

APPENDIX – B:2009

2009 Monitoring Data

Data Summary for All Chemicals of Potential Concern (COPCs) and
Toxicity Values

Table B1. 2009 Chemicals with Toxicity Values at the Bell and Rulison Sites in the Rural Oil & Gas Development Area.

Compound	BELL			RULISON		
	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$
Acetaldehyde	1.398	0.00	0.893	2.757	0.00	1.472
Acetone	5.321	0.00	3.004	5.155	0.00	3.498
Benzene	4.537	0.00	1.977	6.283	1.96	2.711
1,3-Butadiene	0.153	87.50	0.048	0.177	76.5	0.047
Crotonaldehyde	0.553	0.00	0.280	0.482	0.00	0.272
Cyclohexane	12.56	0.00	3.270	12.16	0.00	4.896
Ethylbenzene	1.183	8.93	0.362	1.997	0.00	0.448
Formaldehyde	10.21	0.00	2.936	1.744	0.00	1.328
n-Hexane	24.97	0.00	8.073	19.39	0.00	7.853
Isopropylbenzene	0.144	64.29	0.073	0.126	58.8	0.072
Methylcyclohexane	23.92	0.00	7.749	26.27	0.00	10.59
Nonane	3.077	1.79	0.990	3.456	0.00	1.611
Pentane	53.71	0.00	14.45	34.64	0.00	17.41
Propionaldehyde	0.19	0.00	0.105	0.214	4.17	0.114
Propylene	2.455	0.00	0.489	1.773	0.00	0.567
Propylbenzene	0.397	51.79	0.106	0.221	31.37	0.124
Styrene	0.215	91.07	0.077	0.405	96.08	0.148
Toluene	9.367	0.00	3.728	12.92	0.00	5.643
2,3-1,Trimethylbenzene	0.847	62.50	0.123	0.348	43.14	0.128
1,2,4-Trimethylbenzene	2.96	8.93	0.516	1.071	1.96	0.475
1,3,5-Trimethylbenzene	1.202	28.57	0.193	0.934	3.92	0.388
m-Xylene/p-Xylene	5.064	0.00	1.978	7.924	0.00	3.452
o-Xylene	1.693	7.14	0.463	2.003	0.00	0.589
Aliphatic hydrocarbons C5-C8	207.9	NA	64.36	139.5	NA	61.93
Aliphatic hydrocarbons C9-C18	46.93	NA	6.73	17.40	NA	4.66
Aromatic hydrocarbons C9-C16	4.72	NA	0.89	2.34	NA	0.98

NA = Not Applicable

Table B 1.1 2009 Chemicals with Toxicity Values at the Parachute and Rifle Sites in the Urban Oil & Gas Development Area

Compound	PARACHUTE			RIFLE		
	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$
Acetaldehyde	2.036	0.00	1.111	2.757	0.00	1.573
Acetone	7.293	0.00	3.681	6.485	0.00	3.490
Benzene	10.12	0.00	3.143	6.656	0.00	2.544
1,3-Butadiene	3.147	67.86	0.225	0.402	38.33	0.138
Crotonaldehyde	0.258	0.00	0.127	0.433	0.00	0.199
Cyclohexane	18.76	0.00	4.614	9.925	0.00	3.939
Ethylbenzene	1.916	3.57	0.518	1.661	0.00	0.623
Formaldehyde	3.046	0.00	1.912	2.923	0.00	1.853
n-Hexane	28.90	0.00	7.461	16.8	0.00	7.077
Isopropylbenzene	0.317	57.14	0.094	0.176	61.67	0.093
Methylcyclohexane	48.99	0.00	11.65	24.44	0.00	8.464
Nonane	11.95	0.00	2.452	5.776	1.67	1.505
Pentane	41.08	0.00	11.96	29.92	0.00	10.57
Propionaldehyde	0.316	6.67	0.112	0.444	0.00	0.188
Propylene	1.509	0.00	0.63	2.444	0.00	1.169
Propylbenzene	0.688	26.79	0.181	0.527	18.33	0.188
Styrene	0.163	98.21	n/a	0.16	88.33	0.100
Toluene	24.76	0.00	6.959	15.18	0.00	5.312
1,2,3-Trimethylbenzene	0.623	37.50	0.168	0.579	23.33	0.199
1,2,4-Trimethylbenzene	3.234	1.79	0.938	2.775	1.67	0.998
1,3,5-Trimethylbenzene	2.862	7.14	0.796	1.535	3.33	0.494
m-Xylene/p-Xylene	19.70	0.00	4.429	10.75	0.00	3.113
o-Xylene	3.17	3.57	0.778	2.48	1.67	0.864
Aliphatic hydrocarbons C5-C8	218.7	NA	62.39	179.7	NA	61.40
Aliphatic hydrocarbons C9-C18	40.47	NA	8.41	16.25	NA	4.54
Aromatic hydrocarbons C9-C16	5.78	NA	1.46	4.3	NA	1.57

