ATTACHMENT 7

Biglow Canyon Wind Farm—Final Noise Analysis Phase1 and 2 (CH2M HILL, June 2008)

Biglow Canyon Wind Farm
Final Noise Analysis – Phase 1 & Phase 2

TO: Ray Hendricks, P.E./Portland General Electric

FROM: Mark Bastasch, P.E./CH2M HILL

DATE: June 5, 2008

The purpose of this memorandum is to present the noise analysis required by Condition 91 of the Biglow Canyon Wind Farm Site Certificate for Phase 2. Phase 1 of the Biglow Canyon Wind Farm project was previously analyzed and approved by the Oregon Department of Energy (refer to Attachment 1, memo from Mr. Kerrie Standlee, dated May 15, 2007; note that statements regarding the ground effect calculations were corrected in an email from Mr. Standlee on May 21, 2007). This memorandum addresses the additional construction and overall noise levels of Phase 1 and Phase 2 turbines. Phase 2 consists of 98 Siemens 2.3 MW wind turbines. The Siemens turbines are guaranteed not to exceed 107 dBA and their test data resulted in a maximum level of 105 dBA at any wind speed. Table 1 presents the summary of the Phase 1 and Phase 2 analysis. The accompanying Microsoft Excel spreadsheet presented in Tables 2 and 3 provide the detailed results.

Consistent with the requirements of the conditions and previous request from the Department, the analysis was completed with CADNA/A by DataKustik GmbH of Munich, Germany, and assumed the following input parameters:

- The maximum sound power level warranted by the manufacturer (107 dBA for Siemens 2.3 MW and 109.8 dBA for the Phase 1 Vestas V82's, as previously required by the Department)
- The exact locations of the proposed turbines
- The environmental factors required by ODOE in the Phase 1 analysis, *i.e.*, the temperature, relative humidity and simplified ground effect.

As discussed in Attachment 1, Phase 1 levels at Receptor 2, Kevin McCullough, were analyzed separately given the predominate wind direction and its location within the project. The predicted levels for Phase 2 turbines at this location are presented in Table 3. As shown in Table 1, the overall noise level at R2 from Phase 1 and Phase 2 is 50.1 dBA which complies with the requirements of the "Table 8" rule. Note that this result is likely conservative as the additional reductions discussed in Attachment 1 would also be applicable to the majority of Phase 2 turbines, but were not taken in account in the Phase 2 analysis.

TABLE 1
Biglow Canyon Wind Farm Noise Analysis

Receptor ID	Receptor Name	Predicted Noise Level (dBA)	Waiver Required (≥ 36 dBA)
1	Doug Medler	48.3	Yes
2	Kevin McCullough	50.1	Yes
3	Weir (Harry Macnab)	43.2	Yes
4	Scharf	47.3	Yes
5	Sandy Macnab	49.7	Yes
6	Donna Jean Gatter	47.7	Yes
7	Bo Macnab	48.7	Yes
8	Norm Fridley	30.6	No
9	Kent Thomas	37.9	Yes
10	Dewey Thomas	37.5	Yes
11	Les Gray	48.5	Yes
12	Brett Gray	46.8	Yes
13	John Fields	47.2	Yes
15	Reid Ranch	38.2	Yes
16	Coats	35.8	No
17	Trent & Jill Harrison	39.2	Yes
18	Five Macs	40.2	Yes
19	Richelderfer (Paul Bish)	33.7	No
20	Smith, Delmer	33.8	No
21	Rathbun, Betty J Estate	37.2	Yes
22	Rathbun, Betty J Estate	37	Yes
23	James and Dean Medler	37.2	Yes
23.1	James and Dean Medler (2nd Home)	37.3	Yes
24	Gordon Hildebrand	35.6	No
25	John Hildebrand	34	No

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	Doug Medler	Weir (Harry Macnab)	Scharf	Sandy Macnab	Donna Jean Gatter	Bo Macnab	Norm Fridley
Substation	13.9	13.6	25.9	27.7	25.8	26	6.3
(Phase_Turbine#)							
1_1	25	9.3	12.6	14.9	11.5	12.6	
1_2	25.3	9.5	13	15.5	11.9	13.1	
1_3	25.5	9.8	13.4	16	12.3	13.6	
1_4	25.4	10.2	14.3	17.4	13.2	14.7	
1_5	25.6	10.5	14.7	18	13.6	15.2	5
1_6	26.5	11	15.4	18.6	14.2	15.8	5.4
1_7	23.7	10.8	15.7	20.3	14.7	17.1	5.3
1_8	23.6	11.1	16.2	21.1	15.2	17.8	5.5
1_9	23.6	11.5	16.9	22	15.9	18.5	5.8
1_10	23.5	12	17.8	23.2	16.7	19.5	6.2
1_11	23.2	12.3	18.3	24.1	17.3	20.2	6.5
1_12	22.7	12.6	18.9	25.1	17.9	21	6.7
1_13	22.2	12.8	19.4	26.2	18.4	21.8	6.9
1_14	21.4	12.9	19.7	27.5	18.8	22.7	6.9
1_15	20.3	12.7	19.8	29.2	19	23.8	6.9
1_16	19.4	12.6	19.7	30.6	19.2	24.7	6.9
1_17	18.2	12.3	19.6	32.9	19.3	26.2	6.8
1_18	17.4	12.2	19.6	34.9	19.5	27.5	6.8
1_19	16.2	11.8	19	35.8	19.1	28.6	6.6
1_20	15.2	11.5	18.7	36.5	19.1	30.1	6.6
1_21	14.7	11.4	18.6	36.6	19.1	31.1	6.6
1_22	14.3	11.4	18.5	36.2	19.2	31.9	6.6
1_23	13.9	11.4	18.5	35.7	19.3	32.8	6.7
1_24	13.5	11.3	18.4	34.7	19.3	33.3	6.7
1_25	13.1	11.2	18.2	33.6	19.2	33.7	6.7
1_26	12.7	11.1	18.1	32.4	19.2	33.7	6.7
1_27	12.3	11	17.9	31.2	19.1	33.5	6.7
1_28	29.7	10.4	13.1	14	11.8	11.9	
1_29	30.8	10.7	13.7	14.6	12.3	12.4	5.2
1_30	31.8	11.1	14.2	15.1	12.8	12.9	5.4
1_31	32.9	11.4	14.7	15.7	13.3	13.4	5.7
1_32	33.9	11.8	15.2	16.2	13.8	13.9	5.9
1_33	34.6	12.2	15.8	16.8	14.3	14.4	6.2
1_34	35.1	12.8	16.8	17.8	15.2	15.3	6.6
1_35	30.5	12.5	17	19	15.5	16.3	6.4
1_36	29.8	12.8	17.5	19.7	16	16.8	6.6
1_37	30.4	13.5	18.6	20.3	16.9	17.4	7.1
1_38	30.3	14.1	19.3	20.8	17.6	17.9	7.5
1_39	29.7	14.5	20	21.3	18.2	18.3	7.8
1_40	38	15.2	16.9	14.5	14.9	12.8	8.4
1_41	38.7	15.6	17.5	15	15.4	13.2	8.6
1_42	38.1	16	18.1	15.4	16	13.7	8.8
1_43	37.4	16.4	18.8	15.9	16.5	14.1	9
1_44	36	16.8	19.5	16.4	17.1	14.6	9.3
1_45	35.4	16.6	20.5	18.1	18.1	16	9.1
1_46	33	17	21.4	18.8	18.9	16.7	9.4
1_47	29.2	15	20.8	21.7	18.9	18.8	8.1
1_48	28.4	15.4	21.5	22.3	19.5	19.2	8.4
1_49	27.5	15.8	22.3	22.8	20.2	19.7	8.7
1_50	26.8	16.3	23.1	23.2	20.9	20.2	9
1_51	25.9	16.6	23.9	23.7	21.6	20.7	9.2
1_52	24.9	16.8	24.6	24.5	22.3	21.4	9.4
1_53	24	16.9	25.2	25.3	22.9	22.1	9.5
1_54	23.1	16.9	25.7	26.3	23.5	23	9.6
1_55	27	20.1	21.2	15.6	18.4	14.3	11.4
1_56	26.5	20.7	21.9	16	19.1	14.7	11.6
1_57	25.9	21.2	22.7	16.4	19.7	15.1	11.9
1_58	25.2	21.7	23.6	16.8	20.4	15.5	12.2
1_59	24.9	22	24.7	17.5	21.3	16.2	12.2
1_60	24.9	21.1	26.7	19.6	23	18	11.8
1_61	24.1	21.2	28	20.3	24	18.7	11.9
1_62	23.3	21.3	29.3	21	25	19.5	12
1_63	22.6	21.2	30.6	21.8	26.1	20.3	12
1_64	21.8	20.8	31.9	22.9	27.2	21.3	11.9

