Exhibit 8

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Review of Greens Hollow Sound Study by Tetra Tech (2008)

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Summary of Findings

The Tetra Tech "Green Hollow Sound Study" has several deficiencies, including:

1. Tetra Tech sound level meters measured down to about 27 dBA, but actual sound levels in the area are often less than 15 dBA.
2. Tetra Tech measured sound levels in July; grouse typically display in late March to early May when sound levels are generally lower.
3. Tetra Tech measured from mid-morning to mid-afternoon. Grouse typically display between 1800-0800, which is generally a quieter time of day.
4. Tetra Tech measured for 2-minute periods at several locations. Such a short measurement period does not usually cover normal, natural sound level variability and can either over-estimate or under-estimate actual sound levels.
5. Tetra Tech did not follow protocols developed by the American National Standards Institute (ANSI) for outdoor sound level measurements.
6. Tetra Tech did not use acoustic metrics recommended by ANSI for reporting sound level information (L_{90} for background ambient and L_{50} for existing ambient). Tetra Tech used a metric (L_{eq}) that would suggest higher sound levels at leks than actually present.

The Tetra Tech Greens Hollow Sound Study (2008) concluded that average "background" sound levels in the lek areas was ±34.7 dBA. However, sound level measurements by Sandhill Company between March 29-31, 2015, found that background sound levels (L_{90}) were 16.3 dBA for all hours of the day, and 15.1 dBA for hours important to lekking activity (1800-0800). Using the same (incorrect) metric as Tetra Tech to establish background (L_{eq}), Sandhill Company reported L_{eq} = 24.5 dBA, while Tetra Tech reported L_{eq} = 34.7 dBA.

The existing vent fan is 4350 m from the Wildcat Knolls lek, clearly audible, resulting in a L_{50} of 19.4 dBA at the lek. The proposed vent fan would be 2680 m from the Wildcat Knolls lek. The sound level at the lek, should the new vent fan be constructed, would be approximately 26 dBA (19.4 dBA from the current fan plus an estimated 25 dBA from the proposed fan = 26 dBA, using log additive function). Anthropogenic sounds >25 dBA have the potential to negatively impact greater sage-grouse (see discussion in report on Wildcat Knolls sound levels).

For these reasons, the report by Tetra Tech and subsequent analysis of potential impacts in the DEIS and SEIS are inaccurate and misleading, and could result in harmful impacts to greater sage-grouse.

Introduction

The purpose of this paper is to provide a review of the Greens Hollow Sound Study in 2008, conducted by Tetra Tech, Salt Lake City, UT. The purpose of the Tetra Tech study was to measure sound levels at sensitive resource locations, such as leks of greater sage-grouse (*Centrocercus urophasianus*), and determine potential acoustic impacts of a proposed coal mine vent fan on sensitive resources. Anthropogenic sounds have the potential to negatively impact greater sage-grouse (Blickley et al. 2011; Blickley and Patricelli 2012; Patricelli et al. 2013). Accurate background sound level data are essential for assessment of potential negative impacts.

Specific Issues in the Tetra Tech Study

Equipment

The sound level meter used in this study was a Quest Technologies Model 2200. The manufacturer states that this model is capable of measuring sound levels between 30-140 dBA (this is the range the manufacturer guarantees, most sound level meters will measure slightly better than guaranteed, 27.5 dBA in the Tetra Tech study). The minimum sound levels reported by Tetra Tech are at or near the minimum level that can be measured by this model sound level meter. *This means that actual sound levels are lower than reported.*

Use of inappropriate equipment most often leads to false and deceptive results. Consider a study attempting to determine the average height of all individuals in Utah, and using a 36" stick as a measuring device. The results would show the average height of a person in Utah to be about 35.9" which of course is not true. The average height is about 59 inches, considering babies to adults, but if the measuring device only goes to 36" an accurate study is not possible.