NA = Not Applicable

Table B2. 2009 Total Petroleum Hydrocarbons (TPHs) with Toxicity Values at the Bell and Rulison Sites in the Rural Oil & Gas Development Area.

Compound	BELL			RULISON		
	Max. Conc. µg/m ³	% Samples ND	EPC µg/m ³	Max. Conc. µg/m ³	% Samples ND	EPC µg/m ³
1-Heptene	2.977	3.57	0.864	2.983	1.96	1.133
1-Hexene	0.277	48.21	0.109	0.356	50.98	0.113
1-Octene	0.198	82.14	0.111	0.602	76.47	0.149
1-Pentene	0.380	0.00	0.120	0.535	1.96	0.187
2,2,3-Trimethylpentane	0.590	51.79	0.182	0.718	15.69	0.3
2,2,4-Trimethylpentane	2.476	35.71	0.246	0.712	37.25	0.158
2,2-Dimethylbutane	2.262	0.00	0.770	2.297	0.00	1.104
2,3,4-Trimethylpentane	0.246	41.07	0.100	0.26	33.33	0.106
2,3-Dimethylbutane	5.046	0.00	1.609	4.124	0.00	1.98
2,3-Dimethylpentane	2.078	0.00	0.718	1.95	0.00	0.933
2,4-Dimethylpentane	1.481	0.00	0.514	1.405	0.00	0.622
2-Ethyl-1-butene	NA	100.0	NA	NA	100.00	NA
2-Methyl-1-butene	39.35	78.57	8.682	0.519	66.67	0.138
2-Methyl-1-pentene	NA	100.0	NA	0.111	98.04	0.111
2-Methyl-2-butene	0.182	57.14	0.098	0.302	58.82	0.105
2-Methylheptane	2.756	0.00	0.901	2.908	0.00	1.255
2-Methylhexane	5.714	3.57	1.996	5.913	0.00	2.466
2-Methylpentane	22.03	0.00	7.097	16.74	0.00	8.108
3-Methyl-1-butene	0.185	85.71	0.095	0.0929	90.20	0.0935
3-Methylheptane	1.746	0.00	0.584	2.079	0.00	0.949
3-Methylhexane	4.836	12.50	1.458	4.409	17.65	1.759
3-Methylpentane	11.63	0.00	3.735	9.458	0.00	4.515
4-Methyl-1-pentene	0.435	98.21	0.435	0.1	98.04	0.1
cis-2-Hexene	0.091	83.93	0.066	0.265	80.39	0.068
cis-2-Pentene	0.111	55.36	0.058	0.124	52.94	0.062
Cyclopentane	2.765	0.00	0.918	2.071	0.00	0.997
Cyclopentene	0.585	66.07	0.134	0.618	64.71	0.153
Isopentane	66.69	1.79	22.66	45.74	0.00	21.05
Isoprene	2.134	21.43	0.655	3.115	27.45	0.870
Methylcyclopentane	10.38	0.00	3.442	9.581	0.00	4.604
n-Heptane	11.36	0.00	3.753	11.59	0.00	4.58
n-Octane	6.716	0.00	2.136	7.592	0.00	3.284
trans-2-Hexene	0.030	98.21	0.030	NA	100.0	NA
trans-2-Pentene	0.165	51.79	0.084	0.255	0.00	0.092
Sum of Aliphatic C5-C8 Fraction	207.9	NA	64.36	139.5	NA	61.93

NA = Not Applicable

Table B2 Continued

2009 Total Petroleum Hydrocarbons with Toxicity Values at the Bell and Rulison Sites in the Rural Oil & Gas Development Area.