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	Doug Medler	Weir (Harry Macnab)	Scharf	Sandy Macnab	Donna Jean Gatter	Bo Macnab	Norm Fridley
1_65	21	20.5	33	24	28.4	22.4	11.8
1_66	20.3	20.2	33.7	25	29.4	23.4	11.7
1_67	19.2	19.6	34.2	26.7	31	25.2	11.6
1_68	18.5	19.5	34.8	27.1	32.2	26	11.7
1_69	18.9	14.9	23.9	36	23.4	28.9	8.6
1_70	18.4	15	24.3	37.6	24	30.1	8.8
1_71	18	15.4	25.2	38	25.1	31.2	9.1
1_72	17.6	15.7	26	37.5	26.1	32	9.4
1_73	17.2	16	26.6	36.9	27	32.8	9.7
1_74	16.4	16	26.8	36.7	27.7	34.9	9.9
1_75	15.9	16.1	26.8	35.6	28.2	36.3	10
1_76	15.3	16.1	26.8	34.3	28.7	37.3	10.2
2_138	17.8	21.6	19.2	10.5	16	9.5	9.5
2_139	16.8	23.3	20.1	10.6	16.8	9.8	10.3
2_141	15.7	25.2	21	10.7	17.6	10	11.1
2_142	15.2	26.4	21.8	11	18.4	10.4	11.6
2_143	14.7	27.6	22.7	11.2	19.1	10.7	12
2_144	14.5	28	24.5	12	20.6	11.6	12.1
2_145	14.2	27.9	26.6	12.8	22.2	12.4	12.1
2_146	13.8	27.3	28.9	13.6	24.1	13.3	12
2_147	13.4	26.5	31.5	14.3	26	14.1	12
2_148	12.8	26.5	32.5	14.4	27.1	14.5	12.2
2_149	12.2	26.6	32.9	14.4	28	14.6	12.6
2_150	11.6	26.4	33	14.4	28.9	14.8	12.8
2_151	11	25.9	32.7	14.5	29.8	15	13.1
2_152	10.5	25.1	32.5	14.6	30.9	15.3	13.1
2_153	9.9	24.1	31.6	14.7	31.8	15.6	13.2
2_154	9.4	23.1	30.5	14.8	32.2	15.9	13.1
2_155	8.9	22.2	29.2	14.7	32	16.1	13.1
2_156	8.4	21.4	27.8	14.5	31.1	16	13.2
2_157	7.9	20.6	26.4	14.3	30.1	16	13.1
2_158	7.5	18.5	25.4	15.1	30.3	17.1	12.1
2_159	6.9	17.7	23.9	14.8	28.5	17	11.9
2_160	6.4	16.9	22.7	14.5	27.1	16.9	11.8
2_161	5.9	15.5	21.2	14.5	25.5	17.2	11
2_162	12.1	35.2	21.1	9.8	18.4	9.6	14.6
2_163	11.6	38.2	21.8	10	19.1	10	15.1
2_164	5.4	14.8	20.2	14.2	24.2	17	10.7
2_165	5	14.1	19.2	13.9	23	16.7	10.5
2_166	4.6	13.5	18.3	13.5	21.8	16.3	10.3
2_77	10.3	11.8	23.3	29.9	25.9	35.1	5.3
2_78	7.2	-0.1	4.7	12.1	4.6	10	
2_79	7.3	0.3	5.3	13	5.2	10.9	
2_80	7.5	0.7	5.9	14.1	5.9	11.9	
2_81	9.9	1.3	6.4	13.8	6.1	11.2	
2_82	10.1	1.7	7	14.9	6.7	12.2	
2_83	10.3	2.1	7.6	16.1	7.4	13.2	
2_84	10.6	2.7	8.4	17.4	8.2	14.4	
2_85	16.7	3.9	9	14.7	8.1	11.5	
2_86	16.4	4.2	9.5	15.7	8.7	12.4	
2_87	15.3	3.9	9.4	16.1	8.6	12.8	
2_88	14	3.7	9.3	16.9	8.8	13.5	
2_89	15.5	4.9	11.1	19.1	10.4	15.2	
2_90	14.2	4.9	11.2	20.3	10.7	16.3	
2_91	13.7	4.9	11.4	21.2	11	17	
2_92	12.8	4.8	11.4	22	11.1	17.8	
2_93	12.4	4.9	11.6	22.9	11.4	18.5	
2_94	11.9	4.9	11.7	23.7	11.6	19.3	
2_95	11.5	4.9	11.9	24.4	11.9	20	
2_96	11	4.9	11.9	25	12	20.7	
2_97	10.5	4.9	11.9	25.4	12.1	21.3	
2_98	8	3.3	9.8	21.6	10.2	19.4	
2_99	7.7	3.5	10.1	22.2	10.6	20.3	
2_100	7.4	3.7	10.4	22.8	11.1	21.4	
2_101	5.7	3.9	10.5	21.8	11.7	22.9	
2_102	5.2	3.7	10.3	21	11.5	22.4	
2_103	3.1	1.5	7.1	15.8	8.2	16.7	

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	Doug Medler	Weir (Harry Macnab)	Scharf	Sandy Macnab	Donna Jean Gatter	Bo Macnab	Norm Fridley
2_104	2.8	1.3	6.9	15.2	8	16.3	
2_105	2.3	1.3	6.7	14.6	7.9	16	
2_106	1.8	1.3	6.6	14	7.9	15.6	
2_107	1.5	1.1	6.3	13.4	7.6	15.1	
2_108	7	6.3	14	26.9	15.5	31.1	1.6
2_109	6.5	6.1	13.7	25.4	15.3	29.9	1.6
2_110	5.7	5.5	12.7	23.1	14.4	27.1	1.3
2_111	4.9	5.2	12.1	21	13.9	25	1.2
2_112	4.1	4.8	11.3	19.2	13.1	23	1
2_113	3.8	5.6	12	18.1	14.2	22.4	2.1
2_114	3	4.5	10.5	16.7	12.5	20.3	1.2
2_115	2.6	4.2	10.1	15.8	12	19.3	1.1
2_116	2	3.6	9.1	14.7	11	17.8	0.6
2_117	1.6	3.3	8.7	13.9	10.6	17	0.5
2_118	1.1	2.8	7.9	12.8	9.7	15.7	0.2
2_119	7	8.2	16.6	25.8	18.9	34.6	3.4
2_120	6.5	8	16	24.4	18.4	32.1	3.3
2_121	6	7.7	15.5	23	17.9	29.7	3.3
2_122	4.8	6.9	13.9	20.1	16.3	25.4	2.9
2_123	8.9	12.2	23.2	25.2	27.2	30.8	6.1
2_124	8.4	12	22.4	24.2	26.4	30.1	6.1
2_125	7.8	11.5	21.3	23.4	25.2	29.4	6
2_126	7.2	10.4	19.4	23.4	22.7	30.2	5.3
2_127	6.2	9.9	18.1	21.2	21.4	27.2	5.2
2_128	5.8	9.6	17.4	20.3	20.6	25.9	5.2
2_129	5.3	9.3	16.7	19.4	19.9	24.7	5.1
2_130	4.9	8.9	16	18.6	19.1	23.6	5
2_131	4.2	8.1	14.7	17.4	17.6	22	4.6
2_133	3.7	7.7	14	16.6	16.8	21	4.4
2_135	9.6	13.9	26.4	23.8	31.7	27.4	7.2
2_136	8.9	15.9	27.9	19.6	36.4	22.4	9.1
2_137	8.3	15.5	26.3	19.2	33.5	22.1	9.1
2_217	3.4	7.4	13.4	15.9	16.1	20	4.3
2_219	0.7	2.6	7.6	12.2	9.3	15	0.1
2_220	5.2	7.2	14.5	21.2	16.9	27	3
2_221	4.8	3.5	10	20	11.3	21.8	
2_231	7.3	-0.3	4.4	11.4	4.3	9.3	
2_232	7.3	-0.5	4	10.7	3.8	8.7	
2-Alt_241	10.4	16	31.3	21.9	40.1	23.9	8.3
2-Alt_242	11.9	15.5	32.1	24	35	25	7.5
2-Alt_243	12.6	15.9	33.4	23.8	34.3	24.1	7.5
2-Alt_244	13.3	15.8	33.1	24.1	32.2	23.8	7.2
2-Alt_249	7.7	8.6	17.3	28.1	19.6	39.6	3.4
Results	48.3	43.2	47.3	49.7	47.7	48.7	30.6