Sound level meters used in any measurement should be capable of measuring the full range of sound levels at the study site. Other acoustic studies in sage habitats relative to greater sage-grouse have shown sound levels are often <10 dBA during April during early morning hours (Ambrose et al. 2014). The use of a sound level meter that measures down to only 27 dBA cannot provide accurate results if actual sound levels are lower. If background sound levels are reported as high, a new noise source would be less likely to have any influence, whereas if background sound levels are low, the potential for impacts due to a new noise source is greater.

Metric Used to Establish "Background Sound Level"

The Tetra Tech study used the L_{eq} metric to establish the background sound level. L_{eq} is an energy average (or logarithmic average), and, as such, a very short but very loud sound will greatly influence (increase) the average sound level. The American National Standards Institute (ANSI) recommends that the L_{90} metric be used to establish background sound level (ANSI 1994). L_{90} levels are always lower than L_{eq} levels. The background sound levels reported by Tetra Tech are much higher than typical sound levels in the study area.

Dates and Time of Day

Greater sage-grouse typically display between about 0500-0800, or starting just before sunrise and ending 3-4 hours later. This is usually the quietest time of day, and this is why birds with audio displays are most active at this time; their songs and display sounds carry a great distance because few other sounds are present.

The Tetra Tech study measured sound levels in late July between the hours 0823 and 1433. Grouse typically display in April and May, and typically do not display after about 0800. The time of season and time of day when Tetra Tech measured are not appropriate for measuring sound levels at leks used by greater sage-grouse. One would expect sound levels to be higher in July due to the presence of more birds and insects in July as compared to April, and one would expect sound levels to be higher after 0800 due to increasing winds (which produces sound due to wind through vegetation). Further, meteorological conditions in July are substantially different from April, and as a result, sound attenuation rates would be different. One would expect sound to attenuation more in July than in April due to warmer temperatures.

Sound levels in April during the primary lekking hours (0500-0800) would almost certainly be lower than reported by Tetra Tech, and thus the potential for impacts would be greater than determined in the DEIS and SEIS.

Measurement Duration
Tetra Tech made 2-minute sound level measurements at several locations. A 2-minute sample may or may not be representative of actual conditions. Measurement periods need to be long enough to ensure all variability in sound levels are measured, and this usually requires several days at each measurement location.

Microphone Height
The Tetra Tech study placed microphones at approximately 1 meter off the ground. Grouse ear height is 0.3 m (12"), thus data collected at 1 m may not represent what the target species, greater sage-grouse in this case, experience.

Discussion
The current mine vent fan is 4350 m from the Wildcat Knolls lek and is clearly audible at the lek. The proposed mine vent fan is 2680 m from the Wildcat Knolls lek. One would expect the proposed vent fan to be audible and also result in higher sound levels at the lek than the current vent fan.

Analysis of anthropogenic sound levels at greater sage-grouse leks in the Pinedale Anticline Project Area sound of Pinedale, WY, relative to trends of counts of male greater sage-grouse at those leks, demonstrate that at leks with sound levels <25 dBA, negative impacts are not apparent, while at leks with sound levels >25 dBA, negative impacts begin to occur. L_{50} dBA sound levels are strongly and significantly associated with declining trends ($R^2 = 0.563$, $P = 0.001$) (S. Ambrose, unpublished data). See additional discussion in report on sound levels at the Wildcat Knolls lek (attached).

Summary
The Tetra Tech study (1) used inappropriate equipment (not sensitive enough); (2) measured at inappropriate times of year and times of day (not when greater sage-grouse are displaying); and (3) did not follow protocols developed by the American National Standards Institute (ANSI) for outdoor sound level measurements. Further, Tetra Tech did not use acoustic metrics recommended by ANSI for reporting sound level information, and metrics used by Tetra Tech suggested higher sound levels at leks than probably occurred there during the lekking period.

For these reasons, the report by Tetra Tech and subsequent analysis of potential impacts in the DEIS and SEIS are inaccurate and misleading.

