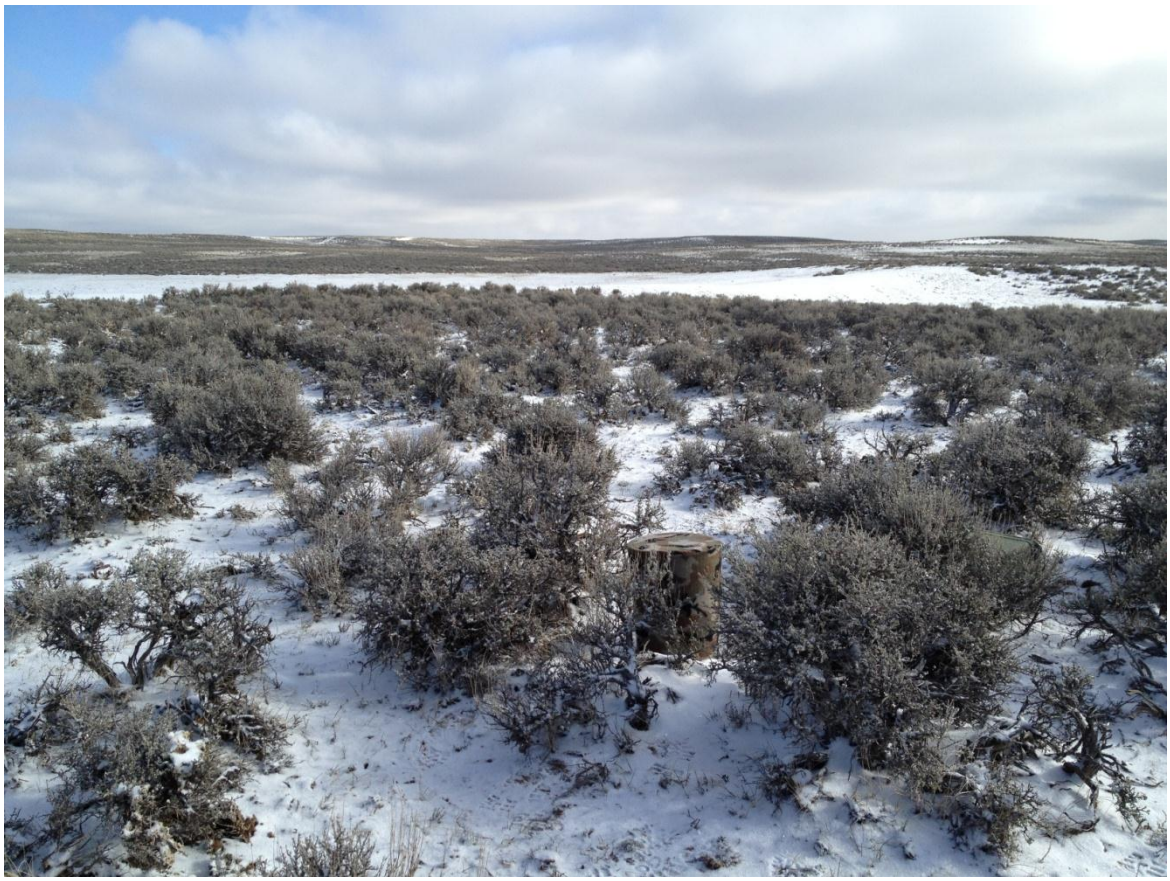
Sound Levels at Greater Sage-grouse Leks, Pinedale Anticline Project Area, Wyoming, April 2013



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Executive Summary

Greater sage-grouse (*Centrocercus urophasianus*) use elaborate acoustic and visual display behaviors to attract and select mates, and depend on vocal communication between females and nestlings during brood rearing. A potential threat to greater sage-grouse is anthropogenic noise associated with human activity, including noise from oil and gas development and production. Several greater sage-grouse leks occur in and around the Pinedale Anticline Project Area (PAPA).

The objectives of this project were to:

- Monitor sound levels at 19 leks in PAPA;
- Monitor sound levels of common gas field activities near leks in PAPA; and
- Determine baseline ambient sound levels in sage land cover at reference areas outside PAPA (3 leks without influence of gas field sounds).

Acoustic data were collected at 39 locations in or near the PAPA in April 2013: 3 reference leks, 19 treatment leks, and 17 gas field sound sources near leks in PAPA. The reference leks were in the Speedway and Ryegrass complexes, and the treatment leks were in the Mesa, Duke's Triangle, and Yellowpoint complexes.

At the three reference leks, the baseline ambient sound level (L_{90}) was 15.8 dBA, and the existing ambient sound level (L_{50}) was 19.4 dBA (all hours, 0000-2400). At two of these leks, L_{50} metrics (and to a lesser extent L_{90} metrics) were influenced by grouse display sounds. For the time period 0000-0500, a time with few grouse display sounds yet with the same general metrological conditions (wind and temperature) as the primary display hours (0500-0900), the L_{50} was 14.6 dBA and the L_{90} was 14.2 dBA for the three reference leks.

The noise floor of sound level meters used at these reference leks were between 13-14 dBA (this is also described as instrument self-noise, the lowest measurement limit of the instrument). Whenever reported sound levels are near the noise floor of the instrument, there is some influence of instrument self-noise on dB data (the closer to the noise floor, the greater the influence). In such situations, actual sound levels are less than recorded by the sound level meter. In other words, actual sound levels at the three reference leks in this study were less than reported above. Results of this 2013 study suggest that future measurements in remote (pre-developed) locations should use instruments that measure down to approximately 5 dBA.

At the 19 treatment leks, the existing ambient sound level (L_{50}) was 26.6 dBA (all hours, 0000-2400). The L_{50} sound level at treatment leks varied according to distance from and type of gas field sound source.

Of the common activities in the gas field, the sound level (L_{50}, 0000-2400 hours) of an active drill rig in the Duke's Triangle complex was the loudest (62 dBA @ 100 m), followed by the injection well complex (56 dBA @ 100 m) in the northern part of the Yellowpoint complex. Other gas field sound sources with L_{50} >50 dBA @ 100 m were a second drill rig being disassembled the Duke's Triangle complex (54 dBA); Jonah compressor station (54 dBA); central gathering facility in the Mesa Complex with generator (52 dBA); and a well pad with 21 well heads and generator (50 dBA).

Equipment type and methods used for sound level measurements relative to greater sage-grouse in Wyoming have varied considerably. Both Type 1 and Type 2 sound level meters have been used, with noise floors ranging from less than 14 dBA to greater than 25 dBA. Microphone height has ranged from 12 inches to 96 inches. Measurement periods have ranged from one hour to more than 14 days. Such inconsistencies can produce significantly difference results. Instruments that measure down to only 25 dBA cannot describe acoustic conditions less than that. Wind pressure influence on dB data varies considerably due to microphone height. Short measurement periods can over- or under-estimate typical acoustic conditions. Collecting acoustic data with such a variety of equipment types and protocols can generate unusable and potentially misleading results. A standardized protocol for sound level measurement is needed to ensure acoustic data are accurate, useful for greater sage-grouse management, and comparable with data from other acoustic studies.

We recommend future acoustic studies follow guidelines prepared by Blickley and Patricelli (2012) "Noise monitoring recommendations for greater sage-grouse habitat in Wyoming" with slight modifications. We suggest these changes based on our experience measuring sound levels at over 150 remote locations in the western United States.

Equipment must be capable of measuring the entire the acoustic environment experienced by greater sage-grouse, and measurement periods must be long enough that natural variations in the acoustic environment are captured. The following basic standards are recommended for data collection:

- Microphone height should be 0.3 m (12") to ensure that measurements capture acoustic conditions experienced by greater sage-grouse.
- Sound level meters should be capable of capturing the full range of sounds (12.5-20,000 Hz) and sound levels (<10 dBA to >80 dBA) experienced by greater sage-grouse.
- Measurement periods should be long enough to capture normal acoustic variation due to seasonal and metrological conditions (estimated 14 days but needs further study).
- Continuous recordings should be collected during the entire measurement period to allow for source identification of all sounds.

The purpose of this study was to monitor sound levels at leks in the PAPA and to determine baseline ambient sound levels near leks outside the PAPA gas field. This study did not attempt to assess impacts of gas field sounds on greater sage-grouse, or at what levels such sounds negatively impact greater sage-grouse.

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Introduction

Greater sage-grouse (*Centrocercus urophasianus*) use elaborate audio and visual display behaviors to attract and select mates, and depend on audio communication between females and nestlings during brood rearing. A potential threat to greater sage-grouse is anthropogenic noise associated with human activity, including noise from oil and gas development and production (BLM 2008, Patricelli et al. 2013).

Objective

The primary objectives of this project were to:

- Monitor sound levels at 19 leks in PAPA;
- Monitor sound levels of common gas field activities near leks in PAPA; and
- Determine baseline ambient sound levels in sage land cover at reference areas outside PAPA (3 leks without influence of gas field sounds).

Study Area

The study area for this project was south and west of Pinedale, WY, primarily in the Pinedale Anticline Project Area (Figure 1). The 6 lek complexes studied were East Fork, Ryegrass, Speedway, Mesa, Duke's Triangle, and Yellowpoint.

Methods

Definitions

The following are definitions of acoustic terms used in this report (NPS 2005). A brief introduction to acoustics is presented in Appendix F.

Audibility: Audibility is the ability of animals with normal hearing, including humans, to hear a given sound. Audibility is affected by the hearing ability of the animal, other simultaneous interfering sounds or stimuli, and by the frequency content and amplitude of the sound.

A-Weighting (dBA): A-weighting is used to account for differences in human hearing sensitivity as a function of frequency. A-weighting de-emphasizes the high (6.3 kHz and above) and low (below 1 kHz) frequencies, and emphasizes the frequencies between 1 kHz and 6.3 kHz, in an effort to simulate the relative response of human hearing.

Decibel (dB): A logarithmic measure commonly used in the measurement of sound. The decibel provides the possibility of representing a large span of signal levels in a simple manner as opposed to using the basic pressure unit Pascal. The difference between the sound pressure of silence versus a loud sound is a factor of 1,000,000:1 or more, therefore it is less cumbersome to use a small range of equivalent values: 0 to 130 decibels.

Frequency: The number of times per second that the sine wave of sound repeats itself. It can be expressed in cycles per second, or Hertz (Hz). Frequency equals Speed of Sound / Wavelength.

L_{eq} (Equivalent Sound Level): The logarithmic average (i.e., on an energy basis) of sound pressure levels over a specific time period. "Energy averaged" sound levels are logarithmic values, and as such are generally much higher than arithmetic averages. L_{eq} values are typically calculated for a specific time period (1-hour and 12-hour time periods are often used). L_{eq} values are computed from

all of the 1-second L_{eq} values for the specific time period. L_{eq} must be used carefully in quantifying natural ambient sound levels because occasional loud sound levels may heavily influence (increase) the L_{eq} value, even though sound levels for that period of time are typically lower.

L_{max}: The maximum sound pressure level for a given period.

L_{min}: The minimum sound pressure level for a given period.

L_x (Exceedance Percentile): This metric is the sound pressure level (L), in decibels, exceeded *x* percent of the time for the specified measurement period. L_{50} is the sound pressure level exceeded 50 percent of the time (L_{50} is the same as the median).

Noise Floor: The lower measurement limit of a sound level meter, also referred to as self-noise or electrical noise of all components of a sound level meter (meter, microphone, and preamplifier).

Sound Level: Generally, *sound level* refers to the *weighted* sound pressure level obtained by frequency weighting, usually A- or C-weighted.

Sound Level, Baseline Ambient: The sound level in a given location including all sounds of nature but absent most human-caused sounds. L_{90} is the sound pressure level exceeded 90 percent of the time, and is commonly used to establish the baseline ambient sound level.

Sound Level, Existing Ambient: The sound level of all sounds in a given area, including all natural sounds as well as all mechanical, electrical and other human-caused sounds. The existing ambient sound level is generally characterized by the L_{50} exceedance level (i.e., the median).

Sound Pressure: Sound pressure is the instantaneous difference between the actual pressure produced by a sound wave and the average barometric pressure at a given point in space. Not all pressure fluctuations detected by a microphone are sound (e.g., wind over the microphone). Sound pressure is measured in Pascals (Pa), Newtons per square meter, which is the metric equivalent of pounds per square inch.

Sound Pressure Level (SPL): The logarithmic form of sound pressure. Generally, sound pressure level refers to unweighted sound pressure levels of one-third octave bands.

Time Weighting: The response speed of a sound level meter. Fast and slow time response were developed primarily to slow needle movement in analog meters so investigators could read and record sound levels. This is not needed with modern digital sound level meters. Both fast and slow time response add a decay factor. Decay factors can induce some error, although over time there is little difference in fast, slow, or actual sound levels.

Measurement Protocol

The Wyoming Game and Fish Department's Request for Proposals (RFP) for this project included acoustic measurement protocols developed for the Pinedale Anticline Project Office by Blickley and Patricelli (2012), "Noise monitoring recommendations for Greater Sage Grouse habitat in Wyoming." Methodology for this project followed the requirements and recommendations provided in the RFP and those of Blickley and Patricelli (2013), and expanded those protocols in a few situations.

In brief, Blickley and Patricelli (2013) recommended the following:

- Measurements should be made with a high quality, calibrated Type I (noise floor < 25 dB) sound level meter (SLM) with a microphone windscreen and environmental housing.
- Measurements should be collected during times when noise exposure is most likely to affect greater sage-grouse— nights and mornings (i.e. 6 pm – 9 am) and should be taken for >1 hour at each site, ideally over multiple days with suitable climactic conditions. To capture typical variability in noise level at the site of interest, deployment of SLM units for multiple days is preferred. If measurements are made on or near a lek, measurements made while birds are present on the lek period (for approximately four hours after sunrise) should be excluded from ambient or noise level calculations.
- Measurements should be made at multiple locations between each noise source and the edge of the protected area. On-lek measurements should exclude time periods when birds are lekking. If measurements are made off-lek to avoid measuring the sound produced by grouse, they should be at an equivalent location with similar topography and relative distance to noise sources in the area.
- Metrics collected should include L_{10} L_{50}, L_{90}, L_{eq}, and L_{max}. All measurements should be collected in A-weighted decibels (dBA) and, if possible, also collected in unweighted (dBF) and C-weighted (dBC) decibels. SLM should log 1/3-octave band levels throughout the measurement period.
- To determine baseline ambient levels, the use of A-weighted L_{90} metric is recommended. As a measure of median noise exposure, the use of A-weighted L_{50} metric is recommended.
- Collect acoustic data with microphone height matching the height of a greater sage-grouse ear, approximately 0.3 m (12 in).

In addition to the protocols above recommended by Blickley and Patricelli (2013), we considered protocols used in other studies in remote areas. In 2000, the National Parks Air Tour Management Act was enacted. This Act required the National Park Service (NPS) and Federal Aviation Administration (FAA) to cooperatively develop air tour management plans for all parks that had commercial air tours (over 100 parks). This process required field measurements to establish baseline ambient sound levels in these parks which were used to assess potential impacts of noise from air tour aircraft via modeling. The NPS and FAA jointly developed protocols for measuring sound levels in remote areas such as national parks. These protocols are discussed in NPS 2005 and 2013, Lee et al. 2006, Lynch et al. 2011, Hari 2005, and Rapoza et al. 2008.

The NPS/FAA protocols are similar to those of Blickley and Patricelli (2013) but differ in a few areas, primarily microphone height, measurement duration, and collection of digital recordings. The NPS/FAA protocol calls for a microphone height of 1.5 m which is generally used for assessing noise impacts to people, while Blickley and Patricelli (2013) recommend a microphone height of 0.3 m, the height of a greater sage-grouse ear. We placed our microphones at 0.3 m.

Blickley and Patricelli (2013) recommended that measurements be for >1 hour at each site, ideally over multiple days. The NPS/FAA protocol calls for baseline ambient sound level measurements of 25 days/season (summer/winter) to ensure that dB data are no more than ±3 dB from actual levels, or 14 days to ensure ±5 dB of actual levels. The NPS/FAA recommendations were based on a statistical review of several long-term (>12 months) data sets (Hari 2005). This review found that sound levels in nature vary considerably, both seasonally and daily. This variation is due to several factors, including seasonal sound differences (birds, insects) and meteorological differences, primarily wind. Short measurement periods of only a few hours could significantly over- or under-estimate real levels. While the sounds of nature vary considerably, some human-caused sounds and patterns do not. In this study, several gas field sounds were remarkably consistent. For some sources, such as injection wells, drill rigs, and compressor stations, primary metrics such as L_{eq}, L_{10}, L_{50}, and L_{90}, were all within 2 dBA of each other. With such consistency, very short measurement periods, 24 hours or less, may be adequate. In consideration of both Blickley and Patricelli (2013) and NPS/FAA experience, we measured more than14 days at reference leks (where human-caused sounds were infrequent and sounds of nature dominated), and more than 24 hours at treatment leks and gas field sources (where human-caused sounds dominated).

NPS/FAA protocol calls for collecting continuous digital recordings with all measurements. This allows researchers to review and identify all sound sources, as well as review any unusual sound level data. Additionally, recordings allow researchers to determine the most common sources of sounds in a study area and to determine the percent of time that each is audible. When assessing potential impacts of noise on wildlife, it is important to know the duration that noise was audible as well as the amplitude of the noise. We collected continuous digital recordings at all measurement locations.

Baseline Ambient and Existing Ambient

The objectives of this study were to determine baseline ambient sound levels in sage land cover similar to that in the PAPA (but without gas field sounds), and to determine existing ambient sound levels at leks in the PAPA area. An explanation of the use of the L_{90} and L_{50} metrics follow.

The L_{90} sound level is the sound level exceeded 90 percent of the time. In computing the L_{90}, most common human-caused sounds such as vehicles, aircraft, and other mechanical and electrical sounds are generally excluded. Such events may have high sound levels but many are relatively short in duration. In computing the L_{90} sound level, these loud but short events are excluded and allow an estimate of the "baseline" sound level without such intrusions. Federal, state, and local governments generally use the L_{90} metric to establish baseline ambient sound levels for use in environmental reviews and for assessing acoustic impacts of proposed projects or activities (EPA 1971). Blickley and Patricelli (2013) recommend the use of L_{90} to establish baseline ambient sound levels. The L_{50} sound level is the sound level exceeded 50% of the time, or the median, half of the levels are above this level and half are below. The L_{50} metric is used to determine existing ambient sound levels, and includes all sounds in a given area (natural and non-natural) (EPA 1971).

Pinedale Anticline Project Area
Greater Sage-grouse Monitoring Area Complexes

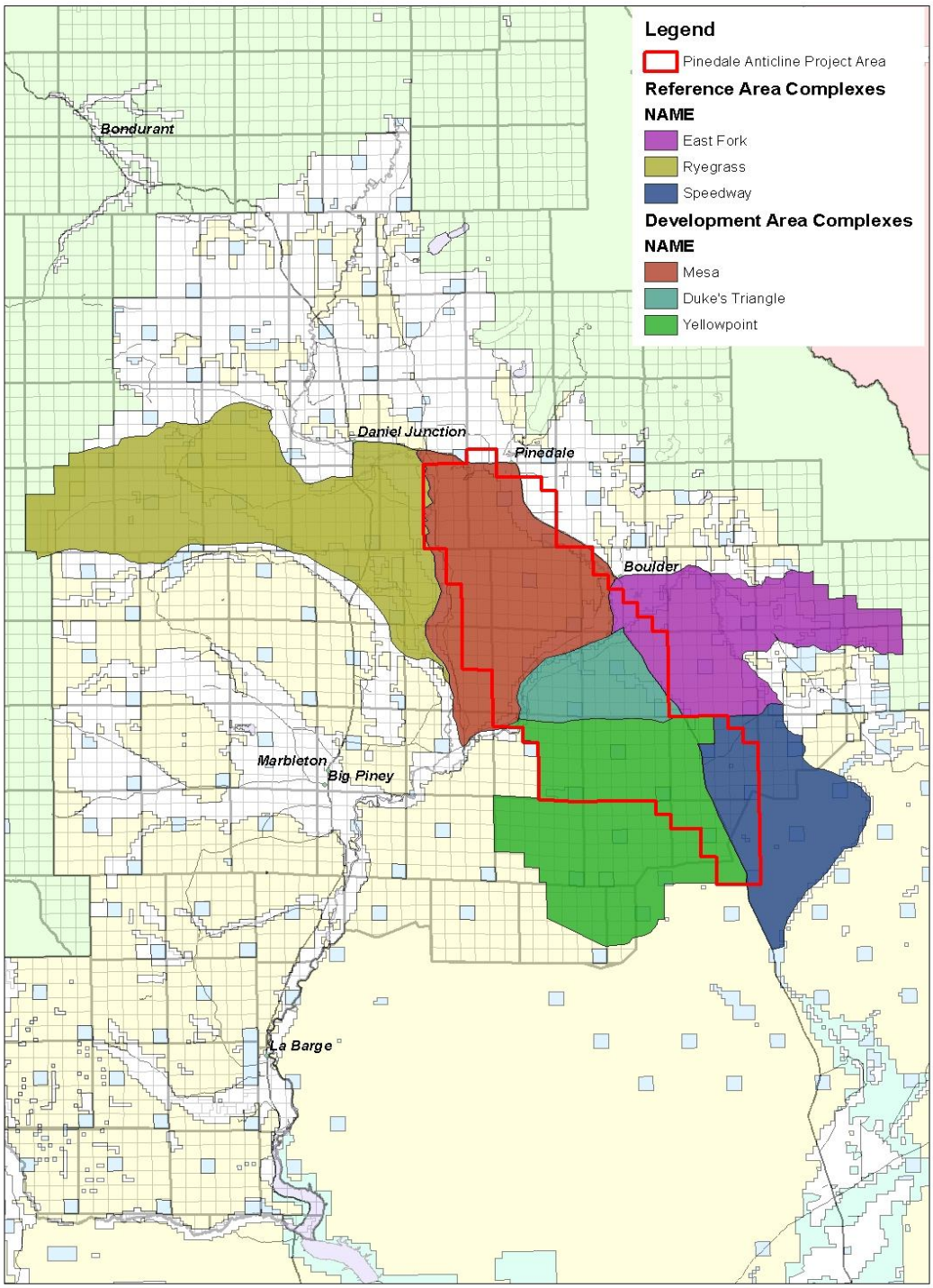

Figure 1. PAPA greater sage-grouse noise monitoring project area and lek complexes.

Sound Level Meters

Acoustic equipment used for data collection (sound level meters, microphones, and preamplifiers) met or exceeded ANSI S1.4-1983 Type 1 standards. One-third octave band analyzers and dBA analyzers met ANSI S1.11-2004 and ANSI S1.42-2001, respectively. All acoustic equipment and field calibrators were calibrated to meet ANSI S1.40-2006 (typically by manufacturer, Larson-Davis or B&K) prior to deployment. All systems and calibrators were factory calibrated as recommended by the manufacturer (Appendix G), and all systems were field calibrated at the beginning and end of each measurement period at each location using a field calibrator that met ANSI S1.40-1984 standards. We also collected continuous digital recordings at all measurement locations. Figure 2 shows a typical deployment (PAPA019, Bloom Reservoir Satellite lek) showing equipment case, microphone with fleece cage cover, and anemometer.

We used nine acoustic systems, each with the following components:

- Sound level meter: Larson-Davis LD831
- Microphone: PCB 377B20 or PCB377B02
- Preamplifier: Larson-Davis PRM831
- Environmental Shroud: Larson-Davis EPS2106 (case, 90 mm foam windscreen)
- Fleece windscreen over 90 mm foam (cylindrical, 0.4 m high and 0.3 m wide)
- Roland R05 digital recorder (to make continuous digital recordings)

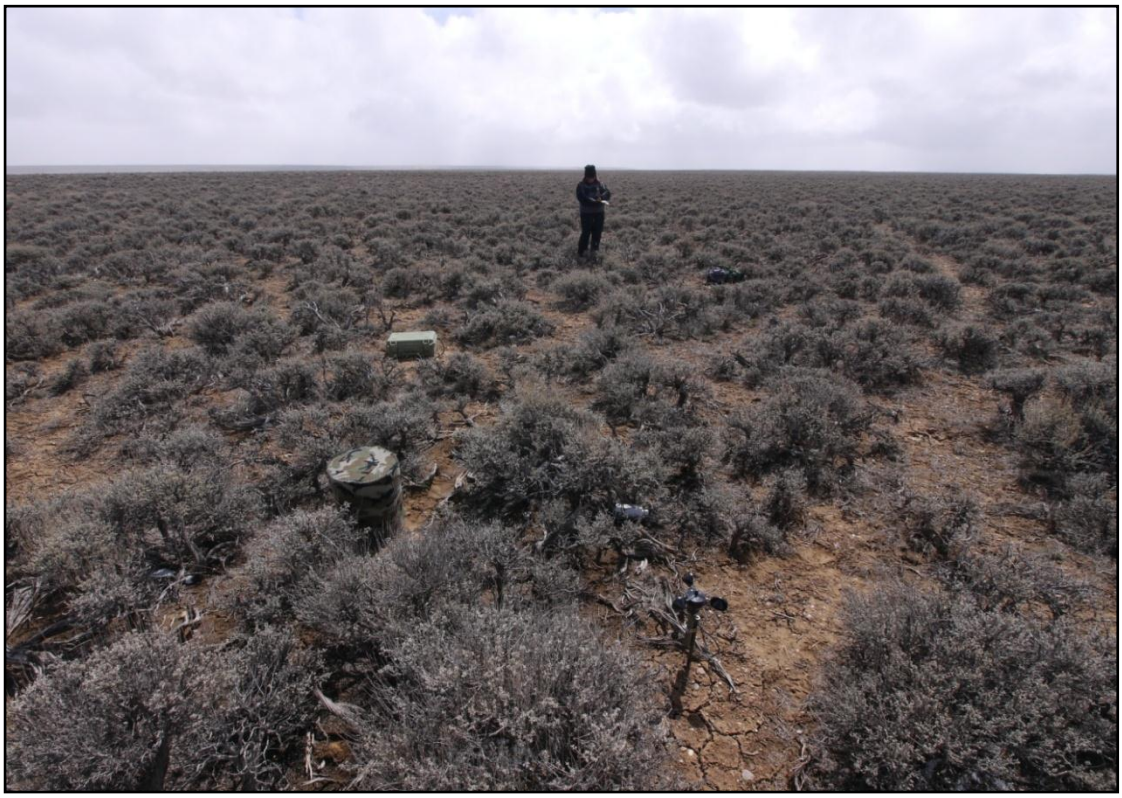

Figure 2. Typical acoustic equipment deployment.

All system components (SLM, digital recorder, and anemometer) were synchronized with GPS time, and differences at the end of the measurement period noted. We used a Bruel and Kjaer (B&K) Acoustic Calibrator Type 4231 for field calibration. In this calibrator, the reference microphone response is independent and does not change with barometric pressure. As a result, there is no need to correct calibration for the effect of elevation above sea level.

The sound level meters used in this study could measure down to approximately 13-14 dBA. This lower measurement limit is referred as the "noise floor" or "instrument self noise." The noise floor of any instrument is essentially the electrical noise of the instrument. Most ANSI Type 1 sound level meters, microphones, and preamplifiers have a noise floor, or instrument self noise, of less than 20 dBA. Manufacturers such as Larson-Davis provide general noise floor data for each of their sound level meter models and components. Although such data are provided for each model, actual noise floor levels can vary by 1-2 dBA per individual instrument. Very sensitive, low-noise microphones and preamplifiers have much lower self noise, and some can measure down to 0 dBA.

Data Collection

All acoustic data were collected continuously at 1-second intervals. Sound level meters were set to collect 1-second dBA, dBF, and dBC, as well as unweighted one-third octave band data, 12.5-20,000 Hz. Because we expected sound levels at some locations to be very low (<20 dBA), sound level meters were set to "low-range" with a gain of +20 dB. These settings ensured meters would collect data at the lowest measurement limit for these systems. Time response was set to "fast."

Data Processing

Acoustic metrics required by the Request for Proposals and recommended by Blickley and Patricelli (2013) were computed for each measurement location, including dBA L_{10}, L_{50}, L_{90}, L_{eq}, L_{min}, and L_{max}. One-third octave data, 20-20,000 Hz, unweighted, were collected at each measurement location. L_{min} and L_{max} values are just that, minimum and maximum values; exceedance metrics, L_{10}, L_{50}, and L_{90}, are the percent time sound levels exceeded 10%, 50%, and 90% of the time; and L_{eq} metrics are energy-averaged from 1-second L_{eq} data. As recommended by Blickley and Patricelli (2012), the L_{90} metric at reference lek locations was considered the "baseline ambient" sound level for native sage land cover in the PAPA. Times during which investigators were present were not included in analysis. Hours with <2700 seconds (75% of an hour) were not included. This ensured that any hour with only a few samples did not bias the analysis

In acoustic studies, it is common to report results in hourly statistics, L_{eq}, L_{10}, L_{50}, L_{90}, etc., over one-hour periods. Two different methods have generally been used to compute acoustic metrics. The first is referred to as the "unpooled" approach, and the second as the "pooled" approach. Both approaches report hourly statistics, but the computational methods differ. The "unpooled" approach computes hourly metrics (L_{eq}, L_{10}, L_{50}, L_{90}, etc.) for each individual hour. For long-term measurements over many days, medians, variances, etc., are computed from hourly data sets. For a 30-day data set, for example, summary hourly metrics for each hour of the day are computed from 30 data points.

Metrics are reported as a function of time of day, for each hour. The "pooled" approach combines all 1-second data from each hour or all hourly data into a single data set, and averages, medians, variances, etc., are computed from the pooled data. As with the "unpooled" approach, metrics are reported as a function of time of day.

Although prior studies (Plotkin 2002) have shown that results for pooled analyses are generally more conservative (i.e., lower) than results for an hourly analysis, analyzing ambient data by hour helps to ensure hour-to-hour and day-to-day variation is addressed. Additionally, many management decisions are based on hour of day. In the case of greater sage-grouse, for example, "lekking" hours may receive special consideration. For these reasons, analysis in this report used "unpooled" data.

We were not able to collect acoustic data for common sources in the gas field at the same distance due to different situations at each source (other nearby sound sources, terrain, land cover, security, etc.). However, it is possible to estimate sound levels at specific distances based on inverse square law and using sound levels measured at known distances. This computation assumes a loss of 6 dB per doubling of distance. Although loss of 6 dB per doubling of distance is commonly used to estimate sound attenuation, several factors influence this rate of loss, including frequency content of the sound, terrain, meteorological conditions, and others. It is important to keep in mind that these calculations are estimates, and we present the results for comparative purposes only. We used 100 meters as a common distance to present the relative (estimated) sound level of common sound sources in the gas field.

Meteorological Data

Meteorological data (wind speed, wind direction, temperature, and humidity) can improve the utility of acoustic data. Previous acoustic studies have established a strong correlation between land cover, wind speed, and ambient sound levels (Lee et al. 2006). Sound levels also attenuate differently in cold or hot temperatures. In general, ambient sound levels tend to increase with increasing wind speeds. Depending primarily upon the vegetative characteristics of the measurement site, a substantial change in sound level can occur as wind speeds increase. For example, ambient sound level data measured at a site containing dense foliage will be influenced by wind, primarily due to the wind interacting with leaves.

Jakobsen and Andersen (1983) described three types of wind sounds: natural wind sounds (sounds of turbulence in the air); vegetation wind sounds (sounds of vegetation being blown by wind): and microphone sounds (sounds of air flow turbulence against windscreen foam or over the microphone, generally considered "distorted" or "contaminated" sound). The first two types of wind sounds listed above are considered natural; the third type of wind sound is considered non-natural.

We used two types of anemometers during measurements. At two of the reference leks, we used Davis anemometers (Model 07911) that input data to the Larson-Davis 831 every second. At three locations in the PAPA gas field area, we use Onset HOBO anemometers (Model S-WSA-M003) that logged 1-second wind speed data to a data logger independent

of the Larson-Davis 831. All anemometers were placed 1.5-2.0 m from the microphone at that site. Anemometers were placed at 0.3 m height to match the height of the microphones.

Microphone Windscreen

In the PAPA area, high winds, animals, and human activity are common. In order to minimize the influence of wind on the decibel data and to protect the equipment, we used a second windscreen in addition to the standard 90 mm foam windscreen. The additional windscreen was made of thin fleece material placed over a 0.4 m (15 in) high and 0.3 m (12 in) wide wire cylindrical cage (Appendix D; Figures 7-8). This approach is similar to the dual-stage windscreen used in noise measurement systems in remote and windy areas of national parks (Miller et al. 1997, Lee et al. 2006). In order to test the influence of the fleece windscreen on decibel data, we collected data simultaneously using two LD 831 sound level meters at the Big John lek from April 7-10, 2013. One system had the standard 90 mm foam windscreen only and the other system had the 90 mm foam windscreen plus the fleece and wire cage windscreen. We tested the influence of the additional windscreen on dBA and one-third octave band decibel data, both daily and for all days, and found the influence to be minimal, generally less than the measurement precision of the instruments. Details on the windscreen test are presented in Appendix D. During the course of this study and data analysis, we determined that we did not have wind, security, or animal issues with our microphones or systems. Therefore, we believe the addition of the fleece windscreen is not required.

Microphone and Anemometer Height

Microphones and anemometers were placed 0.3 m (12 in) above the ground. This placement matched the approximate height of a greater sage-grouse ear and thus provided sound levels experienced by greater sage-grouse (Pater et al. 2009, Blickley and Patricelli 2012).

In order to test the influence of microphone height on decibel data, we collected data simultaneously using two LD 831 sound level meters. One system had the microphone at 1.5 m and the other system had the microphone at 0.3 m. We compared the L_{eq}, L_{10}, L_{50}, L_{90}, L_{min} and L_{max} dBA metrics for 1 hour on March 13, 2013 (prior to deployment in Wyoming). All metrics of the 1.5 m microphone were slightly greater than the 0.3 m microphone, but the differences were small (<1.5 dBA for L_{10}, L_{50}, and L_{90}). Test results are presented in Appendix E.

Measurement Locations

We collected acoustic data at 39 different locations in the PAPA in April 2013 (Table 1). We collected data at three reference leks, 19 treatment leks, and 17 gas field sound sources. The reference leks were in the Speedway and Ryegrass complexes, and the treatment leks were in the Mesa, Duke's Triangle, and Yellowpoint complexes. Exact measurement locations for reference and treatment leks are not provided due to security concerns. Most of the measurement locations for gas field sound sources were near leks, and exact locations are not provided due to security concerns. We collected data at the

Jonah compressor station because the compressor station near the South Rocks and Rocks leks was not operational during April 2013.

We placed sound level meters 100-200 meters from the edge of the leks to minimize the potential of grouse display sounds contaminating measurements data. This proved to be a subjective judgment as lekking grouse used a large area in and around the lek area, and grouse sounds were audible at some measurement locations.

We followed recommendations of Blickley and Patricelli (2013), citing Mueller (2002), for placement of sound level meters relative to gas field sound sources near leks. These recommendations included placing sound level meters two source widths away from the source. In most cases, gas field sound sources had several different sound sources within that activity, and these different individual sources were spread throughout the area of the source. For example, a drill rig might be on a pad 150 m across, with drilling, generators, vehicles, and other activities occurring simultaneously on the pad. In this situation, we placed the sound level meter 300 m from the drill pad (150 m x 2 = 300 m). This was not always possible due to interference from other near-by sound sources in the gas field. We placed multiple sound level meters at different distances from gas field sources, and, whenever possible, we doubled the distance between source and each meter. We used a Leica LRF 1200 laser rangefinder to determine distance from sound source to sound level meter.

Measurement Schedule and Duration

All acoustic data were collected during April 2013. At reference leks, data were collected more than14 days, while at treatment leks and gas field sound sources, data were collected for at least 24 hours at most locations.

Results

Acoustic data were collected at 39 different locations (3 reference leks, 19 treatment leks, and 17 gas field sound sources). 2,549 hours of data were collected, 1,001 hours at reference leks, 999 hours at treatment leks, and 549 hours at gas field sound sources (Table 1). Complete dBA and one-third octave band metrics are presented in Appendix A (reference leks); Appendix B (treatment leks); and Appendix C (gas field sound sources).

Reference Leks

At the three reference leks, the L_{90} levels for all hours (0000-2400) ranged from 14.5 dBA to 17.0 dBA, and the L_{50} levels ranged from 16.8 dBA to 20.4 dBA (Table 2). At reference lek PAPA101, distance highway sounds influenced decibel data, while at reference lek PAPA104, grouse display sounds influenced decibel data. Reference lek PAPA103 was least influenced by vehicle sounds or grouse display sounds (L_{90} = 14.5 dBA; L_{50} = 16.8 dBA). L_{eq}, L_{10}, L_{50}, and L_{90} dBA levels for reference leks are shown in Table 3. Hourly dBA metrics and one-third octave band metrics for all reference leks are shown in Appendix A.

Treatment Leks

At the 19 treatment leks, the median sound level (L_{50}) (0000-2400) for all 999 hours was 26.6 dBA. L_{eq}, L_{10}, L_{50}, and L_{90} dBA levels for all treatment leks are shown in Table 4. The Duke's Triangle Complex had the highest sound levels for all metrics of the three complexes, and the Mesa Complex had the lowest (Table 5). Sounds levels at leks were correlated with the type and distance to gas field activities. The Big Fred lek in Duke's Triangle was close to an active drill rig (1055 m) and had the highest sound levels (35.9 dBA), while the Cat lek was far from current gas field activity and had a median sound level of 17.5 dBA.. Hourly dBA metrics and one-third octave band metrics for all treatment leks are shown in Appendix B.

Gas Field Sound Sources

Sound levels of common PAPA gas field activities are shown in Table 6. Of the common activities in the gas field, the median sound level (L_{50}) of active drill rig in the Duke's Triangle complex was the loudest (est. 62 dBA @ 100 m), followed by the injection well complex (56 dBA @ 100 m) in the northern part of the Yellowpoint complex. Other gas field sound sources with L_{50} >50 dBA @ 100 m were a second drill rig being disassembled in the Duke's Triangle complex (54 dBA); Jonah compressor station (54 dBA); central gathering facility in the Mesa Complex with generator (52 dBA); and a well pad with 21 well heads and generator (50 dBA). Hourly dBA metrics and one-third octave band metrics for gas field sound sources are shown in Appendix C.

Table 1. Number, complex, name, date-time start, date-time end, and number of hours of acoustic data collection sites, PAPA, April 2013.

Site Num.	Complex	Lek Name	Date_Time Start	Date_Time End	Hours
Reference Leks					
PAPA101	Speedway	Big John	20130406_1045	20120421_0850	346
PAPA103	Rye Grass	Jewett Red Flat Res.	20130411_1320	20130425_0738	329
PAPA104	Rye Grass	Onion Springs 2	20130411_1445	20130425_0650	326
Treatment Leks					
PAPA001	Duke's Triangle	Big Fred	20130405_1450	20130407_1520	47
PAPA002	Duke's Triangle	Little Fred	20130405_1150	20130407_1235	47
PAPA003	Duke's Triangle	Lower Sand Springs Draw	20130405_1305	20130407_1645	50
PAPA004	Mesa	Two Buttes	20130418_0910	20120421_1345	75
PAPA005	Mesa	Mesa Spring	20130418_0950	20130421_1410	75
PAPA006	Mesa	Lovatt Draw Res.	20130418_1025	20130421_1433	59
PAPA007	Yellowpoint	Shelter Cabin Res.	20130410_0855	20130412_1145	49
PAPA008	Yellowpoint	The Rocks	20130410_1015	20130412_1330	50
PAPA009	Yellowpoint	South Rocks	20130410_1115	20130412_1404	50
PAPA010	Yellowpoint	Stud Horse Butte	20130410_1200	20130412_1434	49
PAPA011	Yellowpoint	Little Saddle	20130412_0910	20130414_0910	47
PAPA012	Yellowpoint	Alkali Draw	20130412_1100	20130414_1020	46
PAPA013	Yellowpoint	Sand Draw	20130412_1245	20130414_1135	46
PAPA014	Mesa	Lovatt West	20130418_1105	20130421_1456	75
PAPA015	Mesa	Cat	20130421_1100	20130423_1300	49
PAPA016	Mesa	Tyler Draw North	20130415_1000	20130417_0920	46
PAPA017	Mesa	Oil Fork Road	20130415_1100	20130417_1005	46
PAPA018	Mesa	Mesa Road 3	20130415_1145	20130417_1115	47
PAPA019	Mesa	Bloom Res. Sat.	20130415_1230	20130417_1134	46
PAPA Sound Sources					
PAPA201	Yellowpoint	Injection well 100 m	20130414_0810	20130415_1355	28
PAPA202	Yellowpoint	Injection well 200 m	20130414_0810	20130415_1355	28
PAPA203	Yellowpoint	Well (3) pad 50 m	20130415_1520	20130416_1420	22
PAPA204	Yellowpoint	Well (3) pad 100 m	20130415_1520	20130416_1420	22
PAPA205	Mesa	CGF (with gen.) 555 m	20130416_1640	20130417_1035	17
PAPA206	Mesa	CGF (with gen.) 255 m	20130416_1715	20130417_1045	16
PAPA207	Duke's Triangle	Drill rig (pad 9-24) 2300 m	20130405_1600	20130407_1605	47
PAPA208	Duke's Triangle	Drill rig (pad 9-24) 300 m	20130405_1730	20130407_1440	44
PAPA209	Speedway	Hwy 191 100 m	20130417_1325	20130418_1335	23
PAPA210	Speedway	Hwy 191 200 m	20130417_1335	20130418_1338	23
PAPA211	Mesa	Well pad ICI 100 m	20130418_1440	20130421_1510	72
PAPA212	Mesa	Well pad ICI-30 200 m	20130415_1455	20130421_1510	65
PAPA213	Mesa	Gobbler's Knob, North, 150 m	20130422_0820	20130424_0925	48
PAPA214	Mesa	N. Anticline Road, 50 m	20130422_0850	20130423_0905	24
PAPA215	Mesa	Well heads, 21 (pad 3-27), 200 m	20130423_0840	20130424_0910	24
PAPA216	Duke's Triangle	Drill rig (pad 5-19), 435 m	20130423_1020	20130424_1020	23
PAPA217	Jonah	Jonah Compressor Sta., 140 m	20130423_1128	20130424_1105	23

Table 2. Hourly existing ambient and baseline ambient sound levels at three reference leks near PAPA, April 2013.