Table 2
Biglow Phase 1 and 2 Detailed Results

Source Substation (Phase_Turbine#)	Kent Thomas 12.4	Dewey Thomas 12.1	Les Gray 21.3	Brett Gray 19.7	John Fields 13.6	Reid Ranch 7.1	Coats 5.3	Trent & Jill Harrison 6.3
1_1	6.5	6.3	9.5	8.8	9.3	27.2	15.9	16
1_2	6.8	6.6	9.9	9.2	9.7	26.7	16.1	16.3
1_3	7	6.8	10.3	9.5	10.1	26.2	16.2	16.4
1_4	7.6	7.4	11.2	10.3	11	25	16.4	16.8
1_5	7.9	7.6	11.6	10.7	11.3	24.1	16.2	16.7
1_6	8.3	8.1	12.1	11.2	11.5	22.9	15.7	16.2
1_7	8.5	8.3	12.9	11.8	12.9	22.4	16.6	17.4
1_8	8.8	8.6	13.4	12.3	13.3	21.5	16.4	17.3
1_9	9.2	9	14	12.8	13.8	20.6	15.9	16.8
1_10	9.7	9.5	14.7	13.5	14.2	19.5	15.3	16.3
1_11	10.1	9.9	15.3	14	14.6	18.8	15	16
1_12	10.4	10.2	15.9	14.6	15.1	18.1	14.7	15.7
1_13	10.7	10.5	16.4	15.1	15.6	17.5	14.4	15.5
1_14	10.9	10.7	17	15.5	16.2	17	14.3	15.4
1_15	11	10.8	17.6	15.9	17	16.5	14.3	15.5
1_16	11.1	10.9	18	16.2	17.8	16.1	14.3	15.5
1_17	11.1	11	18.7	16.7	19	15.4	14.2	15.5
1_18	11.3	11.1	19.3	17.1	19.9	14.8	14	15.3
1_19	11.1	10.9	19.7	17.3	21.5	14.2	13.9	15.4
1_20	11.1	11	20.4	17.7	23.1	13.4	13.6	15
1_21	11.2	11.1	20.9	18	24	12.9	13.2	14.7
1_22	11.3	11.2	21.3	18.3	24.9	12.5	13	14.4
1_23	11.4	11.3	21.8	18.6	25.7	12.1	12.6	14
1_24	11.5	11.4	22.2	18.9	26.7	11.7	12.3	13.7
1_25	11.6	11.5	22.6	19.1	27.7	11.3	12	13.4
1_26	11.6	11.6	22.9	19.3	28.7	10.9	11.7	13.1
1_27	11.7	11.6	23.2	19.5	29.8	10.5	11.4	12.8
1_28	7.1	6.9	9.3	8.8	8.2	22.4	13.1	13.2
1_29	7.4	7.2	9.7	9.2	8.6	22.2	13.2	13.4
1_30	7.7	7.5	10.2	9.6	8.9	21.9	13.3	13.5
1_31	8.1	7.8	10.6	10.1	9.3	21.5	13.3	13.5
1_32	8.4	8.2	11	10.5	9.6	21	13.2	13.5
1_33	8.8	8.5	11.4	10.9	9.9	20.5	13.1	13.4
1_34	9.4	9.1	12.2	11.6	10.5	19.6	12.9	13.3
1_35	9.4	9.2	12.8	12.1	11.4	20.3	13.8	14.4
1_36	9.7	9.4	13.3	12.5	11.8	19.8	13.8	14.4
1_37	10.3	10.1	13.9	13.1	12	18.7	13.1	13.8
1_38	10.8	10.5	14.3	13.6	12.2	17.9	12.7	13.4
1_39	11.2	10.9	14.8	14.1	12.4	17.3	12.4	13.1
1_40	10.4	10.1	11	11	8	14.9	9	9.3
1_41	10.7	10.4	11.5	11.5	8.3	14.8	9.1	9.4
1_42	11.1	10.7	11.9	11.9	8.6	14.7	9.1	9.5
1_43	11.4	11.1	12.3	12.3	8.9	14.6	9.2	9.6
1_44	11.8	11.5	12.8	12.8	9.2	14.4	9.2	9.6
1_45	12	11.7	13.8	13.6	10.3	15.1	10	10.5
1_46	12.5	12.1	14.4	14.2	10.7	14.9	10	10.5
1_47	11.6	11.3	15.3	14.6	12.5	16.7	12.1	12.7
1_48	12	11.7	15.7	15.1	12.8	16.2	11.8	12.5
1_49	12.4	12.1	16.2	15.6	13	15.7	11.5	12.3
1_50	12.8	12.5	16.7	16.1	13.2	15.2	11.3	12
1_51	13.2	12.9	17.2	16.6	13.4	14.8	11.1	11.8
1_52	13.5	13.2	17.8	17.1	13.8	14.5	11	11.7
1_53	13.8	13.5	18.4	17.6	14.2	14.2	10.9	11.7
1_54	14	13.7	19	18.1	14.6	14	10.9	11.7
1_55	13.7	13.3	13.3	13.7	8.7	11.8	7.4	7.8
1_56	14.2	13.8	13.7	14.2	8.9	11.7	7.4	7.8
1_57	14.6	14.2	14.2	14.6	9.2	11.5	7.4	7.8
1_58	15	14.6	14.6	15.1	9.5	11.4	7.4	7.8
1_59	15.4	15	15.3	15.8	9.9	11.4	7.5	8
1_60	15.6	15.2	16.7	16.9	11.2	12	8.3	8.9
1_61	15.9	15.5	17.4	17.6	11.6	11.9	8.4	9
1_62	16.3	15.9	18.1	18.3	12.1	11.8	8.4	9.1
1_63	16.6	16.2	18.8	19	12.6	11.7	8.5	9.2
1_64	16.7	16.3	19.7	19.8	13.2	11.7	8.7	9.4

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	Kent Thomas	Dewey Thomas	Les Gray	Brett Gray	John Fields	Reid Ranch	Coats	Trent & Jill Harrison
1_65	16.9	16.5	20.6	20.6	13.8	11.6	8.8	9.5
1_66	17	16.7	21.5	21.3	14.4	11.4	8.8	9.6
1_67	17.2	16.9	23	22.5	15.3	11.2	8.9	9.8
1_68	17.5	17.2	23.9	23.4	15.7	10.9	8.8	9.6
1_69	13.5	13.2	21.5	19.5	18.2	13.5	11.8	12.9
1_70	13.7	13.5	22.2	20.1	18.6	13.1	11.5	12.6
1_71	14.3	14.1	23.2	21	18.7	12.6	11.1	12.1
1_72	14.8	14.5	24	21.8	18.8	12.1	10.7	11.7
1_73	15.2	15	24.9	22.6	18.9	11.7	10.3	11.4
1_74	15.6	15.4	26.5	23.7	19.4	11.2	10	11
1_75	15.9	15.7	27.7	24.7	19.7	10.7	9.7	10.7
1_76	16.2	16.1	29.2	25.7	20	10.3	9.4	10.4
2_138	12.1	11.5	9.5	10.5	3.1	4.5	0.3	0.8
2_139	13	12.5	10	11.1	3.3	4	0.1	0.6
2_141	14.1	13.5	10.5	11.8	3.5	3.6		0.4
2_142	14.8	14.2	11	12.4	3.7	3.4		0.3
2_143	15.6	14.9	11.5	13	4	3.2		0.3
2_144	16.4	15.7	12.5	14.1	4.5	3.2		0.5
2_145	17.1	16.4	13.5	15.2	5.1	3.2	0	0.7
2_146	17.8	17.1	14.6	16.4	5.7	3.2	0.2	0.8
2_147	18.4	17.7	15.6	17.5	6.3	3.2	0.3	1
2_148	19.2	18.5	16.3	18.3	6.6	3	0.2	0.9
2_149	20.1	19.3	16.8	19.1	6.7	2.7	0	0.8
2_150	21	20.2	17.4	19.9	6.9	2.4		0.6
2_151	21.9	21.1	18	20.8	7.1	2.2		0.5
2_152	22.6	21.8	18.8	21.9	7.4	2		0.4
2_153	23.4	22.6	19.6	23.2	7.7	1.7		0.4
2_154	24	23.3	20.4	24.4	8	1.5		0.3
2_155	24.6	23.9	21.1	25.6	8.2	1.3		0.2
2_156	25.2	24.6	21.7	26.7	8.3	1		0
2_157	25.7	25.2	22.2	27.7	8.5	0.8		-0.1
2_158	24.1	23.8	24.6	31.8	9.5	0.7		0.1
2_159	24.1	23.9	25.1	33.3	9.6	0.4		0
2_160	23.8	23.8	25.5	34.4	9.8	0.2		-0.2
2_161	22.4	22.5	26.9	37.5	10.4	0		-0.2
2_162	17.7	17	11.2	13.1	3.2	1.7		
2_163	18.8	18	11.7	13.8	3.5	1.6		
2_164	21.9	22.1	26.9	37.1	10.5			-0.3
2_165	21.4	21.6	26.7	35.7	10.6			-0.5
2_166	20.9	21.1	26.2	33.9	10.6			-0.6
2_77	12.4	12.2	27.9	23.6	16.6	4.8	3.9	5
2_78			5.2	3.5	10.9	14.5	23.6	28.3
2_79	-0.5		6	4.1	11.9	13.8	21.6	25.6
2_80	0	-0.2	6.8	4.8	13	13.2	19.9	23.3
2_81	0	-0.1	6.2	4.5	10.5	17.5	22	25.2
2_82	0.5	0.4	6.9	5.1	11.4	16.5	20.4	23.4
2_83	1	0.8	7.7	5.8	12.3	15.7	18.9	21.7
2_84	1.5	1.4	8.5	6.6	13.2	14.9	17.4	20
2_85	1.7	1.4	6.8	5.5	8.1	22.2	15.8	16.8
2_86	2	1.8	7.4	6	8.8	20.7	15.6	16.8
2_87	1.9	1.7	7.6	6.1	9.5	20	16.2	17.6
2_88	2	1.8	8.1	6.4	10.5	18.4	16.7	18.4
2_89	3.1	2.9	9.4	7.7	11.1	16.9	14.4	15.9
2_90	3.2	3	10.1	8.3	12.4	15.6	14.2	16
2_91	3.4	3.2	10.6	8.6	13.1	14.8	14	15.7
2_92	3.5	3.3	11.1	9	14.2	13.8	13.7	15.6
2_93	3.7	3.5	11.5	9.4	15	13.1	13.3	15.2
2_94	3.9	3.7	12	9.7	15.8	12.4	12.9	14.8
2_95	4	3.9	12.5	10.1	16.6	11.7	12.4	14.4
2_96	4.2	4	12.9	10.4	17.5	11.1	12	13.9
2_97	4.3	4.1	13.3	10.7	18.4	10.5	11.6	13.6
2_98	3.1	3	12.2	9.6	20.8	9.2	11.9	14
2_99	3.5	3.4	13	10.2	22.4	8.4	11	13
2_100	3.9	3.8	13.8	10.8	24.2	7.7	10.1	12
2_101	4.8	4.7	16.1	12.6	34	5.1	7.2	8.8
2_102	4.8	4.7	16.2	12.7	37.3	4.6	6.7	8.3
2_103	2.6	2.5	12.4	9.5	32.8	3.6	6.7	8.4