Compound	BELL			RULISON		
	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$
Aliphatic hydrocarbons C9-C18						
1-Decene	NA	100.00	NA	NA	100.00	NA
1-Dodecene	0.585	76.79	0.159	0.406	80.39	0.160
1-Nonene	0.428	55.36	0.147	0.620	41.18	0.228
1-Tridecene	0.204	82.14	0.080	0.217	88.24	0.139
1-Undecene	1.067	53.57	0.254	1.176	56.86	0.257
a-Pinene	0.892	50.00	0.191	2.981	54.90	0.306
b-Pinene	0.309	85.71	0.126	0.337	86.27	0.143
n-Decane	6.168	1.790	1.273	3.975	0.000	1.212
n-Dodecane	19.10	23.21	1.729	2.235	25.49	0.728
n-Undecane	12.50	3.570	2.364	5.085	0.000	1.353
n-Tridecane	5.678	55.36	0.402	0.369	56.86	0.132
Sum of Aliphatic C9-C18 Fraction	46.93	NA	6.73	17.40	NA	4.66
Aromatic Hydrocarbons C9-C18						
p-Diethylbenzene	0.231	69.64	0.068	0.202	60.78	0.082
m-Diethylbenzene	0.388	57.14	0.125	0.457	50.98	0.141
p-Ethyltoluene	1.256	42.86	0.194	0.482	15.69	0.213
m-Ethyltoluene	1.409	7.14	0.321	0.743	1.96	0.337
o-Ethyltoluene	1.437	37.50	0.179	0.456	11.76	0.21
Sum of Aromatic C9-C16 Fraction	4.72	NA	0.89	2.34	NA	0.98

NA = Not Applicable

Table B2.1. 2009 Total Petroleum Hydrocarbons with toxicity values at the Parachute and Rifle Sites in the Urban Oil & Gas Development Area

Compound	PARACHUTE			RIFLE		
	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$
Aliphatic hydrocarbons C5-C8						
1-Heptene	3.448	7.14	1.394	2.685	3.33	1.030
1-Hexene	0.310	48.21	0.115	0.654	35.00	0.156
1-Octene	0.196	85.71	0.109	0.654	81.67	0.115
1-Pentene	0.368	0.00	0.150	0.861	1.67	0.336
2,2,3-Trimethylpentane	1.664	19.64	0.512	0.876	30.00	0.286
2,2,4-Trimethylpentane	5.273	46.43	0.36	1.851	0.00	0.382
2,2-Dimethylbutane	3.008	0.00	1.041	1.61	1.67	0.791
2,3,4-Trimethylpentane	0.239	30.36	0.102	1.04	8.33	0.255
2,3-Dimethylbutane	5.798	0.00	1.603	3.384	1.67	1.540
2,3-Dimethylpentane	3.033	0.00	0.86	1.991	0.00	0.916
2,4-Dimethylpentane	2.307	1.79	0.746	1.393	1.67	0.636
2-Ethyl-1-butene	NA	100.00	NA	NA	100.0	NA
2-Methyl-1-butene	0.614	60.71	0.162	2.553	21.67	0.421
2-Methyl-1-pentene	0.054	96.43	0.060	0.141	75.00	0.078
2-Methyl-2-butene	0.373	26.79	0.141	1.256	5.00	0.439
2-Methylheptane	7.417	0.00	1.622	3.919	0.00	1.199
2-Methylhexane	10.71	0.00	2.652	5.972	0.00	2.372
2-Methylpentane	22.85	0.00	6.527	15.39	0.00	6.655
3-Methyl-1-butene	0.116	83.93	0.091	0.21	88.33	0.095
3-Methylheptane	5.647	0.00	1.312	2.786	0.00	0.893
3-Methylhexane	10.01	10.71	2.165	5.562	15.00	2.018
3-Methylpentane	13.39	0.00	3.708	8.224	0.00	3.679
4-Methyl-1-pentene	NA	100.0	NA	0.0597	96.67	0.069
cis-2-Hexene	0.067	83.93	0.051	0.182	83.33	0.057
cis-2-Pentene	0.159	42.86	0.079	0.552	6.67	0.232
Cyclopentane	2.593	0.00	0.77	1.669	0.00	0.808
Cyclopentene	0.841	58.93	0.165	1.894	45.00	0.285
Isopentane	61.38	1.79	22.09	80.85	1.67	24.23
Isoprene	2.000	21.43	0.753	1.80	5.00	0.728
Methylcyclopentane	14.40	0.00	3.708	7.63	0.00	3.358
n-Heptane	20.73	0.00	4.909	11.07	0.00	4.006
n-Octane	19.33	0.00	4.265	9.519	0.00	2.815
trans-2-Hexene	0.042	92.86	0.039	0.26	75.00	0.064
trans-2-Pentene	0.314	21.43	0.133	1.193	3.33	0.457
Sum of Aliphatic C5-C8 Fraction	218.7	NA	62.39	179.7	NA	61.40