	L50				L90		
Hour	PAPA101	PAPA103	PAPA104		PAPA101	PAPA103	PAPA104
0	16.6	13.7	15.5		15.7	13.5	14.2
1	17.6	13.7	14.8		15.8	13.5	14.2
2	16.4	13.7	14.4		15.5	13.5	14.1
3	16.6	13.6	14.5		15.7	13.4	14.1
4	16.3	13.6	14.6		15.5	13.5	14.3
5	21.5	16.6	34.2		16.8	13.6	16.8
6	23.3	17.0	28.8		18.6	15.3	16.9
7	19.4	16.2	18.0		17.1	14.4	15.0
8	18.0	15.6	16.5		16.3	14.8	14.8
9	19.4	19.6	19.1		16.6	14.5	15.5
10	20.6	20.4	19.0		18.1	15.9	15.3
11	18.5	22.5	20.8		17.2	15.4	17.0
12	21.3	24.0	23.8		17.8	18.4	18.1
13	23.2	24.3	25.7		18.0	18.0	18.2
14	24.2	26.6	26.5		19.1	20.0	20.3
15	24.2	25.1	24.3		19.0	17.6	19.0
16	25.7	26.1	24.6		19.3	18.6	18.7
17	26.6	24.3	22.5		20.6	17.2	15.8
18	25.0	21.4	21.3		19.6	16.4	16.5
19	23.5	17.2	17.2		16.7	14.0	14.4
20	21.4	15.1	19.6		17.6	13.7	14.5
21	20.2	15.4	23.5		16.8	13.7	15.3
22	16.7	14.3	16.1		15.7	13.5	14.3
23	16.8	13.7	15.6		15.6	13.5	14.1

	L50				L90		
Time Period	PAPA101	PAPA103	PAPA104		PAPA101	PAPA103	PAPA104
0000-2400	20.4	16.8	19.4		17.0	14.5	15.3
1800-0900	18.0	15.1	16.5		16.3	13.6	14.4
0500-0900	20.5	16.4	23.4		17.0	14.6	15.9
0000-0500	16.6	13.7	14.6		15.7	13.5	14.2

Time Period	L50 All Sites		L90 All Sites
0000-2400	19.4		15.8
1800-0900	16.6		14.8
0500-0900	18.0		15.8
0000-0500	14.6		14.2

Table 3. L_{eq}, L_{10}, L_{50}, and L_{90} dBA metrics at three reference leks, 0000-2400.

	Lek Name	Hours	Leq	L10	L50	L90
PAPA101	Big John	346	31.0	25.1	20.4	17.0
PAPA103	Jewett Red Flat Res.	329	28.7	24.2	16.8	14.5
PAPA104	Onion Springs 2	326	30.2	29.4	19.4	15.3

Table 4. L_{eq}, L_{10}, L_{50}, and L_{90} dBA metrics at 19 treatment leks, 0000-2400.

Site Number	Complex	Lek Name	Hours	Leq	L10	L50	L90
PAPA001	Duke's Triangle	Big Fred	47	39.8	40.3	36.9	34.8
PAPA002	Duke's Triangle	Little Fred	47	34.7	33.1	28.4	25.2
PAPA003	Duke's Triangle	Lower Sand Springs Draw	50	33.3	32.9	28.4	24.9
PAPA004	Mesa	Two Buttes	75	32.6	30.6	26.4	22.7
PAPA005	Mesa	Mesa Spring	75	36.2	34.6	30.0	26.7
PAPA006	Mesa	Lovatt Draw Res.	59	36.7	35.2	32.0	29.7
PAPA007	Yellowpoint	Shelter Cabin Res.	49	32.7	29.6	26.0	24.1
PAPA008	Yellowpoint	The Rocks	50	32.0	29.5	26.2	24.0
PAPA009	Yellowpoint	South Rocks	50	31.2	30.0	26.2	24.0
PAPA010	Yellowpoint	Stud Horse Butte	49	32.2	31.6	27.3	25.4
PAPA011	Yellowpoint	Little Saddle	47	30.2	29.3	22.3	18.8
PAPA012	Yellowpoint	Alkali Draw	46	31.4	28.7	23.3	20.4
PAPA013	Yellowpoint	Sand Draw	46	36.1	32.0	27.3	23.1
PAPA014	Mesa	Lovatt West	75	33.5	33.7	29.6	27.0
PAPA015	Mesa	Cat	49	28.5	24.8	17.5	16.0
PAPA016	Mesa	Tyler Draw North	46	27.7	26.5	21.8	18.5
PAPA017	Mesa	Oil Road Fork	46	29.2	28.6	24.9	22.2
PAPA018	Mesa	Mesa Road 3	47	30.2	29.3	24.1	20.1
PAPA019	Mesa	Bloom Res. Satellite	46	28.6	26.6	22.0	18.3

Table 5. L_{eq}, L_{10}, L_{50}, and L_{90} dBA metrics for all hours in three complexes.

Complex	Hours	Leq	L10	L50	L90
Duke's Triangle	144	34.7	33.1	28.4	25.2
Mesa	518	30.2	29.3	24.9	22.2
Yellowpoint	337	32.0	29.6	26.2	24.0

Table 6. L_{eq}, L_{10}, L_{50}, and L_{90} dBA metrics for PAPA gas field sound sources, 0000-2400.

Site Number	Complex	Lek Name and Distance	Hours	Leq	L10	L50	L90
PAPA201	Yellowpoint	Injection well 100 m	28	55.6	56.5	55.8	54.9
PAPA202	Yellowpoint	Injection well 200 m	28	48.2	49.5	48.5	47.7
PAPA203	Yellowpoint	Well (3) pad 50 m	22	38.4	39.8	37.5	35.4
PAPA204	Yellowpoint	Well (3) pad 100 m	22	34.8	35.4	31.3	29.3
PAPA205	Mesa	CGF (with gen.) 555 m	17	36.6	37.8	35.7	34.2
PAPA206	Mesa	CGF (with gen.) 255 m	47	39.1	39.5	37.4	35.9
PAPA207	Duke's Triangle	Drill rig (pad 9-24), 2300 m	47	34.9	34.8	30.4	27.2
PAPA208	Duke's Triangle	Drill rig (pad 9-24), 300 m	44	53.7	54.2	52.5	51.0
PAPA209	Speedway	Hwy 191 100 m	23	40.7	34.9	25.8	21.0
PAPA210	Speedway	Hwy 191 200 m	23	36.1	32.6	24.9	21.0
PAPA211	Mesa	Well pad ICI 100 m	72	46.9	46.7	45.5	44.3
PAPA212	Mesa	Well pad ICI-30 200 m	65	40.2	41.4	38.6	37.0
PAPA213	Mesa	Gobbler's Knob, North, 150 m	48	46.0	46.9	43.8	40.3
PAPA214	Mesa	N. Anticline Road, 50 m	24	43.6	39.9	26.9	24.1
PAPA215	Mesa	Pad 3-27 (21 wells), 200 m	24	45.4	47.3	44.4	40.4
PAPA216	Duke's Triangle	Drill rig (pad 5-19), 435 m	23	42.2	42.5	41.2	38.8
PAPA217	Jonah	Jonah Compressor Sta., 140 m	23	51.9	51.8	50.9	50.1

Wind Speed

Wind speed data were collected at five locations in 2013. Wind speed at 0.3 m height rarely exceeded 5 m/s (11 mph) (average 0.022% of the time at five locations) (Table 7). This was due to surrounding sage plants being higher than the anemometers and thus acting as an effective windscreen. As a result, metrics with and without wind >5 m/s did not differ and metrics reported in this report include all 1-second data.

Table 7. Wind speed data at five locations in 2013, three near PAPA leks and two near reference leks.

Wind Speed (m/s)	PAPA011	PAPA019	PAPA207	PAPA101	PAPA103
Mean	0.5	0.4	0.3	0.7	0.2
Min	0.0	0.0	0.0	0.0	0.0
Max	5.7	5.0	6.1	7.2	6.4
Percent >5.0 m/s	0.004%	0.000%	0.003%	0.045%	0.060%

Discussion

Reference Leks

Sound levels at the three reference leks were similar (75% of L_{50} and L_{90} levels <20 dBA). Both PAPA103 (Jewett Red Flat Reservoir) and PAPA104 (Onion Springs 2) were slightly quieter, on average, than PAPA101 (Big John lek), probably due to distant highway noise at PAPA101 (Highway 191 was 7.8 km or 4.5 mi from PAPA101). One-third octave band data were also similar, with higher levels in lower frequencies at Big John lek probably due to distance highway sounds (Figure 3).

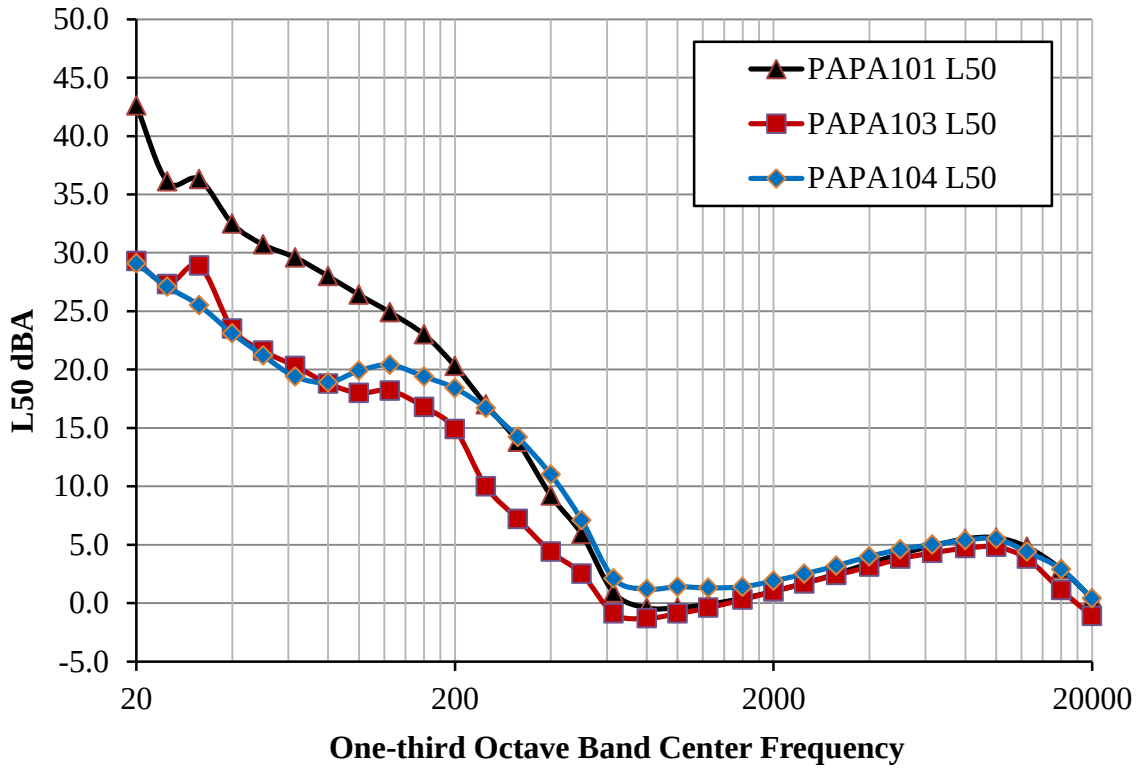

Figure 3. One-third octave band L_{50} levels for all hours at three reference leks, Big John lek, Jewett Flat Red Flat Reservoir lek, and Onion Springs 2 lek, April 2013.

Measurements at Reference Leks and Influence of Greater Sage-Grouse Display Sounds

Sound level meters at the three reference leks were placed 100-200 m from the edge of the lek in an effort to minimize the influence of greater sage-grouse display sounds on the dB data. We assumed this distance would be adequate to minimize such influence but this was not always the case. Both the L_{50} metric, and to a less degree the L_{90} metric, were influenced by grouse sounds (apparent in dB data and verified by playback of recordings). In Figures 4 and 5, it is clear that grouse sounds influenced L_{50} and L_{90} levels during the primary lekking hours, 0500-0900. This was most evident at PAPA104, and to a lesser degree at PAPA101 and PAPA103. Decibel levels from 0000 to 0500 were very low, as was the 0900 hour after lekking activity ended for the day. Review of decibel data and recordings suggest that sound levels during the hours 0500-0900 would be similar to levels during 0000-0500 if grouse were not present. General daily acoustic patterns were

evident at the three reference leks and can be seen in Figures 4 and 5. From 0000-0500, sound levels were generally low with few natural or non-natural sounds. From about 0500-0800, grouse sounds were common, declining between the 0800-0900 hours. After the 0900 hour, sound levels began to increase due to common daily sounds sources, including wind through vegetation and increased human activity (vehicle and aircraft sounds).

Use of L_{90} or L_{50} to Establish Baseline Ambient Sound Level

The appropriateness of using either the L_{90} or the L_{50} to establish baseline ambient sound level depends on the duration (or percent time audible) of human-caused sounds. If no human-caused sounds were present, the L_{50} metric would represent the ambient sound level. However, in most locations, there is usually a great deal of human-caused sounds, often more than 50% and L_{90} is the appropriate metric for establishing baseline ambient sound levels. In situations where human-caused sounds are uncommon, the L_{90} metric can underestimates baseline ambient sound level, and the L_{50} is a more appropriate metric for establishing baseline ambient sound levels. The appropriateness of using the L_{90} or L_{50} for establishing baseline ambient sound levels depends on the amount of time that anthropogenic sounds are audible.

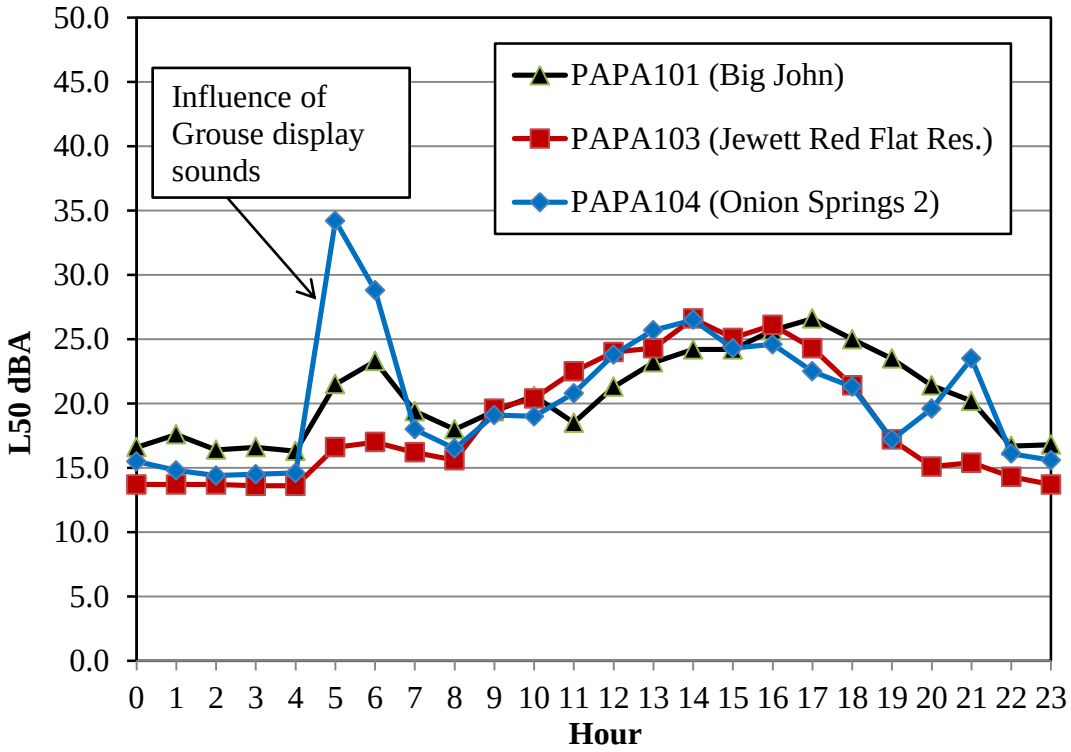

Figure 4. L_{50} dBA at three reference leks, PAPA101, PAPA103, and PAPA104.

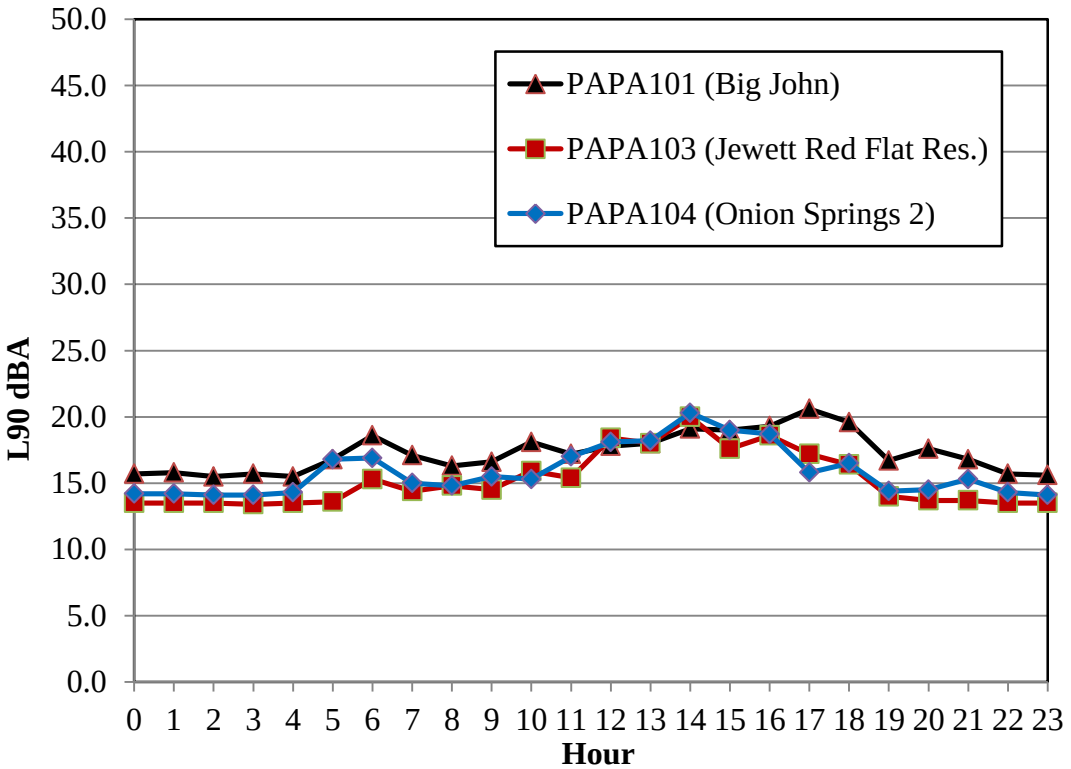

Figure 5. L_{90} dBA at three reference leks, PAPA101, PAPA103, and PAPA104.

Treatment Leks

Sound levels at treatment leks varied a great deal. The lek with the highest median sound level (L_{50}) was the Big Fred lek at 36.9 dBA. This lek was 1050 m from an operating drill rig at pad 9-24 (this drill rig had the highest L_{50} sound level in the gas field, estimated 62 dBA @ 100 m). The treatment lek with the lowest median sound level (L_{50}) was the Cat lek at 17.5 dBA, and the closest gas field activity was 2.6 km. Differences in sound levels at treatment leks were due primarily to distance from and type of gas field activity.

Hours Exceeding Baseline Ambient + 10 dBA

The Record of Decision (ROD) (BLM 2008) specified noise thresholds above baseline levels that should not be exceeded by industry. Specific changes requiring mitigation are described as follows: "Decibel levels at the lek more than 10 dBA above baseline measured from the edge of the lek" (BLM 2008)." The ROD also specifies concurrent declines in grouse numbers, but that aspect was not part of this project. The ROD used 39 dBA as a baseline ambient based on an EPA 1973 study that measured sound levels in a farming area in Ohio. Of the 999 hours measured at the treatment leks, no hours exceeded 49 dBA (39 + 10 = 49 dBA), and 565 (57%) exceeded 26 dBA (10 dBA over baseline ambient, 16+10 = 26 dBA). This study did not attempt to evaluate the appropriateness of either 10 dBA above an ambient of 39 dBA or 10 dBA above an ambient of 16 dBA as a trigger for mitigation. Results of this study show that 16 dBA is a more accurate baseline ambient sound level in the PAPA area, and we concur with the KC Harvey (2009) conclusion that "development of the 39 dBA background level did not include collection or analysis of any noise data from the project area. Therefore, the relevance of the 39 dBA value should be evaluated with respect to noise data from the project area"

Sound Levels in 2013 and 2013 Counts of Greater Sage-grouse at Leks

One should use caution in comparing 2013 sound levels at treatment leks and 2013 counts of greater sage-grouse at these leks. The 2013 count numbers may have been influenced by sound levels in 2013; however, the 2013 counts were also probably influenced by activities and sounds of gas field operations in previous years, among other factors. Sound levels in the gas field change often, depending on the activity and the duration of that activity. For example, an operational drill rig near a lek in some years before 2013 might have produced sound levels sufficient to influence grouse numbers at that lek, but in 2013, that drill rig might have been replaced by well heads only, a much quieter type of activity. The potential influence of gas field sounds on counts of greater sage-grouse, and how long those influences last, are not well understood, and any single year of data should be used with caution.

Gas Field Sound Sources

We measured gas field sound sources at 100 m whenever possible; however, this could not be done for all sources. When we could not measure at 100 m, we estimated sound levels at 100 m by re-computing sound levels measured at known distances (assuming a loss of 6 dBA per doubling of distance). We then used 100 m as the common distance to compared sound levels of different sources in the gas field. The drill rig (pad 9-24) in the Duke's Triangle complex was the loudest sound source (est. 62 dBA @ 100 m) followed by the injection well complex (est. 56 dBA @ 100 m) in the northern part of the

Yellowpoint complex. Other gas field sound sources with L_{50} >50 dBA (est.) @ 100 m were a drill rig (pad 3-21) (54 dBA); Jonah compressor station (54 dBA); central gathering facility in the Mesa Complex, with generator (52 dBA); and a well pad with 21 well heads and generator (50 dBA). Other gas field sound sources measured had L_{50} levels <50 dBA @100 m. Sound levels of gas field activities are shown in Table 8 with the estimated dBA level at 100 m. As discussed earlier, wind speed did not significantly influence sound levels in this study due to the microphones being 0.3 m high and lower than surrounding vegetation. However, sound levels measured long distances from sources can be influenced by wind speed and direction (downwind levels are higher and upwind levels are lower). We did not measure wind direction when collecting data at gas field sound sources, but the levels reported could have some directional wind influence.

At both road measurement sites (Highway 191 and North Anticline Road), median (L_{50}) sound levels for all hours were relatively low, 31 dBA and 21 dBA respectively. Vehicle sounds levels were highest during normal work hours, between about 0500-1900, and some maximum levels were higher than 70 dBA. At both locations, the L_{50} and L_{90} sound levels for all hours were generally close, while the L_{10} and L_{eq} levels were much higher, suggesting the vehicle events, while often at high sound levels, occurred <50% of the time at these locations.

Table 8. Estimated dBA @ 100 m of common gas field activities, PAPA, April 2013.

Site Number	Complex	Gas Field Sound Source	Measured Dist. (m)	L50 @ Meas. Dist.	L50 (est.) @ 100 m
PAPA208	Duke's Triangle	Drill rig, pad 9-24	300	52.5	62.0
PAPA207	Duke's Triangle	Drill rig, pad 9-24	2300	30.4	57.6
PAPA001	Duke's Triangle	Drill rig, pad 9-24	1055	36.9	57.4
PAPA201	Yellowpoint	Injection well	100	55.8	55.8
PAPA202	Yellowpoint	Injection well	200	48.5	54.5
PAPA216	Duke's Triangle	Drill rig, pad 5-19	435	41.2	54.0
PAPA217	Jonah	Jonah Compressor Station	140	50.9	53.8
PAPA206	Mesa	CGF (with generator)	255	37.4	52.3
PAPA215	Mesa	Pad 3-27 (21 wells)	200	44.4	50.4
PAPA213	Mesa	Gobbler's Knob, North	150	43.8	47.3
PAPA211	Mesa	Well pad ICI-30	100	45.5	45.5
PAPA212	Mesa	Well pad ICI-30	200	38.6	44.6
PAPA205	Mesa	CGF (with generator)	555	35.7	43.8
PAPA203	Yellowpoint	Well (3) pad	50	37.5	31.5
PAPA204	Yellowpoint	Well (3) pad	100	31.3	31.3
PAPA210	Speedway	Hwy 191	200	24.9	30.9
PAPA209	Speedway	Hwy 191	100	25.8	25.8
PAPA214	Mesa	North Anticline Road	50	26.9	20.9

Human-caused mechanical sounds tend to have more energy in the lower frequencies (<1,000 Hz), and common sound sources in the gas field followed this trend. Some gas field sound sources had levels higher than ambient at higher frequencies, up to 8,000 Hz. Figure 6 shows the L_{eq} levels for frequency data, 12.5-20,000 Hz, for three measurement locations: PAPA103 (Jewett Red Flat Reservoir reference lek); PAPA208 (drill rig, pad 9-24 in Duke's Triangle complex); and PAPA201 (Yellowpoint injection well complex). Note that Figure 3 is a plot of L_{50} values, whereas this figure is a plot of L_{eq} values

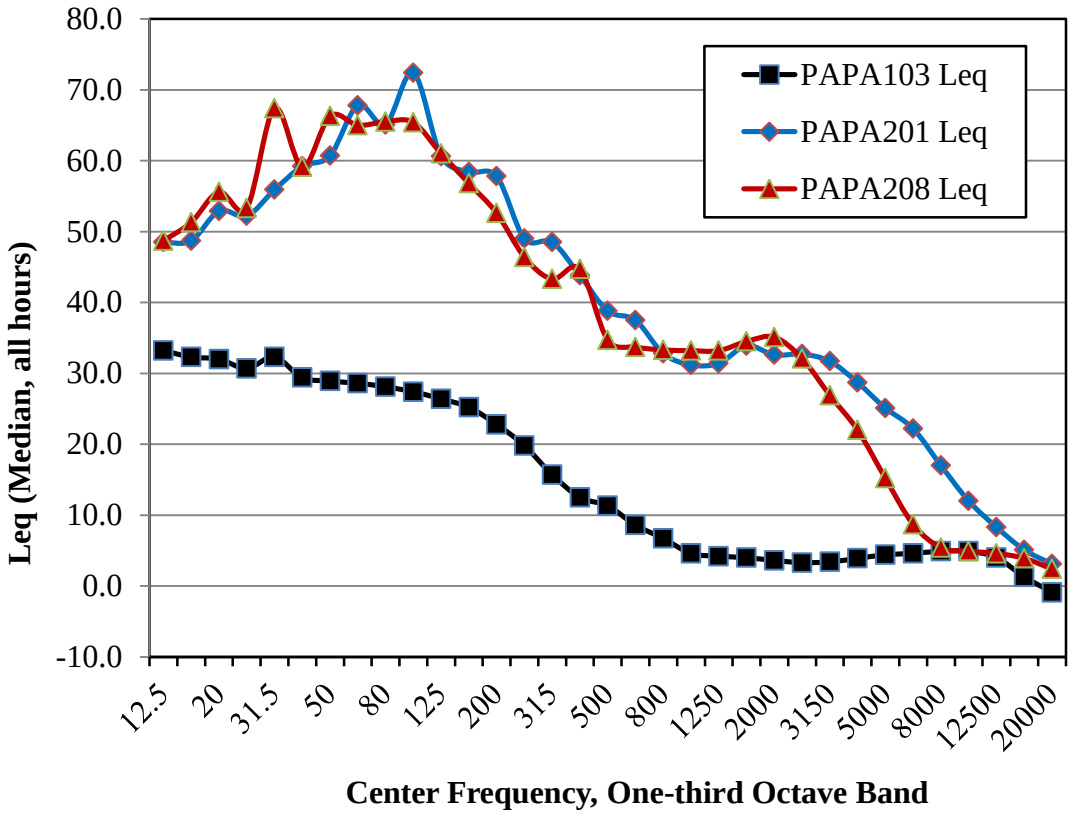

Figure 6. L_{eq} (median, all hours) one-third octave band frequency levels for three measurement sites: PAPA103 (Jewett Red Flat Reservoir reference lek); PAPA201 (Yellowpoint injection wells); and PAPA208 (Drill rig at pad 9-24).

Sound Levels at Treatment Leks Relative to Gas Field Activities

Acoustic measurements at the treatment leks were generally made 100-200 m from the lek (in an effort to minimize lekking sounds influence on dB data). Most of these treatment leks were relatively close to some type of gas field activity (average distance 1690 m, range 375-5800 m). In Table 9, the distance to the nearest gas field activity and the 24-hour L_{50} dBA are presented. As one would expect, the farther the lek was from the sound source, the lower the L_{50} value. However, some gas field activities were much louder than others, especially the active drill rigs, and had a greater influence on sound levels at leks.

Table 9. Sound levels (L_{50} dBA, 0000-2400) of gas field activities as measured at treatment leks, distance from lek to activity, and type of closest activity.

Treatment Lek Name	Treatment Lek	Distance to Activity (m)	L_{50} dBA (24-hr)	Type of Activity
Big Fred	PAPA001	1050	36.9	Drill rig, active
Little Fred	PAPA002	1250	29.3	Pump pad, small, no generator
Lower Sand Springs Draw	PAPA003	1723	29.0	Drill rig, active
Two Buttes	PAPA004	1931	26.4	Pump pad, large (out of view)
Mesa Spring	PAPA005	913	29.9	Pump pad, large (out of view)
Lovatt Draw Res.	PAPA006	710	32.1	Drill rig, maintenance
Shelter Cabin Res.	PAPA007	780	26.6	Pump pad, small, no generator
The Rocks	PAPA008	1590	26.3	Road, inactive compressor
South Rocks	PAPA009	1670	26.2	Pump pad, small
Stud Horse Butte	PAPA010	580	27.4	Pump pad, small, no generator
Little Saddle	PAPA011	5800	22.4	Injection facility, large (out of view)
Alkali Draw	PAPA012	520	22.6	Pump pad, small
Sand Draw	PAPA013	810	27.3	Drill rig
Lovatt West	PAPA014	375	29.6	Pump pad with injection well, generator
Cat	PAPA015	2600	19.0	Pump pad, small (out of view)
Tyler Draw North	PAPA016	810	21.5	Pump pad, small (out of view)
Oil Fork Road	PAPA017	2060	24.8	Central Gathering Fac., generator.
Mesa Road 3	PAPA018	2300	24.1	Pump pad, small
Bloom Res. Sat.	PAPA019	4700	22.0	Pump pad, small

Sound Levels near the Instrument Self Noise (Noise Floor)

When sound levels are very low (near the lower measurement limit of the sound level meter, or "noise floor"), self noise of the instrument can influence decibel readings. When this occurs, actual environmental sound levels are lower than the value reported by the meter. It is important to acknowledge that very low readings reflect some influence by instrument self-noise and actual levels are lower than reported.

All sound level meters have some inherent electrical noise (self noise) in the system components, such as that introduced by the microphone, preamplifier, and power supply. All system components contribute some degree to the inherent noise of the sound level meter system. Highly sensitive, low-noise components have less inherent noise and thus can measure lower sound levels.

The sound pressure level displayed by the sound level meter is actually the addition of instrument self noise and the actual ambient sound level. Two sound levels of equal value, when added together, produce a level 3 dB greater than the sound level from one of these sources because of logarithmic addition [$10*\log_{10}(2)=3$]. For example, if the self noise of the sound level meter was 15.0 dBA, and the actual ambient sound level was 15.0

dBA, the reading on the meter would read 18.0 dBA (15 dBA + 15 dBA = 18 dBA). When two SPLs that are 10 dB different from each other are added together, there is little added influence from the lower value. For example, 15.0 dB + 25.0 dB = 25.5 dB. Thus, the influence of instrument self noise is greatest when actual sound levels are near instrument self-noise, and this influence decreases as environmental sound levels increase. When environmental sound levels are greater than10 dB above instrument self-noise, there is very little influence.

The most important aspect of this issue is that when reported sound levels are near the self noise of the instrument, actual sound levels are lower. The actual sound levels can be estimated using the log additive function. For example, at PAPA103 (reference lek near Jewett Red Flat Reservoir), the reported L_{90} was 14.5 dBA (0000-2400), and the minimum reported level was 13.1 dBA. Assuming a noise floor of approximately this level, the reported L_{90} of 14.5 dBA would represent an estimated L_{90} of 8.9 dBA (13.1 dBA + 8.9 dBA = 14.5 dBA). Similarly, the reported L_{50} of 16.8 dBA would represent an estimated L_{50} of 14.4 dBA. Because these estimated L_{90} and L_{50} values are just estimates, they are generally not reported. Regardless, in such situations, one can be sure that actual values are lower than reported.

Wind Speed

For the five locations where wind speed data were collected, winds rarely exceeded 5 m/s (<0.022% on average). This was due to the sage vegetation being higher than the anemometer and thus providing a "natural" windscreen. The same benefit likely shields greater sage-grouse from experiencing high winds when they are in sage vegetation. Based on these wind speed data collected in 2013, it may not be necessary to collect wind speed relative to decibel data; however, wind speed and wind direction data may be important for other needs, such as modeling sound levels at specific locations upwind or downwind from a sound source.

Audibility and Common Sound Sources

At one location, reference lek PAPA103, Jewett Red Flat Reservoir, we used the digital recordings to determine the percent time that common sound sources were audible for one day, April 19, 2013. We sampled the continuous recording by listening to a 10-second recording every 4 minutes of that day, and logging all sounds heard on those samples. The most common natural sounds were wind (43.9%) and birds (28.9%). The most common non-natural sounds were jet aircraft (16.1%) and vehicles/motors (6.7%). In Table 10, percent time audible of common sound sources, natural and non-natural, are presented for three time periods of the day, all day (0000-2400), day time (0700-1900), and night time (1900-0700).

Table 10. Percent time common sound sources were audible at PAPA103, Jewett Flat Red Reservoir, April 19, 2013, for three time periods of the day.

Sound Source	0000-2400	0700-1900	1900-0700
No Sound Audible	22.2	2.8	41.7
Wind	43.9	80.0	7.8
Bird	28.9	18.9	38.9
Jet	16.1	20.0	12.2
Prop	2.5	2.8	2.2
Helicopter	0.0	0.0	0.0
Road Vehicles	2.8	5.0	0.6
Motor Sounds	3.9	2.8	5.0
Total Non-natural	25.0	30.0	20.0
Total Natural	69.7	92.8	46.7

Recommendations

Establish Protocol for Measuring Sound Levels Relative to Greater Sage-grouse

In previous acoustic studies regarding greater sage-grouse and gas exploration and production activities, several different measurement approaches and instrument types have been used. Noise floors of instruments used in those studies have ranged from less than15 dBA (this study) to 25 dBA (McGregor 2008). Microphone height has ranged from 0.3 m (this study) to 2.4 m (BLM 2012). Measure periods have ranged from less than 1 hour to more than 14 days. A standard protocol for measuring sound levels is necessary to ensure all data are useful for greater sage-grouse management. The measurement protocol below is proposed for acoustic studies regarding greater sage-grouse and anthropogenic noise. This proposed protocol follows recommendations by Blickley and Patricelli (2013) as well as those by the FAA and NPS (NPS 2005 and 2013, Lee et al. 2006, Lynch et al. 2011, Hari 2005, Rapoza et al. 2008), and based on our experience in and near the PAPA in 2013. We recommend that this draft protocol be reviewed by all parties involved in acoustic studies relative to greater sage-grouse, including federal, state, and industry officials, and a common protocol be developed and agreed upon for future acoustic studies.

Sound level measurements must be representative of the sound levels experienced by the target species (Grubb et al. 1998, Delaney et al. 1999, Pater et al. 2009, Blickley and Patricelli 2013). This includes both microphone height as well as equipment sensitivity. For greater sage-grouse, average ear height is about 0.3 m and this species is a ground nester, hence microphones should be 0.3 m high. Although ANSI standards recommend placing microphones at 1.5 m, these standards were written specifically for assessing impacts to human, and use the typical height of a human ear, 1.5 m.

Sound levels vary greater due to seasonal and meteorological conditions, and the appropriate measurement duration for the breeding season of greater sage-grouse is not well understood. This period lasts from approximately mid-March to July. Long-term NPS studies demonstrated that summer and winter seasons vary considerable, and a 25-day measurement period would generally ensure measurement accuracy to ±3 dBA for either season (Hari 2005). Given that the breeding season of greater sage-grouse is typically four to five months, and wind speeds are considerably less at 0.3 m, we recommend a minimum 14-day measurement period until more is known about sound level variability during the March-July period.

Recommended Protocol for Measuring Sound Levels relative to Greater Sage-grouse.

- Sound level meters should meet ANSI Type 1 standards.
- Sound level meters should be capable of measuring <15 dBA.
- Data collected should include dBA, dBC, and dBF, and unweighted one-third octave band frequency data, 12.5-20,000 Hz.
- Decibel data should be collected continuously, at 1-second intervals.
- Data analysis: At a minimum, report hourly dBA, dBC, and dBF, and unweighted one-third octave band metrics, including L_{eq}, L_{10}, L_{50}, L_{90}, L_{min}, and L_{max}.
- Microphone height should be 0.3 m, approximate ear height of greater sage-grouse.
- Measurement duration should be a minimum of 14 days at each location.
- Continuous digital recordings should be collected at all measurement locations. This will ensure all unusual sound sources and sound levels can be reviewed, and will allow the opportunity to determine the percent time that different sound sources are audible. Recording quality should be at a minimum MP3, 16-bit, 128 kbps; uncompressed .wav, 16-bit, 44,100 kHz preferred.
- In most acoustic studies, wind speed data are needed to assess influence of wind pressure on dB data. However, when microphones are placed at 0.3 m and good windscreens are used, and measurements are made in sage habitat that is higher than 0.3 meters, it is unlikely that wind pressure over microphone will influence dB data. Therefore, wind speed data are not required if the microphone height of 0.3 meters is used. If meteorological data are needed for modeling efforts, such should be collected during the measurement period.
- Instruments should be placed >500 m from any lek to ensure grouse display sounds do not significantly influence dB data.
- For determining baseline ambient sound levels, the L_{90} metric should be used if human-caused sounds are audible >25% of the time. If human-caused sounds are audible <25% of the time, the L_{50} metric should be used. Audibility of human-caused sounds should be determined by logging sound sources from a sample of continuous digital recordings (7 days minimum and a sampling rate of 10 seconds every 4 minutes minimum). It is important that all hours of the day be considered when determining baseline ambient sound levels. While lekking hours are important to grouse, females with nestlings rely on relatively low-level calls to maintain contact with each other and to warn of potential predators. Therefore, all hours should be measured and reported.

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Appendix A. dBA and One-third Octave Metrics for PAPA Reference Leks.

Table 11. PAPA101 (Big John lek) hourly dBA metrics, April 6-21, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/6/2013	4/21/2013	0	14	13.7	49.7	23.4	19.3	16.6	15.7
4/6/2013	4/21/2013	1	14	13.8	49.0	22.4	20.0	17.6	15.8
4/6/2013	4/21/2013	2	14	13.7	47.1	21.1	18.4	16.4	15.5
4/6/2013	4/21/2013	3	14	13.7	46.3	21.6	17.8	16.6	15.7
4/6/2013	4/21/2013	4	14	13.7	48.1	22.3	20.2	16.3	15.5
4/6/2013	4/21/2013	5	14	13.8	50.2	24.4	27.0	21.5	16.8
4/6/2013	4/21/2013	6	14	13.8	49.3	25.5	28.0	23.3	18.6
4/6/2013	4/21/2013	7	14	13.8	68.9	33.0	24.3	19.4	17.1
4/6/2013	4/21/2013	8	13	13.9	54.7	26.4	25.6	18.0	16.3
4/6/2013	4/21/2013	9	13	14.0	51.7	26.3	24.8	19.4	16.6
4/6/2013	4/21/2013	10	14	14.2	53.2	30.3	24.7	20.6	18.1
4/6/2013	4/21/2013	11	14	14.4	55.0	31.9	24.4	18.5	17.2
4/6/2013	4/21/2013	12	15	14.4	67.6	34.1	28.5	21.3	17.8
4/6/2013	4/21/2013	13	15	14.9	56.4	33.1	32.3	23.2	18.0
4/6/2013	4/21/2013	14	15	14.5	56.9	33.8	31.1	24.2	19.1
4/6/2013	4/21/2013	15	15	14.4	57.0	34.0	31.4	24.2	19.0
4/6/2013	4/21/2013	16	15	14.2	53.8	32.3	33.6	25.7	19.3
4/6/2013	4/21/2013	17	15	14.3	54.8	31.8	34.5	26.6	20.6
4/6/2013	4/21/2013	18	15	14.0	56.6	32.8	31.2	25.0	19.6
4/6/2013	4/21/2013	19	15	14.1	57.4	32.7	30.2	23.5	16.7
4/6/2013	4/21/2013	20	15	14.0	60.2	30.7	25.4	21.4	17.6
4/6/2013	4/21/2013	21	15	13.8	60.4	31.2	23.8	20.2	16.8
4/6/2013	4/21/2013	22	15	13.8	60.7	32.8	22.2	16.7	15.7
4/6/2013	4/21/2013	23	15	13.7	54.7	24.0	20.9	16.8	15.6

Appendix A. dBA and One-third Octave Metrics for PAPA Reference Leks (cont.).