Literature Cited

Ambrose, S., C. Florian, and J. MacDonald. 2015. Ambient sound levels in sage habitats in Wyoming, April 2014. Unpublished report to Wyoming Department of Game and Fish, Pinedale, WY.

American National Standards Institute (ANSI). 1994. ANSI S12.18-1994, Procedures for Outdoor Measurement of Sound Pressure Level. Acoustical Society of America, New York, NY.

Blickley, J. L., D. Blackwood, and G. L. Patricelli. 2011. Experimental evidence for the effects of chronic anthropogenic noise on abundance of greater sage-grouse at leks. Conservation Biology, Vol. 26, No. 3, 461-471.

Blickley, J. L., and G. L. Patricelli. 2012. Potential acoustic masking of greater sage-grouse (Centrocercus urophasianus) display components by chronic industrial noise. Ornithological Monographs, Vol. 2012, No. 74, 23.35.

Patricelli, G. L., J. L. Blickley, and S. L. Hooper. 2013. Recommended management strategies to limit anthropogenic noise impacts on greater sage-grouse in Wyoming. Human-Wildlife Interactions 7(2):230-249, Fall 2013.

Summary of Sound Level Measurements at Wildcat Knolls Lek, March 29-31, 2015

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Introduction and Methods

Between March 29, 2014, 1400 hours, and March 31, 2015, 1430, we collected continuous 1-second dBA and 1/3 octave band data (12.5-20,000 Hz) at the Wildcat Knolls greater sage-grouse lek. The sound level meter was placed on the north side of the lek, within the boundary of the lek, at 12" above ground height (average grouse ear height). One-third octave band data are useful in determining the potential for masking sounds important to wildlife. For example, most sounds produced by greater sage-grouse during lekking activity are low frequency, typically <500 Hz. Sounds of the current mine vent fan are highest in the 250 Hz range, suggesting the potential for masking grouse sounds is high.

Results

The "existing ambient" (L_{50}) sound level at Wildcat Knolls was 19.4 dBA for all hours (0000-2400) and 17.1 dBA for greater sage-grouse lekking hours (1800-0800) (Table 1). The "background ambient" sound level (L_{90}) was 16.3 dBA for all hours and 15.1 dBA for lekking hours. Daily L_{50} dBA patterns are shown in Figure 1, showing lower sound levels during evening and early morning, with elevated levels during daylight hours when winds are higher.

The current vent fan was audible during all hours of the day, and was clearly noticeable at 250 Hz (Figure 2). This fan sound likely has some influence on both the L_{50} and L_{90} levels.

The Tetra Tech sound study (2008) reported "average" (L_{eq}) sound levels at the Wildcat Knolls lek between 31.0-39.2 dBA. We found L_{eq} = 24.5 dBA, median for all hours of the day, and 21.2 dBA for hours important to lekking greater sage-grouse.

Table 1. Hourly metrics for Wildcat Knoll Greater Sage-grouse lek, March 29-31, 2015.

Hour	NHours	LMin	LMax	Leq	L10	L50	L90
0	2	13.6	44.2	20.9	19.7	16.1	14.5
1	2	13.8	49.0	23.2	23.2	18.0	15.6
2	2	14.6	31.4	19.8	22.2	18.9	16.4
3	2	14.5	47.2	23.3	22.4	18.7	16.2
4	2	13.9	27.6	18.1	20.2	17.4	15.6
5	2	13.9	28.9	17.7	20.0	16.7	14.9
6	2	14.2	47.5	25.6	27.0	20.0	15.9
7	2	15.4	51.7	30.3	31.3	24.1	19.8
8	2	14.4	57.0	29.5	25.0	19.3	16.6
9	2	14.4	58.6	23.4	25.8	19.6	17.2
10	2	15.2	43.2	25.7	28.5	21.1	17.3
11	2	15.3	45.6	26.5	30.4	22.1	18.3
12	2	15.5	46.9	29.5	33.2	25.2	20.0
13	2	15.8	49.3	31.2	35.1	26.2	20.1
14	2	16.0	48.9	29.9	33.9	25.6	20.1
15	2	14.7	45.1	27.1	29.9	21.0	16.6
16	2	15.1	51.0	29.2	30.3	22.1	17.2
17	2	14.6	44.8	26.9	30.1	21.0	17.3
18	2	14.3	37.3	21.5	24.5	19.5	15.3
19	2	13.9	50.4	27.3	23.4	15.3	14.2
20	2	13.7	45.7	23.0	22.7	15.0	14.1
21	2	13.6	40.5	18.7	17.9	14.4	13.9
22	2	13.5	26.2	15.4	16.9	14.7	14.0
23	2	13.6	27.7	17.6	19.9	16.7	14.7
GRHO001	0000-2400	13.5	58.6	24.5	24.8	19.4	16.3
	0800-1800	14.4	58.6	28.2	30.2	21.6	17.3
	1800-0800	13.5	51.7	21.2	22.3	17.1	15.1