NA = Not Applicable

Table B2.1. Continued

2009 Total Petroleum Hydrocarbons with toxicity values at the Parachute and Rifle Sites in the Urban Oil & Gas Development Area

Compound	PARACHUTE			RIFLE		
	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$
Aliphatic hydrocarbons C9-C18						
1-Decene	0.108	98.21	0.108	NA	100.0	NA
1-Dodecene	0.421	73.21	0.142	0.456	70.00	0.167
1-Nonene	1.973	44.64	0.336	0.843	63.33	0.190
1-Tridecene	0.159	92.86	0.115	0.160	85.00	0.113
1-Undecene	0.947	48.21	0.249	1.870	55.00	0.308
a-Pinene	0.377	53.57	0.165	0.425	45.00	0.165
b-Pinene	0.674	89.29	0.133	0.228	88.33	0.137
n-Decane	7.274	1.790	1.992	4.539	3.330	1.299
n-Dodecane	7.605	12.50	1.518	3.512	33.33	0.652
n-Undecane	20.28	1.790	3.484	3.801	1.670	1.370
n-Tridecane	0.655	57.14	0.171	0.414	55.00	0.134
Sum of Aliphatic C9-C18 Fraction	40.73	NA	8.41	16.25	NA	4.54
Aromatic Hydrocarbons C9-C16						
p-Diethylbenzene	0.238	62.50	0.088	0.189	60.00	0.079
m-Diethylbenzene	0.593	48.21	0.179	0.534	46.67	0.162
p-Ethyltoluene	1.518	12.50	0.347	1.016	11.67	0.401
m-Ethyltoluene	2.032	1.79	0.491	1.65	1.67	0.558
o-Ethyltoluene	1.398	8.93	0.353	0.918	3.33	0.368
Sum of Aromatic C9-C16 Fraction	5.78	NA	1.46	4.31	NA	1.57

NA = Not Applicable

Table B3. 2009 Chemicals with no toxicity values at the Bell and Rulison Sites in the Rural Oil & Gas Development Area