Table 12. PAPA101 (Big John lek) dBA and one-third octave band metrics, April 6-12, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/6/13	4/21/13	dBA	346	13.7	68.9	30.8	25.8	20.1	17.1
4/6/13	4/21/13	12.5	346	14.2	78.7	54.2	46.0	39.2	34.0
4/6/13	4/21/13	16	346	16.2	76.3	51.7	45.7	39.3	34.7
4/6/13	4/21/13	20	346	17.2	75.3	50.1	48.0	42.6	37.6
4/6/13	4/21/13	25	346	17.2	74.5	46.5	41.5	36.1	32.1
4/6/13	4/21/13	31.5	346	15.5	71.4	44.3	41.7	36.3	31.7
4/6/13	4/21/13	40	346	13.2	70.7	41.4	36.8	32.5	29.1
4/6/13	4/21/13	50	346	11.1	74.7	38.9	35.5	30.7	27.3
4/6/13	4/21/13	63	346	8.8	81.6	37.3	34.7	29.6	26.1
4/6/13	4/21/13	80	346	4.7	82.2	36.3	33.5	28.0	24.4
4/6/13	4/21/13	100	346	2.7	86.2	35.4	32.0	26.4	22.6
4/6/13	4/21/13	125	346	0.5	74.4	33.0	30.7	24.9	20.8
4/6/13	4/21/13	160	346	-2.5	69.3	30.3	29.7	23.0	18.1
4/6/13	4/21/13	200	346	-3.1	71.6	28.5	27.2	20.3	14.9
4/6/13	4/21/13	250	346	-3.9	64.7	26.6	24.7	17.0	11.2
4/6/13	4/21/13	315	346	-5.0	62.6	24.2	21.9	13.8	7.0
4/6/13	4/21/13	400	346	-4.8	57.7	21.5	17.2	9.2	2.4
4/6/13	4/21/13	500	346	-4.7	53.7	19.7	14.9	5.9	-0.1
4/6/13	4/21/13	630	346	-4.5	50.0	17.3	7.2	0.9	-1.9
4/6/13	4/21/13	800	346	-4.0	47.6	15.8	5.6	-0.4	-2.0
4/6/13	4/21/13	1000	346	-3.3	45.5	15.5	5.5	-0.4	-1.7
4/6/13	4/21/13	1250	346	-2.6	44.8	15.1	5.0	-0.1	-1.1
4/6/13	4/21/13	1600	346	-1.8	42.5	14.8	4.9	0.4	-0.5
4/6/13	4/21/13	2000	346	-0.8	45.7	14.7	4.7	1.0	0.4
4/6/13	4/21/13	2500	346	0.1	56.8	14.4	4.3	1.7	1.2
4/6/13	4/21/13	3150	346	0.3	65.1	16.2	3.8	2.5	2.1
4/6/13	4/21/13	4000	346	-0.2	64.3	14.4	4.2	3.4	3.1
4/6/13	4/21/13	5000	346	-0.4	51.0	8.9	4.8	4.2	3.9
4/6/13	4/21/13	6300	346	-0.7	45.7	8.3	5.4	4.9	4.7
4/6/13	4/21/13	8000	346	-0.9	46.0	8.5	5.8	5.5	5.3
4/6/13	4/21/13	10000	346	-0.7	45.6	8.4	5.9	5.6	5.4
4/6/13	4/21/13	12500	346	-0.9	44.7	7.4	5.3	4.8	4.6
4/6/13	4/21/13	16000	346	-1.2	44.8	5.6	3.5	2.9	2.6
4/6/13	4/21/13	20000	346	-1.0	41.3	2.8	1.4	0.4	0.0

Appendix A. dBA and One-third Octave Metrics for PAPA Reference Leks (cont.).

Table 13. PAPA102 (Big John lek) hourly dBA metrics, April 6-10, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/6/2013	4/10/2013	0	4	14.8	48.1	25.4	24.6	21.0	18.8
4/6/2013	4/10/2013	1	4	15.0	48.1	23.7	23.0	19.2	17.0
4/6/2013	4/10/2013	2	4	15.4	42.5	22.7	22.5	19.8	16.9
4/6/2013	4/10/2013	3	4	15.4	39.4	23.9	24.4	20.9	18.1
4/6/2013	4/10/2013	4	4	15.6	48.4	24.9	21.8	19.2	17.5
4/6/2013	4/10/2013	5	4	15.8	41.8	21.9	24.4	20.5	17.3
4/6/2013	4/10/2013	6	4	15.4	44.8	25.3	28.2	24.7	19.6
4/6/2013	4/10/2013	7	4	14.6	46.8	22.5	24.2	19.9	17.9
4/6/2013	4/10/2013	8	4	14.6	49.4	24.6	23.9	18.0	16.4
4/6/2013	4/10/2013	9	4	14.9	49.2	24.1	23.9	18.6	17.1
4/6/2013	4/10/2013	10	4	15.4	49.5	23.1	23.2	18.4	17.3
4/6/2013	4/10/2013	11	4	15.9	45.6	22.8	22.7	18.2	16.7
4/6/2013	4/10/2013	12	5	15.6	68.5	33.5	24.9	20.3	17.8
4/6/2013	4/10/2013	13	5	15.5	48.1	27.9	29.8	22.6	18.5
4/6/2013	4/10/2013	14	5	15.3	51.1	28.8	28.4	21.2	19.3
4/6/2013	4/10/2013	15	5	15.2	47.5	29.5	28.3	23.5	19.9
4/6/2013	4/10/2013	16	5	15.1	48.9	28.0	27.8	24.1	18.4
4/6/2013	4/10/2013	17	5	15.2	52.3	30.2	27.3	23.0	17.7
4/6/2013	4/10/2013	18	5	14.7	52.5	31.1	30.6	21.6	19.8
4/6/2013	4/10/2013	19	5	14.9	51.1	33.7	29.2	23.2	20.6
4/6/2013	4/10/2013	20	5	15.0	60.3	32.2	27.2	22.4	20.7
4/6/2013	4/10/2013	21	4	14.8	52.4	32.1	26.5	22.5	19.9
4/6/2013	4/10/2013	22	4	14.7	53.8	34.7	26.3	21.5	17.9
4/6/2013	4/10/2013	23	4	15.0	47.2	24.8	25.6	22.0	18.9

Appendix A. dBA and One-third Octave Metrics for PAPA Reference Leks (cont.).

Table 14. PAPA102 (Big John lek) dBA and one-third octave band metrics, April 6-10, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/6/13	4/10/13	dBA	105	14.6	68.5	29.3	25.5	20.9	17.8
4/6/13	4/10/13	12.5	105	15.8	79.2	54.1	45.0	39.2	34.5
4/6/13	4/10/13	16	105	18.2	76.2	51.7	46.1	40.5	35.5
4/6/13	4/10/13	20	105	16.9	74.7	49.2	48.8	43.1	38.9
4/6/13	4/10/13	25	105	17.5	70.5	44.3	41.5	37.2	33.3
4/6/13	4/10/13	31.5	105	16.4	67.5	42.7	41.8	37.3	33.2
4/6/13	4/10/13	40	105	14.1	65.9	39.4	37.2	33.4	30.1
4/6/13	4/10/13	50	105	11.3	75.1	37.3	35.2	31.5	28.6
4/6/13	4/10/13	63	105	9.3	80.8	37.3	34.7	30.5	27.4
4/6/13	4/10/13	80	105	8.7	84.1	37.3	34.0	28.9	25.2
4/6/13	4/10/13	100	105	5.4	84.5	37.7	32.5	27.7	24.4
4/6/13	4/10/13	125	105	3.3	72.7	33.2	31.0	26.4	22.3
4/6/13	4/10/13	160	105	1.1	69.5	30.5	30.4	24.0	19.8
4/6/13	4/10/13	200	105	-0.8	69.4	28.0	27.3	21.2	16.5
4/6/13	4/10/13	250	105	-2.8	66.8	25.2	23.3	17.6	12.5
4/6/13	4/10/13	315	105	-3.4	58.2	23.0	21.2	14.5	9.0
4/6/13	4/10/13	400	105	-4.2	58.5	20.9	16.7	10.1	4.6
4/6/13	4/10/13	500	105	-4.1	51.2	18.9	14.6	6.3	0.3
4/6/13	4/10/13	630	105	-3.7	48.4	16.3	8.5	1.3	-1.3
4/6/13	4/10/13	800	105	-3.0	47.2	14.2	6.2	0.3	-1.1
4/6/13	4/10/13	1000	105	-2.3	43.3	14.0	5.9	0.5	-0.6
4/6/13	4/10/13	1250	105	-1.3	40.3	14.1	5.7	1.0	0.1
4/6/13	4/10/13	1600	105	-0.4	37.8	14.7	5.6	1.7	0.9
4/6/13	4/10/13	2000	105	0.6	38.5	13.7	4.8	2.4	1.8
4/6/13	4/10/13	2500	105	1.5	39.6	12.4	4.7	3.1	2.6
4/6/13	4/10/13	3150	105	2.6	40.4	10.4	4.9	3.8	3.4
4/6/13	4/10/13	4000	105	0.6	42.4	9.0	5.2	4.5	4.2
4/6/13	4/10/13	5000	105	0.0	48.7	8.7	5.6	5.0	4.8
4/6/13	4/10/13	6300	105	0.0	42.6	8.2	5.7	5.3	5.1
4/6/13	4/10/13	8000	105	-0.3	39.2	7.8	5.7	5.4	5.1
4/6/13	4/10/13	10000	105	-0.5	38.4	7.2	5.5	5.2	4.9
4/6/13	4/10/13	12500	105	-0.7	36.9	6.4	5.1	4.7	4.4
4/6/13	4/10/13	16000	105	-0.5	34.1	5.5	4.5	3.9	3.6
4/6/13	4/10/13	20000	105	-0.2	30.9	4.2	3.7	2.8	2.6

Appendix A. dBA and One-third Octave Metrics for PAPA Reference Leks (cont.).

Table 15. PAPA103 (Jewett Red Flat Reservoir lek) hourly dBA metrics, April 11-25, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/11/2013	4/25/2013	0	14	13.2	55.1	23.6	15.1	13.7	13.5
4/11/2013	4/25/2013	1	14	13.2	49.4	20.8	15.5	13.7	13.5
4/11/2013	4/25/2013	2	14	13.1	42.7	16.7	14.4	13.7	13.5
4/11/2013	4/25/2013	3	14	13.1	45.4	16.4	14.0	13.6	13.4
4/11/2013	4/25/2013	4	14	13.1	50.8	21.8	15.5	13.6	13.5
4/11/2013	4/25/2013	5	14	13.1	46.5	20.0	19.9	16.6	13.6
4/11/2013	4/25/2013	6	14	13.1	47.2	19.7	20.9	17.0	15.3
4/11/2013	4/25/2013	7	13	13.1	47.5	19.6	18.7	16.2	14.4
4/11/2013	4/25/2013	8	13	13.3	49.8	25.3	21.9	15.6	14.8
4/11/2013	4/25/2013	9	13	13.6	57.4	28.9	26.5	19.6	14.5
4/11/2013	4/25/2013	10	13	13.7	50.5	28.3	29.7	20.4	15.9
4/11/2013	4/25/2013	11	13	13.7	56.2	28.4	29.9	22.5	15.4
4/11/2013	4/25/2013	12	13	13.9	55.0	33.0	32.2	24.0	18.4
4/11/2013	4/25/2013	13	13	13.9	84.3	42.2	33.8	24.3	18.0
4/11/2013	4/25/2013	14	14	13.9	53.9	31.9	33.4	26.6	20.0
4/11/2013	4/25/2013	15	14	13.8	55.0	31.5	33.0	25.1	17.6
4/11/2013	4/25/2013	16	14	13.6	53.4	32.6	33.2	26.1	18.6
4/11/2013	4/25/2013	17	14	13.5	56.5	31.7	31.7	24.3	17.2
4/11/2013	4/25/2013	18	14	13.4	59.2	33.5	29.8	21.4	16.4
4/11/2013	4/25/2013	19	14	13.4	60.1	35.4	26.7	17.2	14.0
4/11/2013	4/25/2013	20	14	13.3	53.6	29.6	23.3	15.1	13.7
4/11/2013	4/25/2013	21	14	13.2	64.3	32.4	24.4	15.4	13.7
4/11/2013	4/25/2013	22	14	13.2	57.5	32.5	24.0	14.3	13.5
4/11/2013	4/25/2013	23	14	13.2	51.7	23.9	20.1	13.7	13.5

Appendix A. dBA and One-third Octave Metrics for PAPA Reference Leks (cont.).

Table 16. PAPA103 (Jewett Red Flat Reservoir lek) dBA and one-third octave band metrics, April 11-25, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/11/13	4/25/13	dBA	329	13.1	84.3	32.0	24.1	16.4	14.2
4/11/13	4/25/13	12.5	329	8.8	77.0	46.2	34.9	30.1	26.1
4/11/13	4/25/13	16	329	9.9	74.2	43.6	34.0	29.5	25.9
4/11/13	4/25/13	20	329	10.8	73.2	41.6	34.0	29.3	25.6
4/11/13	4/25/13	25	329	9.7	69.6	37.9	32.8	27.3	23.7
4/11/13	4/25/13	31.5	329	9.3	68.1	36.9	34.8	28.9	24.6
4/11/13	4/25/13	40	329	4.2	64.1	34.0	31.8	23.5	20.2
4/11/13	4/25/13	50	329	1.8	66.3	32.5	31.4	21.6	18.3
4/11/13	4/25/13	63	329	-0.4	77.8	32.1	30.8	20.3	16.3
4/11/13	4/25/13	80	329	-1.1	77.5	31.8	30.0	18.8	14.1
4/11/13	4/25/13	100	329	-2.2	77.6	33.5	29.3	18.0	12.9
4/11/13	4/25/13	125	329	-4.2	86.8	36.2	27.9	18.2	11.2
4/11/13	4/25/13	160	329	-4.6	77.2	29.5	26.4	16.8	8.3
4/11/13	4/25/13	200	329	-4.8	68.5	27.2	24.5	14.9	6.1
4/11/13	4/25/13	250	329	-5.2	75.4	26.5	20.4	10.0	2.7
4/11/13	4/25/13	315	329	-5.2	69.6	22.8	16.7	7.2	0.1
4/11/13	4/25/13	400	329	-5.3	72.7	21.0	12.9	4.4	-1.6
4/11/13	4/25/13	500	329	-5.0	68.8	19.0	11.4	2.5	-2.4
4/11/13	4/25/13	630	329	-4.7	65.3	16.8	7.8	-0.9	-2.5
4/11/13	4/25/13	800	329	-4.3	67.7	16.8	6.7	-1.3	-2.3
4/11/13	4/25/13	1000	329	-3.5	70.4	18.4	5.4	-0.9	-1.8
4/11/13	4/25/13	1250	329	-2.8	71.8	19.5	4.6	-0.4	-1.2
4/11/13	4/25/13	1600	329	-1.9	69.8	19.3	4.7	0.3	-0.5
4/11/13	4/25/13	2000	329	-1.0	65.6	18.2	4.4	1.0	0.3
4/11/13	4/25/13	2500	329	-0.1	67.0	15.8	3.7	1.7	1.1
4/11/13	4/25/13	3150	329	1.0	65.6	13.9	3.7	2.4	2.0
4/11/13	4/25/13	4000	329	2.0	63.4	11.3	3.9	3.1	2.8
4/11/13	4/25/13	5000	329	1.5	61.3	10.2	4.2	3.8	3.6
4/11/13	4/25/13	6300	329	1.4	60.1	9.4	4.6	4.3	4.2
4/11/13	4/25/13	8000	329	1.6	56.5	8.7	5.0	4.7	4.6
4/11/13	4/25/13	10000	329	1.3	55.4	8.6	5.1	4.8	4.6
4/11/13	4/25/13	12500	329	0.8	54.6	7.6	4.2	3.8	3.6
4/11/13	4/25/13	16000	329	-0.4	49.4	4.8	1.7	1.1	0.9
4/11/13	4/25/13	20000	329	-1.9	43.8	1.1	-0.6	-1.1	-1.3

Appendix A. dBA and One-third Octave Metrics for PAPA Reference Leks (cont.).

Table 17. PAPA104 (Onion Springs 2 lek) hourly dBA metrics, April 11-25, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/11/2013	4/25/2013	0	14	13.8	52.2	25.3	21.9	15.5	14.2
4/11/2013	4/25/2013	1	14	13.8	53.4	27.2	28.5	14.8	14.2
4/11/2013	4/25/2013	2	14	13.8	42.2	27.2	22.8	14.4	14.1
4/11/2013	4/25/2013	3	14	13.8	58.6	26.2	20.4	14.5	14.1
4/11/2013	4/25/2013	4	14	13.7	55.7	28.6	24.1	14.6	14.3
4/11/2013	4/25/2013	5	14	13.7	52.6	34.3	38.2	34.2	16.8
4/11/2013	4/25/2013	6	13	13.7	51.9	34.1	36.2	28.8	16.9
4/11/2013	4/25/2013	7	13	13.7	51.4	28.9	28.0	18.0	15.0
4/11/2013	4/25/2013	8	13	14.0	61.4	28.8	26.5	16.5	14.8
4/11/2013	4/25/2013	9	13	14.3	62.8	28.6	28.0	19.1	15.5
4/11/2013	4/25/2013	10	13	14.3	65.5	29.6	30.9	19.0	15.3
4/11/2013	4/25/2013	11	13	14.3	56.6	30.3	28.2	20.8	17.0
4/11/2013	4/25/2013	12	13	14.5	78.1	39.6	31.7	23.8	18.1
4/11/2013	4/25/2013	13	13	14.5	64.3	33.4	34.5	25.7	18.2
4/11/2013	4/25/2013	14	13	14.5	49.3	30.1	33.3	26.5	20.3
4/11/2013	4/25/2013	15	13	14.5	55.8	31.4	32.6	24.3	19.0
4/11/2013	4/25/2013	16	14	14.4	52.2	30.5	31.9	24.6	18.7
4/11/2013	4/25/2013	17	14	14.1	54.2	30.4	31.2	22.5	15.8
4/11/2013	4/25/2013	18	14	14.1	55.1	31.8	30.0	21.3	16.5
4/11/2013	4/25/2013	19	14	14.0	57.1	33.5	28.0	17.2	14.4
4/11/2013	4/25/2013	20	14	14.0	60.7	30.9	33.1	19.6	14.5
4/11/2013	4/25/2013	21	14	13.9	64.7	33.0	32.3	23.5	15.3
4/11/2013	4/25/2013	22	14	13.9	53.4	29.5	28.8	16.1	14.3
4/11/2013	4/25/2013	23	14	13.9	49.8	25.2	27.4	15.6	14.1

Appendix A. dBA and One-third Octave Metrics for PAPA Reference Leks (cont.).

Table 18. PAPA104 (Onion Springs 2 lek) dBA and one-third octave band metrics, April 11-25, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/11/13	4/25/13	dBA	326	13.7	78.1	31.7	30.0	19.7	15.2
4/11/13	4/25/13	12.5	326	9.6	78.4	41.8	33.9	29.7	25.9
4/11/13	4/25/13	16	326	11.4	69.7	38.6	34.0	29.4	26.0
4/11/13	4/25/13	20	326	11.9	67.2	37.2	33.8	29.1	25.7
4/11/13	4/25/13	25	326	10.6	67.7	34.6	33.0	27.1	23.9
4/11/13	4/25/13	31.5	326	9.3	67.8	33.8	33.0	25.5	22.3
4/11/13	4/25/13	40	326	6.0	66.6	32.4	32.2	23.1	20.1
4/11/13	4/25/13	50	326	2.8	69.1	31.9	31.5	21.2	17.8
4/11/13	4/25/13	63	326	-0.1	76.7	32.0	30.5	19.4	15.6
4/11/13	4/25/13	80	326	-2.1	76.4	32.4	30.1	18.9	14.6
4/11/13	4/25/13	100	326	-2.4	83.5	34.3	29.6	19.9	13.9
4/11/13	4/25/13	125	326	-3.9	83.7	36.2	30.6	20.4	12.5
4/11/13	4/25/13	160	326	-4.1	77.4	30.9	30.2	19.4	10.6
4/11/13	4/25/13	200	326	-4.2	69.6	29.3	29.2	18.4	8.7
4/11/13	4/25/13	250	326	-4.7	74.1	28.9	27.2	16.7	6.3
4/11/13	4/25/13	315	326	-4.6	61.9	29.7	24.9	14.2	3.6
4/11/13	4/25/13	400	326	-4.4	69.2	25.6	21.6	11.0	1.0
4/11/13	4/25/13	500	326	-4.1	72.7	23.8	19.0	7.1	-1.0
4/11/13	4/25/13	630	326	-3.9	74.2	21.1	10.7	2.1	-1.5
4/11/13	4/25/13	800	326	-3.5	69.3	19.0	9.8	1.2	-1.2
4/11/13	4/25/13	1000	326	-2.9	63.1	17.8	9.6	1.4	-0.7
4/11/13	4/25/13	1250	326	-2.2	67.5	19.0	9.2	1.3	-0.2
4/11/13	4/25/13	1600	326	-1.2	63.2	18.0	7.8	1.4	0.4
4/11/13	4/25/13	2000	326	-0.3	62.5	16.8	7.4	1.9	1.1
4/11/13	4/25/13	2500	326	0.6	59.7	14.3	5.9	2.5	1.9
4/11/13	4/25/13	3150	326	1.6	55.3	11.6	5.2	3.2	2.7
4/11/13	4/25/13	4000	326	2.6	56.6	10.1	5.4	4.0	3.6
4/11/13	4/25/13	5000	326	2.3	59.7	11.0	5.5	4.6	4.2
4/11/13	4/25/13	6300	326	1.4	62.5	10.6	5.6	5.0	4.7
4/11/13	4/25/13	8000	326	0.8	64.4	9.9	5.7	5.4	5.2
4/11/13	4/25/13	10000	326	0.9	40.4	8.1	5.8	5.5	5.3
4/11/13	4/25/13	12500	326	-0.7	39.9	7.1	4.8	4.4	4.2
4/11/13	4/25/13	16000	326	-0.8	45.3	5.7	3.3	2.9	2.7
4/11/13	4/25/13	20000	326	-1.5	35.2	2.6	0.9	0.4	0.3

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks.

Table 19. PAPA001 (Big Fred lek) hourly dBA metrics, April 5-7, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/5/2013	4/7/2013	0	2	33.0	67.1	43.6	44.0	41.2	36.6
4/5/2013	4/7/2013	1	2	31.6	60.6	42.4	44.0	39.7	37.2
4/5/2013	4/7/2013	2	2	31.7	60.7	41.1	43.6	38.2	35.8
4/5/2013	4/7/2013	3	2	30.8	63.2	38.9	39.3	37.1	34.8
4/5/2013	4/7/2013	4	2	34.6	60.4	41.8	44.4	40.2	37.1
4/5/2013	4/7/2013	5	2	32.6	60.4	41.3	44.3	39.2	37.3
4/5/2013	4/7/2013	6	2	32.7	56.0	40.4	42.0	39.1	36.2
4/5/2013	4/7/2013	7	2	27.1	45.1	33.9	36.5	32.6	29.4
4/5/2013	4/7/2013	8	2	28.5	48.6	33.4	34.9	32.5	31.0
4/5/2013	4/7/2013	9	2	26.2	45.4	33.2	34.6	32.6	30.8
4/5/2013	4/7/2013	10	2	22.1	45.9	33.1	34.2	31.2	28.6
4/5/2013	4/7/2013	11	2	23.1	53.7	34.1	35.4	30.9	27.9
4/5/2013	4/7/2013	12	2	26.1	45.9	33.4	35.5	32.3	29.3
4/5/2013	4/7/2013	13	2	28.4	49.2	35.6	37.6	34.2	31.7
4/5/2013	4/7/2013	14	2	25.8	55.2	36.1	37.8	33.3	29.3
4/6/2013	4/6/2013	15	1	29.4	48.6	34.8	36.1	33.9	32.0
4/5/2013	4/7/2013	16	2	26.2	53.0	39.8	40.9	36.7	33.8
4/5/2013	4/7/2013	17	2	28.6	51.4	37.6	38.8	36.0	33.7
4/5/2013	4/7/2013	18	2	30.6	62.1	38.8	39.2	36.4	34.4
4/5/2013	4/7/2013	19	2	30.4	61.8	39.5	40.9	37.4	34.7
4/5/2013	4/7/2013	20	2	34.7	65.7	41.3	41.9	38.9	37.1
4/5/2013	4/7/2013	21	2	33.0	60.7	41.2	41.8	39.4	37.3
4/5/2013	4/7/2013	22	2	34.8	59.6	42.3	43.6	41.0	39.3
4/5/2013	4/7/2013	23	2	33.8	58.2	44.1	45.3	41.8	38.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 20. PAPA001 (Big Fred lek) dBA and one-third octave band metrics, April 5-7, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/5/13	4/7/13	dBA	47	22.1	67.1	39.8	40.3	36.9	34.8
4/5/13	4/7/13	12.5	47	22.0	73.0	47.5	48.2	43.3	38.7
4/5/13	4/7/13	16	47	27.0	70.5	48.3	49.6	46.0	42.2
4/5/13	4/7/13	20	47	34.6	74.0	53.9	56.0	52.2	48.1
4/5/13	4/7/13	25	47	34.9	67.2	51.6	53.2	49.0	45.7
4/5/13	4/7/13	31.5	47	40.2	75.0	63.8	66.4	61.5	56.1
4/5/13	4/7/13	40	47	32.8	66.1	51.7	52.5	49.8	47.3
4/5/13	4/7/13	50	47	35.5	68.7	53.5	55.5	52.9	50.1
4/5/13	4/7/13	63	47	34.9	69.5	52.9	54.8	52.0	49.6
4/5/13	4/7/13	80	47	29.0	71.7	50.2	51.4	48.3	45.9
4/5/13	4/7/13	100	47	28.8	66.5	49.2	49.4	45.9	43.0
4/5/13	4/7/13	125	47	23.7	67.1	45.8	44.6	40.4	37.6
4/5/13	4/7/13	160	47	19.5	67.1	42.6	41.3	36.7	32.2
4/5/13	4/7/13	200	47	17.7	66.6	39.7	39.8	35.4	30.1
4/5/13	4/7/13	250	47	13.7	61.5	37.7	38.3	33.2	28.5
4/5/13	4/7/13	315	47	10.8	57.2	35.2	36.3	31.6	26.1
4/5/13	4/7/13	400	47	8.0	55.6	32.9	35.0	30.4	24.8
4/5/13	4/7/13	500	47	3.5	53.2	26.5	27.6	22.7	16.5
4/5/13	4/7/13	630	47	1.8	50.8	22.9	23.0	18.5	13.5
4/5/13	4/7/13	800	47	2.1	49.8	23.7	24.5	19.8	14.7
4/5/13	4/7/13	1000	47	2.4	48.3	24.9	26.0	21.0	15.8
4/5/13	4/7/13	1250	47	2.2	46.8	25.3	26.3	20.7	14.9
4/5/13	4/7/13	1600	47	1.6	44.8	23.8	24.5	19.4	13.1
4/5/13	4/7/13	2000	47	1.8	58.6	22.4	21.8	17.3	12.6
4/5/13	4/7/13	2500	47	2.3	63.1	19.8	15.2	10.2	6.3
4/5/13	4/7/13	3150	47	3.0	57.3	14.5	9.7	5.2	4.1
4/5/13	4/7/13	4000	47	3.7	47.8	12.4	5.2	4.5	4.2
4/5/13	4/7/13	5000	47	4.3	47.3	11.9	5.3	5.0	4.8
4/5/13	4/7/13	6300	47	4.2	44.6	11.9	5.5	5.3	5.2
4/5/13	4/7/13	8000	47	3.4	43.8	11.9	5.5	5.3	5.2
4/5/13	4/7/13	10000	47	2.3	41.6	10.4	5.1	5.0	4.8
4/5/13	4/7/13	12500	47	1.6	39.8	9.2	4.3	4.2	4.1
4/5/13	4/7/13	16000	47	0.6	37.4	7.6	3.3	3.2	3.1
4/5/13	4/7/13	20000	47	1.3	33.4	4.8	1.9	1.8	1.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 21. PAPA002 (Little Fred lek) hourly dBA metrics, April 5-7, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/5/2013	4/7/2013	0	2	20.6	47.7	31.3	31.4	27.6	25.1
4/5/2013	4/7/2013	1	2	22.4	49.3	29.4	31.0	26.9	24.9
4/5/2013	4/7/2013	2	2	23.9	52.1	32.1	34.5	30.5	26.0
4/5/2013	4/7/2013	3	2	24.3	55.9	31.3	31.0	28.8	27.2
4/5/2013	4/7/2013	4	2	25.6	48.4	31.5	33.2	29.8	27.4
4/5/2013	4/7/2013	5	2	25.9	50.3	34.7	35.6	32.6	29.6
4/5/2013	4/7/2013	6	2	26.0	46.3	32.5	34.1	31.1	29.1
4/5/2013	4/7/2013	7	2	24.8	49.4	33.8	36.0	32.3	28.9
4/5/2013	4/7/2013	8	2	24.6	55.7	34.7	36.8	32.4	29.2
4/5/2013	4/7/2013	9	2	24.3	57.0	34.4	35.1	31.5	28.7
4/5/2013	4/7/2013	10	2	21.2	46.6	30.5	32.9	27.8	25.0
4/5/2013	4/7/2013	11	2	19.5	52.9	29.2	28.4	25.1	23.4
4/6/2013	4/6/2013	12	1	20.1	39.6	25.7	27.4	23.5	21.7
4/5/2013	4/7/2013	13	2	20.1	48.6	32.7	35.9	27.0	23.2
4/5/2013	4/7/2013	14	2	21.9	49.2	32.0	34.6	29.7	25.8
4/5/2013	4/7/2013	15	2	20.6	56.8	38.6	39.5	31.1	23.9
4/5/2013	4/7/2013	16	2	19.5	60.2	42.1	39.1	33.8	29.1
4/5/2013	4/7/2013	17	2	19.6	56.9	38.5	38.1	31.5	26.9
4/5/2013	4/7/2013	18	2	19.1	55.6	39.2	37.8	32.5	26.4
4/5/2013	4/7/2013	19	2	18.8	51.3	33.6	36.8	28.5	22.2
4/5/2013	4/7/2013	20	2	20.9	51.4	28.6	29.7	25.8	23.6
4/5/2013	4/7/2013	21	2	19.0	46.4	25.6	26.9	24.0	21.4
4/5/2013	4/7/2013	22	2	19.2	41.7	26.1	28.1	24.1	21.9
4/5/2013	4/7/2013	23	2	20.5	47.4	30.4	32.2	26.8	23.8

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 22. PAPA002 (Little Fred lek) dBA and one-third octave band metrics, April 5-7, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/5/13	4/7/13	dBA	47	18.8	60.2	34.7	33.1	28.4	25.2
4/5/13	4/7/13	12.5	47	23.9	78.7	55.6	54.5	47.3	41.0
4/5/13	4/7/13	16	47	29.8	75.3	53.3	51.9	48.1	44.3
4/5/13	4/7/13	20	47	36.9	77.4	57.5	58.2	54.8	50.6
4/5/13	4/7/13	25	47	30.4	74.0	53.4	55.7	46.5	42.7
4/5/13	4/7/13	31.5	47	31.2	72.5	50.8	52.2	47.1	43.0
4/5/13	4/7/13	40	47	29.4	70.4	46.4	46.5	43.5	40.8
4/5/13	4/7/13	50	47	30.6	67.4	45.2	46.2	43.3	40.8
4/5/13	4/7/13	63	47	27.7	65.6	42.8	44.2	40.2	37.0
4/5/13	4/7/13	80	47	23.3	71.6	41.0	42.5	37.2	34.0
4/5/13	4/7/13	100	47	21.6	70.5	39.4	39.9	35.6	32.2
4/5/13	4/7/13	125	47	18.9	62.4	36.7	37.2	32.9	30.0
4/5/13	4/7/13	160	47	16.7	62.1	36.7	36.5	31.5	27.4
4/5/13	4/7/13	200	47	13.6	59.3	32.9	32.5	28.8	25.4
4/5/13	4/7/13	250	47	12.2	55.4	30.4	31.4	25.9	22.2
4/5/13	4/7/13	315	47	10.3	55.0	29.2	29.0	24.5	20.8
4/5/13	4/7/13	400	47	5.0	54.0	25.8	25.8	20.9	16.4
4/5/13	4/7/13	500	47	1.0	51.5	23.8	21.5	16.7	12.2
4/5/13	4/7/13	630	47	-0.7	46.9	22.4	19.9	13.4	9.0
4/5/13	4/7/13	800	47	-1.5	42.0	21.4	18.0	9.9	5.5
4/5/13	4/7/13	1000	47	-1.3	42.5	21.2	15.2	7.1	2.8
4/5/13	4/7/13	1250	47	-0.9	40.5	21.1	10.6	4.0	1.5
4/5/13	4/7/13	1600	47	-0.2	41.8	21.1	8.1	2.5	1.5
4/5/13	4/7/13	2000	47	0.6	42.4	19.5	4.5	2.5	1.8
4/5/13	4/7/13	2500	47	1.5	44.2	17.7	4.4	2.9	2.5
4/5/13	4/7/13	3150	47	2.3	41.9	14.9	4.1	3.4	3.1
4/5/13	4/7/13	4000	47	3.1	43.5	12.3	4.8	4.0	3.7
4/5/13	4/7/13	5000	47	3.7	53.6	12.9	5.1	4.4	4.2
4/5/13	4/7/13	6300	47	2.7	53.7	10.9	4.9	4.6	4.4
4/5/13	4/7/13	8000	47	2.1	38.2	8.3	4.7	4.5	4.4
4/5/13	4/7/13	10000	47	1.8	36.1	7.3	4.4	4.3	4.1
4/5/13	4/7/13	12500	47	0.4	35.8	6.7	3.9	3.8	3.6
4/5/13	4/7/13	16000	47	0.3	34.9	6.1	3.1	3.0	2.9
4/5/13	4/7/13	20000	47	1.1	34.8	4.6	1.8	1.8	1.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 23. PAPA003 (Lower Sand Springs Draw) hourly dBA metrics, April 5-7, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/5/2013	4/7/2013	0	2	21.5	49.0	34.5	35.0	29.6	26.5
4/5/2013	4/7/2013	1	2	21.9	51.3	30.5	31.5	29.0	25.7
4/5/2013	4/7/2013	2	2	22.5	47.8	32.7	35.1	30.8	26.8
4/5/2013	4/7/2013	3	2	23.8	52.2	30.4	31.0	28.1	26.1
4/5/2013	4/7/2013	4	2	25.0	49.6	33.4	34.4	31.6	27.5
4/5/2013	4/7/2013	5	2	24.9	51.7	37.3	36.3	33.3	30.8
4/5/2013	4/7/2013	6	2	26.9	50.5	33.8	34.7	32.3	30.9
4/5/2013	4/7/2013	7	2	26.5	54.3	35.7	37.8	34.1	30.3
4/5/2013	4/7/2013	8	2	28.1	59.1	37.0	38.3	34.5	31.9
4/5/2013	4/7/2013	9	2	22.2	53.0	35.2	37.8	33.6	27.4
4/5/2013	4/7/2013	10	2	18.6	50.5	28.3	29.3	26.2	22.7
4/5/2013	4/7/2013	11	2	19.4	47.8	29.6	29.7	25.6	23.4
4/5/2013	4/7/2013	12	2	19.9	48.7	29.2	31.5	24.8	22.1
4/5/2013	4/7/2013	13	2	19.2	49.4	29.0	30.5	25.1	22.1
4/5/2013	4/7/2013	14	3	19.2	48.6	30.5	32.9	28.9	24.9
4/5/2013	4/7/2013	15	3	20.3	52.2	33.9	36.6	26.8	23.9
4/5/2013	4/7/2013	16	2	19.4	52.7	35.5	35.6	30.5	26.2
4/5/2013	4/7/2013	17	2	18.8	51.9	34.9	35.5	29.6	25.7
4/5/2013	4/7/2013	18	2	19.4	53.5	35.2	35.9	30.5	25.6
4/5/2013	4/7/2013	19	2	18.5	54.5	32.5	34.6	28.3	22.8
4/5/2013	4/7/2013	20	2	22.7	51.4	30.5	31.6	28.1	25.7
4/5/2013	4/7/2013	21	2	20.0	46.9	27.2	28.0	25.1	23.1
4/5/2013	4/7/2013	22	2	17.4	43.3	27.2	28.7	25.5	22.1
4/5/2013	4/7/2013	23	2	20.3	52.3	32.3	32.7	28.3	25.1

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 24. PAPA003 (Lower Sand Springs Draw) dBA and one-third octave band metrics, April 5-7, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/5/13	4/7/13	dBA	50	17.4	59.1	33.3	32.9	28.4	24.9
4/5/13	4/7/13	12.5	50	21.8	81.6	59.0	51.4	44.9	39.1
4/5/13	4/7/13	16	50	29.0	77.8	55.7	51.3	46.5	42.0
4/5/13	4/7/13	20	50	34.9	74.4	55.8	56.2	51.3	47.0
4/5/13	4/7/13	25	50	31.3	73.2	51.8	51.9	46.2	42.3
4/5/13	4/7/13	31.5	50	33.3	68.2	53.5	56.1	51.5	46.3
4/5/13	4/7/13	40	50	27.5	66.4	46.8	47.8	44.1	40.0
4/5/13	4/7/13	50	50	26.9	64.8	44.8	45.8	42.1	37.7
4/5/13	4/7/13	63	50	24.8	67.1	44.3	45.4	41.1	37.2
4/5/13	4/7/13	80	50	14.5	69.1	42.5	43.4	39.0	34.1
4/5/13	4/7/13	100	50	16.9	70.5	40.6	40.8	36.4	32.3
4/5/13	4/7/13	125	50	16.4	63.0	38.5	38.0	33.9	30.5
4/5/13	4/7/13	160	50	16.0	65.3	36.8	36.0	31.5	27.8
4/5/13	4/7/13	200	50	13.7	60.1	34.3	33.1	29.1	25.3
4/5/13	4/7/13	250	50	8.7	56.4	31.3	31.2	25.9	22.7
4/5/13	4/7/13	315	50	7.3	53.8	30.4	29.1	24.5	20.3
4/5/13	4/7/13	400	50	2.9	50.7	26.2	26.4	21.0	17.0
4/5/13	4/7/13	500	50	-0.1	50.8	23.8	22.8	16.8	12.4
4/5/13	4/7/13	630	50	-1.4	47.6	21.5	20.2	13.9	8.6
4/5/13	4/7/13	800	50	-2.0	41.6	18.4	17.7	10.7	5.3
4/5/13	4/7/13	1000	50	-1.5	39.4	17.0	15.2	8.5	3.5
4/5/13	4/7/13	1250	50	-1.0	39.4	15.2	12.2	5.1	1.8
4/5/13	4/7/13	1600	50	-0.2	36.4	13.7	9.3	2.8	1.5
4/5/13	4/7/13	2000	50	0.5	39.4	12.6	7.1	2.4	1.8
4/5/13	4/7/13	2500	50	1.5	39.6	11.5	4.8	3.0	2.5
4/5/13	4/7/13	3150	50	2.3	38.6	10.5	4.4	3.5	3.2
4/5/13	4/7/13	4000	50	3.3	50.8	11.3	5.0	4.2	4.0
4/5/13	4/7/13	5000	50	3.6	57.9	14.4	5.4	4.8	4.6
4/5/13	4/7/13	6300	50	3.5	48.8	11.0	5.4	5.1	4.9
4/5/13	4/7/13	8000	50	1.7	41.3	10.7	5.3	5.1	5.0
4/5/13	4/7/13	10000	50	1.4	38.4	9.2	5.0	4.8	4.7
4/5/13	4/7/13	12500	50	1.1	37.8	8.1	4.3	4.2	4.1
4/5/13	4/7/13	16000	50	0.4	35.7	6.7	3.4	3.3	3.2
4/5/13	4/7/13	20000	50	0.9	31.8	4.7	2.1	1.9	1.8