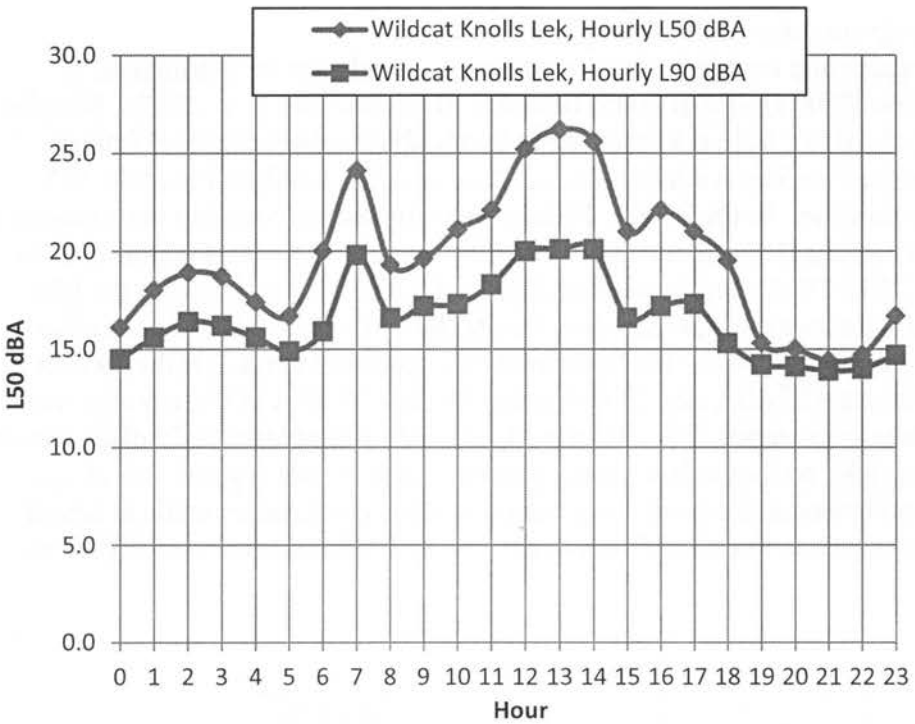

Figure 1. L50 dBA and L90 dBA, Wildcat Knolls lek, March 29-31, 2015.

