Operated Operating hours Capacity (%) Annual Load (%) <b>Potential Fuel Combustion for the Yea</b> Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	24 8,760 100 Winter Summer ar for Unit: 671.00 6,601 1,000	hr/day, (while operatir 25 25 MMSCF Btu/ho-hr	7 ng) Spring Fall	days/wk, 25 25	365	days/yr
Operating Parameters: Operated Operating hours Capacity (%) Annual Load (%) Potential Fuel Combustion for the Yea Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	24 8,760 100 Winter Summer ar for Unit: 671.00 6,601 1,000	hr/day, (while operatir 25 25 MMSCF Btu/hp-hr	7 ng) Spring Fall	days/wk, 25 25	365	days/yr
Operated Operating hours Capacity (%) Annual Load (%) Potential Fuel Combustion for the Yea Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	24 8,760 100 Winter Summer ar for Unit: 671.00 6,601 1,000	hr/day, (while operatir 25 25 MMSCF Btu/ho-hr	7 ng) Spring Fall	days/wk, 25 25	365	days/yr
Operating hours Capacity (%) Annual Load (%) Potential Fuel Combustion for the Yea Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	8,760 100 Winter Summer ar for Unit: 671.00 6,601 1,000	(while operatin 25 25 MMSCF Btu/hp-hr	ng) Spring Fall	25 25		
Capacity (%) Annual Load (%) Potential Fuel Combustion for the Yea Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	100 Winter Summer ar for Unit: 671.00 6,601 1,000	(while operatir 25 25 MMSCF Btu/hp-hr	ng) Spring Fall	25 25		
Annual Load (%) Potential Fuel Combustion for the Yea Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	Winter Summer ar for Unit: 671.00 6,601 1,000	25 25 MMSCF Btu/hp-hr	Spring Fall	25 25		
Potential Fuel Combustion for the Yea Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	Summer ar for Unit: 671.00 6,601 1,000	25 MMSCF Btu/hp-hr	Fall	25		
Potential Fuel Combustion for the Yea Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	ar for Unit: 671.00 6,601 1,000	MMSCF Btu/hp-hr				
Volume of Natural Gas Combusted Assumes gas consumed at rate of Heat Content	671.00 6,601 1,000	MMSCF Btu/hp-hr				
Assumes gas consumed at rate of Heat Content	6,601 1,000	Btu/hp-hr				
Heat Content	1,000	and the second sec				
		Btu/scf				
Emission Data for 11,004 hp:			Method of	Emission		
	lb/hr	TPY	Determination	Factor <sup>1</sup>	Units	
PM <sub>10</sub>	0.0	0.0	AP-42	0.0000771	lb/MMscf	_
PM <sub>2.5</sub>	0.0	0.00	AP-43	0.0000771	lb/MMscf	
SO <sub>2</sub>	0.0	0.0	Fuel Analysis	0.00	lb/MMscf	
NO <sub>x</sub>	17.9	78.4	BACT	0.70	g/hp-hr	
СО	7.7	33.6	Permitted Emissions <sup>2</sup>	0.30	g/hp-hr	
VOC	12.8	56.0	Permitted Emissions <sup>2</sup>	0.50	g/hp-hr	
Formaldehyde	2.0	9.0	Permitted Emissions <sup>2</sup>	0.08	g/hp-hr	
Emission Data for 600 hp:			Method of	Emission		
_	lb/hr	TPY	Determination	Factor'	Units	_
PM <sub>10</sub>	0.0	0.0	AP-42	7.71E-05	lb/MMscf	
PM <sub>2.5</sub>	0.0	0.00	AP-43	7.71E-05	lb/MMscf	
SO <sub>2</sub>	0.0	0.0	Fuel Analysis	0.00	lb/MMscf	
NO <sub>x</sub>	1.3	5.8	BACT	1.0	g/hp-hr	
СО	0.7	2.9	Permitted Emissions <sup>2</sup>	0.50	g/hp-hr	
VOC	0.7	2.9	Permitted Emissions <sup>2</sup>	0.50	g/hp-hr	
Formaldehyde	0.1	0.4	Permitted Emissions <sup>2</sup>	0.07	g/hp-hr	
Total Emissions:	lb/hr	TPY				
PM <sub>10</sub>	0.0	0.0				
PM <sub>2.5</sub>	0.0	0.0				
SO <sub>2</sub>	0.0	0.0				
NO <sub>x</sub>	19.2	84.2				
CO	8.3	36.5				
VOC	13.5	58.9				
Formaldehyde	2.1	9.4				

<sup>2</sup> Emission rates taken from Luman Permit MD-921.