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 25. PAPA004 (Two Buttes lek) hourly dBA metrics, April 18-21, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/18/2013	4/21/2013	0	3	18.0	41.1	28.2	30.6	24.9	23.7
4/18/2013	4/21/2013	1	3	16.5	48.5	29.3	26.2	23.8	21.2
4/18/2013	4/21/2013	2	3	16.1	39.8	27.1	30.3	26.8	24.5
4/18/2013	4/21/2013	3	3	14.8	49.6	29.3	29.3	26.7	23.1
4/18/2013	4/21/2013	4	3	15.0	43.6	27.3	29.4	25.5	22.2
4/18/2013	4/21/2013	5	3	18.3	57.1	29.9	30.0	26.0	23.0
4/18/2013	4/21/2013	6	3	17.0	43.1	30.2	29.7	27.2	23.5
4/18/2013	4/21/2013	7	3	20.0	44.0	28.1	29.9	26.1	23.0
4/18/2013	4/21/2013	8	3	16.8	52.4	29.1	28.5	22.6	19.8
4/18/2013	4/21/2013	9	3	17.3	43.6	25.4	26.8	22.7	19.6
4/18/2013	4/21/2013	10	4	17.2	52.1	26.8	24.5	21.2	19.6
4/18/2013	4/21/2013	11	4	16.3	51.2	30.0	29.7	23.5	20.4
4/18/2013	4/21/2013	12	4	19.8	49.2	31.5	33.8	27.2	23.0
4/18/2013	4/21/2013	13	3	19.2	51.3	32.6	35.9	29.0	23.1
4/18/2013	4/21/2013	14	3	19.7	54.9	33.8	38.0	31.4	25.4
4/18/2013	4/21/2013	15	3	19.0	52.7	36.1	40.6	33.5	27.7
4/18/2013	4/21/2013	16	3	19.1	52.8	36.5	39.5	32.7	26.3
4/18/2013	4/21/2013	17	3	18.5	58.7	38.6	41.2	34.5	28.4
4/18/2013	4/21/2013	18	3	16.6	52.8	36.5	41.0	33.5	27.7
4/18/2013	4/21/2013	19	3	16.4	55.4	36.7	35.1	28.8	25.2
4/18/2013	4/21/2013	20	3	16.4	61.5	35.9	30.5	28.1	26.1
4/18/2013	4/21/2013	21	3	15.3	43.7	27.0	31.3	24.7	22.3
4/18/2013	4/21/2013	22	3	14.6	50.7	27.2	29.6	24.2	21.1
4/18/2013	4/21/2013	23	3	15.1	44.4	28.7	28.7	24.7	21.9

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 26. PAPA004 (Two Buttes lek) dBA and one-third octave band metrics, April 18-21, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/18/13	4/21/13	dBA	75	14.6	61.5	32.6	30.6	26.4	22.7
4/18/13	4/21/13	12.5	75	15.8	81.6	61.7	47.7	41.6	37.4
4/18/13	4/21/13	16	75	24.7	78.0	57.3	47.0	42.3	38.9
4/18/13	4/21/13	20	75	31.2	75.9	56.4	58.6	52.9	46.8
4/18/13	4/21/13	25	75	24.2	72.8	50.8	44.9	40.4	36.4
4/18/13	4/21/13	31.5	75	22.3	70.6	49.9	50.5	42.5	36.4
4/18/13	4/21/13	40	75	21.9	69.3	46.5	43.8	38.6	34.2
4/18/13	4/21/13	50	75	18.8	67.9	44.0	42.4	36.8	32.8
4/18/13	4/21/13	63	75	15.4	66.3	41.5	40.8	35.4	31.7
4/18/13	4/21/13	80	75	11.8	69.1	39.1	38.5	33.6	30.2
4/18/13	4/21/13	100	75	10.8	69.4	37.7	38.7	33.2	29.0
4/18/13	4/21/13	125	75	9.0	65.8	35.6	37.0	31.4	27.6
4/18/13	4/21/13	160	75	5.0	61.9	32.6	33.3	28.5	24.7
4/18/13	4/21/13	200	75	4.5	62.8	31.2	32.5	27.1	23.2
4/18/13	4/21/13	250	75	2.0	58.9	28.5	29.1	24.4	20.6
4/18/13	4/21/13	315	75	0.7	53.3	26.8	27.1	22.3	18.0
4/18/13	4/21/13	400	75	-1.0	50.3	24.9	24.7	19.8	15.5
4/18/13	4/21/13	500	75	-3.0	47.4	22.5	21.5	15.9	12.2
4/18/13	4/21/13	630	75	-3.5	44.3	20.4	18.3	11.2	7.6
4/18/13	4/21/13	800	75	-3.2	47.1	18.6	14.8	8.5	5.1
4/18/13	4/21/13	1000	75	-2.6	51.1	18.7	12.8	5.7	2.4
4/18/13	4/21/13	1250	75	-1.5	50.7	19.7	10.5	4.7	1.2
4/18/13	4/21/13	1600	75	-0.6	52.2	19.4	7.2	2.2	1.1
4/18/13	4/21/13	2000	75	0.3	53.5	17.8	5.8	2.2	1.7
4/18/13	4/21/13	2500	75	1.2	43.2	16.1	5.8	2.9	2.5
4/18/13	4/21/13	3150	75	2.1	39.7	13.1	5.1	3.5	3.2
4/18/13	4/21/13	4000	75	1.2	37.2	10.0	4.8	4.1	3.8
4/18/13	4/21/13	5000	75	0.3	35.5	7.5	4.8	4.5	4.3
4/18/13	4/21/13	6300	75	-0.1	33.7	6.1	4.9	4.7	4.5
4/18/13	4/21/13	8000	75	-0.6	36.3	5.4	4.7	4.6	4.4
4/18/13	4/21/13	10000	75	-0.4	29.5	4.6	4.3	4.2	4.0
4/18/13	4/21/13	12500	75	-0.5	27.8	3.8	3.7	3.5	3.4
4/18/13	4/21/13	16000	75	-1.1	25.9	2.9	2.7	2.5	2.4
4/18/13	4/21/13	20000	75	-0.8	20.2	1.5	1.1	0.8	0.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 27. PAPA005 (Mesa Spring lek) hourly dBA metrics, April 18-21, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/18/2013	4/21/2013	0	3	22.2	53.6	37.5	34.4	31.8	30.0
4/18/2013	4/21/2013	1	3	21.7	50.5	34.2	30.9	27.6	24.1
4/18/2013	4/21/2013	2	3	21.4	45.3	33.2	34.4	29.3	26.7
4/18/2013	4/21/2013	3	3	19.7	47.1	34.2	32.5	29.2	26.8
4/18/2013	4/21/2013	4	3	18.3	46.4	32.0	33.2	29.8	27.5
4/18/2013	4/21/2013	5	3	22.9	45.7	31.1	32.4	29.3	27.2
4/18/2013	4/21/2013	6	3	21.8	45.5	33.6	32.8	29.3	25.0
4/18/2013	4/21/2013	7	3	21.1	44.0	32.7	32.8	28.3	24.3
4/18/2013	4/21/2013	8	3	20.4	50.9	31.9	33.9	29.2	26.5
4/18/2013	4/21/2013	9	3	20.1	45.7	29.4	33.6	27.7	23.7
4/18/2013	4/21/2013	10	3	20.5	51.9	29.9	30.8	27.5	24.7
4/18/2013	4/21/2013	11	4	17.2	51.6	31.6	30.1	26.2	23.8
4/18/2013	4/21/2013	12	4	20.1	62.2	34.8	35.7	29.9	26.7
4/18/2013	4/21/2013	13	4	21.4	56.8	35.4	38.6	31.4	27.0
4/18/2013	4/21/2013	14	3	22.8	63.6	37.9	41.0	34.5	28.4
4/18/2013	4/21/2013	15	3	22.3	66.6	40.9	42.5	35.6	28.9
4/18/2013	4/21/2013	16	3	23.6	57.1	39.7	42.8	36.9	31.6
4/18/2013	4/21/2013	17	3	21.6	60.2	42.0	45.4	39.4	33.7
4/18/2013	4/21/2013	18	3	21.2	54.5	40.0	44.5	37.9	32.9
4/18/2013	4/21/2013	19	3	22.5	52.5	37.5	38.9	32.8	29.4
4/18/2013	4/21/2013	20	3	22.9	51.0	35.8	39.7	34.7	28.6
4/18/2013	4/21/2013	21	3	18.3	43.8	31.8	33.0	30.3	28.6
4/18/2013	4/21/2013	22	3	18.1	50.3	31.7	32.1	29.9	28.4
4/18/2013	4/21/2013	23	3	17.4	53.7	36.0	32.4	30.6	28.8

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 28. PAPA005 (Mesa Spring lek) dBA and one-third octave band metrics, April 18-21, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/18/13	4/21/13	dBA	75	17.2	66.6	36.2	34.6	30.0	26.7
4/18/13	4/21/13	12.5	75	23.5	78.5	58.0	45.8	41.8	37.8
4/18/13	4/21/13	16	75	29.2	78.0	55.8	50.2	46.3	42.5
4/18/13	4/21/13	20	75	36.4	73.6	59.2	62.9	57.0	51.6
4/18/13	4/21/13	25	75	29.7	71.2	49.1	48.0	44.0	40.5
4/18/13	4/21/13	31.5	75	29.3	67.9	49.4	51.2	45.3	41.1
4/18/13	4/21/13	40	75	29.1	66.7	45.9	47.1	43.1	40.3
4/18/13	4/21/13	50	75	24.8	63.8	46.5	48.4	45.2	41.3
4/18/13	4/21/13	63	75	22.5	68.5	43.5	45.2	41.0	37.2
4/18/13	4/21/13	80	75	18.6	77.5	41.9	42.8	37.9	33.3
4/18/13	4/21/13	100	75	16.2	73.8	41.1	42.0	36.7	33.1
4/18/13	4/21/13	125	75	15.7	72.4	38.1	38.4	34.6	31.0
4/18/13	4/21/13	160	75	9.6	64.1	35.5	36.2	31.3	27.6
4/18/13	4/21/13	200	75	7.1	60.0	34.2	35.2	30.7	26.8
4/18/13	4/21/13	250	75	4.3	62.9	32.9	31.8	27.7	24.3
4/18/13	4/21/13	315	75	1.4	56.3	31.0	30.1	25.6	21.6
4/18/13	4/21/13	400	75	-0.4	53.0	28.0	28.0	22.5	18.3
4/18/13	4/21/13	500	75	-1.9	56.4	25.1	25.5	19.5	13.2
4/18/13	4/21/13	630	75	-2.4	53.7	23.4	23.5	16.5	10.2
4/18/13	4/21/13	800	75	-2.4	45.3	23.9	23.5	15.6	8.5
4/18/13	4/21/13	1000	75	-1.4	44.7	24.0	22.9	14.1	7.5
4/18/13	4/21/13	1250	75	-0.9	43.0	23.0	20.4	12.0	5.6
4/18/13	4/21/13	1600	75	-0.2	44.7	22.3	16.8	8.6	3.2
4/18/13	4/21/13	2000	75	0.9	44.1	20.5	9.3	4.1	2.7
4/18/13	4/21/13	2500	75	1.9	43.0	18.6	6.3	3.4	3.0
4/18/13	4/21/13	3150	75	2.8	42.2	15.8	5.7	4.1	3.7
4/18/13	4/21/13	4000	75	3.7	40.7	12.8	5.5	4.7	4.4
4/18/13	4/21/13	5000	75	4.4	62.1	16.4	5.8	5.2	5.0
4/18/13	4/21/13	6300	75	3.3	66.6	23.7	5.8	5.5	5.4
4/18/13	4/21/13	8000	75	3.1	45.7	7.7	5.8	5.6	5.4
4/18/13	4/21/13	10000	75	2.5	41.9	6.6	5.5	5.3	5.2
4/18/13	4/21/13	12500	75	2.0	50.9	10.7	4.9	4.8	4.7
4/18/13	4/21/13	16000	75	1.6	31.7	4.9	4.1	4.0	3.9
4/18/13	4/21/13	20000	75	1.9	31.8	3.7	3.0	2.8	2.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 29. PAPA006 (Lovatt Draw Reservoir lek) hourly dBA metrics, April 18-21, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/18/2013	4/20/2013	0	2	22.0	49.8	31.8	33.2	30.3	27.6
4/18/2013	4/20/2013	1	2	25.7	45.1	32.0	33.8	31.2	29.0
4/18/2013	4/20/2013	2	2	27.9	47.1	33.8	35.7	32.9	31.2
4/18/2013	4/20/2013	3	2	27.0	41.4	33.9	35.6	32.9	30.6
4/18/2013	4/20/2013	4	2	29.5	42.0	34.1	35.8	33.4	31.7
4/18/2013	4/20/2013	5	2	28.7	52.6	33.5	34.8	32.7	30.9
4/18/2013	4/20/2013	6	2	31.4	60.4	47.5	52.9	37.3	33.4
4/18/2013	4/20/2013	7	2	28.4	54.4	35.7	37.0	34.4	32.5
4/18/2013	4/20/2013	8	2	26.8	53.0	33.7	35.2	31.1	28.8
4/18/2013	4/20/2013	9	2	25.4	47.7	30.7	32.6	29.4	27.7
4/18/2013	4/20/2013	10	2	24.8	46.6	31.2	32.6	29.8	28.0
4/18/2013	4/20/2013	11	3	23.2	50.9	32.6	34.0	30.2	28.2
4/18/2013	4/20/2013	12	3	23.8	60.6	33.8	35.2	31.0	28.1
4/18/2013	4/20/2013	13	3	25.1	58.0	34.6	36.1	31.2	28.6
4/18/2013	4/20/2013	14	3	25.1	50.7	34.4	37.3	33.0	29.8
4/18/2013	4/20/2013	15	3	24.8	55.5	36.7	41.1	33.9	29.9
4/18/2013	4/20/2013	16	3	23.7	55.4	36.6	38.7	34.1	31.4
4/18/2013	4/20/2013	17	3	23.2	54.9	38.0	39.5	34.8	30.7
4/18/2013	4/20/2013	18	3	22.6	52.9	35.7	39.4	35.0	31.5
4/18/2013	4/20/2013	19	3	22.4	54.2	36.8	33.7	29.8	27.1
4/18/2013	4/20/2013	20	3	25.0	51.3	34.1	33.8	31.5	26.9
4/18/2013	4/20/2013	21	3	24.6	47.0	33.7	35.6	33.2	31.4
4/18/2013	4/20/2013	22	2	23.7	45.9	32.4	33.6	30.1	28.1
4/18/2013	4/20/2013	23	2	21.4	51.6	31.2	32.9	28.7	26.1

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 30. PAPA006 (Lovatt Draw Reservoir lek) dBA and one-third octave band metrics, April 18-21, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/18/13	4/20/13	dBA	59	21.4	60.6	36.7	35.2	32.0	29.7
4/18/13	4/20/13	12.5	59	27.7	74.8	51.1	48.5	44.5	40.3
4/18/13	4/20/13	16	59	33.9	74.2	51.4	52.3	48.4	45.1
4/18/13	4/20/13	20	59	42.2	75.8	60.6	63.4	58.5	54.6
4/18/13	4/20/13	25	59	35.8	70.1	50.6	52.5	49.0	46.1
4/18/13	4/20/13	31.5	59	36.2	71.1	56.5	59.0	55.1	48.4
4/18/13	4/20/13	40	59	33.2	75.1	51.3	52.7	49.0	46.0
4/18/13	4/20/13	50	59	29.5	73.6	49.7	50.4	46.1	43.0
4/18/13	4/20/13	63	59	28.5	69.4	48.0	49.4	45.7	42.3
4/18/13	4/20/13	80	59	22.9	75.3	43.1	43.7	39.7	36.7
4/18/13	4/20/13	100	59	23.6	72.5	40.8	41.9	38.1	35.3
4/18/13	4/20/13	125	59	22.4	72.2	38.6	39.4	35.9	32.0
4/18/13	4/20/13	160	59	14.2	66.4	35.8	36.7	33.7	30.8
4/18/13	4/20/13	200	59	11.1	66.5	35.9	35.8	32.2	28.7
4/18/13	4/20/13	250	59	8.0	60.7	31.7	32.5	29.2	26.4
4/18/13	4/20/13	315	59	6.3	56.6	29.4	29.3	26.1	23.4
4/18/13	4/20/13	400	59	3.8	52.1	27.2	27.3	23.5	20.4
4/18/13	4/20/13	500	59	0.4	52.9	24.8	23.6	19.5	16.1
4/18/13	4/20/13	630	59	-0.9	50.3	23.2	21.4	16.4	12.6
4/18/13	4/20/13	800	59	-0.6	53.4	25.4	21.1	15.8	11.8
4/18/13	4/20/13	1000	59	-0.4	52.0	26.5	22.3	15.3	11.1
4/18/13	4/20/13	1250	59	0.1	54.8	27.6	20.4	12.9	8.3
4/18/13	4/20/13	1600	59	0.5	53.9	25.1	17.5	10.7	6.0
4/18/13	4/20/13	2000	59	0.9	54.6	23.4	14.9	7.5	4.3
4/18/13	4/20/13	2500	59	1.6	51.3	20.1	11.1	5.5	3.7
4/18/13	4/20/13	3150	59	2.4	51.2	15.1	7.3	4.4	3.8
4/18/13	4/20/13	4000	59	3.4	47.0	10.2	6.0	4.6	4.3
4/18/13	4/20/13	5000	59	3.5	41.7	7.5	5.3	5.0	4.9
4/18/13	4/20/13	6300	59	3.5	38.3	6.8	5.6	5.4	5.2
4/18/13	4/20/13	8000	59	2.9	40.8	6.4	5.6	5.4	5.3
4/18/13	4/20/13	10000	59	1.5	39.6	5.9	5.3	5.2	5.0
4/18/13	4/20/13	12500	59	1.2	40.0	5.2	4.7	4.6	4.4
4/18/13	4/20/13	16000	59	0.5	37.1	4.3	3.9	3.7	3.5
4/18/13	4/20/13	20000	59	1.0	34.8	3.1	2.6	2.4	2.2

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 31. PAPA007 (Shelter Cabin Reservoir lek) hourly dBA metrics, April 10-12, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/10/2013	4/12/2013	0	2	18.1	38.6	23.1	24.4	21.8	20.1
4/10/2013	4/12/2013	1	2	18.0	32.8	23.0	24.9	22.6	20.3
4/10/2013	4/12/2013	2	2	17.1	40.5	24.1	25.2	22.0	20.6
4/10/2013	4/12/2013	3	2	18.3	39.2	23.2	24.9	22.7	20.7
4/10/2013	4/12/2013	4	2	17.9	39.1	23.5	25.4	22.6	20.9
4/10/2013	4/12/2013	5	2	19.4	44.0	25.8	27.6	24.3	22.1
4/10/2013	4/12/2013	6	2	21.8	38.5	27.7	29.6	26.9	24.7
4/10/2013	4/12/2013	7	2	22.3	46.2	27.3	28.8	26.1	24.3
4/10/2013	4/12/2013	8	2	19.5	49.3	28.2	30.2	26.3	23.4
4/10/2013	4/12/2013	9	2	18.6	48.9	30.6	33.1	25.5	22.4
4/10/2013	4/12/2013	10	3	19.7	52.0	33.3	35.8	29.7	24.5
4/10/2013	4/12/2013	11	2	22.1	52.8	34.3	34.8	29.9	26.0
4/10/2013	4/12/2013	12	2	21.7	73.2	40.8	34.0	29.4	25.8
4/10/2013	4/12/2013	13	2	21.4	50.8	32.7	33.6	28.5	24.6
4/10/2013	4/12/2013	14	2	20.9	47.7	31.8	33.8	28.5	24.7
4/10/2013	4/12/2013	15	2	21.4	50.8	33.0	34.6	29.0	25.5
4/10/2013	4/12/2013	16	2	19.6	50.0	34.8	38.4	30.7	25.3
4/10/2013	4/12/2013	17	2	20.4	49.1	34.8	38.3	31.6	26.3
4/10/2013	4/12/2013	18	2	23.1	54.3	37.8	41.1	34.8	29.8
4/10/2013	4/12/2013	19	2	19.5	50.0	34.9	37.6	31.5	26.7
4/10/2013	4/12/2013	20	2	20.8	49.6	32.8	34.0	28.8	25.6
4/10/2013	4/12/2013	21	2	20.0	44.1	27.7	29.6	25.8	23.6
4/10/2013	4/12/2013	22	2	20.2	45.0	26.6	28.7	24.0	22.1
4/10/2013	4/12/2013	23	2	20.4	36.7	24.0	25.9	23.2	21.9

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 32. PAPA007 (Shelter Cabin Reservoir lek) dBA and one-third octave band metrics, April 10-12, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/10/13	4/12/13	dBA	49	17.1	73.2	32.7	29.6	26.0	24.1
4/10/13	4/12/13	12.5	49	24.4	78.3	58.4	53.8	47.2	41.8
4/10/13	4/12/13	16	49	29.0	76.0	56.3	50.9	45.4	41.2
4/10/13	4/12/13	20	49	36.8	73.9	56.3	58.3	54.8	50.5
4/10/13	4/12/13	25	49	33.9	70.6	50.3	50.6	46.6	43.1
4/10/13	4/12/13	31.5	49	30.4	69.3	47.3	49.3	43.2	39.2
4/10/13	4/12/13	40	49	27.8	68.6	44.5	44.5	40.6	37.3
4/10/13	4/12/13	50	49	26.5	75.7	42.3	42.5	38.1	35.2
4/10/13	4/12/13	63	49	23.9	80.7	42.4	41.8	36.9	34.2
4/10/13	4/12/13	80	49	22.1	85.3	42.4	39.6	34.6	31.5
4/10/13	4/12/13	100	49	20.7	83.3	39.8	37.5	33.3	30.2
4/10/13	4/12/13	125	49	20.8	73.3	36.0	36.7	32.6	29.4
4/10/13	4/12/13	160	49	14.5	73.6	33.4	33.0	29.3	26.3
4/10/13	4/12/13	200	49	11.9	78.8	32.5	30.4	26.6	24.1
4/10/13	4/12/13	250	49	10.3	63.6	27.5	27.3	23.5	21.0
4/10/13	4/12/13	315	49	7.1	65.9	25.4	25.1	20.5	17.6
4/10/13	4/12/13	400	49	1.2	68.6	24.1	20.6	15.8	12.7
4/10/13	4/12/13	500	49	-1.5	65.3	21.5	19.2	12.7	8.8
4/10/13	4/12/13	630	49	-2.4	56.9	19.2	17.7	10.0	5.4
4/10/13	4/12/13	800	49	-2.4	53.8	18.7	17.3	9.0	3.9
4/10/13	4/12/13	1000	49	-1.9	49.6	18.9	14.9	7.0	2.2
4/10/13	4/12/13	1250	49	-1.2	48.6	18.8	11.6	4.6	1.1
4/10/13	4/12/13	1600	49	-0.2	43.8	18.8	10.4	4.3	1.8
4/10/13	4/12/13	2000	49	0.5	41.5	17.3	9.7	3.5	2.1
4/10/13	4/12/13	2500	49	1.3	38.4	15.0	8.2	3.7	2.8
4/10/13	4/12/13	3150	49	2.3	46.6	12.9	7.7	3.8	3.4
4/10/13	4/12/13	4000	49	2.0	46.8	10.3	6.3	4.3	4.0
4/10/13	4/12/13	5000	49	1.3	41.7	7.3	5.2	4.6	4.4
4/10/13	4/12/13	6300	49	0.2	34.4	5.7	5.0	4.7	4.5
4/10/13	4/12/13	8000	49	0.1	25.5	5.0	4.9	4.6	4.4
4/10/13	4/12/13	10000	49	-0.6	23.5	4.5	4.5	4.3	4.0
4/10/13	4/12/13	12500	49	-1.3	21.9	3.8	4.0	3.7	3.4
4/10/13	4/12/13	16000	49	-1.3	21.1	3.0	3.2	2.8	2.5
4/10/13	4/12/13	20000	49	-1.2	25.8	1.8	2.0	1.2	0.9

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 33. PAPA008 (The Rocks lek) hourly dBA metrics, April 10-12, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/10/2013	4/12/2013	0	2	19.7	36.5	23.7	25.0	22.5	21.1
4/10/2013	4/12/2013	1	2	20.4	34.5	24.3	25.9	23.6	21.9
4/10/2013	4/12/2013	2	2	19.5	46.0	26.0	26.6	23.9	22.4
4/10/2013	4/12/2013	3	2	19.5	36.2	24.8	25.8	24.0	22.4
4/10/2013	4/12/2013	4	2	18.8	34.7	23.7	25.7	22.8	21.1
4/10/2013	4/12/2013	5	2	20.2	36.7	24.5	26.2	23.8	22.0
4/10/2013	4/12/2013	6	2	21.3	51.5	26.9	28.4	25.2	23.3
4/10/2013	4/12/2013	7	2	21.2	43.8	27.3	29.3	26.1	24.1
4/10/2013	4/12/2013	8	2	19.2	53.6	29.2	30.2	25.6	23.5
4/10/2013	4/12/2013	9	2	18.9	50.9	30.5	31.7	26.5	23.5
4/10/2013	4/12/2013	10	2	20.9	47.1	33.6	36.0	30.8	26.2
4/10/2013	4/12/2013	11	3	19.2	49.5	33.1	32.3	26.5	25.1
4/10/2013	4/12/2013	12	3	18.0	64.5	35.8	31.3	26.5	25.0
4/10/2013	4/12/2013	13	2	22.4	49.8	33.6	34.4	29.9	25.8
4/10/2013	4/12/2013	14	2	20.5	52.6	32.7	34.2	30.0	26.4
4/10/2013	4/12/2013	15	2	21.5	47.6	32.2	34.2	29.1	25.5
4/10/2013	4/12/2013	16	2	22.3	49.0	34.1	36.9	30.7	26.4
4/10/2013	4/12/2013	17	2	22.9	47.6	35.2	38.2	32.7	27.8
4/10/2013	4/12/2013	18	2	21.2	49.6	36.6	39.5	33.8	27.9
4/10/2013	4/12/2013	19	2	22.4	51.7	35.9	38.5	33.1	28.1
4/10/2013	4/12/2013	20	2	21.5	49.9	34.3	35.8	30.3	26.3
4/10/2013	4/12/2013	21	2	20.9	42.9	25.9	28.2	24.8	22.8
4/10/2013	4/12/2013	22	2	21.2	38.6	26.2	28.6	24.7	23.1
4/10/2013	4/12/2013	23	2	20.3	35.2	24.2	25.8	23.5	22.3

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 34. PAPA008 (The Rocks lek) dBA and one-third octave band metrics, April 10-12, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/10/13	4/12/13	dBA	50	18.0	64.5	32.0	29.5	26.2	24.0
4/10/13	4/12/13	12.5	50	26.7	78.6	54.6	53.5	47.5	41.7
4/10/13	4/12/13	16	50	24.1	75.8	52.7	52.2	46.2	41.0
4/10/13	4/12/13	20	50	32.2	73.6	53.5	55.5	51.2	47.3
4/10/13	4/12/13	25	50	28.7	71.0	48.3	50.7	45.0	41.4
4/10/13	4/12/13	31.5	50	28.9	69.1	46.3	48.1	44.1	41.0
4/10/13	4/12/13	40	50	29.7	66.8	43.8	45.7	42.0	38.8
4/10/13	4/12/13	50	50	26.1	66.7	40.4	41.2	37.5	34.9
4/10/13	4/12/13	63	50	24.3	85.0	42.0	41.9	37.6	34.6
4/10/13	4/12/13	80	50	22.7	84.1	41.3	38.4	34.1	31.0
4/10/13	4/12/13	100	50	21.1	79.3	38.1	37.1	33.2	30.2
4/10/13	4/12/13	125	50	20.0	66.9	34.3	35.5	31.7	29.0
4/10/13	4/12/13	160	50	16.9	70.4	31.7	32.4	28.4	25.6
4/10/13	4/12/13	200	50	14.9	65.3	30.1	31.2	27.1	24.0
4/10/13	4/12/13	250	50	13.0	53.3	27.6	28.3	24.0	21.3
4/10/13	4/12/13	315	50	9.8	46.0	25.7	25.0	21.2	18.2
4/10/13	4/12/13	400	50	4.9	47.5	23.2	21.3	16.5	12.9
4/10/13	4/12/13	500	50	1.6	52.4	21.4	19.1	14.3	10.4
4/10/13	4/12/13	630	50	-1.9	48.6	19.2	17.4	11.2	6.5
4/10/13	4/12/13	800	50	-1.7	43.5	18.0	16.7	9.5	4.4
4/10/13	4/12/13	1000	50	-1.0	46.5	18.0	16.0	7.9	3.3
4/10/13	4/12/13	1250	50	-0.9	48.7	18.5	14.8	5.5	1.5
4/10/13	4/12/13	1600	50	-0.2	36.1	19.4	12.6	4.1	1.6
4/10/13	4/12/13	2000	50	0.5	36.7	18.7	9.7	3.3	2.2
4/10/13	4/12/13	2500	50	1.5	35.9	16.4	8.1	3.4	3.0
4/10/13	4/12/13	3150	50	2.4	34.8	13.0	7.2	4.1	3.7
4/10/13	4/12/13	4000	50	2.2	49.3	10.0	5.9	4.7	4.4
4/10/13	4/12/13	5000	50	2.3	52.5	10.7	6.4	5.2	4.8
4/10/13	4/12/13	6300	50	2.6	38.1	6.7	5.9	5.4	5.1
4/10/13	4/12/13	8000	50	2.2	26.1	6.2	5.9	5.4	5.2
4/10/13	4/12/13	10000	50	0.7	28.8	5.8	5.6	5.2	4.9
4/10/13	4/12/13	12500	50	0.4	23.9	5.1	5.1	4.7	4.4
4/10/13	4/12/13	16000	50	-0.3	22.7	4.3	4.4	3.9	3.5
4/10/13	4/12/13	20000	50	0.5	22.3	3.2	3.4	2.7	2.3

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 35. PAPA009 (South Rocks lek) hourly dBA metrics, April 10-12, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/10/2013	4/12/2013	0	2	18.6	34.8	24.2	26.6	23.1	21.0
4/10/2013	4/12/2013	1	2	17.2	40.1	27.2	27.6	23.8	22.1
4/10/2013	4/12/2013	2	2	17.6	49.2	29.9	27.8	25.2	23.4
4/10/2013	4/12/2013	3	2	18.1	38.8	27.6	29.0	24.9	22.2
4/10/2013	4/12/2013	4	2	19.4	33.6	25.0	27.1	24.3	22.1
4/10/2013	4/12/2013	5	2	21.6	32.9	25.9	28.0	25.3	23.3
4/10/2013	4/12/2013	6	2	21.5	39.8	25.4	26.9	25.1	23.5
4/10/2013	4/12/2013	7	2	21.8	44.6	27.1	28.6	26.3	24.4
4/10/2013	4/12/2013	8	2	18.7	46.2	28.9	30.5	26.2	23.0
4/10/2013	4/12/2013	9	2	18.8	47.6	31.3	32.3	26.6	23.9
4/10/2013	4/12/2013	10	2	19.9	47.6	33.3	35.1	29.8	25.6
4/10/2013	4/12/2013	11	2	19.6	50.4	32.9	34.6	28.7	24.6
4/10/2013	4/12/2013	12	3	18.2	59.0	33.4	30.0	23.5	22.1
4/10/2013	4/12/2013	13	3	18.4	54.2	32.0	32.9	26.2	23.3
4/10/2013	4/12/2013	14	2	22.1	47.3	32.0	33.6	29.5	26.1
4/10/2013	4/12/2013	15	2	21.5	47.7	32.4	33.9	29.4	25.9
4/10/2013	4/12/2013	16	2	23.5	49.6	33.9	35.6	30.0	26.1
4/10/2013	4/12/2013	17	2	22.9	48.3	34.1	37.1	31.5	27.3
4/10/2013	4/12/2013	18	2	22.3	48.7	35.5	38.2	33.1	28.2
4/10/2013	4/12/2013	19	2	22.1	52.1	33.6	36.2	31.1	27.1
4/10/2013	4/12/2013	20	2	21.6	45.0	32.8	34.3	29.8	27.0
4/10/2013	4/12/2013	21	2	20.8	38.7	26.1	28.3	25.0	23.1
4/10/2013	4/12/2013	22	2	21.6	37.0	26.3	28.3	25.5	23.6
4/10/2013	4/12/2013	23	2	20.0	39.8	26.7	28.6	25.7	23.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 36. PAPA009 (South Rocks lek) dBA and one-third octave band metrics, April 10-12, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/10/13	4/12/13	dBA	50	17.2	59.0	31.2	30.0	26.2	24.0
4/10/13	4/12/13	12.5	50	26.6	77.2	58.6	56.9	50.5	45.6
4/10/13	4/12/13	16	50	30.2	73.1	55.4	55.3	50.6	45.7
4/10/13	4/12/13	20	50	33.0	71.5	54.0	55.4	50.8	46.6
4/10/13	4/12/13	25	50	30.5	68.1	50.6	51.5	47.2	43.4
4/10/13	4/12/13	31.5	50	30.7	66.9	49.0	50.7	45.8	41.4
4/10/13	4/12/13	40	50	28.8	64.0	45.6	45.5	41.8	38.2
4/10/13	4/12/13	50	50	24.0	73.6	42.5	42.7	38.0	33.6
4/10/13	4/12/13	63	50	24.6	75.9	41.3	42.5	37.9	34.1
4/10/13	4/12/13	80	50	21.6	75.3	39.3	40.1	35.5	31.7
4/10/13	4/12/13	100	50	20.5	73.8	37.8	38.0	34.2	31.2
4/10/13	4/12/13	125	50	19.6	66.0	35.7	37.7	32.6	29.7
4/10/13	4/12/13	160	50	16.0	68.3	32.6	33.7	30.1	27.8
4/10/13	4/12/13	200	50	13.8	66.1	30.9	31.7	27.5	24.9
4/10/13	4/12/13	250	50	11.6	56.4	28.0	28.3	24.6	21.6
4/10/13	4/12/13	315	50	5.9	45.9	25.1	25.0	20.8	16.8
4/10/13	4/12/13	400	50	2.2	43.4	23.0	22.6	17.5	13.4
4/10/13	4/12/13	500	50	-0.2	49.1	20.8	19.8	14.0	9.7
4/10/13	4/12/13	630	50	-1.9	45.4	17.9	15.5	9.7	5.5
4/10/13	4/12/13	800	50	-2.3	40.7	16.2	14.0	7.0	3.3
4/10/13	4/12/13	1000	50	-1.6	37.3	16.0	13.1	5.7	1.9
4/10/13	4/12/13	1250	50	-1.1	40.3	16.3	12.4	3.4	1.5
4/10/13	4/12/13	1600	50	-0.2	40.0	16.0	11.1	2.4	1.7
4/10/13	4/12/13	2000	50	0.7	35.6	15.1	9.0	2.8	2.4
4/10/13	4/12/13	2500	50	1.7	34.6	13.6	7.7	3.5	3.1
4/10/13	4/12/13	3150	50	2.5	41.4	11.0	6.9	4.1	3.8
4/10/13	4/12/13	4000	50	1.7	35.4	8.3	5.8	4.6	4.4
4/10/13	4/12/13	5000	50	0.2	46.6	7.3	5.6	4.9	4.6
4/10/13	4/12/13	6300	50	-0.1	42.6	5.9	5.3	5.0	4.6
4/10/13	4/12/13	8000	50	-0.9	33.4	5.3	5.2	4.9	4.5
4/10/13	4/12/13	10000	50	-0.7	23.6	4.9	5.0	4.7	4.3
4/10/13	4/12/13	12500	50	-0.6	25.4	4.5	4.7	4.4	3.9
4/10/13	4/12/13	16000	50	-0.8	25.1	4.0	4.4	3.9	3.4
4/10/13	4/12/13	20000	50	-0.3	22.5	3.2	4.1	2.8	2.5

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 37. PAPA010 (Stud Horse Butte lek) hourly dBA metrics, April 10-12, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/10/2013	4/12/2013	0	2	19.5	36.7	24.6	26.6	23.4	21.9
4/10/2013	4/12/2013	1	2	18.9	40.1	28.6	29.8	25.8	23.2
4/10/2013	4/12/2013	2	2	19.7	50.0	30.9	31.5	26.5	24.1
4/10/2013	4/12/2013	3	2	18.1	42.0	30.4	29.8	25.8	22.6
4/10/2013	4/12/2013	4	2	20.4	36.2	25.9	27.9	25.0	23.0
4/10/2013	4/12/2013	5	2	21.5	37.4	28.4	29.4	27.1	25.4
4/10/2013	4/12/2013	6	2	22.6	40.1	30.0	31.2	28.1	26.2
4/10/2013	4/12/2013	7	2	22.9	43.4	27.5	29.3	26.7	25.1
4/10/2013	4/12/2013	8	2	19.0	46.0	29.9	31.5	26.6	23.1
4/10/2013	4/12/2013	9	2	19.4	48.5	32.7	33.7	27.6	24.3
4/10/2013	4/12/2013	10	2	20.1	60.3	34.5	36.3	30.3	25.7
4/10/2013	4/12/2013	11	2	19.8	51.6	34.1	35.3	29.2	24.8
4/10/2013	4/12/2013	12	2	19.1	49.9	34.9	35.9	29.4	25.2
4/10/2013	4/12/2013	13	3	19.9	52.0	32.6	33.0	26.6	23.5
4/10/2013	4/12/2013	14	2	23.1	50.8	33.5	34.6	30.3	26.9
4/10/2013	4/12/2013	15	2	22.6	50.4	33.3	34.4	30.1	26.8
4/10/2013	4/12/2013	16	2	22.4	50.6	35.4	36.8	31.0	27.2
4/10/2013	4/12/2013	17	2	22.8	51.7	35.2	37.8	31.9	27.7
4/10/2013	4/12/2013	18	2	24.5	50.0	36.3	39.4	34.1	29.5
4/10/2013	4/12/2013	19	2	22.5	53.8	33.3	35.9	29.9	26.3
4/10/2013	4/12/2013	20	2	22.7	48.9	32.5	34.0	29.2	26.5
4/10/2013	4/12/2013	21	2	22.1	42.4	28.3	31.0	26.7	24.6
4/10/2013	4/12/2013	22	2	22.7	36.6	27.6	29.5	26.9	25.1
4/10/2013	4/12/2013	23	2	20.8	39.4	26.9	28.6	25.8	24.2

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 38. PAPA010 (Stud Horse Butte lek) dBA and one-third octave band metrics, April 10-12, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/10/13	4/12/13	dBA	49	18.1	60.3	32.2	31.6	27.3	25.4
4/10/13	4/12/13	12.5	49	25.2	76.7	57.0	55.3	49.9	45.1
4/10/13	4/12/13	16	49	33.0	74.8	55.9	55.7	52.0	47.6
4/10/13	4/12/13	20	49	34.8	74.5	55.1	56.5	51.9	47.3
4/10/13	4/12/13	25	49	31.6	73.6	51.9	53.0	48.1	44.4
4/10/13	4/12/13	31.5	49	32.9	69.6	49.1	50.7	46.9	42.9
4/10/13	4/12/13	40	49	29.9	65.6	44.8	45.5	42.5	39.1
4/10/13	4/12/13	50	49	25.0	64.1	43.6	45.4	40.8	37.6
4/10/13	4/12/13	63	49	24.6	61.2	40.2	41.9	38.4	35.4
4/10/13	4/12/13	80	49	21.9	70.4	38.3	39.5	35.5	32.6
4/10/13	4/12/13	100	49	18.9	66.3	37.9	37.6	34.0	31.4
4/10/13	4/12/13	125	49	18.6	69.5	34.7	36.4	32.7	29.8
4/10/13	4/12/13	160	49	15.4	63.9	32.7	33.6	30.4	27.6
4/10/13	4/12/13	200	49	14.1	59.4	31.7	33.2	29.2	26.4
4/10/13	4/12/13	250	49	11.5	55.1	29.4	30.8	26.4	23.4
4/10/13	4/12/13	315	49	5.9	44.7	26.9	27.4	22.6	19.0
4/10/13	4/12/13	400	49	3.1	43.4	25.1	25.7	19.5	16.1
4/10/13	4/12/13	500	49	0.0	48.9	22.9	20.8	14.7	11.4
4/10/13	4/12/13	630	49	-1.7	43.8	20.5	18.8	12.5	8.3
4/10/13	4/12/13	800	49	-1.3	41.1	18.3	16.1	9.7	5.5
4/10/13	4/12/13	1000	49	-1.1	40.8	17.9	16.5	8.6	4.8
4/10/13	4/12/13	1250	49	-0.4	37.5	18.3	15.5	7.2	3.6
4/10/13	4/12/13	1600	49	0.2	36.5	18.0	13.0	5.1	2.9
4/10/13	4/12/13	2000	49	1.2	41.2	17.4	9.7	3.7	2.9
4/10/13	4/12/13	2500	49	2.0	58.5	16.4	8.6	3.8	3.4
4/10/13	4/12/13	3150	49	3.0	50.0	12.6	7.0	4.5	4.1
4/10/13	4/12/13	4000	49	3.3	42.6	9.1	6.8	5.1	4.8
4/10/13	4/12/13	5000	49	1.4	50.8	9.6	6.4	5.5	5.3
4/10/13	4/12/13	6300	49	1.6	42.0	6.7	6.1	5.8	5.5
4/10/13	4/12/13	8000	49	-0.2	27.3	6.2	6.0	5.7	5.5
4/10/13	4/12/13	10000	49	-0.3	23.9	5.7	5.7	5.4	5.2
4/10/13	4/12/13	12500	49	-0.6	22.8	5.0	5.2	4.8	4.5
4/10/13	4/12/13	16000	49	-0.9	20.7	4.2	4.5	3.9	3.6
4/10/13	4/12/13	20000	49	-1.1	19.4	3.1	3.1	2.5	2.2