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	Kent Thomas	Dewey Thomas	Les Gray	Brett Gray	John Fields	Reid Ranch	Coats	Trent & Jill Harrison
2_104	2.5	2.5	12.3	9.4	32.9	3.1	6.3	7.9
2_105	2.6	2.6	12.5	9.6	33.4	2.5	5.5	7
2_106	2.9	2.9	12.8	9.9	32.5	1.7	4.5	5.9
2_107	2.8	2.8	12.5	9.7	30.7	1.4	4.1	5.5
2_108	7.3	7.3	21	16.6	27.7	4.8	5.8	7.3
2_109	7.4	7.3	21.3	16.8	28.9	4.3	5.4	6.8
2_110	7	7	20.7	16.3	31.7	3.8	5	6.4
2_111	7	7	20.7	16.4	32.7	3	4.3	5.7
2_112	6.8	6.8	20.1	16	32.7	2.3	3.7	5
2_113	8.2	8.3	22.8	18.3	25.9	1.3	2.3	3.6
2_114	7.1	7.1	20.1	16.3	27.6	1	2.3	3.6
2_115	6.9	6.9	19.5	15.9	26.7	0.7	2	3.3
2_116	6.2	6.3	18	14.7	26.2	0.3	1.8	3
2_117	6.1	6.1	17.5	14.4	25	0	1.5	2.7
2_118	5.6	5.7	16.4	13.5	23.5		1.1	2.2
2_119	9.9	9.9	27.6	21.3	23	3.6	3.9	5.1
2_120	9.9	9.9	27.7	21.4	23.4	3.2	3.6	4.8
2_121	9.9	9.9	27.7	21.4	23.6	2.8	3.2	4.5
2_122	9.5	9.5	26.1	20.6	24.1	1.8	2.5	3.7
2_123	13.8	13.7	34.4	27.9	16.3	3.5	2.7	3.8
2_124	13.9	13.8	37.3	28.9	16.5	3.2	2.5	3.6
2_125	13.8	13.7	40.8	29.3	17	2.8	2.3	3.4
2_126	12.8	12.7	38.2	27.3	18.5	2.7	2.4	3.6
2_127	12.8	12.8	39.1	27.7	18.6	2	1.9	3
2_128	12.7	12.7	37.7	27.5	18.6	1.7	1.6	2.7
2_129	12.7	12.7	35.8	27.2	18.5	1.3	1.4	2.5
2_130	12.4	12.5	33.5	26.4	18.6	1	1.1	2.2
2_131	11.8	11.9	29.8	24.6	18.8	0.6	0.8	1.9
2_133	11.5	11.6	28.3	23.8	18.7	0.3	0.6	1.7
2_135	15.2	15	31.7	28.8	14.4	3.5	2.3	3.4
2_136	18.4	18.1	30.5	33.9	12.3	2.3	1	2
2_137	18.5	18.4	32	37.1	12.4	2	0.8	1.7
2_217	11.3	11.5	26.9	23	18.4	0	0.4	1.4
2_219	5.5	5.6	15.8	13.2	22.4		0.8	1.9
2_220	9.6	9.6	26.7	20.9	24.1	2.2	2.8	4.1
2_221	4.7	4.7	16.2	12.7	42.2	4.1	6.3	7.9
2_231			4.7	3.1	9.9	15.5	25.6	30.9
2_232			4.2	2.6	9.1	16.3	27.8	34.2
2-Alt_241	16.7	16.4	27.7	28	12.5	3.5	1.9	2.9
2-Alt_242	15	14.7	24.9	24.2	12.6	4.6	2.8	3.8
2-Alt_243	14.8	14.5	23.5	23	12.1	4.9	2.9	3.9
2-Alt_244	14.3	13.9	22.4	21.8	11.9	5.3	3.2	4.2
2-Alt_249	10	9.9	27.1	21.2	22.2	4.1	4.3	5.6
Results	37.9	37.5	48.5	46.8	47.2	38.2	35.8	39.2

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	Five Macs	Richelderfer (Paul Bish)	Smith, Delmer	Rathbun, Betty J Estate	Rathbun, Betty J Estate
Substation	9.6	5.5	5.5	7.3	7.2
(Phase_Turbine#)					
1_1	13.3	5.9	5.4	5.2	5.1
1_2	13.7	6.2	5.7	5.5	5.4
1_3	14.1	6.4	6	5.8	5.7
1_4	15	7.1	6.7	6.5	6.4
1_5	15.1	7.3	6.9	6.7	6.6
1_6	15	7.4	7	6.9	6.8
1_7	16.8	8.5	8	7.9	7.8
1_8	17	8.7	8.3	8.2	8.1
1_9	17	8.9	8.5	8.5	8.4
1_10	17	9.1	8.7	8.8	8.8
1_11	17.1	9.3	8.9	9.1	9
1_12	17.1	9.5	9.2	9.4	9.3
1_13	17.2	9.8	9.4	9.8	9.7
1_14	17.6	10.1	9.8	10.2	10.1
1_15	18.1	10.7	10.3	10.8	10.7
1_16	18.6	11.1	10.8	11.2	11.2
1_17	19.3	11.9	11.6	12	12
1_18	19.6	12.4	12.1	12.7	12.6
1_19	20.5	13.3	13	13.6	13.5
1_20	20.7	14.1	13.8	14.6	14.4
1_21	20.6	14.5	14.2	15.1	15
1_22	20.5	14.9	14.6	15.6	15.4
1_23	20.2	15.1	14.9	16	15.9
1_24	20	15.4	15.2	16.5	16.4
1_25	19.8	15.7	15.6	17	16.9
1_26	19.5	16	15.9	17.5	17.4
1_27	19.2	16.3	16.2	18	17.9
1_28	11.2				
1_29	11.5				
1_30	11.8	5.2			
1_31	12	5.4	5.1	5.1	5
1_32	12.2	5.6	5.2	5.3	5.3
1_33	12.4	5.8	5.5	5.6	5.5
1_34	12.6	6.1	5.8	6	5.9
1_35	13.8	6.9	6.6	6.7	6.7
1_36	14.1	7.2	6.8	7	6.9
1_37	13.8	7.2	6.8	7.2	7.1
1_38	13.6	7.2	6.9	7.3	7.2
1_39	13.5	7.3	7	7.5	7.4
1_40	8.9				
1_41	9.1				
1_42	9.2				
1_43	9.5				
1_44	9.6			5.1	5.1
1_45	10.8	5.5	5.3	5.9	5.9
1_46	11	5.8	5.6	6.3	6.2
1_47	13.4	7.3	7	7.6	7.5
1_48	13.4	7.4	7.2	7.8	7.7
1_49	13.3	7.5	7.3	7.9	7.9
1_50	13.2	7.5	7.3	8.1	8
1_51	13.2	7.7	7.5	8.3	8.2
1_52	13.3	7.9	7.7	8.6	8.5
1_53	13.4	8.1	7.9	8.9	8.8
1_54	13.7	8.4	8.2	9.2	9.2
1_55	8.3				
1_56	8.4			5	5
1_57	8.5			5.3	5.2
1_58	8.6			5.5	5.5
1_59	8.9			5.8	5.8
1_60	10	5.8	5.7	6.8	6.8
1_61	10.3	6.1	6	7.2	7.1
1_62	10.5	6.4	6.3	7.5	7.5
1_63	10.8	6.7	6.6	7.9	7.9
1_64	11.2	7.1	7	8.4	8.3