Compound	BELL			RULISON		
	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$
Acetylene	2.918	0.00	0.713	3.227	0.00	0.758
n-Butane	157.5	0.00	30.14	67.75	0.00	30.62
cis-2-Butene	0.373	41.07	0.090	0.192	29.41	0.098
trans-2-Butene	0.461	12.50	0.107	2.278	15.69	0.338
Ethane	382.5	0.00	81.7	258.3	0.00	116.7
Ethylene	2.943	0.00	1.374	3.041	0.00	1.386
Isobutane	98.06	0.00	22.51	64.78	0.00	28.88
Isobutene/1-Butene	4.48	50.00	0.993	3.431	47.06	0.767
Propane	266.9	0.00	64.14	164.7	0.00	72.08
Propyne	NA	100.0	NA	NA	100.00	NA
Carbonyls						
Benzaldehyde	0.204	7.69	0.096	0.191	0.00	0.110
Butyraldehyde	0.118	0.00	0.066	0.195	0.00	0.101
2,5-Dimethylbenzaldehyde	NA	100.0	NA	NA	100.00	NA
Hexaldehyde	0.131	19.23	0.061	0.254	8.33	0.102
Isovaleraldehyde	NA	100.0	NA	0.0317	95.83	NA
Tolualdehydes	0.201	7.69	0.108	0.408	4.17	0.159
Valeraldehyde	0.0634	42.31	0.036	0.159	16.67	0.057

NA = Not Applicable

Table B3.1. 2009 Chemicals with No Toxicity Values at the Parachute and Rifle Sites in the Urban Oil & Gas Development Area

Compound	PARACHUTE			RIFLE		
	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$	Max. Conc. $\mu\text{g}/\text{m}^3$	% Samples ND	EPC $\mu\text{g}/\text{m}^3$
Acetylene	20.55	0.00%	2.659	4.265	0.00%	1.926
n-Butane	76.66	0.00%	26.47	65.97	1.67%	24.21
cis-2-Butene	0.665	19.64%	0.176	1.807	3.33%	0.41
trans-2-Butene	0.843	1.79%	0.255	2.329	1.67%	0.629
Ethane	412.0	0.00%	116.6	264.4	0.00%	93.89
Ethylene	3.522	1.79%	1.744	6.196	0.00%	2.87
Isobutane	76.66	0.00%	25.21	61.81	0.00%	22.72
Isobutene/1-Butene	4.4	39.29%	1.052	4.022	8.33%	1.753
Propane	214.0	0.00%	60.17	143.7	0.00%	55.45
Propyne	NA	100.00%	NA	NA	100.00%	NA
Carbonyls						
Benzaldehyde	0.308	3.33%	0.109	0.291	0.00%	0.155
Butyraldehyde	0.316	6.67%	0.113	0.46	3.57%	0.159
2,5-Dimethylbenzaldehyde	0.17	96.67%	0.17	NA	100.00%	NA
Hexaldehyde	0.164	13.33%	0.075	0.213	7.14%	0.111
Isovaleraldehyde	NA	100.00%	NA	0.0317	96.43%	NA
Tolualdehydes	0.246	3.33%	0.138	0.319	0.00%	0.199
Valeraldehyde	0.0951	30.00%	0.044	0.123	14.29%	0.067

NA = Not Applicable

Table B4. 2009 Summary EPCs at all monitoring sites.

Compound	EPC ($\mu\text{g}/\text{m}^3$)			
	BELL	RULISON	PARACHUTE	RIFLE
Acetaldehyde	0.893	1.472	1.111	1.573
Acetone	3.004	3.498	3.681	3.490
Benzene	1.977	2.711	3.143	2.544
1,3-Butadiene	0.048	0.047	0.225	0.138
Crotonaldehyde	0.280	0.272	0.127	0.199
Cyclohexane	3.270	4.896	4.614	3.939
Ethylbenzene	0.362	0.448	0.518	0.623
Formaldehyde	2.936	1.328	1.912	1.853
n-Hexane	8.073	7.853	7.461	7.077
Isopropylbenzene	0.073	0.072	0.094	0.093
Methylcyclohexane	7.749	10.59	11.65	8.464
Nonane	0.990	1.611	2.452	1.505
Pentane	14.45	17.41	11.96	10.57
Propionaldehyde	0.105	0.114	0.112	0.188
Propylene	0.489	0.567	0.63	1.169
Propylbenzene	0.106	0.124	0.181	0.188
Styrene	0.077	0.148	n/a	0.100
Toluene	3.728	5.643	6.959	5.312
1,2,3-Trimethylbenzene	0.123	0.128	0.168	0.199
1,2,4-Trimethylbenzene	0.516	0.475	0.938	0.998
1,3,5-Trimethylbenzene	0.193	0.388	0.796	0.494
m-Xylene/p-Xylene	1.978	3.452	4.429	3.113
o-Xylene	0.463	0.589	0.778	0.864
Aliphatic hydrocarbons C5-C8	64.36	62.141	62.39	61.40
Aliphatic hydrocarbons C9-C18	6.73	4.66	8.41	4.54
Aromatic hydrocarbons C9-C16	1.00	1.11	1.63	1.70