<b>Table B.2.15</b>
Paradise Compressor Station

TRC Environmental 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317				Project: Scenario: Activity: Emissions: Date:	Jonah Infill [ All Scenarios Projected Pil Paradise C.S 3/24/2004	Drilling Project s nedale Anticline Compression 5.
Fuel Combustion Source:						
Unit Description	Paradise Comp	pressor Station				
Engine design (hp/hr)	7,336					
Operating Parameters:						
Operated	24	hr/dav.	7	davs/wk.	365	davs/vr
Operating hours	8,760	, <b>,</b> ,		, ,		
Capacity (%)	100	(while operating	)			
Annual Load (%)	Winter	25	Spring	25		
	Summer	25	Fall	25		
Potential Fuel Combustion for the	Year for Unit:					
Volume of Natural Gas Combusted	424.20	MMSCF				
Assumes gas consumed at rate of	6,601	Btu/hp-hr				
Heat Content	1,000	Btu/scf				
Emission Data:			Method of	Emission		
	lb/hr	tpy	Determination	Factor <sup>1</sup>	Units	
PM <sub>10</sub>	0.0	0.0	AP-42	0.0000771	lb/MMscf	—
PM <sub>2.5</sub>	0.0	0.00	AP-43	0.0000771	lb/MMscf	
SO <sub>2</sub>	0.0	0.0	Fuel Analysis	0.00	lb/MMscf	
NO <sub>x</sub>	11.3	49.6	BACT	0.7	g/hp-hr	
CO	4.9	21.3	Permitted Emissions <sup>2</sup>	0.300	g/hp-hr	
VOC	8.1	35.4	Permitted Emissions <sup>2</sup>	0.500	g/hp-hr	
Formaldehyde	1.3	5.7	Permitted Emissions <sup>2</sup>	0.080	g/hp-hr	

<sup>1</sup> Based on a 4-stroke lean burn engine, taken from AP-42 Table 3.2-3 (EPA 2004).

<sup>2</sup> Emission rates taken from a Pinedale Anticline WDEQ permit for an engine with 0.7g/hp-hr NO<sub>x</sub>.

Table B.2.16Wind Erosion – 1 Well per Pad

TRC Environmental Corporation 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317					Project: Scenario: 1 Activity: F Emissions: \ Date: 1	Jonah Infill Drilling F I well per pad Production Wind Erosion from V I0/30/2003	Project Vell Pads	
Emission Factor :	0.3733	lb/hr/100m <sup>2</sup>	B	Based on AP-42 Cha	pter 13.2.5 (EPA 20	004), Industrial Wind E	Erosion	
Control Efficiency:	0	using Jonah Field, wyoming meteorological data.						
<b>Disturbed Area:</b> Well Pad Production:	0.9	acres	3642.30 n	1 <sup>2</sup>				
PM-10 Emissions Calculations:								
	PM <sub>10</sub>	PM <sub>2.5</sub>		Control	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	Emission Factor	Emission Factor	Area	Efficiency	Emissions	Emissions	Emissions	Emissions
	(lb/hr/100 m <sup>2</sup> )	(lb/hr/100 m <sup>2</sup> )	(100 m <sup>2</sup> )	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)
Well Pad - Production:	0.3733	0.1493	36.42	0	13.60	5.438341379	1.71	0.69