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	Five Macs	Richelderfer (Paul Bish)	Smith, Delmer	Rathbun, Betty J Estate	Rathbun, Betty J Estate
1_65	11.6	7.5	7.4	8.8	8.8
1_66	11.8	7.9	7.8	9.3	9.2
1_67	12.3	8.4	8.4	10	9.9
1_68	12.3	8.6	8.6	10.3	10.2
1_69	16.2	10.7	10.5	11.6	11.6
1_70	16.1	10.9	10.7	11.9	11.8
1_71	15.6	10.8	10.7	12	12
1_72	15.2	10.8	10.7	12.1	12.1
1_73	14.9	10.8	10.7	12.3	12.2
1_74	14.7	11	11	12.7	12.7
1_75	14.5	11.1	11.1	13	13
1_76	14.3	11.2	11.3	13.3	13.3
2_138	1.7				
2_139	1.6				
2_141	1.6				
2_142	1.6				
2_143	1.7				
2_144	2			0.4	0.4
2_145	2.4			0.9	0.9
2_146	2.7			1.4	1.4
2_147	3		0	1.9	1.9
2_148	3.1	0.1	0.1	2.1	2.1
2_149	3	0.2	0.2	2.3	2.3
2_150	3	0.3	0.4	2.5	2.5
2_151	2.9	0.4	0.5	2.7	2.7
2_152	3	0.6	0.7	3	3
2_153	3	0.8	1	3.4	3.4
2_154	3	1	1.2	3.7	3.7
2_155	3	1.1	1.4	3.9	4
2_156	2.9	1.3	1.5	4.2	4.2
2_157	2.9	1.4	1.6	4.4	4.4
2_158	3.3	2	2.3	5.3	5.3
2_159	3.2	2.2	2.5	5.5	5.6
2_160	3.2	2.3	2.6	5.8	5.9
2_161	3.3	2.8	3.1	6.5	6.6
2_162	0.6				
2_163	0.7				
2_164	3.2	2.9	3.3	6.8	6.8
2_165	3.1	3	3.4	7	7.1
2_166	3	3.1	3.6	7.2	7.3
2_77	9.6	6.5	6.6	9.1	9.1
2_78	28.3	9.2	8.1	5.8	5.6
2_79	30.8	9.9	8.8	6.5	6.3
2_80	32.6	10.5	9.4	7.2	7
2_81	23.3	7.5	6.5	5	4.8
2_82	24.2	8	7.1	5.6	5.4
2_83	24.5	8.4	7.5	6.1	5.9
2_84	24.4	8.7	7.9	6.6	6.5
2_85	14.5	3.8	3.2	2.6	2.5
2_86	15.3	4.3	3.7	3.1	3
2_87	16.5	4.9	4.3	3.6	3.5
2_88	18.3	5.9	5.2	4.5	4.4
2_89	16.9	5.8	5.2	4.7	4.6
2_90	18.3	6.7	6.1	5.7	5.5
2_91	18.9	7.2	6.6	6.2	6
2_92	19.9	8	7.3	6.9	6.8
2_93	20.2	8.4	7.8	7.4	7.3
2_94	20.5	8.9	8.3	7.9	7.8
2_95	20.7	9.3	8.7	8.5	8.3
2_96	20.8	9.8	9.2	9	8.9
2_97	21	10.3	9.7	9.6	9.5
2_98	24.8	13	12.3	11.5	11.3
2_99	23.5	13.6	12.9	12.3	12.2
2_100	22.1	14	13.4	13.2	13
2_101	17.6	15.7	15.5	16.9	16.7
2_102	17	16.2	16.1	17.8	17.6
2_103	17.9	21.7	21.4	21.1	20.7

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	Five Macs	Richelderfer (Paul Bish)	Smith, Delmer	Rathbun, Betty J Estate	Rathbun, Betty J Estate
2_104	17.1	22.3	22.2	22.2	21.8
2_105	15.6	22.6	23	24.3	23.9
2_106	14	22.1	23.1	27.2	26.7
2_107	13.4	22.4	23.6	28.8	28.3
2_108	14.3	12.1	12.2	14.8	14.7
2_109	13.8	12.4	12.6	15.5	15.4
2_110	13.6	13.3	13.5	16.9	16.8
2_111	12.6	13.7	14.1	18.2	18.1
2_112	11.9	14.1	14.7	19.7	19.6
2_113	9.7	12.1	12.8	18.4	18.4
2_114	10	13.5	14.3	20.8	20.9
2_115	9.6	13.6	14.5	21.5	21.6
2_116	9.3	14.3	15.4	23.3	23.4
2_117	8.9	14.2	15.4	23.7	23.9
2_118	8.3	14.3	15.6	24.9	25.1
2_119	11	9.8	10.1	13.5	13.5
2_120	10.7	10	10.3	14	14
2_121	10.3	10.2	10.6	14.6	14.6
2_122	9.6	10.8	11.3	16.1	16.1
2_123	8.3	6.2	6.5	9.4	9.4
2_124	8.1	6.4	6.6	9.8	9.8
2_125	8	6.7	7	10.3	10.3
2_126	8.5	7.5	7.9	11.4	11.4
2_127	8	7.7	8.1	12.1	12.1
2_128	7.7	7.8	8.2	12.4	12.4
2_129	7.5	7.8	8.3	12.7	12.7
2_130	7.3	8	8.5	13.1	13.1
2_131	7	8.3	9	13.9	14
2_133	6.8	8.4	9.1	14.2	14.3
2_135	7.4	5.1	5.3	8.1	8.1
2_136	5.6	3.8	4.1	7	7
2_137	5.5	3.9	4.2	7.2	7.3
2_217	6.5	8.4	9.1	14.5	14.6
2_219	7.9	14.1	15.5	25.1	25.4
2_220	10	10.6	11.1	15.6	15.6
2_221	16.4	16.7	16.7	18.9	18.6
2_231	25.8	8.3	7.3	5	4.9
2_232	23.9	7.6	6.6	4.4	4.2
2-Alt_241	6.5	3.9	4.1	6.7	6.7
2-Alt_242	7.3	4.1	4.2	6.5	6.4
2-Alt_243	7.3	3.8	3.9	6.1	6
2-Alt_244	7.5	3.7	3.8	5.8	5.8
2-Alt_249	11.3	9.5	9.7	12.7	12.7
Results	40.2	33.7	33.8	37.2	37

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	James and Dean Medler	James and Dean Medler #2	Gordon Hildebrand	John Hildebrand
Substation	11.7	11.8	8.2	7.2
(Phase_Turbine#)				
1_1	5.8	5.9		
1_2	6.1	6.1		
1_3	6.3	6.4		
1_4	6.9	6.9	5.2	
1_5	7.2	7.2	5.5	
1_6	7.6	7.6	5.8	5.1
1_7	7.8	7.9	6.5	5.9
1_8	8.2	8.2	6.9	6.2
1_9	8.6	8.6	7.2	6.5
1_10	9.1	9.1	7.7	6.9
1_11	9.5	9.5	8	7.3
1_12	9.8	9.9	8.4	7.6
1_13	10.1	10.2	8.7	8
1_14	10.4	10.4	9.1	8.3
1_15	10.5	10.6	9.6	8.8
1_16	10.6	10.7	10	9.2
1_17	10.8	10.8	10.6	9.8
1_18	10.9	11	11.2	10.3
1_19	10.9	10.9	11.8	10.9
1_20	11	11.1	12.6	11.7
1_21	11.1	11.2	13.1	12.1
1_22	11.3	11.3	13.5	12.5
1_23	11.4	11.5	13.9	13
1_24	11.6	11.6	14.4	13.4
1_25	11.7	11.7	14.9	13.9
1_26	11.8	11.8	15.4	14.3
1_27	11.9	11.9	15.8	14.8
1_28	6.3	6.3		
1_29	6.6	6.6		
1_30	6.9	6.9		
1_31	7.2	7.3		
1_32	7.6	7.6		
1_33	7.9	7.9	5	
1_34	8.5	8.5	5.5	
1_35	8.6	8.6	6	5.3
1_36	8.9	8.9	6.3	5.6
1_37	9.5	9.5	6.6	5.9
1_38	9.9	9.9	6.9	6.2
1_39	10.3	10.3	7.1	6.4
1_40	9.2	9.2		
1_41	9.5	9.5		
1_42	9.8	9.9		
1_43	10.2	10.2	5.2	
1_44	10.5	10.6	5.5	
1_45	10.8	10.9	6.2	5.5
1_46	11.3	11.3	6.6	5.8
1_47	10.7	10.7	7.4	6.6
1_48	11.1	11.1	7.6	6.9
1_49	11.5	11.5	7.9	7.1
1_50	11.9	11.9	8.1	7.4
1_51	12.2	12.3	8.4	7.6
1_52	12.6	12.6	8.7	7.9
1_53	12.8	12.9	9.1	8.2
1_54	13.1	13.1	9.4	8.6
1_55	12.2	12.2	5.7	5
1_56	12.6	12.6	6	5.3
1_57	13	13	6.3	5.6
1_58	13.4	13.4	6.6	5.8
1_59	13.8	13.8	7	6.2
1_60	14.1	14.1	7.8	7
1_61	14.5	14.5	8.2	7.4
1_62	14.9	14.9	8.6	7.8
1_63	15.2	15.2	9	8.2
1_64	15.4	15.5	9.5	8.6

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	James and Dean Medler	James and Dean Medler #2	Gordon Hildebrand	John Hildebrand
1_65	15.7	15.7	10	9.1
1_66	15.9	16	10.4	9.5
1_67	16.3	16.3	11.2	10.2
1_68	16.6	16.7	11.6	10.6
1_69	13	13	11.3	10.4
1_70	13.3	13.3	11.7	10.8
1_71	13.8	13.9	12.1	11.1
1_72	14.3	14.4	12.4	11.4
1_73	14.7	14.8	12.7	11.7
1_74	15.2	15.3	13.4	12.3
1_75	15.6	15.7	13.9	12.8
1_76	16	16.1	14.4	13.3
2_138	9.9	9.9	0.7	-0.1
2_139	10.8	10.8	1	0.3
2_141	11.7	11.7	1.4	0.6
2_142	12.3	12.3	1.7	0.9
2_143	13	13	2.1	1.2
2_144	13.7	13.8	2.6	1.8
2_145	14.5	14.5	3.2	2.3
2_146	15.2	15.2	3.8	2.9
2_147	15.9	15.9	4.4	3.5
2_148	16.6	16.6	4.8	3.9
2_149	17.4	17.5	5.2	4.2
2_150	18.3	18.3	5.5	4.6
2_151	19.1	19.2	5.9	4.9
2_152	19.9	20	6.4	5.4
2_153	20.9	20.9	6.9	5.9
2_154	21.7	21.8	7.4	6.4
2_155	22.5	22.6	7.9	6.8
2_156	23.4	23.5	8.4	7.2
2_157	24.3	24.4	8.8	7.7
2_158	23.8	23.9	10	8.8
2_159	24.3	24.5	10.6	9.3
2_160	24.6	24.8	11.1	9.9
2_161	23.9	24	12.2	10.9
2_162	14.7	14.7	2.1	1.3
2_163	15.6	15.6	2.5	1.7
2_164	23.7	23.9	12.9	11.5
2_165	23.5	23.7	13.5	12.1
2_166	23.3	23.5	14	12.6
2_77	12.2	12.3	10.6	9.3
2_78			1.4	0.8
2_79			2	1.4
2_80	-0.2	-0.2	2.6	2
2_81	-0.2	-0.2	1.3	0.7
2_82	0.2	0.3	1.9	1.3
2_83	0.7	0.8	2.5	1.8
2_84	1.3	1.3	3.1	2.3
2_85	1.1	1.1	0.5	-0.2
2_86	1.5	1.5	1	0.3
2_87	1.4	1.4	1.3	0.6
2_88	1.5	1.5	1.9	1.1
2_89	2.6	2.6	2.5	1.7
2_90	2.8	2.8	3.2	2.4
2_91	3	3.1	3.6	2.8
2_92	3.2	3.2	4.1	3.3
2_93	3.4	3.4	4.6	3.7
2_94	3.6	3.6	5	4.2
2_95	3.8	3.8	5.5	4.6
2_96	4	4	5.9	5
2_97	4.1	4.1	6.3	5.5
2_98	3.1	3.2	6.9	6.1
2_99	3.5	3.6	7.7	6.8
2_100	3.9	4	8.5	7.5
2_101	5.1	5.2	11.7	10.6
2_102	5.1	5.2	12.3	11.2
2_103	3	3	11.6	10.9