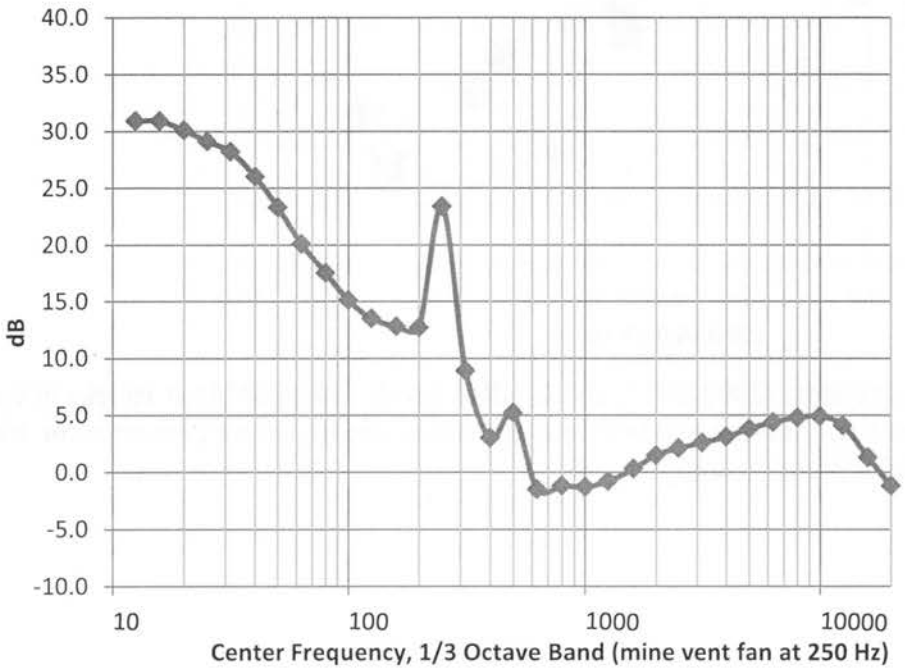

Figure 2. One-third octave band levels, Wildcat Knoll Greater Sage-grouse lek, March 29-31, 2015. Note higher levels at 250 Hz; this is noise from the mine vent fan, 4350 m from the lek.

Discussion

Impacts to Greater Sage-grouse due to Anthropogenic Sounds

While several studies suggest and demonstrate anthropogenic sounds can be detrimental to greater sage-grouse (Braun 1998; Holloran 2005; Blickley 2012; Blickley et al. 2012a; Blickley et al 2012b; Patricelli et al. 2013), little is known about levels above which negative impacts occur. Recent studies in the Pinedale Anticline Project Area (PAPA) south of Pinedale, WY, provide insight into this question. In the PAPA, 19 leks were studied by counting male grouse at the leks (2000-2014) (Wyoming Department Game and Fish, unpublished data) and measuring sound levels at the leks (2013-2014) (Ambrose et al. 2014). L_{50} dBA sound levels at the leks were strongly associated with trends in grouse count trends ($R^2 = 0.563$, $P = 0.001$). In other words, the higher the L_{50} dBA, the greater the likelihood of a declining trend. Of the 19 leks in the PAPA, 6 had sound levels <25 dBA and 13 had sound levels >25 dBA. Of the 6 leks with sound levels <25 dBA, trends averaged -2%. Of the 13 leks with sound levels >25 dBA, trends averaged -22% (6 of these leks no longer had grouse present). These data suggest that at L_{50} sound levels <25 dBA, anthropogenic sounds have minimal impact on grouse, while at sound levels >25 dBA, impacts to grouse due to anthropogenic sounds begin to occur (see Figure 3).