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 39. PAPA011 (Little Saddle lek) hourly dBA metrics, April 12-14, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/12/2013	4/14/2013	0	2	15.3	39.0	21.3	21.8	19.4	17.8
4/12/2013	4/14/2013	1	2	16.0	38.6	21.9	23.5	20.4	18.0
4/12/2013	4/14/2013	2	2	16.0	36.9	22.0	23.2	19.8	18.1
4/12/2013	4/14/2013	3	2	16.0	41.8	24.4	24.4	21.2	19.3
4/12/2013	4/14/2013	4	2	15.8	42.7	25.9	25.7	22.1	20.1
4/12/2013	4/14/2013	5	2	16.0	40.0	26.5	30.5	23.4	19.5
4/12/2013	4/14/2013	6	2	17.2	44.1	29.4	32.3	25.0	19.9
4/12/2013	4/14/2013	7	2	16.8	39.5	24.6	27.6	21.7	19.2
4/12/2013	4/14/2013	8	2	18	49	27	29	22	20
4/13/2013	4/13/2013	9	1	17	50	28	28	21	19
4/12/2013	4/14/2013	10	2	18	57	31	32	27	23
4/12/2013	4/14/2013	11	2	17	52	32	32	26	22
4/12/2013	4/14/2013	12	2	17	51	33	34	27	23
4/12/2013	4/14/2013	13	2	17	55	38	39	33	27
4/12/2013	4/14/2013	14	2	17	49	34	34	27	23
4/12/2013	4/14/2013	15	2	16.6	51.0	35.1	35.3	29.1	23.9
4/12/2013	4/14/2013	16	2	16.1	48.8	30.5	33.5	26.5	20.7
4/12/2013	4/14/2013	17	2	16.0	51.3	26.2	28.0	21.6	18.1
4/12/2013	4/14/2013	18	2	15.5	54.2	28.1	28.3	22.5	19.1
4/12/2013	4/14/2013	19	2	15.1	47.2	24.4	25.2	19.8	17.4
4/12/2013	4/14/2013	20	2	14.9	50.5	26.6	27.3	21.4	17.9
4/12/2013	4/14/2013	21	2	15.3	50.9	29.2	28.0	23.2	20.1
4/12/2013	4/14/2013	22	2	15.2	46.2	26.1	25.6	21.3	18.7
4/12/2013	4/14/2013	23	2	15.1	44.0	27.7	26.9	22.7	18.1

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 40. PAPA011 (Little Saddle lek) dBA and one-third octave band metrics, April 12-14, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/12/13	4/14/13	dBA	47	14.9	57.4	30.2	29.3	22.3	18.8
4/12/13	4/14/13	12.5	47	19.3	77.8	56.2	52.0	40.4	34.7
4/12/13	4/14/13	16	47	20.7	76.6	54.3	48.0	40.3	34.6
4/12/13	4/14/13	20	47	21.2	77.6	52.3	49.0	42.4	37.2
4/12/13	4/14/13	25	47	17.3	71.3	48.1	41.5	35.2	30.8
4/12/13	4/14/13	31.5	47	17.8	69.6	46.1	45.0	39.0	33.3
4/12/13	4/14/13	40	47	13.6	67.4	42.4	37.1	32.7	29.2
4/12/13	4/14/13	50	47	13.4	65.7	39.9	37.0	32.2	28.7
4/12/13	4/14/13	63	47	12.8	64.5	38.1	36.9	31.5	28.4
4/12/13	4/14/13	80	47	13.1	69.3	36.0	34.2	29.9	26.5
4/12/13	4/14/13	100	47	12.5	68.1	35.7	36.7	31.5	27.1
4/12/13	4/14/13	125	47	10.3	73.3	34.1	31.5	26.7	23.0
4/12/13	4/14/13	160	47	6.2	62.7	30.5	30.4	24.7	20.0
4/12/13	4/14/13	200	47	4.2	55.9	28.4	29.2	23.2	18.7
4/12/13	4/14/13	250	47	0.0	60.0	26.4	26.6	19.7	13.7
4/12/13	4/14/13	315	47	-2.3	55.8	25.1	25.2	17.8	10.7
4/12/13	4/14/13	400	47	-3.4	50.1	22.5	23.0	15.2	7.2
4/12/13	4/14/13	500	47	-3.8	44.7	20.2	19.0	11.8	3.2
4/12/13	4/14/13	630	47	-3.5	44.5	17.5	16.3	7.4	0.6
4/12/13	4/14/13	800	47	-3.1	41.5	15.5	14.3	5.1	-0.1
4/12/13	4/14/13	1000	47	-2.1	34.6	15.1	14.0	4.0	0.0
4/12/13	4/14/13	1250	47	-1.2	34.1	15.2	13.1	3.9	0.5
4/12/13	4/14/13	1600	47	-0.3	35.1	15.7	11.8	3.4	1.3
4/12/13	4/14/13	2000	47	0.7	34.7	15.0	10.2	3.4	1.9
4/12/13	4/14/13	2500	47	1.6	34.6	13.4	8.7	3.8	2.7
4/12/13	4/14/13	3150	47	2.2	38.6	11.4	7.7	4.4	3.4
4/12/13	4/14/13	4000	47	1.6	45.5	9.3	6.3	4.6	4.2
4/12/13	4/14/13	5000	47	1.5	49.2	9.9	6.1	5.0	4.7
4/12/13	4/14/13	6300	47	1.5	41.2	7.1	5.8	5.3	5.0
4/12/13	4/14/13	8000	47	1.0	23.4	5.8	5.7	5.3	5.1
4/12/13	4/14/13	10000	47	0.7	27.3	5.5	5.4	5.1	4.9
4/12/13	4/14/13	12500	47	0.4	26.8	5.1	5.0	4.6	4.3
4/12/13	4/14/13	16000	47	0.2	28.5	4.4	4.5	3.8	3.6
4/12/13	4/14/13	20000	47	0.4	27.2	3.5	4.1	2.7	2.4

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 41. PAPA012 (Alkali Draw lek) hourly dBA metrics, April 12-14, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/12/2013	4/14/2013	0	2	16.0	36.0	22.1	23.5	20.7	19.0
4/12/2013	4/14/2013	1	2	18.4	44.2	23.8	24.9	21.6	19.9
4/12/2013	4/14/2013	2	2	16.7	39.7	23.6	24.4	21.2	19.7
4/12/2013	4/14/2013	3	2	16.7	40.5	23.7	24.3	21.2	19.7
4/12/2013	4/14/2013	4	2	16.1	42.0	23.8	25.1	21.3	19.4
4/12/2013	4/14/2013	5	2	17.3	44.0	24.2	27.2	21.8	20.0
4/12/2013	4/14/2013	6	2	19.2	41.0	27.5	30.0	26.1	22.7
4/12/2013	4/14/2013	7	2	18.0	59.5	27.9	28.7	24.3	21.7
4/12/2013	4/14/2013	8	2	19.0	48.9	28.6	31.2	24.5	21.6
4/12/2013	4/14/2013	9	2	17.4	50.6	30.8	31.5	26.0	21.6
4/13/2013	4/13/2013	10	1	17.6	65.5	37.3	33.9	27.1	21.4
4/13/2013	4/13/2013	11	1	19.8	47.0	33.1	36.7	29.8	23.7
4/12/2013	4/14/2013	12	2	17.1	49.0	33.5	35.8	28.6	22.6
4/12/2013	4/14/2013	13	2	17.0	53.2	37.7	39.2	31.7	25.2
4/12/2013	4/14/2013	14	2	16.9	54.5	37.1	36.7	29.8	24.9
4/12/2013	4/14/2013	15	2	16.7	57.0	37.5	37.8	30.1	24.0
4/12/2013	4/14/2013	16	2	16.6	51.2	32.6	35.5	28.1	22.4
4/12/2013	4/14/2013	17	2	15.6	47.0	26.3	29.3	22.1	18.1
4/12/2013	4/14/2013	18	2	14.7	49.8	27.8	28.3	21.9	18.6
4/12/2013	4/14/2013	19	2	14.6	41.7	23.7	25.9	19.6	17.7
4/12/2013	4/14/2013	20	2	15.4	38.2	22.9	25.0	19.7	17.9
4/12/2013	4/14/2013	21	2	15.2	46.7	29.4	28.0	23.0	19.7
4/12/2013	4/14/2013	22	2	15.2	43.1	26.6	25.9	21.9	19.2
4/12/2013	4/14/2013	23	2	15.1	38.9	23.5	24.1	20.6	18.4

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 42. PAPA012 (Alkali Draw lek) dBA and one-third octave band metrics, April 12-14, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/12/13	4/14/13	dBA	46	14.6	65.5	31.4	28.7	23.3	20.4
4/12/13	4/14/13	12.5	46	20.7	73.9	49.7	48.5	43.2	38.1
4/12/13	4/14/13	16	46	23.0	70.9	47.0	47.1	42.3	38.7
4/12/13	4/14/13	20	46	25.3	69.0	48.1	50.5	46.1	41.8
4/12/13	4/14/13	25	46	21.3	67.2	43.2	44.3	38.6	35.1
4/12/13	4/14/13	31.5	46	21.8	67.6	43.4	45.5	40.3	35.8
4/12/13	4/14/13	40	46	16.2	63.5	37.4	38.0	34.2	31.3
4/12/13	4/14/13	50	46	15.2	59.7	36.4	37.3	33.6	30.9
4/12/13	4/14/13	63	46	15.8	57.6	36.4	38.3	33.9	30.7
4/12/13	4/14/13	80	46	14.6	66.2	34.1	35.3	31.5	28.5
4/12/13	4/14/13	100	46	12.6	73.4	34.5	34.9	31.3	28.3
4/12/13	4/14/13	125	46	11.8	77.0	33.7	32.0	28.4	25.5
4/12/13	4/14/13	160	46	9.2	70.0	30.8	30.0	25.6	22.8
4/12/13	4/14/13	200	46	7.4	68.1	28.3	28.5	23.6	20.5
4/12/13	4/14/13	250	46	3.3	66.7	26.6	26.1	20.6	16.5
4/12/13	4/14/13	315	46	-0.3	60.5	24.0	23.7	17.4	12.4
4/12/13	4/14/13	400	46	-3.0	56.7	20.9	20.0	12.5	6.9
4/12/13	4/14/13	500	46	-3.8	55.1	18.2	15.5	8.0	2.1
4/12/13	4/14/13	630	46	-3.7	53.2	16.2	13.8	5.8	-0.3
4/12/13	4/14/13	800	46	-3.7	56.5	17.2	16.1	6.3	-1.0
4/12/13	4/14/13	1000	46	-2.9	54.9	18.6	17.1	6.4	-0.9
4/12/13	4/14/13	1250	46	-2.2	51.2	19.1	16.6	5.3	-0.5
4/12/13	4/14/13	1600	46	-1.4	45.2	19.0	15.0	3.6	0.3
4/12/13	4/14/13	2000	46	-0.7	42.8	18.1	12.7	2.8	0.8
4/12/13	4/14/13	2500	46	0.4	41.9	16.3	10.3	2.3	1.4
4/12/13	4/14/13	3150	46	1.3	42.3	13.4	7.1	2.6	2.2
4/12/13	4/14/13	4000	46	1.4	43.5	10.3	5.7	3.3	3.0
4/12/13	4/14/13	5000	46	1.4	41.0	9.0	4.9	4.0	3.7
4/12/13	4/14/13	6300	46	1.0	43.5	8.1	5.0	4.6	4.4
4/12/13	4/14/13	8000	46	0.4	46.2	8.6	5.3	5.1	4.9
4/12/13	4/14/13	10000	46	0.1	38.4	7.7	5.5	5.3	5.1
4/12/13	4/14/13	12500	46	0.3	39.7	7.7	5.2	4.9	4.7
4/12/13	4/14/13	16000	46	-0.4	36.7	5.7	3.4	2.8	2.7
4/12/13	4/14/13	20000	46	-0.7	29.3	2.3	2.1	0.3	0.1

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 43. PAPA013 (Sand Draw lek) hourly dBA metrics, April 12-14, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/12/2013	4/14/2013	0	2	18.5	36.7	26.3	27.6	24.7	22.2
4/12/2013	4/14/2013	1	2	16.7	36.9	27.0	27.6	24.9	21.6
4/12/2013	4/14/2013	2	2	17.2	39.1	29.2	29.5	25.8	23.8
4/12/2013	4/14/2013	3	2	19.2	41.6	30.5	32.7	28.4	25.6
4/12/2013	4/14/2013	4	2	18.7	42.2	31.1	31.7	27.5	25.2
4/12/2013	4/14/2013	5	2	17.8	38.7	26.4	27.4	23.9	21.0
4/12/2013	4/14/2013	6	2	17.7	53.6	25.1	25.3	22.5	20.3
4/12/2013	4/14/2013	7	2	19.1	63.1	31.7	25.8	23.6	21.2
4/12/2013	4/14/2013	8	2	19.8	75.0	44.8	32.3	26.5	23.2
4/12/2013	4/14/2013	9	2	20.3	50.5	34.1	35.5	29.9	25.1
4/12/2013	4/14/2013	10	2	21.4	51.6	37.7	41.2	35.0	29.3
4/13/2013	4/13/2013	11	1	24.8	49.0	37.8	41.6	35.1	29.5
4/13/2013	4/13/2013	12	1	24.5	51.7	38.8	42.5	36.3	30.3
4/12/2013	4/14/2013	13	2	19.6	53.7	37.6	40.2	33.0	27.4
4/12/2013	4/14/2013	14	2	21.3	56.3	40.2	40.6	34.3	29.4
4/12/2013	4/14/2013	15	2	18.6	56.2	41.5	40.2	33.6	28.8
4/12/2013	4/14/2013	16	2	18.6	57.1	36.5	38.9	30.9	24.4
4/12/2013	4/14/2013	17	2	18.2	48.6	29.2	32.4	24.7	20.4
4/12/2013	4/14/2013	18	2	17.4	44.4	28.6	31.6	24.9	20.5
4/12/2013	4/14/2013	19	2	17.5	39.8	26.0	28.5	23.6	21.2
4/12/2013	4/14/2013	20	2	20.6	47.1	28.1	30.4	26.6	23.7
4/12/2013	4/14/2013	21	2	23.2	53.8	33.2	34.2	29.9	26.6
4/12/2013	4/14/2013	22	2	22.6	47.4	31.4	33.4	29.3	26.3
4/12/2013	4/14/2013	23	2	19.4	45.5	29.0	31.9	27.1	23.1

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 44. PAPA013 (Sand Draw lek) dBA and one-third octave band metrics, April 12-14, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/12/13	4/14/13	dBA	46	16.7	75.0	36.1	32.0	27.3	23.1
4/12/13	4/14/13	12.5	46	23.7	79.5	60.1	56.1	49.9	43.8
4/12/13	4/14/13	16	46	27.0	76.5	57.2	54.8	47.0	41.3
4/12/13	4/14/13	20	46	29.2	73.1	54.4	53.6	48.3	42.4
4/12/13	4/14/13	25	46	24.3	71.3	50.9	50.6	45.5	40.6
4/12/13	4/14/13	31.5	46	28.3	68.3	49.9	51.1	46.4	41.7
4/12/13	4/14/13	40	46	25.6	65.9	45.9	44.3	40.0	36.7
4/12/13	4/14/13	50	46	24.0	65.1	42.9	40.2	35.8	32.5
4/12/13	4/14/13	63	46	24.1	61.9	40.7	39.7	35.3	32.2
4/12/13	4/14/13	80	46	20.6	61.8	38.1	37.1	33.3	30.1
4/12/13	4/14/13	100	46	18.7	63.9	39.8	37.8	33.9	30.5
4/12/13	4/14/13	125	46	16.3	66.3	35.3	35.1	31.2	27.5
4/12/13	4/14/13	160	46	15.1	70.2	32.6	32.1	28.4	24.7
4/12/13	4/14/13	200	46	13.4	55.5	31.1	31.9	27.8	23.5
4/12/13	4/14/13	250	46	9.7	57.3	28.8	29.9	25.3	21.2
4/12/13	4/14/13	315	46	6.4	51.2	26.8	27.2	22.3	17.2
4/12/13	4/14/13	400	46	2.6	50.5	24.8	25.2	19.8	14.5
4/12/13	4/14/13	500	46	-0.7	49.2	22.7	22.8	17.1	11.2
4/12/13	4/14/13	630	46	-2.6	42.7	20.8	20.0	13.5	7.5
4/12/13	4/14/13	800	46	-2.8	38.2	20.5	20.0	12.3	5.5
4/12/13	4/14/13	1000	46	-1.9	38.1	21.2	21.1	12.5	5.4
4/12/13	4/14/13	1250	46	-1.6	38.5	20.9	18.1	8.2	2.4
4/12/13	4/14/13	1600	46	-0.7	39.4	21.0	15.8	6.2	2.0
4/12/13	4/14/13	2000	46	0.4	44.9	20.0	11.8	3.6	1.7
4/12/13	4/14/13	2500	46	1.3	62.8	21.7	10.1	3.2	2.4
4/12/13	4/14/13	3150	46	2.1	71.2	28.4	8.8	3.6	3.1
4/12/13	4/14/13	4000	46	3.1	69.5	24.8	7.0	4.1	3.8
4/12/13	4/14/13	5000	46	2.7	45.2	10.8	6.1	4.5	4.2
4/12/13	4/14/13	6300	46	1.6	46.7	8.6	5.3	4.7	4.5
4/12/13	4/14/13	8000	46	1.6	57.9	11.0	4.8	4.6	4.4
4/12/13	4/14/13	10000	46	0.3	38.0	6.1	4.4	4.2	4.1
4/12/13	4/14/13	12500	46	0.1	34.6	5.3	3.8	3.5	3.3
4/12/13	4/14/13	16000	46	-0.3	35.7	4.4	3.0	2.6	2.4
4/12/13	4/14/13	20000	46	-1.1	29.5	2.7	1.9	1.0	0.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 45. PAPA014 (Lovatt West lek) hourly dBA metrics, April 18-21, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/18/2013	4/21/2013	0	3	19.8	36.4	29.3	30.7	29.5	28.5
4/18/2013	4/21/2013	1	3	24.9	38.9	30.9	33.0	30.2	27.3
4/18/2013	4/21/2013	2	3	23.7	41.6	31.5	32.0	30.5	28.9
4/18/2013	4/21/2013	3	3	25.9	42.4	32.9	30.0	28.9	27.7
4/18/2013	4/21/2013	4	3	25.6	43.1	34.0	33.3	29.7	27.3
4/18/2013	4/21/2013	5	3	27.0	46.7	34.0	35.3	32.6	29.7
4/18/2013	4/21/2013	6	3	27.6	43.6	31.9	32.5	30.9	29.6
4/18/2013	4/21/2013	7	3	23.1	43.7	31.2	33.9	30.2	28.4
4/18/2013	4/21/2013	8	3	21.0	52.4	31.4	32.4	28.0	24.1
4/18/2013	4/21/2013	9	3	19.8	48.7	26.4	28.7	24.8	22.6
4/18/2013	4/21/2013	10	3	19.0	58.0	29.8	28.4	25.4	23.1
4/18/2013	4/21/2013	11	3	19.6	47.0	29.4	33.3	26.9	23.3
4/18/2013	4/21/2013	12	4	19.8	56.8	32.5	34.6	28.2	23.9
4/18/2013	4/21/2013	13	4	19.9	58.3	34.1	36.2	29.3	24.9
4/18/2013	4/21/2013	14	4	19.8	49.3	33.9	36.8	30.6	25.4
4/18/2013	4/21/2013	15	3	20.9	55.0	36.3	40.8	31.9	25.0
4/18/2013	4/21/2013	16	3	21.1	59.5	36.8	40.2	34.7	28.9
4/18/2013	4/21/2013	17	3	20.5	55.0	38.1	40.1	34.8	29.8
4/18/2013	4/21/2013	18	3	19.9	50.9	35.7	38.9	33.2	27.8
4/18/2013	4/21/2013	19	3	20.0	52.6	36.0	33.6	28.4	24.5
4/18/2013	4/21/2013	20	3	21.6	51.5	32.8	30.6	28.9	24.5
4/18/2013	4/21/2013	21	3	22.6	44.2	31.2	30.8	29.2	27.1
4/18/2013	4/21/2013	22	3	23.7	44.7	33.1	36.5	30.0	27.0
4/18/2013	4/21/2013	23	3	21.2	38.7	29.2	31.8	29.1	27.2

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 46. PAPA014 (Lovatt West lek) dBA and one-third octave band metrics, April 18-21, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/18/13	4/21/13	dBA	75	19.0	59.5	33.5	33.7	29.6	27.0
4/18/13	4/21/13	12.5	75	20.5	73.7	49.9	45.7	41.4	35.5
4/18/13	4/21/13	16	75	24.6	71.1	49.6	50.6	44.4	40.1
4/18/13	4/21/13	20	75	31.0	76.1	59.9	61.4	52.6	48.4
4/18/13	4/21/13	25	75	23.6	66.3	44.7	46.0	42.4	39.2
4/18/13	4/21/13	31.5	75	26.3	66.1	49.3	51.8	47.5	42.6
4/18/13	4/21/13	40	75	25.6	64.0	45.1	47.0	44.0	41.1
4/18/13	4/21/13	50	75	25.9	67.6	43.7	45.2	41.4	38.8
4/18/13	4/21/13	63	75	25.1	68.3	42.5	43.8	40.0	36.5
4/18/13	4/21/13	80	75	22.8	70.9	39.4	40.3	36.1	33.3
4/18/13	4/21/13	100	75	22.2	72.8	38.7	39.7	36.2	33.0
4/18/13	4/21/13	125	75	21.6	70.4	39.3	40.3	36.8	34.1
4/18/13	4/21/13	160	75	19.1	65.4	34.1	34.8	31.5	28.0
4/18/13	4/21/13	200	75	8.6	66.2	32.6	32.9	28.1	24.2
4/18/13	4/21/13	250	75	5.8	62.0	29.2	29.7	25.2	21.4
4/18/13	4/21/13	315	75	3.4	57.5	27.2	28.2	22.6	18.9
4/18/13	4/21/13	400	75	0.3	50.6	24.2	23.7	19.0	15.5
4/18/13	4/21/13	500	75	-1.6	48.6	21.4	22.9	15.3	10.6
4/18/13	4/21/13	630	75	-2.9	46.9	17.9	18.3	10.3	5.8
4/18/13	4/21/13	800	75	-2.1	41.9	17.8	19.4	8.7	5.4
4/18/13	4/21/13	1000	75	-1.8	38.4	18.8	20.4	8.7	4.7
4/18/13	4/21/13	1250	75	-1.4	42.4	20.9	21.8	11.7	5.1
4/18/13	4/21/13	1600	75	-0.9	48.6	20.9	22.1	11.0	4.2
4/18/13	4/21/13	2000	75	-0.4	51.8	19.6	17.6	8.2	2.8
4/18/13	4/21/13	2500	75	0.3	53.9	17.9	12.8	5.2	2.1
4/18/13	4/21/13	3150	75	1.3	52.6	14.8	12.2	4.5	2.9
4/18/13	4/21/13	4000	75	2.2	52.8	11.2	4.6	3.4	3.0
4/18/13	4/21/13	5000	75	1.9	57.1	12.7	4.3	3.9	3.7
4/18/13	4/21/13	6300	75	1.1	43.7	7.2	4.7	4.5	4.4
4/18/13	4/21/13	8000	75	0.6	40.0	6.3	5.2	5.0	4.9
4/18/13	4/21/13	10000	75	-0.2	31.8	5.9	5.5	5.3	5.2
4/18/13	4/21/13	12500	75	-0.5	33.1	5.6	5.0	4.9	4.7
4/18/13	4/21/13	16000	75	-1.1	29.3	3.6	2.9	2.8	2.6
4/18/13	4/21/13	20000	75	-1.0	22.6	1.3	0.5	0.2	0.1

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 47. PAPA015 (Cat lek) hourly dBA metrics, April 21-23, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/21/2013	4/23/2013	0	2	13.9	44.6	21.3	17.2	15.3	14.6
4/21/2013	4/23/2013	1	2	14.4	44.1	22.7	22.3	16.4	15.3
4/21/2013	4/23/2013	2	2	13.9	48.6	23.7	23.8	16.7	14.9
4/21/2013	4/23/2013	3	2	13.8	35.5	20.9	21.3	17.9	15.1
4/21/2013	4/23/2013	4	2	13.8	50.0	26.6	22.6	19.1	17.8
4/21/2013	4/23/2013	5	2	13.9	36.8	22.0	22.2	18.9	17.2
4/21/2013	4/23/2013	6	2	13.8	34.6	18.0	19.1	16.3	15.2
4/21/2013	4/23/2013	7	2	14.0	46.6	21.8	20.7	16.4	14.7
4/21/2013	4/23/2013	8	2	14.9	47.1	26.8	25.7	20.2	17.0
4/21/2013	4/23/2013	9	2	15.1	40.3	23.3	24.8	18.8	16.3
4/21/2013	4/23/2013	10	2	14.9	45.1	23.6	26.9	17.4	15.7
4/21/2013	4/23/2013	11	2	15.3	50.9	35.4	32.7	24.3	19.5
4/21/2013	4/23/2013	12	3	14.9	49.9	29.2	24.8	19.0	17.2
4/21/2013	4/23/2013	13	2	15.9	51.9	30.0	32.5	24.6	20.2
4/21/2013	4/23/2013	14	2	16.1	53.6	31.0	33.9	26.1	20.1
4/21/2013	4/23/2013	15	2	16.2	51.9	31.4	34.6	26.9	20.7
4/21/2013	4/23/2013	16	2	15.6	49.3	29.9	32.1	24.5	19.1
4/21/2013	4/23/2013	17	2	15.0	52.2	34.0	33.8	24.3	18.6
4/21/2013	4/23/2013	18	2	15.0	55.6	33.3	30.4	22.7	17.1
4/21/2013	4/23/2013	19	2	15.3	44.7	25.1	26.2	20.2	16.8
4/21/2013	4/23/2013	20	2	14.7	42.0	25.3	26.7	19.5	16.3
4/21/2013	4/23/2013	21	2	14.1	38.4	19.2	20.3	15.2	14.4
4/21/2013	4/23/2013	22	2	14.1	41.4	20.5	19.5	15.9	14.9
4/21/2013	4/23/2013	23	2	14.2	41.7	19.9	17.0	15.5	14.8

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 48. PAPA015 (Cat lek) dBA and one-third octave band metrics, April 21-23, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/21/13	4/23/13	dBA	49	13.8	55.6	28.5	24.8	17.5	16.0
4/21/13	4/23/13	12.5	49	16.0	78.4	55.6	43.0	38.5	34.1
4/21/13	4/23/13	16	49	16.8	76.1	52.3	46.4	41.9	35.8
4/21/13	4/23/13	20	49	18.3	74.0	50.3	51.6	44.6	37.4
4/21/13	4/23/13	25	49	14.2	71.8	43.6	40.9	35.0	29.0
4/21/13	4/23/13	31.5	49	13.4	68.3	43.0	42.6	35.2	29.1
4/21/13	4/23/13	40	49	11.5	65.4	37.9	34.7	28.9	24.8
4/21/13	4/23/13	50	49	9.5	64.3	35.7	33.6	27.8	23.9
4/21/13	4/23/13	63	49	8.9	66.8	34.8	33.0	27.2	23.2
4/21/13	4/23/13	80	49	7.3	72.0	35.1	32.0	24.6	20.9
4/21/13	4/23/13	100	49	3.6	71.5	33.0	29.9	23.4	19.1
4/21/13	4/23/13	125	49	1.6	67.9	30.5	28.4	21.8	17.2
4/21/13	4/23/13	160	49	-0.5	60.3	28.0	25.8	19.0	13.5
4/21/13	4/23/13	200	49	-1.2	59.2	26.3	23.7	17.2	11.3
4/21/13	4/23/13	250	49	-3.2	53.3	22.8	21.8	12.4	6.9
4/21/13	4/23/13	315	49	-3.8	45.8	20.0	17.8	8.5	3.5
4/21/13	4/23/13	400	49	-3.7	47.9	19.3	13.3	5.0	1.7
4/21/13	4/23/13	500	49	-4.0	50.0	19.2	9.5	3.3	0.1
4/21/13	4/23/13	630	49	-3.8	46.0	18.3	7.0	1.0	-0.8
4/21/13	4/23/13	800	49	-3.8	41.4	16.8	5.0	-0.5	-1.4
4/21/13	4/23/13	1000	49	-3.3	37.7	16.6	1.9	-0.6	-1.3
4/21/13	4/23/13	1250	49	-2.6	37.1	16.8	0.4	-0.7	-1.1
4/21/13	4/23/13	1600	49	-1.9	38.1	16.1	1.0	0.0	-0.5
4/21/13	4/23/13	2000	49	-0.8	39.8	14.7	1.6	0.9	0.5
4/21/13	4/23/13	2500	49	0.0	39.8	12.4	2.4	1.8	1.3
4/21/13	4/23/13	3150	49	1.2	41.0	10.7	3.2	2.5	2.2
4/21/13	4/23/13	4000	49	2.3	38.3	10.3	3.9	3.4	3.2
4/21/13	4/23/13	5000	49	3.4	43.2	10.8	4.7	4.3	4.1
4/21/13	4/23/13	6300	49	3.8	39.0	11.4	5.4	5.0	4.8
4/21/13	4/23/13	8000	49	3.4	39.4	11.9	5.9	5.5	5.4
4/21/13	4/23/13	10000	49	3.3	45.7	12.0	6.1	5.8	5.5
4/21/13	4/23/13	12500	49	3.0	44.1	11.1	5.5	5.2	4.8
4/21/13	4/23/13	16000	49	1.8	38.5	9.5	3.7	3.3	2.8
4/21/13	4/23/13	20000	49	-0.5	35.6	5.3	1.6	0.6	0.2

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 49. PAPA016 (Tyler Draw North lek) hourly dBA metrics, April 15-17, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/15/2013	4/17/2013	0	2	15.7	32.7	20.3	22.2	19.0	17.6
4/15/2013	4/17/2013	1	2	16.6	57.3	29.7	23.5	20.5	18.5
4/15/2013	4/17/2013	2	2	14.9	31.6	21.6	22.3	20.2	17.9
4/15/2013	4/17/2013	3	2	14.4	45.3	25.7	22.6	20.5	19.3
4/15/2013	4/17/2013	4	2	14.3	38.1	26.7	23.4	21.6	20.6
4/15/2013	4/17/2013	5	2	14.3	41.4	25.0	24.8	21.3	19.8
4/15/2013	4/17/2013	6	2	15.7	45.3	25.0	25.9	22.7	20.8
4/15/2013	4/17/2013	7	2	18.6	41.1	25.7	27.6	24.5	21.9
4/15/2013	4/17/2013	8	2	20.3	43.3	30.5	32.1	28.0	24.4
4/16/2013	4/16/2013	9	1	22.1	41.8	27.8	29.5	26.1	24.3
4/16/2013	4/16/2013	10	1	22.0	39.4	27.5	29.7	26.5	24.4
4/15/2013	4/17/2013	11	2	15.2	43.5	24.1	24.5	19.4	17.6
4/15/2013	4/17/2013	12	2	15.4	45.1	26.2	28.0	19.6	16.3
4/15/2013	4/17/2013	13	2	15.3	54.7	29.7	29.9	19.1	16.2
4/15/2013	4/17/2013	14	2	16.0	43.4	27.4	28.0	22.3	18.7
4/15/2013	4/17/2013	15	2	16.0	42.2	28.1	31.4	23.9	18.9
4/15/2013	4/17/2013	16	2	16.5	46.1	30.5	32.7	25.5	19.7
4/15/2013	4/17/2013	17	2	15.7	53.6	31.6	30.9	23.6	18.6
4/15/2013	4/17/2013	18	2	14.9	48.9	30.4	29.1	22.7	17.1
4/15/2013	4/17/2013	19	2	14.8	48.9	31.3	30.2	22.9	19.2
4/15/2013	4/17/2013	20	2	14.5	40.6	23.7	24.4	19.7	17.7
4/15/2013	4/17/2013	21	2	14.3	42.3	26.1	26.0	20.6	19.1
4/15/2013	4/17/2013	22	2	14.7	38.5	23.4	24.7	19.5	17.1
4/15/2013	4/17/2013	23	2	14.7	40.4	24.3	26.2	20.3	17.4

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 50. PAPA016 (Tyler Draw North lek) dBA and one-third octave band metrics, April 15-17, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/15/13	4/17/13	dBA	46	14.3	57.3	27.7	26.5	21.8	18.5
4/15/13	4/17/13	12.5	46	16.5	74.5	45.6	40.6	35.7	31.1
4/15/13	4/17/13	16	46	22.3	71.8	44.3	43.4	37.0	32.4
4/15/13	4/17/13	20	46	22.9	68.9	49.7	49.1	41.6	36.3
4/15/13	4/17/13	25	46	20.2	65.2	40.9	39.6	33.6	29.9
4/15/13	4/17/13	31.5	46	18.0	65.9	44.8	41.3	34.3	29.8
4/15/13	4/17/13	40	46	15.8	58.3	37.3	35.9	30.6	27.0
4/15/13	4/17/13	50	46	13.9	58.7	37.0	36.4	29.8	25.2
4/15/13	4/17/13	63	46	12.7	66.1	37.6	36.6	29.9	24.9
4/15/13	4/17/13	80	46	9.2	71.4	36.1	35.7	28.9	25.0
4/15/13	4/17/13	100	46	7.0	75.7	36.2	34.6	28.3	24.6
4/15/13	4/17/13	125	46	4.4	73.4	34.5	32.7	26.6	23.1
4/15/13	4/17/13	160	46	2.2	64.3	30.2	29.3	23.7	20.2
4/15/13	4/17/13	200	46	0.2	56.5	26.5	27.8	21.9	17.7
4/15/13	4/17/13	250	46	-3.3	52.6	22.0	21.4	17.1	12.4
4/15/13	4/17/13	315	46	-4.4	46.4	18.1	17.3	13.3	7.7
4/15/13	4/17/13	400	46	-4.5	52.3	16.6	13.1	8.6	2.5
4/15/13	4/17/13	500	46	-4.5	48.1	15.4	9.1	2.5	-0.8
4/15/13	4/17/13	630	46	-4.0	40.4	14.8	9.2	1.1	-1.4
4/15/13	4/17/13	800	46	-3.2	42.0	16.1	9.4	1.5	-1.0
4/15/13	4/17/13	1000	46	-2.4	38.5	16.9	8.3	1.2	-0.5
4/15/13	4/17/13	1250	46	-1.6	38.7	15.9	6.9	1.0	-0.1
4/15/13	4/17/13	1600	46	-0.6	48.1	15.1	6.2	1.5	0.8
4/15/13	4/17/13	2000	46	0.4	37.8	13.3	4.4	2.1	1.5
4/15/13	4/17/13	2500	46	1.3	35.5	10.6	3.8	2.8	2.3
4/15/13	4/17/13	3150	46	2.2	35.0	8.2	4.1	3.5	3.1
4/15/13	4/17/13	4000	46	3.2	33.2	6.5	4.7	4.1	3.9
4/15/13	4/17/13	5000	46	3.6	37.7	6.3	5.3	4.8	4.5
4/15/13	4/17/13	6300	46	3.5	38.0	6.6	5.6	5.2	5.0
4/15/13	4/17/13	8000	46	3.6	41.3	7.5	5.6	5.3	5.1
4/15/13	4/17/13	10000	46	3.1	35.5	6.0	5.4	5.0	4.8
4/15/13	4/17/13	12500	46	2.8	35.7	5.2	4.7	4.3	4.1
4/15/13	4/17/13	16000	46	2.5	33.5	4.5	3.8	3.3	3.1
4/15/13	4/17/13	20000	46	1.2	32.9	3.2	2.6	2.0	1.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 51. PAPA017 (Oil Fork Road lek) hourly dBA metrics, April 15-17, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/15/2013	4/17/2013	0	2	20.3	37.0	25.4	27.4	24.7	22.6
4/15/2013	4/17/2013	1	2	19.3	53.6	28.5	27.7	25.3	22.9
4/15/2013	4/17/2013	2	2	18.1	37.5	24.7	26.0	23.6	21.3
4/15/2013	4/17/2013	3	2	17.4	42.6	27.0	28.9	23.6	22.0
4/15/2013	4/17/2013	4	2	15.2	46.5	31.4	28.5	24.6	22.9
4/15/2013	4/17/2013	5	2	15.2	54.3	32.3	31.1	27.3	23.8
4/15/2013	4/17/2013	6	2	17.5	50.1	32.7	33.1	29.7	26.9
4/15/2013	4/17/2013	7	2	18.5	40.8	25.4	27.5	24.5	21.9
4/15/2013	4/17/2013	8	2	18.6	47.0	27.8	29.6	25.4	22.3
4/15/2013	4/17/2013	9	2	17.8	40.8	28.4	30.7	26.5	22.8
4/16/2013	4/16/2013	10	1	19.7	52.4	28.1	31.3	24.4	21.9
4/16/2013	4/16/2013	11	1	19.2	27.5	21.7	23.1	21.3	20.3
4/15/2013	4/17/2013	12	2	18.0	43.7	26.9	29.3	23.7	20.5
4/15/2013	4/17/2013	13	2	19.0	58.2	31.6	29.5	23.7	21.3
4/15/2013	4/17/2013	14	2	19.4	44.1	26.8	28.2	24.4	22.3
4/15/2013	4/17/2013	15	2	19.4	42.1	27.5	30.0	24.3	21.9
4/15/2013	4/17/2013	16	2	19.5	45.4	28.5	30.5	25.4	22.6
4/15/2013	4/17/2013	17	2	19.3	56.7	31.9	30.3	25.4	22.9
4/15/2013	4/17/2013	18	2	18.1	47.7	30.8	30.6	26.3	23.5
4/15/2013	4/17/2013	19	2	18.7	49.4	31.6	31.9	27.3	24.5
4/15/2013	4/17/2013	20	2	18.9	50.4	27.6	28.9	26.6	24.4
4/15/2013	4/17/2013	21	2	17.6	47.7	29.2	29.4	27.0	23.9
4/15/2013	4/17/2013	22	2	16.4	36.2	27.8	27.2	24.7	22.6
4/15/2013	4/17/2013	23	2	18.3	36.0	25.7	27.9	24.9	22.1

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 52. PAPA017 (Oil Fork Road lek) dBA and one-third octave band metrics, April 15-17, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/15/13	4/17/13	dBA	46	15.2	58.2	29.2	28.6	24.9	22.2
4/15/13	4/17/13	12.5	46	25.3	78.3	53.5	50.6	44.1	39.3
4/15/13	4/17/13	16	46	25.1	77.6	51.2	49.7	44.1	39.3
4/15/13	4/17/13	20	46	29.6	75.9	57.6	60.8	50.8	46.2
4/15/13	4/17/13	25	46	27.6	70.6	48.9	50.3	46.3	42.8
4/15/13	4/17/13	31.5	46	26.1	69.4	55.9	58.2	52.7	46.8
4/15/13	4/17/13	40	46	24.6	64.5	43.8	45.1	41.8	38.0
4/15/13	4/17/13	50	46	24.1	63.8	40.7	41.5	37.7	34.8
4/15/13	4/17/13	63	46	21.8	62.8	40.8	40.0	36.8	33.7
4/15/13	4/17/13	80	46	17.2	68.7	38.0	36.7	32.8	29.2
4/15/13	4/17/13	100	46	13.4	69.9	37.4	35.5	30.1	26.7
4/15/13	4/17/13	125	46	7.5	74.7	37.8	34.8	29.2	25.6
4/15/13	4/17/13	160	46	4.5	71.3	32.9	32.3	27.6	24.0
4/15/13	4/17/13	200	46	4.5	57.8	30.9	30.6	26.5	22.5
4/15/13	4/17/13	250	46	1.1	55.1	26.8	26.9	23.0	19.2
4/15/13	4/17/13	315	46	-1.1	47.9	23.1	23.5	18.9	15.6
4/15/13	4/17/13	400	46	-3.0	49.2	19.9	19.1	15.1	11.1
4/15/13	4/17/13	500	46	-3.4	47.3	16.8	14.8	9.3	6.1
4/15/13	4/17/13	630	46	-3.4	41.4	13.9	10.7	4.9	1.2
4/15/13	4/17/13	800	46	-3.1	39.4	12.2	8.5	2.9	-0.1
4/15/13	4/17/13	1000	46	-2.1	50.9	12.2	9.1	1.7	-0.1
4/15/13	4/17/13	1250	46	-1.3	42.2	11.6	7.7	1.3	0.3
4/15/13	4/17/13	1600	46	-0.5	37.5	11.6	5.6	1.6	1.0
4/15/13	4/17/13	2000	46	0.6	33.7	10.1	3.8	2.3	1.7
4/15/13	4/17/13	2500	46	1.6	35.2	8.5	3.6	2.9	2.5
4/15/13	4/17/13	3150	46	2.5	48.5	11.2	4.1	3.7	3.3
4/15/13	4/17/13	4000	46	3.2	38.5	6.6	4.8	4.4	4.1
4/15/13	4/17/13	5000	46	2.7	45.2	7.0	5.3	4.9	4.7
4/15/13	4/17/13	6300	46	2.7	41.5	5.9	5.5	5.2	5.0
4/15/13	4/17/13	8000	46	2.2	29.5	5.7	5.5	5.3	5.1
4/15/13	4/17/13	10000	46	2.4	26.2	5.5	5.2	5.0	4.9
4/15/13	4/17/13	12500	46	1.9	26.2	5.0	4.7	4.5	4.3
4/15/13	4/17/13	16000	46	1.8	23.6	4.3	3.9	3.6	3.5
4/15/13	4/17/13	20000	46	1.7	20.5	3.1	3.0	2.4	2.3