Table 2
Biglow Phase 1 and 2 Detailed Results

Source	James and Dean Medler	James and Dean Medler #2	Gordon Hildebrand	John Hildebrand
2_104	3	3	12.1	11.3
2_105	3.2	3.2	13.1	12.4
2_106	3.5	3.5	14.6	13.8
2_107	3.4	3.5	15	14.3
2_108	7.6	7.7	12.7	11.4
2_109	7.8	7.8	13.5	12.1
2_110	7.5	7.6	14.4	13.1
2_111	7.6	7.7	15.9	14.4
2_112	7.5	7.5	17.2	15.7
2_113	9.1	9.2	19.9	17.9
2_114	8	8	20.6	18.7
2_115	7.8	7.9	21.5	19.6
2_116	7.2	7.3	22.2	20.5
2_117	7.1	7.1	23.2	21.4
2_118	6.7	6.7	24.4	22.7
2_119	10.4	10.5	14.3	12.8
2_120	10.4	10.5	15.1	13.5
2_121	10.5	10.6	16	14.3
2_122	10.3	10.4	18.2	16.4
2_123	14	14	12	10.6
2_124	14.2	14.3	12.7	11.2
2_125	14.2	14.3	13.4	11.9
2_126	13.3	13.4	14.5	12.8
2_127	13.6	13.7	15.9	14.2
2_128	13.6	13.7	16.7	14.9
2_129	13.7	13.8	17.5	15.6
2_130	13.5	13.6	18.4	16.4
2_131	13	13.1	20	17.8
2_133	12.8	12.9	21	18.7
2_135	15.1	15.2	10.9	9.6
2_136	18.2	18.3	10.8	9.4
2_137	18.6	18.7	11.3	10
2_217	12.7	12.8	22	19.6
2_219	6.5	6.6	25.3	23.7
2_220	10.3	10.4	17.3	15.5
2_221	5.1	5.2	12.9	11.9
2_231			0.8	0.3
2_232			0.3	-0.2
2-Alt_241	16.1	16.2	9.6	8.3
2-Alt_242	14.3	14.4	8.6	7.4
2-Alt_243	14	14	8.1	6.9
2-Alt_244	13.4	13.4	7.6	6.5
2-Alt_249	10.3	10.4	13.3	11.8
Results	37.2	37.3	35.6	34

Table 3
Biglow Phase 1 and 2 Detailed Results

Source Name	Kevin McCullough
Phase 1	49.8
2_138	16.2
2_139	16.2
2_141	16.2
2_142	16.4
2_143	16.5
2_144	17.3
2_145	18.1
2_146	18.8
2_147	19.4
2_148	19.3
2_149	18.9
2_150	18.6
2_151	18.2
2_152	18
2_153	17.6
2_154	17.3
2_155	16.8
2_156	16.3
2_157	15.8
2_158	15.8
2_159	15.2
2_160	14.6
2_161	14.1
2_162	14.2
2_163	14.3
2_164	13.5
2_165	13
2_166	12.4
2_77	24.5
2_78	9.8
2_79	10.5
2_80	11.2
2_81	12.2
2_82	13
2_83	13.9
2_84	14.9
2_85	16
2_86	16.8
2_87	16.6
2_88	16.6
2_89	19.2
2_90	19.3
2_91	19.5
2_92	19.3
2_93	19.4
2_94	19.4
2_95	19.4
2_96	19.2

2_97	18.9
2_98	15.4
2_99	15.4
2_100	15.4
2_101	14.1
2_102	13.5
2_103	9.9
2_104	9.5
2_105	9.1
2_106	8.6
2_107	8.1
2_108	17.2
2_109	16.4
2_110	15.1
2_111	13.8
2_112	12.6
2_113	12.3
2_114	11
2_115	10.4
2_116	9.5
2_117	9
2_118	8.1
2_119	17.8
2_120	16.9
2_121	16
2_122	14
2_123	21.2
2_124	20.2
2_125	19.1
2_126	18.1
2_127	16.4
2_128	15.6
2_129	14.9
2_130	14.1
2_131	13
2_133	12.3
2_135	22.1
2_136	19.6
2_137	18.6
2_217	11.7
2_219	7.7
2_220	14.8
2_221	12.9
2_231	9.5
2_232	9.1
2-Alt_241	22.7
2-Alt_242	26.3
2-Alt_243	27.4
2-Alt_244	29.1
2-Alt_249	19.1

Table 4
Biglow Receptor Coordinates

ID	Name	Height	Coordinates		
			X	Y	Z
		(m)	(m)	(m)	(m)
1	Doug Medler	1.5	686620.5	5061699	1.5
2	Kevin McCullough	1.5	686072.2	5058546	1.5
3	Weir (Harry Macnab)	1.5	690435.3	5057972	1.5
4	Scharf	1.5	687866.7	5057546	1.5
5	Sandy Macnab	1.5	684944.5	5057305	1.5
6	Donna Jean Gatter	1.5	687693.2	5056840	1.5
7	Bo Macnab	1.5	685196.4	5056443	1.5
8	Norm Fridley	1.5	692944	5056133	1.5
9	Kent Thomas	1.5	690338.2	5055576	1.5
10	Dewey Thomas	1.5	690355.4	5055416	1.5
11	Les Gray	1.5	686578.6	5055298	1.5
12	Brett Gray	1.5	687492.6	5055250	1.5
13	John Fields	1.5	683077	5054934	1.5
15	Reid Ranch	1.5	682466.2	5062885	1.5
16	Coats	1.5	679844.8	5061106	1.5
17	Trent & Jill Harrison	1.5	680076	5060533	1.5
18	Five Macs	1.5	680799.4	5057927	1.5
19	Richelderfer (Paul Bish)	1.5	680112	5053902	1.5
20	Smith, Delmer	1.5	680379.1	5053470	1.5
21	Rathbun, Betty J Estate	1.5	682155.8	5052679	1.5
22	Rathbun, Betty J Estate	1.5	682204.7	5052617	1.5
23	James and Dean Medler	1.5	690135	5054840	1.5
23.1	Medler second house	1.5	690105.9	5054834	1.5
24	Gordon Hildebrand	1.5	685272	5051670	1.5
25	John Hildebrand	1.5	685146	5051246	1.5

Table 5
Biglow Noise Source Cooridnates

			Height	Coordinates		
				X	Y	Z
ID	PWL (dBA)	Source	(m)	(m)	(m)	(m)
substation	106.4	xfmr	4	686272	5057615	4
1_1	109.8	V82Site	80	684359	5062311	80
1_2	109.8	V82Site	80	684361	5062108	80
1_3	109.8	V82Site	80	684364	5061905	80
1_4	109.8	V82Site	80	684349	5061467	80
1_5	109.8	V82Site	80	684421	5061301	80
1_6	109.8	V82Site	80	684615	5061137	80
1_7	109.8	V82Site	80	684258	5060622	80
1_8	109.8	V82Site	80	684319	5060426	80
1_9	109.8	V82Site	80	684445	5060226	80
1_10	109.8	V82Site	80	684596	5059991	80
1_11	109.8	V82Site	80	684671	5059815	80
1_12	109.8	V82Site	80	684739	5059618	80
1_13	109.8	V82Site	80	684775	5059425	80
1_14	109.8	V82Site	80	684744	5059220	80
1_15	109.8	V82Site	80	684641	5058958	80
1_16	109.8	V82Site	80	684548	5058751	80
1_17	109.8	V82Site	80	684410	5058424	80
1_18	109.8	V82Site	80	684349	5058166	80
1_19	109.8	V82Site	80	684138	5057841	80
1_20	109.8	V82Site	80	684048	5057486	80
1_21	109.8	V82Site	80	684033	5057282	80
1_22	109.8	V82Site	80	684024	5057104	80
1_23	109.8	V82Site	80	684044	5056924	80
1_24	109.8	V82Site	80	684043	5056743	80
1_25	109.8	V82Site	80	684042	5056563	80
1_26	109.8	V82Site	80	684041	5056382	80
1_27	109.8	V82Site	80	684039	5056212	80
1_28	109.8	V82Site	80	685341	5062667	80
1_29	109.8	V82Site	80	685362	5062451	80
1_30	109.8	V82Site	80	685382	5062235	80
1_31	109.8	V82Site	80	685436	5062034	80
1_32	109.8	V82Site	80	685497	5061850	80
1_33	109.8	V82Site	80	685552	5061653	80
1_34	109.8	V82Site	80	685659	5061328	80
1_35	109.8	V82Site	80	685287	5061005	80
1_36	109.8	V82Site	80	685296	5060815	80
1_37	109.8	V82Site	80	685546	5060619	80
1_38	109.8	V82Site	80	685699	5060470	80
1_39	109.8	V82Site	80	685811	5060314	80
1_40	109.8	V82Site	80	687413	5061867	80
1_41	109.8	V82Site	80	687386	5061678	80
1_42	109.8	V82Site	80	687393	5061490	80
1_43	109.8	V82Site	80	687374	5061300	80
1_44	109.8	V82Site	80	687369	5061109	80
1_45	109.8	V82Site	80	686932	5060745	80
1_46	109.8	V82Site	80	686929	5060511	80
1_47	109.8	V82Site	80	685940	5060166	80