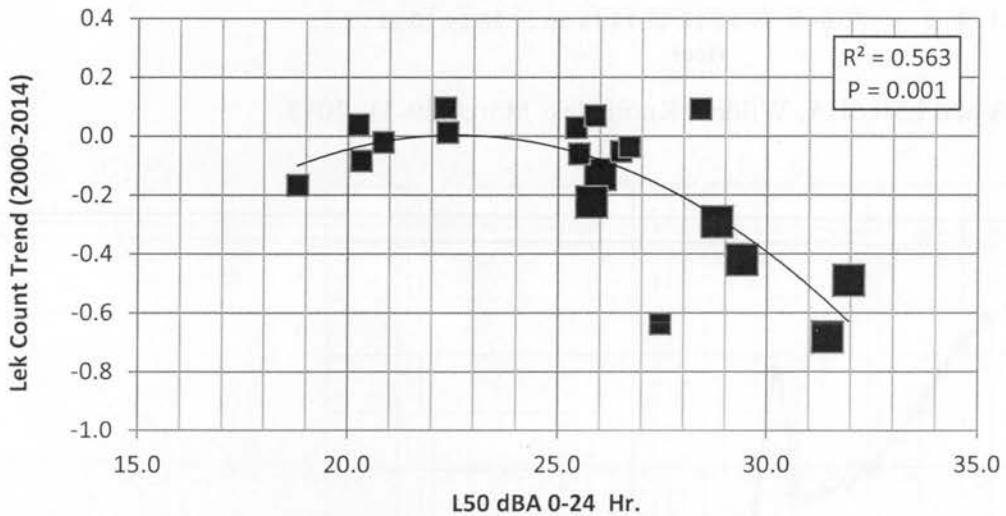

Figure 3. Trends of grouse counts (2000-2014) and L_{50} dBA levels (2013-2014) at 19 leks in the Pinedale Anticline Project Area. Larger symbols indicate grouse are no longer present at the lek. Trend lines are polynomial regression analysis.

Literature Cited

Ambrose, S., C. Florian, and J. MacDonald. 2014. Sound Levels at Greater Sage-grouse Leks in the Pinedale Anticline Project Area, WY, April 2013-2014. Unpublished report to Wyoming Department of Game and Fish, Cheyenne, WY.

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Braun, C. E. 1998. Sage-grouse declines in western North America: what are the problems? Proceedings of the Western Association of State Fish and Wildlife Agencies 78:139–156.

Holloran, M. J. 2005. Greater sage-grouse (*Centrocercus urophasianus*) population response to natural gas field development in western Wyoming. Department of Zoology and Physiology, University of Wyoming, Laramie.

Review of Wildlife Section, Technical Report, Greens Hollow Coal Lease Tract

Section 3.2.5.1.2.1 TES Birds. P. 92

> "As the drilling activities would occur year-round, breeding birds would either become habituated to the noise and disturbance or move to another location for that breeding period or permanently."

Comment: This statement implies that grouse have the option of simply moving to an alternate location. This is rarely the case for wildlife species. They are where they are for a reason.

Section 3.2.5.1.2.1 TES Birds. P. 92

> "If vent shaft construction occurred during sage-grouse lekking season, noise from the construction measured at the edge of the lek would not be allowed to exceed 10 dB above ambient sound level at sunrise."

Comment: For this assessment, it is essential to know the actual ambient sound level at sunrise. The Tetra Tech does not provide such information.

Section 3.2.5.2.4 Constant Background Sound. P. 99

> "Sampling in the study area determined that background sound levels for the analysis area averaged 34.0 dBA. This level was recorded within the vicinity of the analysis area where the currently-operating SUFCO fan was not audible to human researchers sampling noise levels. These readings were taken at various locations throughout the analysis area to get an average baseline across the area without noise interference from passing vehicles, overhead airplanes, during calm wind conditions, quiet researchers, and as stated above, where the SUFCO mine was inaudible to researchers. This is considered to be the background noise levels for the analysis area in mid-summer (Tetra Tech 2008).
>
> "Current guidelines for limiting noise impacts on sage-grouse suggest a maximum of 10 dB above ambient measured at the edge of the lek (Morales et al 2011). Noise levels above this threshold have been shown to reduce peak male attendance at affected leks. This same study also showed intermittent noise to be more detrimental than constant noise of the same decibel level (Blickley et al 2012)."

Comment: For this assessment, it is essential to know the actual ambient sound level at sunrise during the time of grouse lekking in order to assess the 10 dBA over ambient threshold. The SEIS points out some of the shortcomings in the Tetra Tech sound study (time of year of sound study not during lekking, different meteorological conditions in April versus July), but regardless used the findings of that study to establish a "background noise" level for impact analysis.

As pointed out earlier, the Tetra Tech analysis did not use appropriate equipment or appropriate metrics to establish background ambient sound level. Tetra Tech used sound level meters that

would not capable of measuring as low as actual conditions, and also used L_{eq} establish "background ambient sound level" while ANSI recommends L_{90}.