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 53. PAPA018 (Mesa Road 3 lek) hourly dBA metrics, April 15-17, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/15/2013	4/17/2013	0	2	16.2	35.7	26.6	30.1	24.2	20.2
4/15/2013	4/17/2013	1	2	21.6	47.6	28.2	30.2	27.0	25.0
4/15/2013	4/17/2013	2	2	22.4	36.7	28.8	31.0	28.2	25.5
4/15/2013	4/17/2013	3	2	19.0	40.6	29.7	29.4	27.2	25.3
4/15/2013	4/17/2013	4	2	14.9	48.5	33.7	30.5	25.4	23.3
4/15/2013	4/17/2013	5	2	14.4	50.7	33.0	30.5	24.5	23.0
4/15/2013	4/17/2013	6	2	19.6	49.2	33.5	34.7	29.9	26.3
4/15/2013	4/17/2013	7	2	19.2	45.3	31.1	33.3	28.2	23.2
4/15/2013	4/17/2013	8	2	16.7	46.5	26.4	27.6	22.5	20.1
4/15/2013	4/17/2013	9	2	17.4	50.1	27.3	29.7	24.3	19.7
4/15/2013	4/17/2013	10	2	17.4	42.2	26.5	29.7	23.3	19.8
4/16/2013	4/16/2013	11	1	18.0	34.6	21.7	23.4	20.8	19.6
4/15/2013	4/17/2013	12	2	16.4	44.4	27.8	31.2	23.6	19.3
4/15/2013	4/17/2013	13	2	16.5	59.1	33.0	29.3	23.1	19.3
4/15/2013	4/17/2013	14	2	17.1	45.2	26.8	29.7	23.4	19.7
4/15/2013	4/17/2013	15	2	17.3	56.7	30.6	31.4	23.5	19.8
4/15/2013	4/17/2013	16	2	16.9	42.6	27.6	29.5	23.1	19.5
4/15/2013	4/17/2013	17	2	16.8	49.8	30.8	31.9	24.1	19.6
4/15/2013	4/17/2013	18	2	15.3	49.3	34.1	33.4	25.8	22.2
4/15/2013	4/17/2013	19	2	15.1	47.7	30.8	30.1	24.1	20.1
4/15/2013	4/17/2013	20	2	15.6	37.0	23.5	25.9	21.1	18.4
4/15/2013	4/17/2013	21	2	14.5	61.4	33.0	25.2	21.8	18.0
4/15/2013	4/17/2013	22	2	15.2	35.9	24.3	24.7	21.5	20.0
4/15/2013	4/17/2013	23	2	14.8	40.0	25.0	27.7	24.4	19.2

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 54. PAPA018 (Mesa Road 3 lek) dBA and one-third octave band metrics, April 15-17, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/15/13	4/17/13	dBA	47	14.4	61.4	30.2	29.3	24.1	20.1
4/15/13	4/17/13	12.5	47	19.0	78.4	55.6	47.9	41.8	36.8
4/15/13	4/17/13	16	47	23.7	75.3	51.9	50.1	44.7	38.4
4/15/13	4/17/13	20	47	29.4	75.1	56.4	58.5	49.3	45.1
4/15/13	4/17/13	25	47	22.0	70.9	46.4	45.5	41.0	36.5
4/15/13	4/17/13	31.5	47	23.7	69.4	50.8	51.6	45.4	39.5
4/15/13	4/17/13	40	47	21.0	65.1	42.6	42.7	37.8	34.3
4/15/13	4/17/13	50	47	20.6	64.2	40.8	40.6	36.0	32.1
4/15/13	4/17/13	63	47	17.8	66.0	41.0	40.8	34.7	30.7
4/15/13	4/17/13	80	47	14.1	68.8	37.8	37.8	31.5	26.4
4/15/13	4/17/13	100	47	12.9	77.6	38.6	37.3	29.8	25.2
4/15/13	4/17/13	125	47	11.6	76.8	36.6	35.0	28.8	24.0
4/15/13	4/17/13	160	47	8.4	60.3	33.0	32.7	26.1	22.4
4/15/13	4/17/13	200	47	7.6	68.3	33.4	32.4	26.2	21.8
4/15/13	4/17/13	250	47	2.7	63.9	27.9	28.0	22.7	18.0
4/15/13	4/17/13	315	47	-0.1	52.9	25.3	24.3	19.3	15.0
4/15/13	4/17/13	400	47	-3.3	57.8	22.4	19.1	13.9	9.8
4/15/13	4/17/13	500	47	-3.8	59.7	20.4	14.6	9.1	4.7
4/15/13	4/17/13	630	47	-3.9	52.9	16.2	10.8	5.0	1.0
4/15/13	4/17/13	800	47	-3.6	39.9	13.2	10.7	2.8	-0.3
4/15/13	4/17/13	1000	47	-2.9	38.3	12.7	8.3	0.5	-1.1
4/15/13	4/17/13	1250	47	-2.4	34.1	13.1	6.8	-0.2	-0.9
4/15/13	4/17/13	1600	47	-1.5	35.5	13.0	3.8	0.2	-0.4
4/15/13	4/17/13	2000	47	-0.7	37.3	11.8	3.0	0.9	0.3
4/15/13	4/17/13	2500	47	0.2	36.9	9.7	2.6	1.5	1.1
4/15/13	4/17/13	3150	47	1.2	34.4	7.0	2.8	2.2	1.9
4/15/13	4/17/13	4000	47	2.2	43.8	5.9	3.4	3.0	2.8
4/15/13	4/17/13	5000	47	2.9	47.8	7.5	4.1	3.8	3.6
4/15/13	4/17/13	6300	47	2.8	54.3	10.2	4.7	4.5	4.4
4/15/13	4/17/13	8000	47	2.6	55.8	13.4	5.2	5.1	4.9
4/15/13	4/17/13	10000	47	2.7	36.8	5.9	5.5	5.3	5.2
4/15/13	4/17/13	12500	47	2.5	28.0	5.7	5.2	4.8	4.7
4/15/13	4/17/13	16000	47	1.6	33.5	3.9	3.2	2.8	2.6
4/15/13	4/17/13	20000	47	-0.4	19.2	1.1	0.7	0.2	0.0

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 55. PAPA019 (Bloom Reservoir lek) hourly dBA metrics, April 15-17, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/15/2013	4/17/2013	0	2	15.1	37.4	23.7	25.6	21.5	17.9
4/15/2013	4/17/2013	1	2	18.7	42.5	29.4	29.9	25.9	23.1
4/15/2013	4/17/2013	2	2	20.6	38.2	24.7	26.1	24.2	23.0
4/15/2013	4/17/2013	3	2	23.0	43.1	30.0	32.3	27.8	25.5
4/15/2013	4/17/2013	4	2	19.2	44.4	28.8	30.1	27.9	25.6
4/15/2013	4/17/2013	5	2	16.2	60.1	27.0	26.0	23.4	21.8
4/15/2013	4/17/2013	6	2	20.6	37.7	26.2	27.4	25.3	23.8
4/15/2013	4/17/2013	7	2	18.5	39.3	25.7	27.5	24.4	21.3
4/15/2013	4/17/2013	8	2	15.6	43.7	24.0	24.5	20.3	18.4
4/15/2013	4/17/2013	9	2	16.5	38.5	23.4	26.4	21.5	18.0
4/15/2013	4/17/2013	10	2	16.1	41.0	24.8	27.6	21.4	18.2
4/16/2013	4/16/2013	11	1	15.9	36.1	18.9	20.5	17.9	16.8
4/16/2013	4/16/2013	12	1	15.5	42.0	22.2	24.7	19.2	16.6
4/15/2013	4/17/2013	13	2	15.7	55.9	31.2	27.6	21.2	17.5
4/15/2013	4/17/2013	14	2	16.2	43.1	26.2	27.7	21.4	17.6
4/15/2013	4/17/2013	15	2	15.5	52.2	30.0	32.3	22.5	17.9
4/15/2013	4/17/2013	16	2	15.6	47.1	29.1	30.2	23.1	18.6
4/15/2013	4/17/2013	17	2	16.6	51.8	32.1	34.3	26.2	20.5
4/15/2013	4/17/2013	18	2	15.7	53.1	34.1	32.0	26.1	22.2
4/15/2013	4/17/2013	19	2	15.9	48.4	31.0	30.1	24.3	19.3
4/15/2013	4/17/2013	20	2	14.9	53.8	24.8	26.2	19.7	17.5
4/15/2013	4/17/2013	21	2	16.0	61.2	33.2	26.2	21.0	17.9
4/15/2013	4/17/2013	22	2	14.7	35.4	19.0	21.0	17.4	15.5
4/15/2013	4/17/2013	23	2	14.9	29.3	20.0	22.2	19.4	16.7

Appendix B. dBA and One-third Octave Metrics for PAPA Treatment Leks (cont.).

Table 56. PAPA019 (Bloom Reservoir lek) dBA and one-third octave band metrics, April 15-17, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/15/13	4/17/13	dBA	46	14.7	61.2	28.6	26.6	22.0	18.3
4/15/13	4/17/13	12.5	46	16.2	73.2	47.0	43.7	38.5	33.9
4/15/13	4/17/13	16	46	19.9	69.7	46.2	44.9	40.0	34.9
4/15/13	4/17/13	20	46	22.6	71.7	52.3	52.9	43.9	39.5
4/15/13	4/17/13	25	46	20.7	63.8	42.1	42.2	36.7	32.1
4/15/13	4/17/13	31.5	46	20.7	63.6	45.9	45.2	39.5	33.6
4/15/13	4/17/13	40	46	18.5	60.9	39.5	39.1	34.3	29.6
4/15/13	4/17/13	50	46	16.6	59.7	38.4	39.0	33.1	28.8
4/15/13	4/17/13	63	46	18.5	65.6	39.2	38.6	32.9	28.5
4/15/13	4/17/13	80	46	14.5	76.9	37.9	36.8	30.8	26.7
4/15/13	4/17/13	100	46	14.3	74.5	37.1	35.3	28.8	24.9
4/15/13	4/17/13	125	46	11.3	71.6	34.3	33.1	27.1	22.5
4/15/13	4/17/13	160	46	7.8	60.1	30.4	29.4	24.5	20.0
4/15/13	4/17/13	200	46	4.8	68.0	29.5	27.6	22.5	18.2
4/15/13	4/17/13	250	46	1.1	65.3	25.3	23.4	18.5	14.9
4/15/13	4/17/13	315	46	-1.9	52.1	21.3	20.5	14.7	10.8
4/15/13	4/17/13	400	46	-3.3	56.2	19.8	16.1	10.0	5.8
4/15/13	4/17/13	500	46	-3.9	56.8	18.9	12.2	5.4	1.0
4/15/13	4/17/13	630	46	-3.6	52.4	16.2	8.6	1.9	-1.4
4/15/13	4/17/13	800	46	-3.3	48.5	13.7	8.2	0.5	-1.5
4/15/13	4/17/13	1000	46	-2.4	50.7	14.4	7.7	0.2	-1.0
4/15/13	4/17/13	1250	46	-1.6	53.4	15.1	6.9	0.4	-0.3
4/15/13	4/17/13	1600	46	-0.7	54.4	14.7	5.9	1.1	0.5
4/15/13	4/17/13	2000	46	0.3	49.9	12.4	3.5	1.8	1.3
4/15/13	4/17/13	2500	46	1.3	43.8	10.2	3.1	2.5	2.0
4/15/13	4/17/13	3150	46	2.1	35.2	7.4	3.7	3.2	2.9
4/15/13	4/17/13	4000	46	2.0	37.0	5.4	4.3	3.9	3.6
4/15/13	4/17/13	5000	46	2.4	35.9	5.1	4.7	4.4	4.2
4/15/13	4/17/13	6300	46	1.4	37.7	5.1	4.9	4.7	4.5
4/15/13	4/17/13	8000	46	1.1	29.6	4.9	4.8	4.6	4.4
4/15/13	4/17/13	10000	46	0.5	32.1	4.5	4.5	4.2	4.0
4/15/13	4/17/13	12500	46	0.0	28.3	3.8	3.8	3.5	3.3
4/15/13	4/17/13	16000	46	-0.4	26.5	2.9	2.9	2.5	2.3
4/15/13	4/17/13	20000	46	-0.3	26.4	1.3	1.4	0.9	0.6

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites.

Table 57. PAPA201 (Injection Well 100 m) hourly dBA metrics, April 14-15, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/15/2013	4/15/2013	0	1	53.8	58.4	56.0	56.8	55.9	55.1
4/15/2013	4/15/2013	1	1	53.9	58.3	56.2	56.9	56.1	55.4
4/15/2013	4/15/2013	2	1	53.3	58.4	56.2	57.1	56.2	54.9
4/15/2013	4/15/2013	3	1	52.7	57.5	55.3	56.1	55.3	54.4
4/15/2013	4/15/2013	4	1	53.2	58.2	56.3	57.0	56.3	55.4
4/15/2013	4/15/2013	5	1	53.3	57.9	56.3	57.0	56.3	55.6
4/15/2013	4/15/2013	6	1	53.5	57.9	56.1	56.8	56.1	55.4
4/15/2013	4/15/2013	7	1	54.3	58.2	56.4	57.0	56.4	55.8
4/15/2013	4/15/2013	8	1	53.5	58.0	56.2	56.8	56.2	55.4
4/14/2013	4/15/2013	9	2	50.2	58.1	55.3	56.2	55.3	54.3
4/14/2013	4/15/2013	10	2	50.3	66.3	55.5	56.1	55.3	54.3
4/14/2013	4/15/2013	11	2	50.5	58.0	55.3	56.0	55.1	54.0
4/14/2013	4/15/2013	12	2	50.5	60.9	54.9	56.0	55.0	52.7
4/14/2013	4/14/2013	13	1	50.3	57.6	54.5	55.5	54.4	53.2
4/14/2013	4/14/2013	14	1	50.9	62.1	54.6	55.6	54.6	53.3
4/14/2013	4/14/2013	15	1	51.5	57.7	55.6	56.5	55.6	54.4
4/14/2013	4/14/2013	16	1	52.1	58.1	55.6	56.5	55.7	54.5
4/14/2013	4/14/2013	17	1	52.2	57.4	55.6	56.5	55.6	54.4
4/14/2013	4/14/2013	18	1	52.1	57.1	55.2	55.9	55.2	54.3
4/14/2013	4/14/2013	19	1	52.6	57.4	55.6	56.2	55.6	54.9
4/14/2013	4/14/2013	20	1	53.7	59.1	55.9	56.5	55.9	55.2
4/14/2013	4/14/2013	21	1	53.8	64.7	55.9	56.4	55.9	55.2
4/14/2013	4/14/2013	22	1	53.8	57.9	56.2	56.7	56.2	55.6
4/14/2013	4/14/2013	23	1	52.9	57.3	55.6	56.3	55.6	54.9

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 58. PAPA201 (Injection Well 100 m) dBA and one-third octave band metrics, April 14-15, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/14/13	4/15/13	dBA	28	50.2	66.3	55.6	56.5	55.8	54.9
4/14/13	4/15/13	12.5	28	29.0	76.4	56.2	50.5	46.0	42.4
4/14/13	4/15/13	16	28	33.9	76.6	54.7	51.1	47.7	44.7
4/14/13	4/15/13	20	28	40.0	74.9	55.4	54.8	52.0	48.5
4/14/13	4/15/13	25	28	43.0	72.6	54.2	53.9	51.8	49.6
4/14/13	4/15/13	31.5	28	44.7	70.7	56.1	58.0	55.7	52.4
4/14/13	4/15/13	40	28	49.2	77.7	59.3	61.1	59.1	56.3
4/14/13	4/15/13	50	28	49.0	68.2	60.7	61.8	60.7	59.4
4/14/13	4/15/13	63	28	53.9	78.3	67.7	69.2	67.6	65.6
4/14/13	4/15/13	80	28	55.2	77.2	65.9	66.2	65.0	63.9
4/14/13	4/15/13	100	28	56.4	79.0	71.8	73.3	72.4	71.5
4/14/13	4/15/13	125	28	50.8	77.7	60.5	61.9	60.5	59.2
4/14/13	4/15/13	160	28	48.5	73.1	58.4	59.5	58.4	57.3
4/14/13	4/15/13	200	28	45.9	72.8	57.6	58.8	57.7	56.5
4/14/13	4/15/13	250	28	36.9	62.2	49.0	50.3	48.9	47.6
4/14/13	4/15/13	315	28	37.4	53.6	48.4	49.9	48.4	47.0
4/14/13	4/15/13	400	28	30.6	50.0	43.7	45.4	43.7	42.2
4/14/13	4/15/13	500	28	27.3	48.7	38.9	40.5	38.6	36.5
4/14/13	4/15/13	630	28	24.8	47.5	37.6	39.2	37.0	34.4
4/14/13	4/15/13	800	28	17.4	47.0	33.3	35.3	32.6	30.0
4/14/13	4/15/13	1000	28	14.1	47.5	31.6	34.3	30.8	28.0
4/14/13	4/15/13	1250	28	11.7	47.4	31.6	33.6	31.1	28.1
4/14/13	4/15/13	1600	28	9.9	45.8	33.8	35.9	33.4	29.8
4/14/13	4/15/13	2000	28	8.8	47.0	32.8	34.8	32.0	28.2
4/14/13	4/15/13	2500	28	7.5	47.6	32.8	35.0	32.2	27.6
4/14/13	4/15/13	3150	28	8.0	46.5	31.0	34.0	30.7	25.5
4/14/13	4/15/13	4000	28	8.4	44.3	28.7	30.8	27.9	22.1
4/14/13	4/15/13	5000	28	7.4	53.0	26.2	28.1	24.6	19.4
4/14/13	4/15/13	6300	28	6.8	60.0	22.6	24.6	21.3	16.4
4/14/13	4/15/13	8000	28	6.1	37.0	16.5	19.4	16.6	12.0
4/14/13	4/15/13	10000	28	4.6	33.4	12.1	13.8	11.2	8.3
4/14/13	4/15/13	12500	28	3.8	32.7	8.2	9.9	7.2	5.9
4/14/13	4/15/13	16000	28	3.2	28.1	5.5	6.1	4.7	4.1
4/14/13	4/15/13	20000	28	1.8	23.3	4.0	3.3	2.8	2.5

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 59. PAPA202 (Injection Well 200 m) hourly dBA metrics, April 14-15, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/15/2013	4/15/2013	0	1	46.0	51.5	49.2	50.1	49.2	48.2
4/15/2013	4/15/2013	1	1	46.1	51.6	49.4	50.2	49.3	48.4
4/15/2013	4/15/2013	2	1	45.1	52.0	49.3	50.4	49.3	47.7
4/15/2013	4/15/2013	3	1	44.6	51.0	48.4	49.4	48.3	47.1
4/15/2013	4/15/2013	4	1	46.0	51.6	49.2	50.0	49.1	48.2
4/15/2013	4/15/2013	5	1	45.8	51.0	49.3	50.1	49.3	48.2
4/15/2013	4/15/2013	6	1	45.7	51.2	49.0	49.7	48.9	48.1
4/15/2013	4/15/2013	7	1	46.1	50.9	49.3	50.0	49.2	48.4
4/15/2013	4/15/2013	8	1	45.0	51.2	48.8	49.7	48.8	47.9
4/14/2013	4/15/2013	9	2	38.4	51.0	47.4	48.4	47.0	45.4
4/14/2013	4/15/2013	10	2	37.8	52.8	47.4	48.1	46.7	45.3
4/14/2013	4/15/2013	11	2	37.5	53.9	47.4	48.3	46.8	45.2
4/14/2013	4/15/2013	12	2	39.4	51.1	47.1	48.4	46.8	44.2
4/14/2013	4/14/2013	13	1	39.5	61.0	45.9	47.6	45.5	43.2
4/14/2013	4/14/2013	14	1	38.3	59.8	46.1	47.9	45.8	43.2
4/14/2013	4/14/2013	15	1	39.1	51.6	47.9	49.5	47.9	45.4
4/14/2013	4/14/2013	16	1	41.0	51.2	48.1	49.5	48.2	45.5
4/14/2013	4/14/2013	17	1	39.9	51.4	47.9	49.3	47.9	45.3
4/14/2013	4/14/2013	18	1	42.1	50.2	47.2	48.4	47.1	45.4
4/14/2013	4/14/2013	19	1	44.1	52.1	48.0	48.9	47.9	46.9
4/14/2013	4/14/2013	20	1	45.1	52.6	48.4	49.1	48.3	47.6
4/14/2013	4/14/2013	21	1	45.4	62.1	48.8	49.1	48.5	47.7
4/14/2013	4/14/2013	22	1	46.5	50.9	49.2	49.9	49.2	48.3
4/14/2013	4/14/2013	23	1	46.1	50.9	49.1	49.8	49.0	48.3

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 60. PAPA202 (Injection Well 200 m) dBA and one-third octave band metrics, April 14-15, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/14/13	4/15/13	dBA	28	37.5	62.1	48.2	49.5	48.5	47.7
4/14/13	4/15/13	12.5	28	26.5	74.3	52.8	47.1	43.2	39.2
4/14/13	4/15/13	16	28	28.7	71.7	50.0	48.6	44.8	40.4
4/14/13	4/15/13	20	28	31.9	73.5	50.2	52.5	47.3	43.2
4/14/13	4/15/13	25	28	37.2	66.9	47.7	48.3	46.0	43.4
4/14/13	4/15/13	31.5	28	39.8	67.6	50.9	52.9	50.5	47.1
4/14/13	4/15/13	40	28	42.8	71.5	53.2	55.3	53.3	50.5
4/14/13	4/15/13	50	28	44.2	67.8	55.2	56.5	55.4	54.1
4/14/13	4/15/13	63	28	44.2	76.8	63.1	64.7	63.2	61.1
4/14/13	4/15/13	80	28	43.4	77.9	59.4	60.9	59.2	57.7
4/14/13	4/15/13	100	28	44.7	79.5	65.4	67.1	65.9	64.7
4/14/13	4/15/13	125	28	35.8	77.0	53.2	54.7	53.3	51.8
4/14/13	4/15/13	160	28	34.2	70.4	49.7	51.5	50.2	47.5
4/14/13	4/15/13	200	28	30.7	71.6	47.0	48.9	47.3	44.4
4/14/13	4/15/13	250	28	26.0	59.5	39.1	40.9	39.0	36.1
4/14/13	4/15/13	315	28	23.7	49.9	37.3	39.4	37.2	34.3
4/14/13	4/15/13	400	28	17.9	49.3	31.7	33.6	31.1	27.3
4/14/13	4/15/13	500	28	11.5	50.8	26.9	28.8	26.3	22.4
4/14/13	4/15/13	630	28	7.9	44.2	25.1	26.9	23.8	19.7
4/14/13	4/15/13	800	28	3.8	42.6	22.1	24.6	21.0	16.8
4/14/13	4/15/13	1000	28	2.0	44.4	21.0	23.3	19.6	14.4
4/14/13	4/15/13	1250	28	2.5	40.5	22.2	25.0	20.8	14.3
4/14/13	4/15/13	1600	28	3.3	42.7	24.3	27.5	21.7	13.2
4/14/13	4/15/13	2000	28	3.1	37.7	21.9	25.7	19.1	10.2
4/14/13	4/15/13	2500	28	3.0	35.9	20.3	23.6	16.2	8.3
4/14/13	4/15/13	3150	28	3.7	35.1	17.5	20.1	12.7	7.1
4/14/13	4/15/13	4000	28	4.0	37.8	14.2	16.0	9.8	6.3
4/14/13	4/15/13	5000	28	4.3	46.0	10.8	12.1	7.8	5.7
4/14/13	4/15/13	6300	28	3.4	43.5	7.4	8.9	6.6	5.4
4/14/13	4/15/13	8000	28	1.9	60.7	14.2	6.3	5.4	5.1
4/14/13	4/15/13	10000	28	0.8	44.6	5.8	5.3	4.9	4.7
4/14/13	4/15/13	12500	28	0.1	23.9	4.8	4.9	4.4	4.3
4/14/13	4/15/13	16000	28	0.4	39.9	4.4	4.4	3.8	3.5
4/14/13	4/15/13	20000	28	0.7	21.9	3.4	3.4	2.6	2.3

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 61. PAPA203 (Well Pad, 3 wells, 50 m) hourly dBA metrics, April 15-16, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/16/2013	4/16/2013	0	1	34.2	45.1	40.2	42.2	39.8	37.1
4/16/2013	4/16/2013	1	1	33.7	40.9	37.7	39.6	37.3	35.6
4/16/2013	4/16/2013	2	1	32.5	42.6	37.4	39.9	36.6	34.4
4/16/2013	4/16/2013	3	1	31.9	40.8	37.1	39.1	37.0	33.9
4/16/2013	4/16/2013	4	1	32.6	41.3	37.8	39.7	37.6	35.0
4/16/2013	4/16/2013	5	1	32.7	41.5	37.4	39.2	37.2	35.1
4/16/2013	4/16/2013	6	1	33.3	41.1	37.2	38.9	37.0	35.2
4/16/2013	4/16/2013	7	1	31.8	41.6	37.7	39.9	37.4	34.2
4/16/2013	4/16/2013	8	1	32.3	47.5	37.9	40.0	37.3	34.8
4/16/2013	4/16/2013	9	1	32.0	44.1	37.4	39.6	36.9	34.1
4/16/2013	4/16/2013	10	1	31.9	40.3	36.8	38.6	36.7	33.9
4/16/2013	4/16/2013	11	1	30.8	53.9	38.2	39.9	37.1	34.0
4/16/2013	4/16/2013	12	1	32.7	44.2	37.9	39.7	37.6	35.5
4/16/2013	4/16/2013	13	1	32.5	41.7	36.8	38.0	36.8	35.2
4/16/2013	4/16/2013	14	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	15	0	NA	NA	NA	NA	NA	NA
4/15/2013	4/15/2013	16	1	35.1	44.0	38.0	39.0	37.9	36.9
4/15/2013	4/15/2013	17	1	35.6	53.4	39.9	41.3	38.9	37.7
4/15/2013	4/15/2013	18	1	36.0	49.6	41.2	42.8	41.1	38.4
4/15/2013	4/15/2013	19	1	35.9	44.5	38.9	39.8	38.7	37.7
4/15/2013	4/15/2013	20	1	34.6	47.0	38.7	39.7	38.3	37.1
4/15/2013	4/15/2013	21	1	35.2	59.0	40.4	40.0	38.5	37.4
4/15/2013	4/15/2013	22	1	35.4	43.9	38.8	40.3	38.5	37.3
4/15/2013	4/15/2013	23	1	34.2	42.2	38.3	40.2	37.9	36.7

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 62. PAPA203 (Well Pad, 3 wells, 50 m) dBA and one-third octave band metrics, April 15-16, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/15/13	4/16/13	dBA	22	30.8	59.0	38.4	39.8	37.5	35.4
4/15/13	4/16/13	12.5	22	29.5	77.5	55.6	53.6	47.6	42.3
4/15/13	4/16/13	16	22	32.2	76.0	54.0	53.1	48.9	44.9
4/15/13	4/16/13	20	22	39.8	74.3	55.5	56.4	53.3	49.2
4/15/13	4/16/13	25	22	39.3	70.1	53.1	54.7	51.3	48.1
4/15/13	4/16/13	31.5	22	37.7	66.7	49.1	50.3	48.0	45.7
4/15/13	4/16/13	40	22	39.9	68.7	54.0	55.4	53.2	50.0
4/15/13	4/16/13	50	22	40.6	66.5	61.4	63.2	61.1	56.3
4/15/13	4/16/13	63	22	32.0	68.3	55.3	60.2	46.7	40.8
4/15/13	4/16/13	80	22	33.2	63.8	47.2	51.0	42.6	40.0
4/15/13	4/16/13	100	22	34.8	67.8	44.7	46.2	44.1	42.3
4/15/13	4/16/13	125	22	36.3	68.0	43.0	43.8	42.1	40.5
4/15/13	4/16/13	160	22	36.9	62.3	44.3	45.3	43.8	42.1
4/15/13	4/16/13	200	22	31.9	66.3	39.0	39.0	37.7	36.6
4/15/13	4/16/13	250	22	26.4	63.8	37.7	39.4	37.0	33.4
4/15/13	4/16/13	315	22	20.8	55.7	29.2	29.0	27.4	26.0
4/15/13	4/16/13	400	22	18.0	48.4	28.0	28.6	27.0	24.9
4/15/13	4/16/13	500	22	14.1	48.2	24.1	23.5	22.0	20.5
4/15/13	4/16/13	630	22	9.8	44.7	20.6	17.9	16.5	15.3
4/15/13	4/16/13	800	22	7.1	39.4	17.4	15.2	13.2	11.8
4/15/13	4/16/13	1000	22	5.4	38.7	15.2	13.0	10.5	9.3
4/15/13	4/16/13	1250	22	3.2	39.7	14.6	11.9	9.4	7.8
4/15/13	4/16/13	1600	22	3.4	43.5	15.3	13.0	10.6	8.9
4/15/13	4/16/13	2000	22	3.3	44.3	15.3	13.4	10.1	8.7
4/15/13	4/16/13	2500	22	3.7	45.9	14.9	13.2	10.1	8.3
4/15/13	4/16/13	3150	22	3.9	46.1	13.9	12.5	9.0	7.2
4/15/13	4/16/13	4000	22	4.4	44.4	11.5	10.2	7.2	5.9
4/15/13	4/16/13	5000	22	4.3	40.1	9.4	8.3	6.0	5.2
4/15/13	4/16/13	6300	22	3.4	40.5	7.5	7.5	5.8	5.2
4/15/13	4/16/13	8000	22	2.1	39.2	6.6	6.3	5.3	5.0
4/15/13	4/16/13	10000	22	1.6	23.2	5.4	5.9	5.0	4.7
4/15/13	4/16/13	12500	22	1.3	18.8	4.7	4.8	4.4	4.1
4/15/13	4/16/13	16000	22	1.0	16.0	4.0	4.2	3.6	3.3
4/15/13	4/16/13	20000	22	1.3	14.1	2.9	3.0	2.4	2.1

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 63. PAPA204 (Well Pad, 3 wells, 100 m) hourly dBA metrics, April 15-16, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/16/2013	4/16/2013	0	1	28.1	38.7	33.6	35.5	33.5	30.4
4/16/2013	4/16/2013	1	1	27.1	39.2	32.1	35.1	30.5	28.9
4/16/2013	4/16/2013	2	1	26.1	37.3	32.3	35.7	30.3	28.0
4/16/2013	4/16/2013	3	1	26.5	36.6	31.7	34.2	30.9	28.6
4/16/2013	4/16/2013	4	1	27.6	39.7	32.7	34.8	31.9	29.9
4/16/2013	4/16/2013	5	1	27.1	38.7	31.8	33.9	31.1	29.1
4/16/2013	4/16/2013	6	1	27.5	36.3	31.9	34.1	31.2	29.5
4/16/2013	4/16/2013	7	1	25.5	37.1	32.3	35.4	30.8	28.1
4/16/2013	4/16/2013	8	1	25.8	44.8	32.5	35.1	31.2	28.8
4/16/2013	4/16/2013	9	1	24.7	41.8	31.5	34.5	29.9	27.3
4/16/2013	4/16/2013	10	1	24.5	36.8	30.5	33.1	29.5	26.6
4/16/2013	4/16/2013	11	1	23.8	43.3	31.7	34.2	30.4	26.8
4/16/2013	4/16/2013	12	1	26.1	40.8	32.7	35.4	31.5	28.6
4/16/2013	4/16/2013	13	1	24.8	38.7	30.4	32.1	30.1	27.9
4/15/2013	4/15/2013	14	0	NA	NA	NA	NA	NA	NA
4/15/2013	4/15/2013	15	0	NA	NA	NA	NA	NA	NA
4/15/2013	4/15/2013	16	1	27.9	46.7	35.3	38.0	33.8	31.1
4/15/2013	4/15/2013	17	1	30.1	55.6	40.2	43.3	38.1	33.8
4/15/2013	4/15/2013	18	1	32.4	51.2	40.6	43.6	39.0	35.7
4/15/2013	4/15/2013	19	1	30.5	47.4	36.5	39.1	35.3	33.1
4/15/2013	4/15/2013	20	1	28.4	48.2	34.3	35.9	32.9	30.9
4/15/2013	4/15/2013	21	1	29.8	60.7	38.3	37.6	34.4	32.0
4/15/2013	4/15/2013	22	1	29.0	41.6	33.8	36.0	32.9	31.0
4/15/2013	4/15/2013	23	1	28.1	39.0	32.7	35.8	31.4	29.9

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 64. PAPA204 (Well Pad, 3 wells, 100 m) dBA and one-third octave band metrics, April 15-16, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/15/13	4/16/13	dBA	22	23.8	60.7	34.8	35.4	31.3	29.3
4/15/13	4/16/13	12.5	22	28.0	78.3	60.1	55.9	49.6	43.6
4/15/13	4/16/13	16	22	32.5	79.7	59.6	53.2	49.8	45.5
4/15/13	4/16/13	20	22	38.0	77.9	57.3	56.2	52.8	48.9
4/15/13	4/16/13	25	22	37.3	72.0	53.3	54.1	50.1	46.4
4/15/13	4/16/13	31.5	22	34.7	68.6	49.3	49.1	46.7	43.6
4/15/13	4/16/13	40	22	36.4	66.7	49.3	49.8	47.4	45.2
4/15/13	4/16/13	50	22	35.8	66.5	55.3	57.0	54.9	50.0
4/15/13	4/16/13	63	22	29.5	65.8	51.8	56.4	45.7	38.3
4/15/13	4/16/13	80	22	30.9	60.9	44.4	48.9	39.7	37.0
4/15/13	4/16/13	100	22	30.4	61.2	40.4	41.3	38.8	36.9
4/15/13	4/16/13	125	22	29.7	68.9	39.5	40.6	38.4	36.3
4/15/13	4/16/13	160	22	27.5	62.3	36.1	36.8	34.6	32.8
4/15/13	4/16/13	200	22	24.4	66.9	34.2	32.6	31.1	29.6
4/15/13	4/16/13	250	22	18.4	66.4	32.0	31.7	29.7	26.9
4/15/13	4/16/13	315	22	10.1	57.3	26.8	24.1	21.2	18.3
4/15/13	4/16/13	400	22	5.9	52.7	24.7	19.0	15.3	13.0
4/15/13	4/16/13	500	22	2.5	50.4	22.9	14.2	10.5	8.0
4/15/13	4/16/13	630	22	-0.1	45.2	20.5	10.6	6.5	4.2
4/15/13	4/16/13	800	22	-0.4	38.6	18.1	10.7	7.4	4.2
4/15/13	4/16/13	1000	22	-0.3	39.8	17.3	10.3	7.5	4.7
4/15/13	4/16/13	1250	22	0.0	36.5	18.4	10.9	8.1	4.7
4/15/13	4/16/13	1600	22	0.9	37.7	19.1	9.9	7.8	5.1
4/15/13	4/16/13	2000	22	1.4	39.3	18.9	10.7	8.2	5.1
4/15/13	4/16/13	2500	22	2.4	39.7	17.8	10.2	7.7	5.2
4/15/13	4/16/13	3150	22	3.1	39.4	15.5	9.0	6.2	4.9
4/15/13	4/16/13	4000	22	3.9	37.0	12.2	6.4	5.4	4.9
4/15/13	4/16/13	5000	22	4.6	33.4	9.5	6.0	5.5	5.2
4/15/13	4/16/13	6300	22	4.9	33.2	8.0	6.2	5.7	5.5
4/15/13	4/16/13	8000	22	4.7	29.3	7.3	6.3	5.7	5.5
4/15/13	4/16/13	10000	22	4.3	24.6	6.4	5.9	5.4	5.2
4/15/13	4/16/13	12500	22	3.9	25.8	5.6	5.3	4.7	4.4
4/15/13	4/16/13	16000	22	3.0	24.6	4.5	4.3	3.6	3.4
4/15/13	4/16/13	20000	22	1.6	21.8	3.1	2.9	2.2	1.9

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 65. PAPA205 (Central Gathering Facility, with generator, 255 m) hourly dBA metrics, April 16-17, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/17/2013	4/17/2013	0	1	33.0	46.3	36.9	38.6	36.4	34.9
4/17/2013	4/17/2013	1	1	31.2	45.0	35.7	37.3	35.2	33.5
4/17/2013	4/17/2013	2	1	31.3	40.7	36.7	38.1	36.7	34.4
4/17/2013	4/17/2013	3	1	32.1	50.5	39.0	42.1	36.8	34.7
4/17/2013	4/17/2013	4	1	29.9	41.9	33.6	35.0	33.2	31.6
4/17/2013	4/17/2013	5	1	32.1	39.9	35.0	36.0	35.0	33.7
4/17/2013	4/17/2013	6	1	33.1	44.1	36.5	37.9	36.2	35.0
4/17/2013	4/17/2013	7	1	25.5	37.6	31.8	33.8	31.5	28.5
4/17/2013	4/17/2013	8	1	25.0	40.8	30.3	32.0	29.9	28.1
4/17/2013	4/17/2013	9	1	25.5	44.1	31.4	33.5	30.3	28.4
4/16/2013	4/16/2013	10	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	11	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	12	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	13	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	14	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	15	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	16	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	17	1	30.5	67.8	38.2	36.2	34.2	32.6
4/16/2013	4/16/2013	18	1	32.1	43.6	35.9	37.3	35.6	34.1
4/16/2013	4/16/2013	19	1	31.5	41.7	36.1	37.8	35.7	34.2
4/16/2013	4/16/2013	20	1	33.5	41.5	37.6	39.3	37.2	35.6
4/16/2013	4/16/2013	21	1	35.1	44.2	39.6	40.6	39.6	38.2
4/16/2013	4/16/2013	22	1	33.8	43.4	37.3	38.7	37.0	35.6
4/16/2013	4/16/2013	23	1	32.4	46.2	38.4	40.4	37.9	35.5

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 66. PAPA205 (Central Gathering Facility, with generator, 255 m) dBA and one-third octave band metrics, April 16-17, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/16/13	4/17/13	dBA	17	25.0	67.8	36.6	37.8	35.7	34.2
4/16/13	4/17/13	12.5	17	32.1	71.1	53.4	54.7	53.0	51.6
4/16/13	4/17/13	16	17	32.6	71.5	51.2	53.3	48.1	44.5
4/16/13	4/17/13	20	17	39.8	74.6	61.1	66.4	56.2	51.1
4/16/13	4/17/13	25	17	39.6	69.1	52.4	52.7	50.5	48.2
4/16/13	4/17/13	31.5	17	38.6	78.9	66.4	68.9	64.8	58.4
4/16/13	4/17/13	40	17	35.4	64.3	50.1	52.0	49.1	46.0
4/16/13	4/17/13	50	17	32.0	64.7	49.5	51.6	49.7	47.5
4/16/13	4/17/13	63	17	36.0	62.7	52.4	54.1	51.1	48.0
4/16/13	4/17/13	80	17	35.1	60.8	52.3	54.3	52.4	47.1
4/16/13	4/17/13	100	17	28.8	60.8	43.8	45.5	43.5	41.1
4/16/13	4/17/13	125	17	27.4	62.3	41.6	42.7	40.3	37.6
4/16/13	4/17/13	160	17	24.6	55.9	35.5	36.8	33.8	30.8
4/16/13	4/17/13	200	17	22.0	54.5	33.9	34.6	30.7	28.3
4/16/13	4/17/13	250	17	17.3	54.4	32.9	34.5	30.6	27.7
4/16/13	4/17/13	315	17	12.0	56.1	31.8	34.0	29.8	26.6
4/16/13	4/17/13	400	17	8.8	61.7	30.2	31.4	27.4	23.5
4/16/13	4/17/13	500	17	3.0	60.4	25.5	26.4	22.9	19.5
4/16/13	4/17/13	630	17	-0.1	59.9	21.7	22.9	19.8	14.3
4/16/13	4/17/13	800	17	-0.1	56.3	19.8	21.7	17.8	12.7
4/16/13	4/17/13	1000	17	0.9	54.3	20.2	22.3	17.8	14.0
4/16/13	4/17/13	1250	17	0.9	49.6	20.9	20.7	16.6	12.2
4/16/13	4/17/13	1600	17	1.1	50.9	18.8	19.1	15.1	11.7
4/16/13	4/17/13	2000	17	1.5	50.5	15.2	14.8	11.2	7.6
4/16/13	4/17/13	2500	17	2.2	51.6	12.4	10.7	6.9	4.7
4/16/13	4/17/13	3150	17	2.9	53.5	10.6	6.2	4.7	4.0
4/16/13	4/17/13	4000	17	3.8	53.4	10.2	5.1	4.7	4.4
4/16/13	4/17/13	5000	17	4.5	52.8	10.6	5.6	5.2	5.0
4/16/13	4/17/13	6300	17	5.0	50.4	8.3	5.9	5.6	5.4
4/16/13	4/17/13	8000	17	4.8	45.7	7.2	5.7	5.6	5.4
4/16/13	4/17/13	10000	17	4.5	44.4	6.2	5.4	5.2	5.0
4/16/13	4/17/13	12500	17	3.9	40.2	4.9	4.6	4.4	4.2
4/16/13	4/17/13	16000	17	2.8	34.8	3.6	3.5	3.3	3.1
4/16/13	4/17/13	20000	17	1.4	36.1	2.3	2.2	1.9	1.8