Table 5
Biglow Noise Source Cooridnates

1_48	109.8	V82Site	80	686025	5060007	80
1_49	109.8	V82Site	80	686111	5059851	80
1_50	109.8	V82Site	80	686213	5059702	80
1_51	109.8	V82Site	80	686266	5059537	80
1_52	109.8	V82Site	80	686269	5059367	80
1_53	109.8	V82Site	80	686253	5059193	80
1_54	109.8	V82Site	80	686194	5059012	80
1_55	109.8	V82Site	80	688335	5060678	80
1_56	109.8	V82Site	80	688329	5060496	80
1_57	109.8	V82Site	80	688322	5060314	80
1_58	109.8	V82Site	80	688316	5060132	80
1_59	109.8	V82Site	80	688189	5059929	80
1_60	109.8	V82Site	80	687695	5059586	80
1_61	109.8	V82Site	80	687615	5059378	80
1_62	109.8	V82Site	80	687545	5059176	80
1_63	109.8	V82Site	80	687446	5058978	80
1_64	109.8	V82Site	80	687290	5058762	80
1_65	109.8	V82Site	80	687158	5058549	80
1_66	109.8	V82Site	80	687044	5058355	80
1_67	109.8	V82Site	80	686868	5058030	80
1_68	109.8	V82Site	80	686854	5057843	80
1_69	109.8	V82Site	80	685387	5058151	80
1_70	109.8	V82Site	80	685428	5057988	80
1_71	109.8	V82Site	80	685576	5057815	80
1_72	109.8	V82Site	80	685706	5057674	80
1_73	109.8	V82Site	80	685805	5057526	80
1_74	109.8	V82Site	80	685848	5057258	80
1_75	109.8	V82Site	80	685896	5057055	80
1_76	109.8	V82Site	80	685951	5056852	80
2_138	107	S23a	80	689215.5	5060003	80
2_139	107	s23a	80	689321.8	5059739	80
2_141	107	s23a	80	689419.2	5059471	80
2_142	107	s23a	80	689422.4	5059273	80
2_143	107	s23a	80	689419.5	5059077	80
2_144	107	s23a	80	689265	5058834	80
2_145	107	s23a	80	689108.3	5058596	80
2_146	107	s23a	80	688949.7	5058355	80
2_147	107	s23a	80	688805.8	5058125	80
2_148	107	s23a	80	688799.7	5057937	80
2_149	107	s23a	80	688831.7	5057744	80
2_150	107	s23a	80	688840.8	5057550	80
2_151	107	s23a	80	688844	5057352	80
2_152	107	s23a	80	688805.2	5057150	80
2_153	107	s23a	80	688767.2	5056927	80
2_154	107	s23a	80	688722.6	5056719	80
2_155	107	s23a	80	688696.8	5056521	80
2_156	107	s23a	80	688697.1	5056319	80
2_157	107	s23a	80	688691.1	5056125	80
2_158	107	s23a	80	688389.6	5055847	80
2_159	107	s23a	80	688372.7	5055620	80
2_160	107	s23a	80	688343.9	5055420	80

Table 5
Biglow Noise Source Cooridnates

2_161	107	s23a	80	688158.7	5055136	80
2_162	107	s23a	80	690041.1	5058683	80
2_163	107	s23a	80	690013.4	5058451	80
2_164	107	s23a	80	688119.8	5054939	80
2_165	107	s23a	80	688087	5054738	80
2_166	107	s23a	80	688067	5054546	80
2_77	107	s23a	80	685997.6	5056636	80
2_78	107	s23a	80	680855.3	5059342	80
2_79	107	s23a	80	681040	5059066	80
2_80	107	s23a	80	681260.7	5058825	80
2_81	107	s23a	80	681726.6	5059796	80
2_82	107	s23a	80	681899.7	5059542	80
2_83	107	s23a	80	682093.4	5059328	80
2_84	107	s23a	80	682317.6	5059103	80
2_85	107	s23a	80	683387.8	5060814	80
2_86	107	s23a	80	683410.6	5060534	80
2_87	107	s23a	80	683210	5060326	80
2_88	107	s23a	80	683005	5059968	80
2_89	107	s23a	80	683530.5	5059768	80
2_90	107	s23a	80	683409.2	5059392	80
2_91	107	s23a	80	683390.6	5059186	80
2_92	107	s23a	80	683301.5	5058898	80
2_93	107	s23a	80	683299.8	5058697	80
2_94	107	s23a	80	683302	5058497	80
2_95	107	s23a	80	683304.2	5058300	80
2_96	107	s23a	80	683299.3	5058104	80
2_97	107	s23a	80	683275.5	5057904	80
2_98	107	s23a	80	682585.9	5057399	80
2_99	107	s23a	80	682691.4	5057128	80
2_100	107	s23a	80	682825.7	5056866	80
2_101	107	s23a	80	683133.1	5055831	80
2_102	107	s23a	80	683125.7	5055620	80
2_103	107	s23a	80	682109.1	5055133	80
2_104	107	s23a	80	682095.9	5054938	80
2_105	107	s23a	80	682190.8	5054605	80
2_106	107	s23a	80	682366.2	5054212	80
2_107	107	s23a	80	682340.8	5054026	80
2_108	107	s23a	80	684189.7	5055912	80
2_109	107	s23a	80	684196.2	5055692	80
2_110	107	s23a	80	684058.8	5055386	80
2_111	107	s23a	80	684076.6	5054999	80
2_112	107	s23a	80	684030.4	5054651	80
2_113	107	s23a	80	684661.2	5054283	80
2_114	107	s23a	80	684269.3	5054017	80
2_115	107	s23a	80	684246.4	5053821	80
2_116	107	s23a	80	684045.2	5053567	80
2_117	107	s23a	80	684048.3	5053372	80
2_118	107	s23a	80	683965.4	5053078	80
2_119	107	s23a	80	685106.6	5055595	80
2_120	107	s23a	80	685099.7	5055398	80
2_121	107	s23a	80	685100.5	5055180	80

Table 5
Biglow Noise Source Cooridnates

2_122	107	s23a	80	685020.4	5054669	80
2_123	107	s23a	80	686313.7	5056128	80
2_124	107	s23a	80	686318.7	5055933	80
2_125	107	s23a	80	686271.4	5055718	80
2_126	107	s23a	80	685975.9	5055506	80
2_127	107	s23a	80	686010.7	5055126	80
2_128	107	s23a	80	686014.5	5054942	80
2_129	107	s23a	80	686023.3	5054756	80
2_130	107	s23a	80	685997.2	5054564	80
2_131	107	s23a	80	685886.9	5054250	80
2_133	107	s23a	80	685864.7	5054066	80
2_135	107	s23a	80	686718.4	5056369	80
2_136	107	s23a	80	687412.5	5056153	80
2_137	107	s23a	80	687417	5055946	80
2_217	107	s23a	80	685866.7	5053880	80
2_219	107	s23a	80	683964.2	5052892	80
2_220	107	s23a	80	685033	5054875	80
2_221	107	s23a	80	683108.6	5055398	80
2_231	107	s23a	80	680809.8	5059645	80
2_232	107	s23a	80	680710.4	5059913	80
2-Alt_241	107	s23a	80	687174.4	5056665	80
2-Alt_242	107	S23a	80	686911.4	5057109	80
2-Alt_243	107	s23a	80	686951.2	5057310	80
2-Alt_244	107	s23a	80	686900	5057506	80
2-Alt_249	107	s23a	80	685131.2	5055876	80

ATTACHMENT 1

ODOE's Biglow Phase 1 Analysis

Memo

Daly • Standlee & Associates, Inc.
4900 S.W. Griffith Drive
Suite 216
Beaverton, Oregon 97005
(503) 646-4420
Fax (503) 646-3385

Date: **May 15, 2007**

To: **John White**

Oregon Department Of Energy

From: **Kerrie G. Standlee, P.E.**

Re: **Biglow Canyon Wind Farm Phase I - Review of Site Certificate Application Noise Section**

DSA File #: 210051

CC: **John Larsen, Pacific Energy Systems**

Message: John,

As you will recall, Biglow Canyon Wind Farm project representatives requested that the Oregon Department of Energy review and consider the effects of two noise attenuation factors not previously included in their analysis of noise levels at Receiver R2 of their study. The applicant stated that they believed the effect of the two factors should be included prior to the Department making a finding relative to the noise levels expected at Receiver R2. I have been researching both factors relative to the prediction of turbine noise levels at Receiver R2 and I am sending you this memo to address the applicant's request.