### Table B.2.17Production Traffic – 2 Wells per Pad

TRC Environmental       Project: Jonah Infill Drilling Project         605 Skyline Drive       Scenario: 2 wells per pad         Laramie, WY 82070       Activity: Production Traffic         Phone: (307) 742-3843       Emissions: Fugitive Particulate Emission         Fax: (307) 745-8317       from Traffic on Unpaved Road											ons bads				
Vehicle Type	Road Type	Dust Control Method	Average Vehicle Weight	Average Vehicle Speed	Silt Content <sup>2</sup>	Moisture Content <sup>3</sup>	RTs per Well <sup>4</sup>	RTs per Pad <sup>4</sup>	RT Distance	VMT <sup>5</sup>	Emission Control Efficiency	PM <sub>10</sub> Emission Factor <sup>6</sup>	PM <sub>2.5</sub> Emission Factor <sup>6</sup>	PM <sub>10</sub> Emissions <sup>7</sup> (controlled)	PM <sub>2.5</sub> Emissions <sup>7</sup> (controlled)
			(lb)	(mph)	(%)	(%)	(RTs/yr)	(RTs/year)	(miles)	(VMT/well/yr)	(%)	(Ib/VMT)	(Ib/VMT)	(lb/well/yr)	(lb/well/yr)
Workover Rig	Primary Access	magnesium chloride	90,000	20	5.1	2.4	1	na	14	14	85	2.35	0.36	4.93	0.76
	Resource	water	90,000	15	5.1	2.4	1	na	5	5	50	2.35	0.36	5.87	0.90
Haul trucks (water/condensate) <sup>1</sup>	Primary Access	magnesium chloride	54,000	20	5.1	2.4	35	na	14	490	85	1.87	0.29	137.19	21.04
	Resource	water	54,000	15	5.1	2.4	35	na	5	175	50	1.87	0.29	163.33	25.04
										T	Fotal Unpavec	Road Emissi	ons (lb/well/yr)	311.33	47.74
Light trucks/ pickups/pumpers <sup>8</sup>	Primary Access	magnesium chloride	7,000	30	5.1	2.4	na	122	14	1,708	85	0.56	0.08	143.10	21.39
	Resource	water	7,000	20	5.1	2.4	na	122	5	610	50	0.46	0.07	139.07	20.77
										-	Fotal Unpaved	l Road Emissi	ons (lb/pad/yr)	282.16	42.16
										Total Unpav	ed Road Emis	ssions - All Tra	affic (lb/pad/yr)	904.8	137.6
<ol> <li>Haul trucks weight</li> <li>AP-42 (EPA 2004),</li> <li>AP-42 (EPA 2004)</li> <li>AP-42 (EPA 2004)</li> <li>Includes Supervisc equipment operatir</li> </ol>	<ul> <li>Haul trucks weight range is 28,000-80,000 lbs; average weight of 54,000 lbs used for calculations.</li> <li>AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."</li> <li>AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."</li> <li>AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."</li> <li>Includes Supervisory Control and Data Acquisitions system (SCADA). SCADA is being installed at wells to increase production efficiency by providing real-time operating data to field staff including well flow rates and pressures, processing</li> </ul>														

<sup>5</sup> Calculated as Round Trips per Vehicle Type x Round Trip Distance

<sup>6</sup> AP-42 (EPA 2004), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

<sup>7</sup> Calculated as lb/VMT x VMT/well x control efficiency.

### Table B.2.18Production Traffic – 5 Wells per Pad

TRC EnvironmentalProject: Jonah Infill Drilling Project605 Skyline DriveScenario: 5 wells per padLaramie, WY 82070Activity: Production TrafficPhone: (307) 742-3843Emissions: Fugitive Particulate EmisFax: (307) 745-8317from Traffic on UnpavedDate: 3/24/2004Date: 3/24/2004										ject issions d Roads					
Vehicle Type	Road Type	Dust Control Method	Average Vehicle Weight	Average Vehicle Speed	Silt Content <sup>2</sup>	Moisture Content <sup>3</sup>	RTs per Well⁴	RTs per Pad <sup>4</sup>	RT Distance	VMT⁵	Emission Control Efficiency	PM <sub>10</sub> Emission Factor <sup>6</sup>	PM <sub>2.5</sub> Emission Factor <sup>6</sup>	PM <sub>10</sub> Emissions <sup>7</sup> (controlled)	PM <sub>2.5</sub> Emissions <sup>7</sup> (controlled)
,,	71		(lb)	(mph)	(%)	(%)	(RTs/yr)	(RTs/year)	(miles)	(VMT/well/yr)	(%)	(Ib/VMT)	(lb/VMT)	(lb/well/yr)	(lb/well/yr)
Workover Rig	Primary Access Resource	magnesium chloride water	90,000	20 15	5.1	2.4	1	na	14 5	14 5	85 50	2.35	0.36	4.93	0.76
Haul trucks (water/condensate) <sup>1</sup>	Primary Access	magnesium chloride	54,000	20	5.1	2.4	35	na	14	490	85	1.87	0.29	137.19	21.04
	Resource	water	54,000	15	5.1	2.4	35	na	5	175	50	1.87	0.29	163.33	25.04
										Total	Unpaved Ro	ad Emission	s (lb/well/yr)	311.33	47.74
Light trucks/ pickups/pumpers <sup>8</sup>	Primary Access	magnesium chloride	7,000	30	5.1	2.4	na	122	14	1,708	85	0.56	0.08	143.10	21.39
	Resource	water	7,000	20	5.1	2.4	na	122	5	610	50	0.46	0.07	139.07	20.77
									Тс	Total	Unpaved Ro	ad Emission ns - All Traffi	is (lb/pad/yr)	282.16	42.16

<sup>1</sup> Haul trucks weight range is 28,000-80,000 lbs; average weight of 54,000 lbs used for calculations.