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 67. PAPA206 (Central Gathering Facility, with generator, 555 m) hourly dBA metrics, April 16-17, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/17/2013	4/17/2013	0	1	33.0	44.2	36.7	38.6	36.2	34.8
4/17/2013	4/17/2013	1	1	33.1	46.7	37.5	39.4	36.9	35.2
4/17/2013	4/17/2013	2	1	34.2	42.4	38.1	39.6	37.9	36.0
4/17/2013	4/17/2013	3	1	34.4	53.5	41.5	44.8	38.6	36.4
4/17/2013	4/17/2013	4	1	33.1	44.9	36.5	38.3	35.8	34.8
4/17/2013	4/17/2013	5	1	34.1	39.6	36.4	37.9	36.0	35.2
4/17/2013	4/17/2013	6	1	35.6	43.7	38.1	39.2	37.9	36.8
4/17/2013	4/17/2013	7	1	31.6	50.5	37.4	39.0	35.9	34.1
4/17/2013	4/17/2013	8	1	31.1	44.5	36.7	38.7	36.1	33.8
4/17/2013	4/17/2013	9	1	31.3	43.8	37.2	39.6	36.5	33.9
4/17/2013	4/17/2013	10	0	NA	NA	NA	NA	NA	NA
4/17/2013	4/17/2013	11	0	NA	NA	NA	NA	NA	NA
4/17/2013	4/17/2013	12	0	NA	NA	NA	NA	NA	NA
4/17/2013	4/17/2013	13	0	NA	NA	NA	NA	NA	NA
4/17/2013	4/17/2013	14	0	NA	NA	NA	NA	NA	NA
4/17/2013	4/17/2013	15	0	NA	NA	NA	NA	NA	NA
4/17/2013	4/17/2013	16	0	NA	NA	NA	NA	NA	NA
4/17/2013	4/17/2013	17	0	NA	NA	NA	NA	NA	NA
4/16/2013	4/16/2013	18	1	36.6	47.0	41.0	42.9	40.5	38.6
4/16/2013	4/16/2013	19	1	37.7	50.1	41.6	43.5	41.0	39.2
4/16/2013	4/16/2013	20	1	37.2	45.2	41.5	42.9	41.3	39.7
4/16/2013	4/16/2013	21	1	38.5	44.9	41.7	42.7	41.6	40.5
4/16/2013	4/16/2013	22	1	34.4	41.8	37.8	39.4	37.4	36.1
4/16/2013	4/16/2013	23	1	33.7	47.3	38.2	40.2	37.4	35.7

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 68. PAPA206 (Central Gathering Facility, with generator, 555 m) dBA and one-third octave band metrics, April 16-17, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/16/13	4/17/13	dBA	16	31.1	53.5	39.1	39.5	37.4	35.9
4/16/13	4/17/13	12.5	16	33.9	69.7	59.2	60.5	59.5	58.4
4/16/13	4/17/13	16	16	35.6	69.4	52.2	54.4	49.1	45.5
4/16/13	4/17/13	20	16	44.2	76.0	62.8	67.1	58.6	53.5
4/16/13	4/17/13	25	16	42.3	64.7	57.1	58.5	56.8	54.2
4/16/13	4/17/13	31.5	16	42.8	74.4	63.3	66.3	62.5	57.9
4/16/13	4/17/13	40	16	40.9	63.2	52.0	53.5	51.6	49.5
4/16/13	4/17/13	50	16	38.1	66.0	53.1	55.8	53.4	50.8
4/16/13	4/17/13	63	16	42.1	67.1	54.0	55.1	53.0	51.2
4/16/13	4/17/13	80	16	43.2	60.9	51.8	52.4	50.6	49.2
4/16/13	4/17/13	100	16	36.2	60.5	46.8	47.6	45.3	43.3
4/16/13	4/17/13	125	16	34.9	58.5	45.8	47.4	43.7	41.6
4/16/13	4/17/13	160	16	30.0	57.3	42.0	43.6	39.5	37.3
4/16/13	4/17/13	200	16	29.6	59.3	39.0	41.4	37.2	34.0
4/16/13	4/17/13	250	16	24.6	52.7	35.8	38.0	34.6	31.3
4/16/13	4/17/13	315	16	23.3	51.7	35.1	36.5	33.4	30.7
4/16/13	4/17/13	400	16	18.8	51.4	34.3	34.9	30.8	27.8
4/16/13	4/17/13	500	16	9.9	45.6	28.1	28.0	25.0	22.0
4/16/13	4/17/13	630	16	3.3	36.5	22.1	23.7	20.6	17.6
4/16/13	4/17/13	800	16	1.9	33.9	20.3	22.3	19.1	15.9
4/16/13	4/17/13	1000	16	3.7	42.1	24.3	23.1	19.7	16.8
4/16/13	4/17/13	1250	16	3.7	41.3	23.2	20.2	17.2	14.7
4/16/13	4/17/13	1600	16	2.9	36.9	20.1	18.2	14.6	12.2
4/16/13	4/17/13	2000	16	2.9	35.8	17.7	15.7	11.4	8.6
4/16/13	4/17/13	2500	16	2.7	38.4	12.8	11.2	7.2	5.5
4/16/13	4/17/13	3150	16	2.8	48.9	15.0	10.1	4.6	4.0
4/16/13	4/17/13	4000	16	3.4	42.9	8.2	6.9	4.3	4.0
4/16/13	4/17/13	5000	16	3.2	33.5	5.7	5.2	4.7	4.5
4/16/13	4/17/13	6300	16	3.3	33.6	5.5	5.3	5.0	4.8
4/16/13	4/17/13	8000	16	3.3	38.1	6.3	5.3	5.0	4.8
4/16/13	4/17/13	10000	16	2.6	19.0	4.7	4.9	4.7	4.5
4/16/13	4/17/13	12500	16	2.7	17.7	4.1	4.3	4.1	3.9
4/16/13	4/17/13	16000	16	2.5	15.6	3.4	3.6	3.3	3.1
4/16/13	4/17/13	20000	16	1.5	11.3	2.2	2.3	2.1	1.8

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 69. PAPA207 (Drill Rig, pad 9-24, 2300 m) hourly dBA metrics, April 5-7, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/5/2013	4/7/2013	0	2	24.9	55.2	41.1	39.9	36.2	33.1
4/5/2013	4/7/2013	1	2	25.0	51.4	34.3	34.7	31.8	29.6
4/5/2013	4/7/2013	2	2	24.8	54.9	33.6	34.1	30.8	28.9
4/5/2013	4/7/2013	3	2	26.0	56.4	34.1	34.8	30.9	27.9
4/5/2013	4/7/2013	4	2	26.6	58.0	35.2	34.5	31.9	30.2
4/5/2013	4/7/2013	5	2	28.6	57.7	35.0	35.6	33.2	31.4
4/5/2013	4/7/2013	6	2	28.3	58.9	37.8	38.8	35.5	32.1
4/5/2013	4/7/2013	7	2	24.6	61.1	33.5	35.4	31.5	28.3
4/5/2013	4/7/2013	8	2	24.7	48.1	33.3	35.6	31.7	27.7
4/5/2013	4/7/2013	9	2	19.9	54.8	31.2	32.7	27.7	25.2
4/5/2013	4/7/2013	10	2	20.5	60.9	31.6	30.9	26.8	24.7
4/5/2013	4/7/2013	11	2	21.0	50.2	28.0	29.4	25.8	23.3
4/5/2013	4/7/2013	12	2	20.8	46.6	28.3	30.4	25.9	23.3
4/5/2013	4/7/2013	13	2.0	21.1	47.7	30.3	32.2	27.1	24.3
4/5/2013	4/7/2013	14	2.0	20.3	52.7	33.2	34.8	27.9	24.6
4/5/2013	4/7/2013	15	2.0	22.1	51.5	32.1	33.9	27.2	24.7
4/5/2013	4/7/2013	16	1.0	20.6	47.5	29.8	33.2	27.2	23.3
4/5/2013	4/7/2013	17	2.0	21.3	68.7	40.0	34.6	29.4	26.2
4/5/2013	4/7/2013	18	2.0	22.3	55.3	34.3	33.7	29.9	27.1
4/5/2013	4/7/2013	19	2.0	22.2	51.3	32.9	35.1	30.7	26.2
4/5/2013	4/7/2013	20	2.0	26.0	54.6	34.4	36.3	32.4	29.9
4/5/2013	4/7/2013	21	2.0	21.8	49.6	33.2	34.1	30.3	27.0
4/5/2013	4/7/2013	22	2.0	21.5	49.6	32.6	33.1	30.4	27.7
4/5/2013	4/7/2013	23	2.0	26.0	55.9	37.5	39.3	33.1	30.4

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 70. PAPA207 (Drill Rig, pad 9-24, 2300 m) dBA and one-third octave band metrics, April 5-7, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/5/13	4/7/13	dBA	47	19.9	68.7	34.9	34.8	30.4	27.2
4/5/13	4/7/13	12.5	47	25.1	78.3	50.9	49.4	44.0	38.5
4/5/13	4/7/13	16	47	29.3	74.2	50.7	49.5	45.8	41.9
4/5/13	4/7/13	20	47	34.5	72.2	54.7	55.0	51.1	47.4
4/5/13	4/7/13	25	47	32.3	68.5	52.4	53.2	48.7	44.3
4/5/13	4/7/13	31.5	47	34.8	69.3	57.1	60.2	54.6	49.8
4/5/13	4/7/13	40	47	30.2	64.1	46.3	48.1	45.4	42.8
4/5/13	4/7/13	50	47	30.8	63.0	47.1	49.2	46.0	42.5
4/5/13	4/7/13	63	47	31.4	71.5	45.3	46.4	43.3	40.2
4/5/13	4/7/13	80	47	25.4	69.9	42.8	44.2	39.2	36.1
4/5/13	4/7/13	100	47	22.8	71.7	44.6	42.0	37.4	34.1
4/5/13	4/7/13	125	47	19.8	63.9	40.2	39.8	35.8	32.2
4/5/13	4/7/13	160	47	15.9	66.2	37.8	37.1	32.5	29.6
4/5/13	4/7/13	200	47	14.7	60.5	36.5	35.4	31.1	27.5
4/5/13	4/7/13	250	47	11.4	61.1	33.1	32.8	28.5	25.1
4/5/13	4/7/13	315	47	9.1	59.0	30.2	29.9	25.4	21.8
4/5/13	4/7/13	400	47	7.1	60.1	28.2	28.8	23.1	18.3
4/5/13	4/7/13	500	47	2.3	65.3	25.3	22.9	17.3	12.5
4/5/13	4/7/13	630	47	0.6	63.5	23.5	21.2	15.0	9.9
4/5/13	4/7/13	800	47	0.1	56.9	21.1	20.4	14.1	8.7
4/5/13	4/7/13	1000	47	0.0	55.1	19.3	19.2	12.0	7.9
4/5/13	4/7/13	1250	47	0.0	57.6	17.2	15.6	9.7	6.0
4/5/13	4/7/13	1600	47	0.2	56.6	14.5	10.9	5.4	2.9
4/5/13	4/7/13	2000	47	0.8	54.1	12.9	7.0	3.1	2.1
4/5/13	4/7/13	2500	47	1.4	52.4	12.5	3.4	2.7	2.3
4/5/13	4/7/13	3150	47	2.2	59.1	13.5	3.8	3.2	3.0
4/5/13	4/7/13	4000	47	3.0	50.4	10.8	4.6	3.9	3.6
4/5/13	4/7/13	5000	47	2.8	57.8	14.6	5.2	4.4	4.2
4/5/13	4/7/13	6300	47	1.4	56.5	12.4	4.8	4.6	4.4
4/5/13	4/7/13	8000	47	0.6	51.0	9.4	4.6	4.5	4.4
4/5/13	4/7/13	10000	47	-0.1	51.0	8.2	4.2	4.1	4.0
4/5/13	4/7/13	12500	47	-0.4	50.7	7.1	3.5	3.4	3.3
4/5/13	4/7/13	16000	47	0.0	51.2	6.0	2.5	2.3	2.2
4/5/13	4/7/13	20000	47	0.2	55.9	6.3	0.8	0.7	0.6

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 71. PAPA208 (Drill Rig, pad 9-24, 300 m) hourly dBA metrics, April 5-7, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/5/2013	4/7/2013	0	2	47.5	61.6	56.3	57.4	55.6	53.0
4/5/2013	4/7/2013	1	2	45.6	60.8	52.7	55.2	51.1	48.4
4/5/2013	4/7/2013	2	2	44.6	61.2	52.0	54.3	51.2	48.6
4/5/2013	4/7/2013	3	2	43.8	63.8	51.1	52.1	50.3	48.0
4/5/2013	4/7/2013	4	2	47.6	62.4	51.8	53.3	51.5	50.0
4/5/2013	4/7/2013	5	2	47.2	61.8	53.0	54.6	52.7	50.9
4/5/2013	4/7/2013	6	2	50.3	84.5	53.9	54.2	53.0	51.8
4/5/2013	4/7/2013	7	2	47.5	59.5	52.1	53.5	51.7	50.5
4/5/2013	4/7/2013	8	2	47.3	57.4	51.9	53.2	51.6	50.1
4/5/2013	4/7/2013	9	2	49.7	59.7	52.3	53.3	52.1	51.2
4/5/2013	4/7/2013	10	2	43.4	58.9	51.4	52.8	51.0	48.6
4/5/2013	4/7/2013	11	2	43.1	60.9	51.1	52.0	50.4	48.1
4/5/2013	4/7/2013	12	2	43.9	58.2	51.5	53.1	51.3	48.3
4/5/2013	4/7/2013	13	2	47.2	60.2	53.1	54.8	52.8	50.9
4/6/2013	4/6/2013	14	1	46.6	64.2	53.3	54.9	53.1	49.9
4/6/2013	4/6/2013	15	1	50.1	66.5	53.3	54.1	53.0	52.0
4/6/2013	4/6/2013	16	1	46.4	57.5	51.3	54.1	50.0	48.2
4/6/2013	4/6/2013	17	1	45.4	64.7	51.2	53.0	51.0	48.3
4/5/2013	4/7/2013	18	2	48.9	58.7	52.5	53.6	52.3	51.2
4/5/2013	4/7/2013	19	2	48.9	61.9	53.7	55.0	53.3	52.0
4/5/2013	4/7/2013	20	2	51.6	64.8	55.6	56.7	55.3	54.1
4/5/2013	4/7/2013	21	2	51.8	63.5	55.2	56.2	55.0	53.7
4/5/2013	4/7/2013	22	2	52.5	63.5	57.0	57.8	56.4	55.2
4/5/2013	4/7/2013	23	2	51.5	65.0	57.7	59.8	57.3	54.0

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 72. PAPA208 (Drill Rig, pad 9-24, 300 m) dBA and one-third octave band metrics, April 5-7, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/5/13	4/7/13	dBA	44	43.1	84.5	53.7	54.2	52.5	51.0
4/5/13	4/7/13	12.5	44	29.9	76.7	51.6	51.4	47.3	43.2
4/5/13	4/7/13	16	44	35.8	73.2	52.3	53.8	49.8	46.0
4/5/13	4/7/13	20	44	39.6	74.9	56.5	58.1	54.7	51.4
4/5/13	4/7/13	25	44	41.0	73.7	54.4	55.5	52.2	49.6
4/5/13	4/7/13	31.5	44	43.8	76.5	67.4	70.4	66.3	61.0
4/5/13	4/7/13	40	44	46.5	74.7	59.1	61.3	58.6	55.5
4/5/13	4/7/13	50	44	54.4	78.0	66.2	67.8	65.9	64.0
4/5/13	4/7/13	63	44	53.0	78.7	65.2	66.8	64.8	62.4
4/5/13	4/7/13	80	44	50.6	77.4	65.8	67.2	65.1	62.9
4/5/13	4/7/13	100	44	35.9	77.8	66.4	67.2	65.0	62.9
4/5/13	4/7/13	125	44	44.1	77.0	62.2	62.8	60.6	58.1
4/5/13	4/7/13	160	44	41.1	79.1	58.5	58.2	56.2	54.2
4/5/13	4/7/13	200	44	38.1	71.7	55.1	54.2	52.0	50.0
4/5/13	4/7/13	250	44	33.5	62.3	46.6	47.8	45.5	43.1
4/5/13	4/7/13	315	44	24.5	59.8	43.6	45.9	42.3	39.4
4/5/13	4/7/13	400	44	21.6	59.3	44.3	47.5	43.7	39.7
4/5/13	4/7/13	500	44	17.7	55.1	36.4	37.3	33.2	30.1
4/5/13	4/7/13	630	44	15.7	55.6	35.5	37.2	32.0	28.2
4/5/13	4/7/13	800	44	13.4	57.5	34.4	36.8	30.5	25.7
4/5/13	4/7/13	1000	44	12.0	56.4	34.5	36.3	30.8	25.2
4/5/13	4/7/13	1250	44	11.3	56.6	35.2	36.2	30.9	24.9
4/5/13	4/7/13	1600	44	11.2	62.6	35.9	37.9	32.1	24.7
4/5/13	4/7/13	2000	44	10.8	57.3	36.4	38.3	32.6	25.4
4/5/13	4/7/13	2500	44	8.0	52.9	33.4	35.7	29.6	21.9
4/5/13	4/7/13	3150	44	5.5	53.1	28.7	30.0	24.9	16.9
4/5/13	4/7/13	4000	44	4.6	55.3	23.8	25.2	18.9	11.8
4/5/13	4/7/13	5000	44	4.3	53.1	17.7	17.1	11.7	7.4
4/5/13	4/7/13	6300	44	4.4	47.9	11.0	10.3	6.6	5.5
4/5/13	4/7/13	8000	44	4.2	35.3	7.1	5.6	5.2	5.0
4/5/13	4/7/13	10000	44	3.8	32.2	6.4	5.0	4.8	4.7
4/5/13	4/7/13	12500	44	3.4	31.8	6.0	4.7	4.6	4.5
4/5/13	4/7/13	16000	44	3.1	32.3	5.2	3.9	3.8	3.7
4/5/13	4/7/13	20000	44	1.6	30.8	3.4	2.5	2.3	2.2

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 73. PAPA209 (Highway 191, 100 m) hourly dBA metrics, April 17-18, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
04/18/13	04/18/13	0	1	15.5	48.8	23.2	19.0	17.0	16.1
04/18/13	04/18/13	1	1	15.3	47.2	23.1	18.4	16.8	15.8
04/18/13	04/18/13	2	1	14.8	46.1	21.1	16.7	15.4	15.1
04/18/13	04/18/13	3	1	15.1	45.0	19.6	17.5	16.3	15.7
04/18/13	04/18/13	4	1	15.8	53.0	32.9	26.0	18.0	16.6
04/18/13	04/18/13	5	1	16.8	58.1	41.5	45.7	26.4	18.0
04/18/13	04/18/13	6	1	16.7	64.0	48.0	52.7	40.7	24.2
04/18/13	04/18/13	7	1	17.3	63.8	45.1	48.9	34.1	21.4
04/18/13	04/18/13	8	1	18.6	55.5	33.7	34.9	24.9	20.6
04/18/13	04/18/13	9	1	18.8	52.2	32.5	34.7	24.5	21.0
04/18/13	04/18/13	10	1	19.1	60.2	35.6	34.8	25.8	22.2
04/18/13	04/18/13	11	1	20.1	59.5	37.5	37.8	27.2	22.6
04/18/13	04/18/13	12	1	18.5	59.2	39.7	42.1	28.3	21.6
04/17/13	04/17/13	13	0	NA	NA	NA	NA	NA	NA
04/17/13	04/17/13	14	1	18.2	60.8	43.5	47.3	31.9	23.0
04/17/13	04/17/13	15	1	20.0	64.2	45.2	46.9	32.4	23.9
04/17/13	04/17/13	16	1	23.4	64.0	43.5	46.9	34.1	26.9
04/17/13	04/17/13	17	1	23.4	65.1	45.1	48.7	35.7	27.8
04/17/13	04/17/13	18	1	23.8	59.8	42.5	46.0	35.0	28.3
04/17/13	04/17/13	19	1	20.0	58.0	38.0	37.7	26.3	22.7
04/17/13	04/17/13	20	1	16.1	54.7	31.4	31.4	20.5	17.5
04/17/13	04/17/13	21	1	15.8	45.3	26.0	28.0	18.6	16.7
04/17/13	04/17/13	22	1	14.9	47.1	24.9	24.3	16.3	15.4
04/17/13	04/17/13	23	1	15.5	41.3	22.8	21.3	18.0	16.5

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 74. PAPA209 (Highway 191, 100 m) dBA and one-third octave band metrics, April 17-18, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/17/13	4/18/13	dBA	23	14.8	65.1	40.7	34.9	25.8	21.0
4/17/13	4/18/13	12.5	23	24.7	77.2	51.8	47.3	42.1	37.9
4/17/13	4/18/13	16	23	27.6	71.7	48.6	47.1	42.8	39.1
4/17/13	4/18/13	20	23	31.3	71.1	49.6	51.6	47.2	43.5
4/17/13	4/18/13	25	23	21.6	71.7	45.1	48.2	41.2	35.4
4/17/13	4/18/13	31.5	23	20.8	75.3	47.0	48.9	41.8	35.8
4/17/13	4/18/13	40	23	18.6	73.2	44.5	48.1	38.7	31.7
4/17/13	4/18/13	50	23	16.5	70.7	44.9	48.4	35.9	30.2
4/17/13	4/18/13	63	23	16.3	82.1	50.0	47.9	35.2	30.1
4/17/13	4/18/13	80	23	12.4	83.4	49.6	43.8	33.7	29.0
4/17/13	4/18/13	100	23	10.7	78.1	48.1	39.7	31.0	27.3
4/17/13	4/18/13	125	23	9.3	80.5	46.7	35.0	29.7	25.5
4/17/13	4/18/13	160	23	6.7	78.2	42.8	31.8	26.1	22.6
4/17/13	4/18/13	200	23	4.9	73.5	38.6	30.7	23.5	19.9
4/17/13	4/18/13	250	23	1.8	66.4	33.1	26.6	20.2	16.2
4/17/13	4/18/13	315	23	0.1	56.8	27.9	23.0	15.9	12.2
4/17/13	4/18/13	400	23	-2.9	54.2	26.4	20.6	13.5	8.4
4/17/13	4/18/13	500	23	-3.3	53.6	27.8	21.0	10.5	4.5
4/17/13	4/18/13	630	23	-3.2	61.0	30.4	23.3	11.7	3.3
4/17/13	4/18/13	800	23	-2.5	58.3	32.2	24.1	12.2	2.5
4/17/13	4/18/13	1000	23	-2.1	59.4	32.0	23.6	11.9	1.4
4/17/13	4/18/13	1250	23	-1.3	59.1	30.8	22.9	9.3	1.3
4/17/13	4/18/13	1600	23	-0.2	53.7	28.5	20.6	6.7	1.3
4/17/13	4/18/13	2000	23	0.8	51.4	25.1	16.2	4.1	1.7
4/17/13	4/18/13	2500	23	1.5	46.8	21.8	11.9	3.5	2.4
4/17/13	4/18/13	3150	23	2.5	47.1	18.4	8.6	4.1	3.2
4/17/13	4/18/13	4000	23	3.3	45.1	14.1	6.9	4.2	3.9
4/17/13	4/18/13	5000	23	3.9	44.3	10.5	7.0	4.7	4.5
4/17/13	4/18/13	6300	23	4.2	41.2	8.2	6.4	5.0	4.7
4/17/13	4/18/13	8000	23	3.8	38.0	6.7	5.9	4.9	4.8
4/17/13	4/18/13	10000	23	3.6	36.1	5.8	5.1	4.6	4.5
4/17/13	4/18/13	12500	23	3.5	35.5	5.1	4.7	4.1	3.9
4/17/13	4/18/13	16000	23	2.6	32.4	4.4	3.8	3.3	3.1
4/17/13	4/18/13	20000	23	1.2	32.9	3.1	2.4	1.9	1.8

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 75. PAPA210 (Highway 191, 200 m) hourly dBA metrics, April 17-18, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
04/18/13	04/18/13	0	1	15.9	40.4	20.3	19.4	17.3	16.4
04/18/13	04/18/13	1	1	15.5	48.0	23.8	18.7	17.1	16.1
04/18/13	04/18/13	2	1	15.2	37.4	18.1	17.1	15.8	15.5
04/18/13	04/18/13	3	1	15.5	38.0	19.1	18.0	16.6	16.0
04/18/13	04/18/13	4	1	16.2	46.9	27.8	26.3	18.4	17.0
04/18/13	04/18/13	5	1	16.9	51.9	37.0	41.6	25.9	18.3
04/18/13	04/18/13	6	1	17.0	55.7	43.2	47.6	39.0	23.9
04/18/13	04/18/13	7	1	17.5	55.9	41.8	46.5	33.6	21.9
04/18/13	04/18/13	8	1	18.9	45.0	29.0	32.6	24.1	20.5
04/18/13	04/18/13	9	1	19.3	45.8	28.3	29.2	24.0	21.0
04/18/13	04/18/13	10	1	20.0	49.2	29.3	30.7	24.9	22.0
04/18/13	04/18/13	11	1	20.8	49.4	30.7	32.6	26.6	22.9
04/18/13	04/18/13	12	1	18.8	51.5	34.2	37.2	27.3	21.3
04/17/13	04/17/13	13	0	NA	NA	NA	NA	NA	NA
04/17/13	04/17/13	14	1	18.3	53.6	38.8	42.9	32.0	22.9
04/17/13	04/17/13	15	1	19.8	56.9	39.3	42.0	31.1	23.6
04/17/13	04/17/13	16	1	23.2	56.1	37.2	40.6	32.0	26.7
04/17/13	04/17/13	17	1	24.2	55.9	39.8	43.7	34.8	27.7
04/17/13	04/17/13	18	1	23.9	56.0	39.6	43.2	35.5	29.0
04/17/13	04/17/13	19	1	20.7	57.5	35.9	34.7	26.5	23.2
04/17/13	04/17/13	20	1	16.4	51.1	29.4	29.8	20.7	17.8
04/17/13	04/17/13	21	1	16.1	44.0	24.5	27.7	19.0	17.1
04/17/13	04/17/13	22	1	15.4	42.7	22.0	23.8	16.7	15.8
04/17/13	04/17/13	23	1	15.9	41.3	22.3	21.8	18.4	16.9

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 76. PAPA210 (Highway 191, 200 m) dBA and one-third octave band metrics, April 17-18, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/17/13	4/18/13	dBA	23	15.2	57.5	36.1	32.6	24.9	21.0
4/17/13	4/18/13	12.5	23	27.2	79.5	54.9	46.8	42.1	37.9
4/17/13	4/18/13	16	23	27.6	76.9	49.8	46.4	42.7	39.2
4/17/13	4/18/13	20	23	31.2	72.2	49.4	50.8	46.6	43.4
4/17/13	4/18/13	25	23	20.8	68.6	44.5	46.4	40.7	35.2
4/17/13	4/18/13	31.5	23	20.5	70.1	45.7	47.4	41.3	35.7
4/17/13	4/18/13	40	23	18.0	67.8	42.5	45.3	37.4	31.7
4/17/13	4/18/13	50	23	16.7	63.9	41.9	43.1	34.9	30.1
4/17/13	4/18/13	63	23	16.2	71.4	43.8	40.3	33.9	30.2
4/17/13	4/18/13	80	23	13.4	76.3	44.9	38.5	32.7	28.7
4/17/13	4/18/13	100	23	12.5	74.1	43.9	34.8	30.4	27.4
4/17/13	4/18/13	125	23	10.0	73.0	41.4	33.5	29.1	24.8
4/17/13	4/18/13	160	23	6.5	68.9	36.1	31.1	25.9	21.7
4/17/13	4/18/13	200	23	5.3	67.1	32.1	29.2	23.0	19.2
4/17/13	4/18/13	250	23	2.1	61.2	27.4	25.5	19.4	15.6
4/17/13	4/18/13	315	23	-0.3	50.3	23.9	21.7	15.3	12.0
4/17/13	4/18/13	400	23	-2.4	50.5	23.9	17.3	12.4	8.2
4/17/13	4/18/13	500	23	-2.8	50.4	25.6	18.2	10.4	4.8
4/17/13	4/18/13	630	23	-2.6	53.6	28.0	19.9	11.2	3.6
4/17/13	4/18/13	800	23	-2.3	54.5	28.8	20.1	11.8	2.4
4/17/13	4/18/13	1000	23	-1.7	51.5	27.5	20.4	10.8	1.6
4/17/13	4/18/13	1250	23	-1.0	53.9	25.8	19.1	8.7	1.7
4/17/13	4/18/13	1600	23	0.0	48.2	23.0	16.6	5.9	1.4
4/17/13	4/18/13	2000	23	1.0	42.9	19.4	12.6	3.5	1.8
4/17/13	4/18/13	2500	23	1.9	44.0	16.2	9.5	3.8	2.6
4/17/13	4/18/13	3150	23	2.8	43.7	12.2	7.6	4.1	3.5
4/17/13	4/18/13	4000	23	3.7	41.4	9.0	7.1	4.6	4.3
4/17/13	4/18/13	5000	23	4.5	37.4	7.3	6.1	5.2	5.0
4/17/13	4/18/13	6300	23	4.7	41.3	7.7	6.1	5.6	5.4
4/17/13	4/18/13	8000	23	4.9	35.4	6.9	6.0	5.7	5.5
4/17/13	4/18/13	10000	23	4.7	33.9	6.3	5.6	5.3	5.1
4/17/13	4/18/13	12500	23	3.8	33.6	5.6	4.9	4.4	4.3
4/17/13	4/18/13	16000	23	2.7	31.1	4.6	3.9	3.4	3.2
4/17/13	4/18/13	20000	23	1.2	34.7	3.2	2.4	1.9	1.7

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 77. PAPA211 (Well heads, 3, and injection well, with generator, 100 m) hourly dBA metrics, April 18-21, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/18/2013	4/21/2013	0	3	42.2	53.3	47.2	48.5	46.3	45.0
4/18/2013	4/21/2013	1	3	43.2	54.0	48.1	49.8	48.0	46.5
4/18/2013	4/21/2013	2	3	43.5	56.4	48.4	49.8	47.5	45.9
4/18/2013	4/21/2013	3	3	44.1	54.7	49.3	51.6	49.3	46.8
4/18/2013	4/21/2013	4	3	43.2	56.9	50.9	53.1	51.8	50.4
4/18/2013	4/21/2013	5	3	45.1	56.1	50.7	53.1	50.0	47.5
4/18/2013	4/21/2013	6	3	41.3	57.2	49.8	50.7	48.6	46.3
4/18/2013	4/21/2013	7	3	42.8	56.5	47.8	50.1	46.3	44.8
4/18/2013	4/21/2013	8	3	40.7	59.5	45.6	46.1	45.1	44.0
4/18/2013	4/21/2013	9	3	38.8	57.2	44.7	46.0	44.4	42.7
4/18/2013	4/21/2013	10	3	34.4	53.2	44.3	46.4	44.5	42.4
4/18/2013	4/21/2013	11	3	34.8	49.7	43.3	45.0	43.0	40.5
4/18/2013	4/21/2013	12	3	32.1	50.4	41.7	43.8	41.4	38.1
4/18/2013	4/21/2013	13	3	32.7	58.3	42.0	44.4	41.5	37.8
4/18/2013	4/21/2013	14	3	30.6	50.6	42.0	44.2	42.2	39.5
4/18/2013	4/21/2013	15	3	35.6	54.5	42.8	44.6	42.3	40.0
4/18/2013	4/21/2013	16	3	35.8	58.1	43.7	45.5	42.4	39.9
4/18/2013	4/21/2013	17	3	37.2	57.8	43.9	46.1	43.1	41.1
4/18/2013	4/21/2013	18	3	38.9	51.4	44.1	45.1	43.6	42.3
4/18/2013	4/21/2013	19	3	39.1	51.4	45.1	45.9	44.6	43.5
4/18/2013	4/21/2013	20	3	42.3	51.0	45.6	46.8	45.6	44.4
4/18/2013	4/21/2013	21	3	42.7	53.2	47.0	47.0	45.7	44.8
4/18/2013	4/21/2013	22	3	43.2	59.6	50.1	53.6	46.3	45.2
4/18/2013	4/21/2013	23	3	42.2	54.4	46.4	48.4	46.1	45.1

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 78. PAPA211 (Well heads, 3, and injection well, with generator, 200 m) dBA and one-third octave band metrics, April 18-21, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/18/13	4/21/13	dBA	72	30.6	59.6	46.9	46.7	45.5	44.3
4/18/13	4/21/13	12.5	72	25.6	73.4	50.4	46.5	42.8	38.4
4/18/13	4/21/13	16	72	34.0	71.6	52.5	54.1	50.1	46.2
4/18/13	4/21/13	20	72	38.2	77.9	61.9	63.3	56.0	52.0
4/18/13	4/21/13	25	72	32.8	68.0	49.4	50.8	47.3	44.0
4/18/13	4/21/13	31.5	72	38.9	72.1	53.6	55.4	51.7	47.9
4/18/13	4/21/13	40	72	38.9	75.1	53.2	54.0	52.5	50.9
4/18/13	4/21/13	50	72	37.8	77.5	52.3	54.0	50.7	48.1
4/18/13	4/21/13	63	72	35.9	77.0	48.5	49.7	47.6	45.8
4/18/13	4/21/13	80	72	32.9	71.6	48.4	49.7	48.0	46.1
4/18/13	4/21/13	100	72	33.3	69.7	49.1	50.3	48.6	47.0
4/18/13	4/21/13	125	72	34.2	69.3	55.5	57.2	55.3	53.1
4/18/13	4/21/13	160	72	31.3	67.9	49.2	50.1	48.8	47.5
4/18/13	4/21/13	200	72	26.9	66.2	47.0	48.2	47.0	45.5
4/18/13	4/21/13	250	72	28.4	63.0	47.2	48.9	47.2	45.3
4/18/13	4/21/13	315	72	22.7	62.0	41.7	42.3	41.1	39.3
4/18/13	4/21/13	400	72	19.9	50.3	37.3	39.1	37.1	34.7
4/18/13	4/21/13	500	72	17.2	53.5	30.2	32.1	29.3	27.0
4/18/13	4/21/13	630	72	9.6	51.8	24.0	24.7	22.3	19.9
4/18/13	4/21/13	800	72	8.1	48.8	27.5	26.0	22.3	18.7
4/18/13	4/21/13	1000	72	6.8	44.2	26.7	24.8	20.3	16.9
4/18/13	4/21/13	1250	72	8.5	52.9	32.1	28.5	23.5	19.3
4/18/13	4/21/13	1600	72	6.9	49.7	31.5	28.4	22.7	18.0
4/18/13	4/21/13	2000	72	6.3	51.1	33.6	28.8	23.5	18.7
4/18/13	4/21/13	2500	72	5.2	54.6	32.4	27.7	22.8	17.3
4/18/13	4/21/13	3150	72	6.3	52.8	36.1	32.3	26.1	20.9
4/18/13	4/21/13	4000	72	4.5	51.3	26.7	22.7	17.3	12.2
4/18/13	4/21/13	5000	72	2.7	52.7	19.6	16.5	12.0	7.8
4/18/13	4/21/13	6300	72	1.6	50.2	15.8	12.3	8.4	6.3
4/18/13	4/21/13	8000	72	0.5	56.6	12.0	7.9	5.9	5.2
4/18/13	4/21/13	10000	72	-0.6	44.5	6.3	6.2	5.1	4.8
4/18/13	4/21/13	12500	72	-1.0	36.2	4.8	4.6	4.2	4.1
4/18/13	4/21/13	16000	72	-1.0	31.1	4.1	3.8	3.4	3.3
4/18/13	4/21/13	20000	72	-0.3	31.5	3.0	2.3	2.1	1.9

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 79. PAPA212 (Well heads, 3, and injection well, with generator, 200 m) hourly dBA metrics, April 18-21, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/18/2013	4/21/2013	0	3	35.0	45.8	40.1	42.0	39.0	37.5
4/18/2013	4/21/2013	1	3	36.0	47.7	41.1	42.6	40.5	39.2
4/18/2013	4/21/2013	2	3	35.6	50.3	41.9	44.7	41.2	38.7
4/18/2013	4/21/2013	3	3	36.4	49.3	42.4	43.5	40.9	38.8
4/18/2013	4/21/2013	4	3	34.9	51.0	43.7	44.8	42.9	41.2
4/18/2013	4/21/2013	5	3	36.9	48.5	43.1	45.1	43.0	40.8
4/18/2013	4/21/2013	6	3	35.2	51.0	42.1	42.1	40.4	38.7
4/18/2013	4/21/2013	7	3	35.1	51.1	40.5	44.2	39.0	37.4
4/18/2013	4/21/2013	8	3	32.3	50.2	38.6	39.4	37.8	36.4
4/18/2013	4/21/2013	9	2	29.7	51.2	37.4	38.9	37.1	35.1
4/18/2013	4/21/2013	10	2	28.8	45.2	37.2	39.4	36.8	33.8
4/18/2013	4/21/2013	11	2	27.0	54.6	36.0	38.2	34.9	31.9
4/18/2013	4/21/2013	12	2	26.4	47.7	34.8	37.4	33.2	30.1
4/18/2013	4/21/2013	13	2	25.9	56.0	36.4	38.1	33.6	30.4
4/18/2013	4/21/2013	14	2	26.8	55.1	35.8	38.3	34.5	30.8
4/18/2013	4/21/2013	15	2	27.5	53.7	37.3	39.7	34.8	31.7
4/18/2013	4/21/2013	16	3	26.7	57.9	38.0	41.1	36.4	32.7
4/18/2013	4/21/2013	17	3	28.3	55.0	39.1	41.6	37.8	33.7
4/18/2013	4/21/2013	18	3	30.0	51.0	38.2	39.7	36.5	34.4
4/18/2013	4/21/2013	19	3	30.4	53.0	39.5	39.0	37.0	35.6
4/18/2013	4/21/2013	20	3	34.6	49.0	39.1	40.5	38.4	37.0
4/18/2013	4/21/2013	21	3	35.5	46.2	39.5	41.4	39.1	37.7
4/18/2013	4/21/2013	22	3	35.8	51.6	42.2	45.2	39.5	37.9
4/18/2013	4/21/2013	23	3	34.8	48.3	39.3	41.0	39.0	37.8

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 80. PAPA212 (Well heads, 3, and injection well, with generator, 200 m) dBA and one-third octave band metrics, April 18-21, 2013, 0000-2300.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/18/13	4/21/13	dBA	65	25.9	57.9	40.2	41.4	38.6	37.0
4/18/13	4/21/13	12.5	65	24.1	77.9	53.6	46.4	43.2	38.1
4/18/13	4/21/13	16	65	32.5	76.9	53.9	54.0	48.2	44.3
4/18/13	4/21/13	20	65	36.2	77.1	62.1	63.4	57.4	52.3
4/18/13	4/21/13	25	65	31.8	72.0	48.8	49.3	45.9	42.4
4/18/13	4/21/13	31.5	65	33.6	68.2	51.9	54.3	50.3	45.7
4/18/13	4/21/13	40	65	33.9	70.0	49.7	51.0	48.8	46.5
4/18/13	4/21/13	50	65	34.0	70.6	48.7	50.5	47.1	44.7
4/18/13	4/21/13	63	65	32.5	69.5	46.1	47.9	45.1	42.7
4/18/13	4/21/13	80	65	31.2	69.8	44.8	46.0	44.1	41.7
4/18/13	4/21/13	100	65	29.9	66.3	44.9	46.5	44.4	42.7
4/18/13	4/21/13	125	65	28.4	63.0	50.7	52.7	50.4	48.2
4/18/13	4/21/13	160	65	27.1	65.0	43.9	45.4	43.9	42.3
4/18/13	4/21/13	200	65	24.2	98.9	46.6	41.5	40.2	38.4
4/18/13	4/21/13	250	65	22.0	61.3	36.0	37.6	35.0	32.8
4/18/13	4/21/13	315	65	16.8	54.5	30.3	30.7	27.8	25.4
4/18/13	4/21/13	400	65	11.1	47.3	26.6	27.4	23.5	20.8
4/18/13	4/21/13	500	65	7.0	51.7	26.0	26.3	21.4	17.7
4/18/13	4/21/13	630	65	2.4	50.8	22.3	22.7	16.9	13.1
4/18/13	4/21/13	800	65	1.9	45.7	23.9	23.4	17.7	12.6
4/18/13	4/21/13	1000	65	1.9	39.1	22.9	23.4	16.4	11.1
4/18/13	4/21/13	1250	65	3.3	44.4	26.6	25.9	18.1	12.9
4/18/13	4/21/13	1600	65	3.2	43.2	26.9	26.6	17.8	12.4
4/18/13	4/21/13	2000	65	3.2	45.5	25.4	26.3	15.6	10.5
4/18/13	4/21/13	2500	65	3.4	44.8	23.0	25.2	14.1	8.6
4/18/13	4/21/13	3150	65	4.7	47.0	27.0	24.2	17.3	11.7
4/18/13	4/21/13	4000	65	4.4	47.7	17.7	17.7	9.2	6.3
4/18/13	4/21/13	5000	65	4.0	54.2	13.8	10.8	6.5	5.7
4/18/13	4/21/13	6300	65	3.5	43.1	8.6	7.9	6.0	5.7
4/18/13	4/21/13	8000	65	1.4	43.4	6.7	6.1	5.7	5.5
4/18/13	4/21/13	10000	65	1.3	29.5	5.7	5.4	5.3	5.1
4/18/13	4/21/13	12500	65	1.1	28.7	4.9	4.6	4.5	4.4
4/18/13	4/21/13	16000	65	1.1	27.1	4.0	3.6	3.5	3.3
4/18/13	4/21/13	20000	65	1.5	22.8	2.8	2.2	2.1	2.0