The two noise attenuation factors of interest are:

1. The additional attenuation of turbine noise attributable to wind for those turbines located downwind of Receiver R2.

2. The additional attenuation of turbine noise due to ground effects between turbines and Receiver R2.

Relative to the wind attenuation factor, based on what I learned during my research into the inclusion of the factor in predicting environmental noise levels, I provide the following comments:

1. Any additional attenuation of Biglow Phase I turbine noise at Receiver R2 will potentially only be associated with the noise radiating from turbines T55 through T68 due to the fact that only those turbines are located downwind of Receiver R2. All other turbines are located "upwind" of the receiver and there will be no potential for wind effects on the noise radiating to the receiver from those turbines.

2. The additional attenuation of turbine noise caused by wind will only be a factor for those turbines within the string of T55 through T68 that are more than 2000 feet from Receiver R2 and only for those turbines when winds blow at velocities greater than 20 mph.

3. The additional attenuation of noise generated by those turbines in string T55 through T68 that are more than 2000 feet from Receiver R2 will (based on the data in Figure 7.17 of the text, *Noise and Vibration Control*, by Leo Beranek, 1971) reduce the contribution of noise from those turbines considered as a group to a level of 35.5 dBA at R2. This level is approximately 7.6 dB less than the 43.1 dBA calculated for the turbines by the applicant's analysis. The overall maximum noise level at R2 caused by Biglow Phase I turbines will be reduced from 50.5 dBA to 49.8 dBA if the wind attenuation is included in the analysis.

4. With the inclusion of wind attenuation in the calculation of noise levels at Receiver R2, the overall turbine generated noise level will meet the DEQ maximum allowable criteria level of 50 dBA at the receiver.

With respect to the ground attenuation factor, representatives for the applicant have stated that they feel it is reasonable to use the procedures outlined in ISO 9613-2 to predict excess attenuation provided by the ground between the wind turbines and a receiver. In addition, they have stated that they feel it is reasonable to use a ground factor of 1.0 in the calculation rather than the 0.5 used in their analysis. To help get a better understanding of the use of the factor in predicting environmental noise levels, I reviewed ISO 9613-2 and I contacted others familiar with the use of ISO 9613-2. Based on what I learned, I provide the following comments relative to including the attenuation factor when predicting wind turbine noise levels at Receiver R2:

1. The "general method of calculation" of ground attenuation presented in ISO 9613-2 does not accurately predict ground attenuation for wind turbines due to the height of the wind turbines and due to the effect of the high wind speeds associated with the maximum noise levels generated by wind turbines.

2. Within the "Scope" section of ISO 9613-2, it states that the calculation procedure "*is applicable, directly or indirectly, to most situations concerning road or rail traffic, industrial noise sources, construction activities, and many other ground-based noise sources. It does not apply to sound from aircraft in flight….*" While the scope does not specifically state that the calculation method is not intended to be used to predict noise from wind turbines, it does state that the procedure is not intended to be used to

predict noise associated with aircraft in flight. The restriction on the use of the procedure to predict aircraft noise is likely due to the fact that aircraft in flight are too high above the ground to be included in the group of sources addressed by the procedure. When an inquiry was made to others about the use of the "general method of calculation" of ground attenuation for sources located 100 meters above the ground, one respondent commented that they run into the situation every now and then "with wind turbines and quarries" and that they recommended using the "alternative method" stated in ISO 9613-2 instead of the "general method".

3. Section 5, "Meteorological conditions", of ISO 9613-2 states,

   Downwind propagation conditions for the method specified in this part of ISO 9613 are as specified in 5.4.3.3 of ISO 1996-2:1987, namely

   -- *wind speed between approximately 1 m/s and 5 m/s, measured at a height of 3m to 11 m above the ground.*

   This indicates the procedure is not necessarily intended to be used in calculating noise levels associated with wind turbines that operate in wind speeds of 10 m/s and higher when generating maximum noise levels.

4. The "alternative method" of calculating ground attenuation in ISO 9613-2 states:

   Under the following specific conditions

   - *only the A-weighted sound pressure level at the receiver position is of interest*
   - *the sound propagation occurs over porous ground or mixed ground most of which is porous (see 7.3.1),*
   - *the sound is not a pure tone,*

   and for ground surfaces of any shape, the ground attenuation may be calculated from equation (10):

   $$A_{gr} = 4.8 - (2h_m/d)\,[17 + (300/d)]$$

   where

   A_{gr} *is the ground attenuation*

   h_m *is the mean height of the propagation path above the ground, in meters;*

   d *is the distance from the source to receiver, in meters.*

   The mean height h_m may be evaluated by the method shown in figure 3. Negative values for A_{gr} from equation (10) shall be replaced by zero.

   All of the conditions listed above for the use of the alternative method are met when it comes to predicting noise levels radiating from wind turbines. Therefore, considering

all of the information I reviewed and considering the fact that another consultant stated that they use the “alternate method” to calculate ground attenuation for wind turbine projects, I conclude the alternate method of calculating ground attenuation in ISO 9613-2 would be more appropriate than the “general method, in predicting ground attenuation between wind turbines in the Biglow Phase I project and Receiver R2.

If one uses the alternative method in ISO 9613-2 to calculate ground attenuation between turbines in the Biglow Phase I project and Receiver R2, it will be seen that there will be no effect of ground attenuation on turbine noise levels predicted at Receiver R2 for turbines that are located within approximately 850 meters (almost 2800 feet) of the residence. Beyond that distance, ground attenuation begins to have an influence on predicted turbine noise levels but it does not have a significant influence on the amount of noise from an individual turbine that reaches Residence R2 (significant is defined as 3 dB or more reduction of the noise from an individual turbine) until the turbine is more than approximately 1800 meters (approximately 5900 feet) away from the residence.

I believe the use of the alternative method to calculate ground effects on wind turbine noise levels is consistent with the procedure used on other projects reviewed by the Department whereby the noise contributed by all turbines within a 3000 to 4000 foot range of a receiver was included in the calculation with no ground attenuation between the source and receiver. Therefore, I would recommend we provide the applicant the option of using the alternative method in ISO 9613-2 to calculate ground attenuation between turbines in the Biglow Phase I project and Receiver R2.

If you have any questions concerning the information in this memo, please give me a call to discuss them.

Bastasch, Mark/PDX

From: Kerrie Standlee [kstandlee@acoustechgroup.com]
Sent: Monday, May 21, 2007 1:09 PM
To: Bastasch, Mark/PDX; John.White@state.or.us; Rick.Tetzloff@pgn.com
Subject: RE: Biglow Phase 1 noise analysis

Attachments: ISO ground attenuation using alternative method.xls

ISO ground attenuation using a..

Mark,

I reviewed the calculations I made using the ISO alternative method to calculate the ground attenuation for wind turbines and I found that you are correct. The mean height term in the equation was not divided by 2. The corrected spreadsheet is attached. I believe it agrees with your results.
The results indicate there would be little or no ground attenuation of turbine noise (1 dB or less) for turbines located within 1600 feet of a receiver and basically no ground attenuation for turbines located within 1400 feet of a receiver (half the distance of what I said in the May 15 memo). I will correct the memo and get that out to John today.

Relative to the names of who offered advice regarding the use of the alternative method instead of the general method in calculating ground attenuation for wind turbines, I do not know the names of the responders.
The actual response I received came back from Rich Peppin. However, as when the question went out for comment to you and who ever else he surveyed, the response came back from him with no name attributed to the response. Since you were included in the list of recipients of the question that I sent to Rich, you might be better than me to answer that question. I am not sure if Rich will share the name of that responder or not. You might try him to see.
He told me he would not be sending me the names of the people asked for comment.

Kerrie Standlee
phone 503-646-4420; fax 503-646-3385

-----Original Message-----
From: Mark.Bastasch@CH2M.com [mailto:Mark.Bastasch@CH2M.com]
Sent: Sunday, May 20, 2007 7:55 PM
To: John.White@state.or.us; Rick.Tetzloff@pgn.com
Cc: kstandlee@acoustechgroup.com
Subject: Biglow Phase 1 noise analysis

John/Kerrie-

Can you please provide me a copy of all correspondence including the names of those who offered the advice that these findings were based on?

In addition, can you review the statement that even under the simplified method, ground attenuation will not play a role for turbines within 850 meters. As I calculate it using the formulas presented in the memo and a hub height of 100 meters (which I believe results in a mean path height of path of 50 meters), the ground effect at 850 meters is 2.8 dBA. I would consider that a significant effect, particularly considering that the simplified model's maximum attenuation is 4.8 dBA.

Best Regards,

Mark

-----Original Message-----
From: John White [mailto:John.White@state.or.us]
Sent: Thursday, May 17, 2007 4:43 PM
To: Rick.Tetzloff@pgn.com
Cc: Bastasch, Mark/PDX
Subject: Phase 1 noise analysis

Rick,
Attached is a memo from Kerrie Standlee containing his analysis of the noise affecting property R2. This will resolve the matter for Phase 1. Please let me know if you have any questions.

Regards,
-John

John G. White
Oregon Department of Energy
625 Marion St., NE
Salem, Oregon 97301-3742
john.white@state.or.us