<sup>2</sup> AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

<sup>3</sup> AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

<sup>4</sup> Includes Supervisory Control and Data Acquisitions system (SCADA). SCADA is being installed at wells to increase production efficiency by providing real-time operating data to field staff including well flow rates and pressures, processingequipment operating conditions, tank levels, and emissions control equipment status. SCADA implementation is expected to reduce well site visits by 30-40% and reduce potential for spills.

<sup>5</sup> Calculated as Round Trips per Vehicle Type x Round Trip Distance

<sup>6</sup> AP-42 (EPA 2004), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

<sup>7</sup> Calculated as lb/VMT x VMT/well x control efficiency.

### Table B.2.19Production Traffic – 10 Wells per Pad

Dust Control Method magnesium chloride water	Average Vehicle Weight (Ib) 90,000	Average Vehicle Speed (mph)	Silt Content <sup>2</sup> (%)	Moisture Content <sup>3</sup>	RTs per				Emission	PM <sub>10</sub>	PMar	PM.	DM
magnesium chloride water	(lb) 90,000	(mph) 20	(%)		Well <sup>4</sup>	RTs per Pad <sup>₄</sup>	RT Distance	VMT <sup>5</sup>	Control	Emission Factor <sup>6</sup>	Emission Factor <sup>6</sup>	Emissions <sup>7</sup> (controlled)	Emissions <sup>7</sup> (controlled)
magnesium chloride water	90,000	20		(%)	(RTs/yr)	(RTs/year)	(miles)	(VMT/well/yr)	(%)	(lb/VMT)	(lb/VMT)	(lb/well/yr)	(lb/well/yr)
water		20	5.1	2.4	1	na	14	14	85	2.35	0.36	4.93	0.76
	90,000	15	5.1	2.4	1	na	5	5	50	2.35	0.36	5.87	0.90
magnesium chloride	54,000	20	5.1	2.4	35	na	14	490	85	1.87	0.29	137.19	21.04
water	54,000	15	5.1	2.4	35	na	5	175	50	1.87	0.29	163.33	25.04
									Total Unpave	d Road Emissi	ons (lb/well/yr)	311.33	47.74
magnesium chloride	7,000	30	5.1	2.4	na	122	14	1,708	85	0.56	0.08	143.10	21.39
water	7,000	20	5.1	2.4	na	122	5	610	50	0.46	0.07	139.07	20.77
									Total Unpave	d Road Emissi	ons (lb/pad/yr)	282.16	42.16
						-		Total Unpa	ved Road Em	issions - All Tra	affic (lb/pad/yr)	3,395.4	519.5
ma ch wa	agnesium loride ater	agnesium 7,000 loride ater 7,000	agnesium 7,000 30 Ioride ater 7,000 20	agnesium 7,000 30 5.1 Ioride ater 7,000 20 5.1	agnesium 7,000 30 5.1 2.4 Ioride ater 7,000 20 5.1 2.4	agnesium 7,000 30 5.1 2.4 na Ioride ater 7,000 20 5.1 2.4 na	agnesium 7,000 30 5.1 2.4 na 122 loride ater 7,000 20 5.1 2.4 na 122	agnesium 7,000 30 5.1 2.4 na 122 14 loride ater 7,000 20 5.1 2.4 na 122 5	agnesium 7,000 30 5.1 2.4 na 122 14 1,708 loride ater 7,000 20 5.1 2.4 na 122 5 610 	agnesium 7,000 30 5.1 2.4 na 122 14 1,708 85 loride ater 7,000 20 5.1 2.4 na 122 5 610 50 Total Unpave	agnesium 7,000 30 5.1 2.4 na 122 14 1,708 85 0.56 loride iter 7,000 20 5.1 2.4 na 122 5 610 50 0.46 Total Unpaved Road Emissions - All Tra	agnesium 7,000 30 5.1 2.4 na 122 14 1,708 85 0.56 0.08 loride iter 7,000 20 5.1 2.4 na 122 5 610 50 0.46 0.07 Total Unpaved Road Emissions (lb/pad/yr) Total Unpaved Road Emissions - All Traffic (lb/pad/yr)	agnesium       7,000       30       5.1       2.4       na       122       14       1,708       85       0.56       0.08       143.10         loride       agnesium       7,000       20       5.1       2.4       na       122       5       610       50       0.46       0.07       139.07         Total Unpaved Road Emissions (lb/pad/yr)       282.16

<sup>2</sup> AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."