Table B5. 2009 Estimated Potential Lifetime Cancer Risks and Noncancer Hazards (HQ)

Compound	BELL		RULISON		PARACHUTE		RIFLE	
	Cancer Risk	HQ	Cancer Risk	HQ	Cancer Risk	HQ	Cancer Risk	HQ
Acetaldehyde	1.96E-06	0.10	3.24E-06	0.16	2.44E-06	0.12	3.46E-06	0.17
Acetone	NC	0.00	NC	0.00	NC	0.00	NC	0.00
Benzene	1.54E-05	0.07	2.11E-05	0.09	2.45E-05	0.10	1.98E-05	0.08
1,3-Butadiene	1.44E-06	0.02	1.41E-06	0.02	6.75E-06	0.11	4.14E-06	0.07
Crotonaldehyde	1.52E-04	NA	1.48E-04	NA	6.90E-05	NA	1.08E-04	NA
Cyclohexane	NC	0.00	NC	0.00	NC	0.00	NC	0.00
Ethylbenzene	9.05E-07	0.00	1.12E-06	0.00	1.30E-06	0.00	1.56E-06	0.00
Formaldehyde	3.82E-05	0.30	1.73E-05	0.14	2.49E-05	0.20	2.41E-05	0.19
n-Hexane	NC	0.01	NC	0.01	NC	0.01	NC	0.01
Isopropylbenzene	NC	0.00	NC	0.00	NC	0.00	NC	0.00
Methylcyclohexane	NC	0.00	NC	0.00	NC	0.00	NC	0.00
n-Nonane	NC	0.00	NC	0.01	NC	0.01	NC	0.01
Pentane	NC	0.01	NC	0.02	NC	0.01	NC	0.01
Propionaldehyde	NC	0.01	NC	0.01	NC	0.01	NC	0.02
Propylene	NC	0.00	NC	0.00	NC	0.00	NC	0.00
n-propylbenzene	NC	0.00	NC	0.00	NC	0.00	NC	0.00
Styrene	NC	0.00	NC	0.00	NC	NC	NC	0.00
Toluene	NC	0.00	NC	0.00	NC	0.00	NC	0.00
1,2,3-Trimethylbenzene	NC	0.02	NC	0.03	NC	0.03	NC	0.04
1,2,4-Trimethylbenzene	NC	0.07	NC	0.07	NC	0.13	NC	0.14
1,3,5-Trimethylbenzene	NC	0.01	NC	0.02	NC	0.04	NC	0.02
m-Xylene/p-Xylene	NC	0.02	NC	0.03	NC	0.04	NC	0.03
o-Xylene	NC	0.00	NC	0.01	NC	0.01	NC	0.01
Aliphatic hydrocarbons C5-C8	1.22E-05	0.11	1.18E-05	0.10	1.19E-05	0.10	1.17E-05	0.10
Aliphatic hydrocarbons C9-C18	3.03E-05	0.07	2.10E-05	0.05	3.78E-05	0.08	2.04E-05	0.05
Aromatic hydrocarbons C9-C16	NC	0.01	NC	0.01	NC	0.02	NC	0.02
Cumulative Risk	2.52E-04	0.85	2.25E-04	0.78	1.79E-04	1.05	1.93E-04	0.99

NC = NonCarcinogen; NA = Not Available