<sup>3</sup> AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."

<sup>4</sup> Includes Supervisory Control and Data Acquisitions system (SCADA). SCADA is being installed at wells to increase production efficiency by providing real-time operating data to field staff including well flow rates and pressures, processing equipment operating conditions, tank levels, and emissions control equipment status. SCADA implementation is expected to reduce well site visits by 30-40% and reduce potential for spills.

<sup>5</sup> Calculated as Round Trips per Vehicle Type x Round Trip Distance

<sup>6</sup> AP-42 (EPA 2004), Section 13.2.2 "Unpaved Roads", equations 1a and 1b.

<sup>7</sup> Calculated as lb/VMT x VMT/well x control efficiency.

Table B.2.20Wind Erosion – 2 Wells per Pad

TRC Environmental Corporatio 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317	on				Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drill 2 wells per pad Production Wind Erosion fr 10/30/2003	ing Project om Well Pade	5
Emission Factor : 0.3733 lb/hr/100m <sup>2</sup>				Based on AP	-42 Chapter 13	.2.5 (EPA 2004),	ndustrial Wind	d Erosion
Control Efficiency:	0	%		using Jonan F	-ieid, vvyoming	meteorological d	ata.	
<b>Disturbed Area:</b> Well Pad Production:	1.2	acres	4,856.40	m²				
PM <sub>10</sub> Emissions Calculations:								
	PM <sub>10</sub>	PM <sub>2.5</sub>		Control	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	Emission Factor	Emission Factor	Area	Efficiency	Emissions	Emissions	Emissions	Emissions
	(lb/hr/100 m <sup>2</sup> )	(lb/hr/100 m <sup>2</sup> )	(100 m <sup>2</sup> )	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)
Well Pad - Production	0.3733	0.1493	48.56	0	18.13	7.251121838	2.28	0.91

# Table B.2.21Wind Erosion – 5 Wells per Pad

TRC Environmental Corporation 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drilli 5 well per pad Production Wind Erosion fr 10/30/2003	ing Project om Well Pads	3						
Emission Factor :	0.3733	lb/hr/100m <sup>2</sup>		Based on AP-42 Chapter 13.2.5 (EPA 2004), Industrial Wind Erosion								
Control Efficiency:	0	%		using Jonan i	neid, wyorning	Thereofological da	ala.					
Disturbed Area: Well Pad Production:	2	acres	8,094.00	m²								
PM <sub>10</sub> Emissions Calculations:												
	PM <sub>10</sub>	PM <sub>2.5</sub>		Control	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>				
	Emission Factor	Emission Factor	Area	Efficiency	Emissions	Emissions	Emissions	Emissions				
	(lb/hr/100 m <sup>2</sup> )	(lb/hr/100 m <sup>2</sup> )	(100 m <sup>2</sup> )	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)				
Well Pad - Production	0.3733	0.1493	80.94	0	30.21	12.08520306	3.81	1.52				

# Table B.2.22Wind Erosion – 10 Wells per Pad

TRC Environmental Corporation 605 Skyline Drive Laramie, WY 82070 Phone: (307) 742-3843 Fax: (307) 745-8317	n			Project: Scenario: Activity: Emissions: Date:	Jonah Infill Drill 10 well per pad Production Wind Erosion fr 10/30/2003	ing Project om Well Pads	5						
Emission Factor :	0.3733	lb/hr/100m <sup>2</sup>		Based on AP-42 Chapter 13.2.5 (EPA 2004), Industrial Wind Erosion									
Control Efficiency:	0	%		using sonan i	iela, wyonning	meteorological u	ala.						
Disturbed Area:													
Well Pad Production:	2	8,094.00	m²										
PM <sub>10</sub> Emissions Calculations:													
	PM <sub>10</sub>	PM <sub>2.5</sub>		Control	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>					
	Emission Factor	Emission Factor	Area	Efficiency	Emissions	Emissions	Emissions	Emissions					
	(lb/hr/100 m <sup>2</sup> )	(lb/hr/100 m <sup>2</sup> )	(100 m <sup>2</sup> )	(%)	(lb/hr)	(lb/hr)	(g/sec)	(g/sec)					
Well Pad - Production	0.3733	0.1493	80.94	0	30.21	12.08520306	3.81	1.52					