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 81. PAPA213 (Gobbler's Knob, north side, liquid stabilizing facility and central gathering facility, 150 m) hourly dBA metrics, April 22-24, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/22/2013	4/24/2013	0	2	35.3	55.9	45.9	48.7	44.9	40.6
4/22/2013	4/24/2013	1	2	35.9	54.3	43.8	45.4	42.8	40.6
4/22/2013	4/24/2013	2	2	34.6	52.7	44.4	46.3	43.6	40.3
4/22/2013	4/24/2013	3	2	34.4	54.8	47.4	45.8	44.1	41.3
4/22/2013	4/24/2013	4	2	34.3	55.3	46.1	46.5	43.1	41.3
4/22/2013	4/24/2013	5	2	37.3	54.3	45.9	47.7	45.5	41.5
4/22/2013	4/24/2013	6	2	37.4	53.7	45.5	47.8	44.9	41.4
4/22/2013	4/24/2013	7	2	37.5	57.6	47.1	49.2	46.6	42.9
4/22/2013	4/24/2013	8	2	36.5	53.6	44.9	47.6	44.1	40.6
4/22/2013	4/24/2013	9	2	35.2	69.5	46.5	46.6	42.4	38.7
4/22/2013	4/24/2013	10	2	36.2	58.4	47.1	46.7	43.9	40.1
4/22/2013	4/24/2013	11	2	37.7	61.0	50.1	49.4	46.9	44.9
4/22/2013	4/24/2013	12	2	38.9	75.7	50.3	49.5	44.8	42.6
4/22/2013	4/24/2013	13	2	33.9	55.3	43.8	45.7	43.5	40.3
4/22/2013	4/24/2013	14	2	33.7	57.1	42.2	43.8	40.8	38.3
4/22/2013	4/24/2013	15	2	34.3	62.0	43.3	44.8	41.2	38.7
4/22/2013	4/24/2013	16	2	34.2	64.5	44.4	45.7	42.5	39.5
4/22/2013	4/24/2013	17	2	33.9	61.6	44.3	46.4	43.4	40.1
4/22/2013	4/24/2013	18	2	36.4	58.8	43.1	44.6	41.7	40.0
4/22/2013	4/24/2013	19	2	37.5	63.2	44.0	45.1	42.5	40.7
4/22/2013	4/24/2013	20	2	38.7	54.6	44.2	46.5	43.2	41.6
4/22/2013	4/24/2013	21	2	37.4	55.8	46.6	48.1	44.9	43.2
4/22/2013	4/24/2013	22	2	36.0	53.8	46.0	48.5	45.0	40.1
4/22/2013	4/24/2013	23	2	34.5	54.2	45.5	48.4	44.5	39.7

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 82. PAPA213 (Gobbler's Knob, north side, liquid stabilizing facility and central gathering facility, 150 m) dBA and one-third octave band metrics, April 22-24, 2013.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/22/13	4/24/13	dBA	48	33.7	75.7	46.0	46.9	43.8	40.3
4/22/13	4/24/13	12.5	48	36.4	75.2	55.3	56.8	53.2	49.7
4/22/13	4/24/13	16	48	44.7	75.9	59.4	61.6	57.4	54.4
4/22/13	4/24/13	20	48	46.1	74.6	61.8	64.3	60.7	57.6
4/22/13	4/24/13	25	48	47.3	76.3	61.5	63.2	59.7	56.5
4/22/13	4/24/13	31.5	48	45.5	75.7	61.4	63.0	59.7	56.7
4/22/13	4/24/13	40	48	47.7	77.6	62.7	64.9	61.2	58.3
4/22/13	4/24/13	50	48	50.9	74.8	64.4	66.5	63.8	61.1
4/22/13	4/24/13	63	48	45.1	78.7	58.6	60.2	56.6	53.5
4/22/13	4/24/13	80	48	38.9	76.5	60.2	62.7	59.8	55.2
4/22/13	4/24/13	100	48	29.6	82.4	54.7	54.8	51.2	47.6
4/22/13	4/24/13	125	48	25.7	85.0	51.9	51.3	45.3	41.5
4/22/13	4/24/13	160	48	22.2	73.1	49.0	47.0	42.1	38.4
4/22/13	4/24/13	200	48	20.4	71.8	44.9	43.5	38.5	35.2
4/22/13	4/24/13	250	48	16.7	65.1	40.9	41.1	35.6	31.8
4/22/13	4/24/13	315	48	14.6	60.7	37.0	37.3	32.3	28.7
4/22/13	4/24/13	400	48	10.4	64.8	33.1	34.3	29.5	25.3
4/22/13	4/24/13	500	48	10.5	57.0	29.5	29.0	25.6	22.2
4/22/13	4/24/13	630	48	9.9	56.6	28.0	27.9	23.5	19.1
4/22/13	4/24/13	800	48	7.6	61.7	29.2	28.2	23.3	18.0
4/22/13	4/24/13	1000	48	10.4	65.2	33.0	31.4	26.6	20.0
4/22/13	4/24/13	1250	48	9.7	67.8	33.9	32.5	27.4	19.6
4/22/13	4/24/13	1600	48	7.8	68.8	33.1	31.6	25.5	17.9
4/22/13	4/24/13	2000	48	5.5	68.7	31.5	28.6	22.3	15.3
4/22/13	4/24/13	2500	48	4.4	66.0	30.6	26.1	19.9	14.0
4/22/13	4/24/13	3150	48	3.4	58.6	23.2	20.7	14.0	7.7
4/22/13	4/24/13	4000	48	3.4	49.6	16.8	13.5	9.0	4.8
4/22/13	4/24/13	5000	48	3.9	42.9	11.2	8.8	5.7	4.7
4/22/13	4/24/13	6300	48	4.1	36.9	6.9	5.3	4.9	4.6
4/22/13	4/24/13	8000	48	4.1	38.1	6.5	4.9	4.7	4.5
4/22/13	4/24/13	10000	48	3.6	40.7	6.1	4.5	4.3	4.2
4/22/13	4/24/13	12500	48	2.8	38.3	5.8	4.1	3.7	3.5
4/22/13	4/24/13	16000	48	1.7	29.7	5.1	3.2	2.8	2.5
4/22/13	4/24/13	20000	48	0.1	29.1	3.6	1.7	1.3	0.9

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 83. PAPA214 (North Anticline Road, east side, 50 m from centerline) hourly dBA metrics, April 22-23, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/23/2013	4/23/2013	0	1	20.8	61.0	36.6	33.4	24.8	22.7
4/23/2013	4/23/2013	1	1	21.5	58.0	35.9	30.6	24.5	23.1
4/23/2013	4/23/2013	2	1	21.5	59.6	35.2	27.1	24.5	23.0
4/23/2013	4/23/2013	3	1	21.0	55.5	33.8	29.6	24.5	23.0
4/23/2013	4/23/2013	4	1	22.2	58.2	37.6	39.0	26.7	24.2
4/23/2013	4/23/2013	5	1	24.6	66.0	43.4	45.6	31.7	27.2
4/23/2013	4/23/2013	6	1	24.9	66.5	44.1	46.0	30.2	27.0
4/23/2013	4/23/2013	7	1	25.4	64.6	44.8	47.2	33.2	27.6
4/23/2013	4/23/2013	8	1	23.4	60.7	39.4	42.5	29.8	25.7
4/22/2013	4/22/2013	9	1	29.4	75.8	50.6	51.3	37.2	31.5
4/22/2013	4/22/2013	10	1	29.2	67.6	48.6	50.8	35.3	31.2
4/22/2013	4/22/2013	11	1	31.4	66.1	47.0	49.0	36.5	34.1
4/22/2013	4/22/2013	12	1	27.2	79.2	50.1	47.0	34.5	29.9
4/22/2013	4/22/2013	13	1	24.4	54.7	38.6	42.2	31.1	27.1
4/22/2013	4/22/2013	14	1	24.2	59.6	42.8	47.7	32.4	27.2
4/22/2013	4/22/2013	15	1	23.6	58.8	40.1	42.5	28.9	25.5
4/22/2013	4/22/2013	16	1	22.2	56.3	35.7	36.8	26.2	24.0
4/22/2013	4/22/2013	17	1	21.9	64.8	39.7	40.3	27.0	24.0
4/22/2013	4/22/2013	18	1	21.8	57.7	37.8	39.3	25.7	23.4
4/22/2013	4/22/2013	19	1	21.2	57.1	38.3	39.4	25.5	23.5
4/22/2013	4/22/2013	20	1	21.7	56.8	37.8	36.2	25.2	23.5
4/22/2013	4/22/2013	21	1	20.9	71.3	44.0	36.4	25.3	23.0
4/22/2013	4/22/2013	22	1	21.2	52.7	32.1	27.9	24.2	22.6
4/22/2013	4/22/2013	23	1	20.0	60.3	37.5	35.5	23.6	21.8

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 84. PAPA214 (North Anticline Road, east side, 50 m from centerline) dBA and one-third octave band metrics, April 22-23, 2013.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/22/13	4/23/13	dBA	24	20.0	79.2	43.6	39.9	26.9	24.1
4/22/13	4/23/13	12.5	24	28.7	76.1	52.7	54.1	48.0	42.9
4/22/13	4/23/13	16	24	35.0	78.6	53.8	55.4	52.1	48.9
4/22/13	4/23/13	20	24	45.2	74.7	60.3	62.4	59.6	56.6
4/22/13	4/23/13	25	24	36.8	79.5	52.0	53.8	49.6	46.6
4/22/13	4/23/13	31.5	24	35.5	75.6	50.5	52.2	47.5	44.4
4/22/13	4/23/13	40	24	37.3	79.0	52.7	54.2	50.6	46.6
4/22/13	4/23/13	50	24	40.1	82.7	54.5	55.0	50.7	47.5
4/22/13	4/23/13	63	24	30.4	85.1	54.5	54.6	43.2	38.7
4/22/13	4/23/13	80	24	24.8	84.8	55.2	53.3	36.9	34.2
4/22/13	4/23/13	100	24	15.8	83.0	51.6	46.5	29.5	26.2
4/22/13	4/23/13	125	24	11.0	83.6	47.9	36.9	25.9	21.6
4/22/13	4/23/13	160	24	8.6	79.7	46.6	32.6	22.1	17.4
4/22/13	4/23/13	200	24	6.5	77.2	43.3	29.4	19.8	16.3
4/22/13	4/23/13	250	24	3.1	73.8	39.9	25.5	16.3	12.4
4/22/13	4/23/13	315	24	4.5	69.9	36.3	21.7	17.8	14.9
4/22/13	4/23/13	400	24	2.1	66.4	31.0	18.4	12.8	10.1
4/22/13	4/23/13	500	24	1.5	63.7	28.1	17.9	11.3	8.5
4/22/13	4/23/13	630	24	1.9	63.6	27.8	19.1	12.4	9.0
4/22/13	4/23/13	800	24	2.1	64.0	28.5	20.8	13.5	9.0
4/22/13	4/23/13	1000	24	2.6	65.1	29.1	22.1	12.2	8.1
4/22/13	4/23/13	1250	24	1.9	67.4	29.7	23.7	11.5	6.9
4/22/13	4/23/13	1600	24	1.9	67.8	30.0	24.6	9.1	5.9
4/22/13	4/23/13	2000	24	1.9	67.2	30.0	23.7	6.3	4.4
4/22/13	4/23/13	2500	24	2.5	66.4	28.8	22.5	5.3	4.2
4/22/13	4/23/13	3150	24	3.3	62.9	27.1	20.7	5.0	4.2
4/22/13	4/23/13	4000	24	3.9	63.2	24.7	18.0	5.1	4.6
4/22/13	4/23/13	5000	24	4.5	62.6	23.7	14.9	5.5	5.2
4/22/13	4/23/13	6300	24	5.0	58.9	19.2	11.0	5.8	5.5
4/22/13	4/23/13	8000	24	5.1	57.0	16.2	8.2	5.8	5.6
4/22/13	4/23/13	10000	24	4.7	53.2	13.5	7.0	5.5	5.3
4/22/13	4/23/13	12500	24	3.9	50.8	10.7	5.8	4.7	4.5
4/22/13	4/23/13	16000	24	2.7	50.3	10.0	4.5	3.8	3.5
4/22/13	4/23/13	20000	24	1.4	49.6	8.0	3.0	2.4	2.1

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 85. PAPA215 (Mesa pad 3-27, 21 wells, with intermittent generator, 200 m) hourly dBA metrics, April 23-24, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/24/2013	4/24/2013	0	1	40.3	58.9	49.0	52.1	47.4	44.1
4/24/2013	4/24/2013	1	1	37.1	52.6	44.2	46.8	43.1	40.4
4/24/2013	4/24/2013	2	1	37.3	60.2	47.0	50.3	43.3	40.0
4/24/2013	4/24/2013	3	1	38.3	56.7	42.2	43.9	41.3	39.8
4/24/2013	4/24/2013	4	1	37.6	47.5	41.1	42.5	40.7	39.4
4/24/2013	4/24/2013	5	1	36.7	56.2	41.1	41.3	40.1	38.7
4/24/2013	4/24/2013	6	1	32.2	48.9	37.8	40.3	36.5	33.8
4/24/2013	4/24/2013	7	1	32.6	45.1	35.8	37.1	35.4	34.1
4/24/2013	4/24/2013	8	1	29.1	43.0	33.5	35.0	33.2	31.5
4/23/2013	4/23/2013	9	1	32.5	50.7	37.1	37.7	36.2	34.6
4/23/2013	4/23/2013	10	1	33.9	45.3	39.8	42.5	39.0	36.4
4/23/2013	4/23/2013	11	1	37.0	49.1	44.6	46.9	44.4	40.8
4/23/2013	4/23/2013	12	1	36.9	56.5	45.0	47.3	44.7	40.3
4/23/2013	4/23/2013	13	1	36.1	49.3	44.9	47.2	44.7	40.4
4/23/2013	4/23/2013	14	1	34.9	49.8	44.6	47.1	44.2	40.3
4/23/2013	4/23/2013	15	1	35.8	58.3	45.1	47.4	44.4	40.9
4/23/2013	4/23/2013	16	1	36.0	51.5	45.6	48.0	45.0	41.4
4/23/2013	4/23/2013	17	1	36.2	50.1	45.2	47.5	44.8	41.5
4/23/2013	4/23/2013	18	1	39.7	52.2	47.6	49.6	47.3	44.6
4/23/2013	4/23/2013	19	1	43.6	52.0	47.5	48.9	47.3	45.6
4/23/2013	4/23/2013	20	1	44.0	53.5	47.6	48.6	47.4	46.5
4/23/2013	4/23/2013	21	1	44.6	56.5	49.9	51.6	49.5	48.0
4/23/2013	4/23/2013	22	1	45.5	57.1	48.7	49.8	48.3	47.1
4/23/2013	4/23/2013	23	1	41.9	60.9	46.6	47.9	45.8	44.4

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 86. PAPA215 (Mesa pad 3-27, 21 wells, with intermittent generator, 200 m) dBA and one-third octave band metrics, April 23-24, 2013.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/23/13	4/24/13	dBA	24	29.1	60.9	45.4	47.3	44.4	40.4
4/23/13	4/24/13	12.5	24	31.5	73.6	49.9	50.7	45.9	42.3
4/23/13	4/24/13	16	24	37.2	73.8	51.5	53.7	50.1	46.7
4/23/13	4/24/13	20	24	41.8	75.5	64.2	65.7	60.5	56.2
4/23/13	4/24/13	25	24	36.1	72.5	48.6	50.6	47.5	44.7
4/23/13	4/24/13	31.5	24	39.5	68.9	51.4	53.2	50.6	47.7
4/23/13	4/24/13	40	24	42.3	73.3	55.0	54.6	51.3	49.1
4/23/13	4/24/13	50	24	43.8	80.8	55.8	56.1	52.7	50.0
4/23/13	4/24/13	63	24	40.5	81.6	59.1	55.5	52.0	48.0
4/23/13	4/24/13	80	24	38.5	76.8	61.7	63.9	61.4	54.4
4/23/13	4/24/13	100	24	35.7	79.9	52.6	53.3	50.5	48.0
4/23/13	4/24/13	125	24	23.9	75.1	51.5	51.3	48.0	45.6
4/23/13	4/24/13	160	24	22.7	71.7	47.2	47.3	44.5	42.0
4/23/13	4/24/13	200	24	25.5	65.9	47.4	47.8	43.8	40.4
4/23/13	4/24/13	250	24	21.7	61.8	44.6	45.2	41.5	37.3
4/23/13	4/24/13	315	24	18.0	60.1	40.5	40.1	36.1	32.7
4/23/13	4/24/13	400	24	14.7	58.5	37.3	36.7	31.8	28.4
4/23/13	4/24/13	500	24	9.4	56.2	32.4	32.3	27.2	23.5
4/23/13	4/24/13	630	24	5.3	55.9	29.2	29.2	24.4	21.1
4/23/13	4/24/13	800	24	2.8	48.9	27.1	27.8	23.5	19.1
4/23/13	4/24/13	1000	24	2.2	44.8	25.8	26.8	22.4	17.9
4/23/13	4/24/13	1250	24	2.1	43.3	24.0	24.9	20.4	15.9
4/23/13	4/24/13	1600	24	1.5	39.1	20.9	22.7	18.7	14.0
4/23/13	4/24/13	2000	24	1.6	32.0	15.8	17.4	12.6	9.1
4/23/13	4/24/13	2500	24	2.2	39.9	13.0	11.3	8.2	6.2
4/23/13	4/24/13	3150	24	2.8	34.4	10.9	8.8	6.5	5.3
4/23/13	4/24/13	4000	24	3.6	50.7	9.4	6.2	5.3	4.9
4/23/13	4/24/13	5000	24	4.3	52.4	11.1	5.6	5.2	5.0
4/23/13	4/24/13	6300	24	4.6	46.0	7.1	5.7	5.5	5.3
4/23/13	4/24/13	8000	24	4.7	27.9	5.6	5.7	5.5	5.3
4/23/13	4/24/13	10000	24	4.6	28.1	5.3	5.4	5.1	5.0
4/23/13	4/24/13	12500	24	4.0	20.5	4.6	4.8	4.5	4.4
4/23/13	4/24/13	16000	24	3.1	20.8	3.8	3.8	3.6	3.5
4/23/13	4/24/13	20000	24	1.7	16.2	2.6	2.8	2.4	2.2

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 87. PAPA216 (Drill rig, pad 5-19, 435 m) hourly dBA metrics, April 23-24, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/24/2013	4/24/2013	0	1	35.5	58.9	41.0	42.2	40.4	38.2
4/24/2013	4/24/2013	1	1	37.4	58.4	42.0	42.7	41.3	39.8
4/24/2013	4/24/2013	2	1	37.6	52.9	42.5	43.8	42.0	40.4
4/24/2013	4/24/2013	3	1	40.3	62.9	44.5	45.5	43.9	42.3
4/24/2013	4/24/2013	4	1	39.7	61.8	44.5	45.2	43.6	41.9
4/24/2013	4/24/2013	5	1	40.7	65.9	46.1	46.0	44.5	43.2
4/24/2013	4/24/2013	6	1	41.4	65.1	46.3	45.9	44.3	43.0
4/24/2013	4/24/2013	7	1	40.1	49.0	43.4	44.6	43.2	41.9
4/24/2013	4/24/2013	8	1	35.9	53.9	41.5	43.4	41.2	38.4
4/24/2013	4/24/2013	9	1	34.0	49.6	39.0	40.6	38.6	36.9
4/24/2013	4/24/2013	10	1	NA	NA	NA	NA	NA	NA
4/23/2013	4/23/2013	11	1	29.9	49.6	36.9	39.1	36.2	33.7
4/23/2013	4/23/2013	12	1	30.3	61.6	39.0	40.5	37.9	34.4
4/23/2013	4/23/2013	13	1	35.5	45.0	40.5	42.0	40.3	38.6
4/23/2013	4/23/2013	14	1	38.1	51.8	41.8	43.0	41.4	40.0
4/23/2013	4/23/2013	15	1	35.5	53.3	42.7	44.4	42.5	39.0
4/23/2013	4/23/2013	16	1	36.1	55.9	41.9	44.1	41.2	38.8
4/23/2013	4/23/2013	17	1	35.3	58.4	41.4	41.8	39.5	37.6
4/23/2013	4/23/2013	18	1	34.0	44.9	39.5	41.0	39.2	37.6
4/23/2013	4/23/2013	19	1	35.8	44.4	39.0	40.2	38.8	37.5
4/23/2013	4/23/2013	20	1	36.7	45.6	39.9	41.0	39.7	38.6
4/23/2013	4/23/2013	21	1	37.1	49.5	40.6	41.8	40.2	38.8
4/23/2013	4/23/2013	22	1	36.9	51.7	41.2	42.4	40.7	39.3
4/23/2013	4/23/2013	23	1	38.5	49.4	41.5	42.5	41.2	40.1

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 88. PAPA216 (Drill rig, pad 5-19, 435 m) dBA and one-third octave band metrics, April 23-24, 2013.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/23/13	4/24/13	dBA	23	29.9	65.9	42.2	42.5	41.2	38.8
4/23/13	4/24/13	12.5	23	32.2	71.0	49.0	50.7	46.4	42.1
4/23/13	4/24/13	16	23	37.9	69.8	52.5	54.6	51.4	47.7
4/23/13	4/24/13	20	23	47.5	73.9	65.0	68.0	64.7	59.9
4/23/13	4/24/13	25	23	43.7	75.0	60.9	64.1	57.4	53.2
4/23/13	4/24/13	31.5	23	52.9	82.4	72.3	74.6	70.3	64.4
4/23/13	4/24/13	40	23	44.3	68.2	58.1	59.7	57.5	55.7
4/23/13	4/24/13	50	23	40.8	69.4	57.5	58.6	55.2	52.7
4/23/13	4/24/13	63	23	36.8	73.4	62.8	64.4	61.6	58.3
4/23/13	4/24/13	80	23	31.2	73.9	55.4	57.4	54.2	51.0
4/23/13	4/24/13	100	23	28.0	76.8	52.2	54.1	51.7	49.1
4/23/13	4/24/13	125	23	25.3	71.5	43.5	44.8	43.2	40.1
4/23/13	4/24/13	160	23	23.0	64.4	42.7	40.9	38.2	35.8
4/23/13	4/24/13	200	23	21.0	65.2	38.1	37.3	34.4	31.8
4/23/13	4/24/13	250	23	16.8	62.4	35.0	34.4	30.7	27.5
4/23/13	4/24/13	315	23	16.8	57.9	34.5	35.2	31.1	27.5
4/23/13	4/24/13	400	23	14.8	53.4	32.8	33.2	29.0	25.2
4/23/13	4/24/13	500	23	8.8	53.8	27.5	27.0	22.3	18.5
4/23/13	4/24/13	630	23	8.9	54.0	26.3	25.1	20.7	17.4
4/23/13	4/24/13	800	23	7.8	50.4	25.5	25.3	21.5	17.4
4/23/13	4/24/13	1000	23	7.6	49.3	24.5	24.1	20.4	16.9
4/23/13	4/24/13	1250	23	7.7	45.9	24.6	22.6	19.5	16.7
4/23/13	4/24/13	1600	23	7.0	44.8	24.6	21.0	18.3	15.5
4/23/13	4/24/13	2000	23	4.4	51.3	20.0	17.2	13.7	10.5
4/23/13	4/24/13	2500	23	3.7	37.9	15.0	15.1	10.3	7.5
4/23/13	4/24/13	3150	23	3.4	44.0	10.8	8.8	5.9	4.9
4/23/13	4/24/13	4000	23	3.6	41.9	7.9	5.8	4.7	4.4
4/23/13	4/24/13	5000	23	4.0	40.6	7.2	5.1	4.7	4.5
4/23/13	4/24/13	6300	23	4.3	37.7	5.6	5.1	4.9	4.7
4/23/13	4/24/13	8000	23	4.4	39.5	5.4	5.0	4.8	4.7
4/23/13	4/24/13	10000	23	4.1	36.0	4.9	4.7	4.6	4.4
4/23/13	4/24/13	12500	23	3.5	28.9	4.3	4.2	4.1	3.9
4/23/13	4/24/13	16000	23	2.7	27.6	3.6	3.5	3.3	3.2
4/23/13	4/24/13	20000	23	1.5	24.9	2.5	2.5	2.2	1.9

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 89. PAPA217 (Johan compressor station, 140 m ESE) hourly dBA metrics, April 23-24, 2013.

Date Start	Date End	Hour	N. Hrs.	Lmin	Lmax	Leq	L10	L50	L90
4/24/2013	4/24/2013	0	1	49.6	68.9	51.9	52.0	51.2	50.5
4/24/2013	4/24/2013	1	1	49.2	55.9	51.3	52.2	51.1	50.4
4/24/2013	4/24/2013	2	1	49.2	60.0	51.3	51.8	51.0	50.4
4/24/2013	4/24/2013	3	1	48.7	59.0	51.0	51.8	50.8	49.9
4/24/2013	4/24/2013	4	1	49.0	54.5	51.0	51.8	50.8	50.0
4/24/2013	4/24/2013	5	1	48.6	59.2	50.6	51.5	50.4	49.6
4/24/2013	4/24/2013	6	1	48.5	56.8	50.7	51.5	50.6	49.8
4/24/2013	4/24/2013	7	1	48.3	63.7	50.6	51.5	50.4	49.5
4/24/2013	4/24/2013	8	1	48.2	54.5	50.4	51.3	50.2	49.4
4/24/2013	4/24/2013	9	1	47.6	62.1	50.1	50.9	49.8	49.0
4/24/2013	4/24/2013	10	1	48.1	55.8	50.8	51.8	50.6	49.6
4/23/2013	4/23/2013	11	1	NA	NA	NA	NA	NA	NA
4/23/2013	4/23/2013	12	1	46.1	60.9	51.7	54.5	50.4	47.7
4/23/2013	4/23/2013	13	1	48.8	59.5	54.8	56.1	55.0	50.5
4/23/2013	4/23/2013	14	1	48.7	60.8	55.9	58.2	56.3	50.4
4/23/2013	4/23/2013	15	1	48.6	66.8	55.0	58.2	53.6	50.5
4/23/2013	4/23/2013	16	1	49.2	58.3	51.1	51.9	51.0	50.2
4/23/2013	4/23/2013	17	1	48.9	58.1	50.9	51.8	50.8	50.0
4/23/2013	4/23/2013	18	1	48.9	56.0	51.0	51.9	50.8	50.0
4/23/2013	4/23/2013	19	1	48.9	55.0	51.0	51.8	50.9	50.1
4/23/2013	4/23/2013	20	1	49.6	54.4	51.2	51.8	51.2	50.6
4/23/2013	4/23/2013	21	1	49.1	64.5	51.2	51.7	50.9	50.3
4/23/2013	4/23/2013	22	1	49.7	65.0	51.9	52.3	51.5	50.9
4/23/2013	4/23/2013	23	1	50.0	60.9	51.8	52.3	51.5	50.9

Appendix C. dBA and One-third Octave Metrics for PAPA Noise Source Sites (cont.).

Table 90. PAPA217 (Johan compressor station, 140 m ESE) dBA and one-third octave band metrics, April 23-24, 2013.

Date Start	Date End	dBA/Freq	N. Hrs	LMin	LMax	Leq	L10	L50	L90
4/23/13	4/24/13	dBA	23	46.1	68.9	51.9	51.8	50.9	50.1
4/23/13	4/24/13	12.5	23	41.8	73.7	56.2	58.1	54.8	50.9
4/23/13	4/24/13	16	23	47.6	78.1	62.6	64.5	61.3	57.2
4/23/13	4/24/13	20	23	49.4	78.8	66.2	68.9	64.5	60.6
4/23/13	4/24/13	25	23	48.6	78.6	59.9	61.6	59.3	56.9
4/23/13	4/24/13	31.5	23	52.6	76.7	62.8	64.6	62.3	59.9
4/23/13	4/24/13	40	23	52.9	79.2	60.6	61.6	59.9	58.0
4/23/13	4/24/13	50	23	55.5	82.7	64.4	64.5	62.9	61.1
4/23/13	4/24/13	63	23	56.2	81.2	64.3	65.3	64.0	62.6
4/23/13	4/24/13	80	23	57.9	80.5	65.5	66.2	64.9	63.6
4/23/13	4/24/13	100	23	53.0	75.4	63.5	62.9	61.4	60.0
4/23/13	4/24/13	125	23	49.1	71.1	57.8	58.5	56.9	55.1
4/23/13	4/24/13	160	23	47.9	75.8	56.4	55.8	54.5	53.4
4/23/13	4/24/13	200	23	41.5	67.2	54.7	55.5	54.2	52.4
4/23/13	4/24/13	250	23	41.2	63.4	50.9	51.7	50.1	48.7
4/23/13	4/24/13	315	23	32.2	63.6	42.1	42.1	40.3	38.5
4/23/13	4/24/13	400	23	28.7	55.9	37.3	37.8	35.7	34.1
4/23/13	4/24/13	500	23	26.3	57.3	34.8	35.7	33.6	31.9
4/23/13	4/24/13	630	23	22.4	56.0	30.9	31.9	30.0	27.9
4/23/13	4/24/13	800	23	19.5	52.3	28.8	30.0	27.3	25.1
4/23/13	4/24/13	1000	23	19.7	55.9	30.6	32.1	29.4	27.0
4/23/13	4/24/13	1250	23	21.5	60.0	33.1	35.2	32.0	29.3
4/23/13	4/24/13	1600	23	22.8	60.9	36.0	38.5	34.9	31.8
4/23/13	4/24/13	2000	23	21.3	60.9	33.7	35.1	32.5	30.0
4/23/13	4/24/13	2500	23	22.2	57.0	33.2	34.4	32.4	30.0
4/23/13	4/24/13	3150	23	18.0	59.7	30.1	31.1	29.3	26.5
4/23/13	4/24/13	4000	23	14.7	52.9	26.2	27.3	25.5	23.1
4/23/13	4/24/13	5000	23	10.7	56.4	21.5	22.2	20.0	17.8
4/23/13	4/24/13	6300	23	6.8	55.7	16.7	15.2	13.6	11.6
4/23/13	4/24/13	8000	23	5.4	49.1	11.1	9.8	8.5	7.3
4/23/13	4/24/13	10000	23	5.2	42.8	7.7	6.9	6.3	5.9
4/23/13	4/24/13	12500	23	4.4	40.6	6.6	5.2	5.0	4.8
4/23/13	4/24/13	16000	23	2.3	33.9	4.1	3.0	2.9	2.7
4/23/13	4/24/13	20000	23	-0.1	30.6	2.1	0.6	0.5	0.3

Appendix D. Influence of Fleece Windscreen on Decibel Data.

In the PAPA area, high winds, animals, and human activity are common. In order to minimize the influence of wind on the decibel data and to protect the equipment, we used a second windscreen in addition to the standard 90 mm foam windscreen. The additional windscreen was made of thin fleece material placed over a 0.4 m (15 in) high and 0.3 m (12 in) wide wire cylindrical cage (Figures 7-8). This approach is similar to the dual-stage windscreen used in noise measurement systems in remote and windy areas of national parks (Miller et al. 1997, Lee et al. 2006).

In order to test the influence of the fleece windscreen on decibel data, we collected data simultaneously using two LD 831 sound level meters at the Big John lek from April 7-10, 2013. One system had the standard 90 mm foam windscreen only and the other system had the 90 mm foam windscreen plus the fleece and wire cage windscreen (Figures 7-8). We tested the influence of the additional windscreen on dBA and one-third octave band decibel data, both daily and for all days, and found the influence to be minimal.

For daily L_{50} dBA levels, the mean difference was 0.0 dBA (min = -0.1, max = +0.2); for daily L_{90} dBA levels, the mean difference was +0.1 dBA (min = +0.3; max = 0.0). For daily L_{eq} levels, the mean difference was -1.5 dBA (min = -2.8; max = -0.1) (Table 92). Overall, for all days, L_{eq} dBA was slightly higher for the system with the foam only windscreen, L_{90} dBA was slightly higher for the system with the foam/fleece windscreen, and L_{50} dBA was the same for both systems.

L_{50} one-third octave band frequency levels were on average +0.1 dB different (min = -1.8; max = +2.1) between the two windscreens; L_{90} levels were on average +0.3 dB different (min = -1.4; max = +2.5); and L_{eq} levels were on average -1.6 dB different (min = -4.5; max = +0.9) (Tables 93-94; Figures 9-13). For all metrics, the largest differences were at low (<40 Hz) or high frequencies (>4000 Hz).

Normally, the addition of windscreen material over a microphone results in lower decibel levels at high frequencies. However, this comparison revealed that the addition of the fleece windscreen did not always result in lower levels for this system, and frequently this system had higher levels. These small differences in dBA levels, with each system occasionally higher or lower, suggest that differences in dBA and dB levels were likely due to localized effects related to wind through vegetation, the presence of insects or other acoustic phenomena. All of the dBA level differences and most of the dB level differences were within the precision limits of the instruments.

Appendix D. Influence of Fleece Windscreen on Decibel Data (cont.).

In addition to providing extra wind protection, the fleece cover also protected the 90 mm foam windscreen from disturbance by mammals in the area. In previous long-term measurements in remote locations, mammals such as deer, moose, bear, and small rodents frequently chewed on or removed the foam windscreen from the microphone, resulting in unusable decibel data. Using the fleece material and cylindrical cage over the microphone prevented damage to the microphones and foam windscreens due to animals. A third benefit of the fleece material was security. We used a camouflage colored fleece material that was similar to the sage land cover, and this made the acoustic systems harder to see. At several measurement locations, acoustic systems were near roads and human activity, and thus susceptible to disturbance or theft. The use of camouflage fleece material minimized the risk of this issue.

Figure 7. Windscreen made of fleece material placed over a 0.4 m (15 in) high and 0.3 m (12 in) wide wire cylindrical cage.

Appendix D. Influence of Fleece Windscreen on Decibel Data (cont.).

Figure 8. Data collection with LD 831 systems using two different types of windscreens, foam only and foam/fleece, both microphones 0.3 m high, 2.0 m apart.

Appendix D. Influence of Fleece Windscreen on Decibel Data (cont.).

Table 91. PAPA101 (foam only windscreen) and PAPA102 (foam/fleece windscreen) L_{10}, L_{50}, L_{90}, and L_{eq} dBA metrics, April 7-10, 2013, 0000-2400.

	Foam	Foam/Fleece	
L10	PAPA101	PAPA102	Difference
4/7/2013	25.3	25.3	0.0
4/8/2013	25.6	25.9	0.3
4/9/2013	25.3	24.3	-1.0
4/10/2013	26.9	26.2	-0.7
Mean	25.8	25.4	

L50	PAPA101	PAPA102	Difference
4/7/2013	21.2	21.2	0.0
4/8/2013	21.9	22.1	0.2
4/9/2013	18.3	18.2	-0.1
4/10/2013	21.0	20.9	-0.1
Mean	20.6	20.6	

L90	PAPA101	PAPA102	Difference
4/7/2013	19.0	19.1	0.1
4/8/2013	19.7	19.9	0.2
4/9/2013	16.1	16.4	0.3
4/10/2013	18.6	18.6	0.0
Mean	18.4	18.5	

Leq	PAPA101	PAPA102	Difference
4/7/2013	28.0	26.3	-1.7
4/8/2013	35.0	32.2	-2.8
4/9/2013	25.6	24.4	-1.2
4/10/2013	31.0	30.9	-0.1
Mean	29.9	28.5	

Appendix D. Influence of Fleece Windscreen on Decibel Data (cont.).

Table 92. PAPA101 (foam only windscreen), dBA and one-third octave band levels, April 7-10, 2013.

Freq./dBA	NHours	LMin	LMax	Leq	L10	L50	L90
dBA	96	13.9	67.6	31.3	25.9	21.2	18.0
20	96	17.2	75.3	52.3	51.2	45.5	40.3
25	96	17.8	74.5	49.0	44.6	39.0	34.6
31.5	96	16.2	71.4	47.0	44.7	39.2	34.6
40	96	13.2	70.7	44.2	39.3	34.6	31.0
50	96	11.1	74.7	41.6	36.8	32.4	29.1
63	96	10.0	81.6	40.1	36.2	31.4	28.4
80	96	9.0	82.2	39.2	35.1	30.0	26.6
100	96	5.7	86.2	38.3	32.9	28.4	25.4
125	96	4.3	74.4	34.4	31.4	26.5	22.9
160	96	1.7	69.3	31.7	30.6	24.7	20.3
200	96	-0.7	71.6	29.3	27.6	21.5	17.0
250	96	-1.9	64.0	26.8	24.6	18.5	13.6
315	96	-3.0	56.1	23.9	21.5	14.7	9.5
400	96	-4.2	57.7	21.2	17.1	10.2	4.5
500	96	-4.2	53.7	19.3	14.6	7.3	0.5
630	96	-4.2	46.2	16.9	7.6	1.4	-1.6
800	96	-4.0	45.7	15.0	6.0	-0.3	-2.0
1000	96	-3.3	41.4	14.6	5.5	-0.6	-1.7
1250	96	-2.6	38.3	14.2	4.8	-0.3	-1.2
1600	96	-1.7	38.5	14.1	3.6	0.2	-0.5
2000	96	-0.8	38.2	13.5	3.8	0.9	0.3
2500	96	0.2	40.5	12.0	3.9	1.6	1.2
3150	96	0.3	42.3	10.3	3.7	2.5	2.1
4000	96	-0.2	44.3	9.9	4.2	3.4	3.1
5000	96	-0.4	46.1	10.6	4.9	4.2	3.9
6300	96	-0.7	45.7	10.8	5.5	5.0	4.7
8000	96	-0.9	46.0	11.1	5.9	5.5	5.3
10000	96	-0.7	45.6	11.0	6.1	5.7	5.4
12500	96	-0.9	44.7	9.8	5.5	5.0	4.6
16000	96	-1.1	44.8	8.2	4.1	3.1	2.6
20000	96	-1.0	41.3	4.9	3.1	0.7	0.1

Appendix D. Influence of Fleece Windscreen on Decibel Data (cont.).

Table 93. PAPA102 (foam/fleece windscreen), dBA and one-third octave band levels, April 7-10, 2013.

Freq./dBA	NHours	LMin	LMax	Leq	L10	L50	L90
dBA	93	14.6	68.5	29.5	25.3	20.9	18.4
20	93	16.9	74.7	49.4	48.9	43.7	39.3
25	93	17.5	70.5	44.6	41.5	37.3	33.8
31.5	93	16.4	67.5	43.0	42.5	37.8	33.2
40	93	14.1	65.9	39.7	37.3	34.0	30.8
50	93	11.3	75.1	37.5	35.3	32.0	28.8
63	93	9.3	80.8	37.6	34.7	30.9	28.0
80	93	8.7	84.1	37.7	33.9	29.1	26.2
100	93	5.4	84.5	38.1	32.4	28.0	25.2
125	93	3.3	72.7	33.5	31.0	26.6	23.0
160	93	1.1	69.5	30.7	30.4	24.4	20.4
200	93	-0.8	69.4	28.1	27.1	21.2	16.9
250	93	-2.8	66.8	25.3	23.0	17.7	12.5
315	93	-3.4	58.2	23.2	20.7	14.5	9.0
400	93	-4.1	58.5	21.0	16.4	10.1	4.6
500	93	-4.1	51.2	18.9	13.9	6.3	0.3
630	93	-3.7	48.4	16.4	5.9	1.3	-1.3
800	93	-3.0	47.2	14.3	5.0	0.1	-1.1
1000	93	-2.3	43.3	14.1	5.0	0.5	-0.6
1250	93	-1.3	40.3	14.3	4.8	1.0	0.1
1600	93	-0.4	37.8	15.0	4.1	1.7	0.9
2000	93	0.6	38.5	14.0	4.0	2.4	1.8
2500	93	1.5	39.6	12.6	4.3	3.1	2.6
3150	93	2.6	40.4	10.6	4.7	3.8	3.4
4000	93	0.6	42.4	9.1	5.2	4.5	4.1
5000	93	0.0	48.7	8.8	5.6	5.0	4.7
6300	93	0.0	42.6	8.2	5.7	5.3	5.1
8000	93	-0.3	39.2	7.9	5.7	5.4	5.1
10000	93	-0.5	38.4	7.2	5.5	5.2	4.9
12500	93	-0.7	36.9	6.3	5.1	4.7	4.4
16000	93	-0.5	34.1	5.5	4.5	3.9	3.6
20000	93	-0.2	30.9	4.2	3.7	2.8	2.6

Appendix D. Influence of Fleece Windscreen on Decibel Data (cont.).

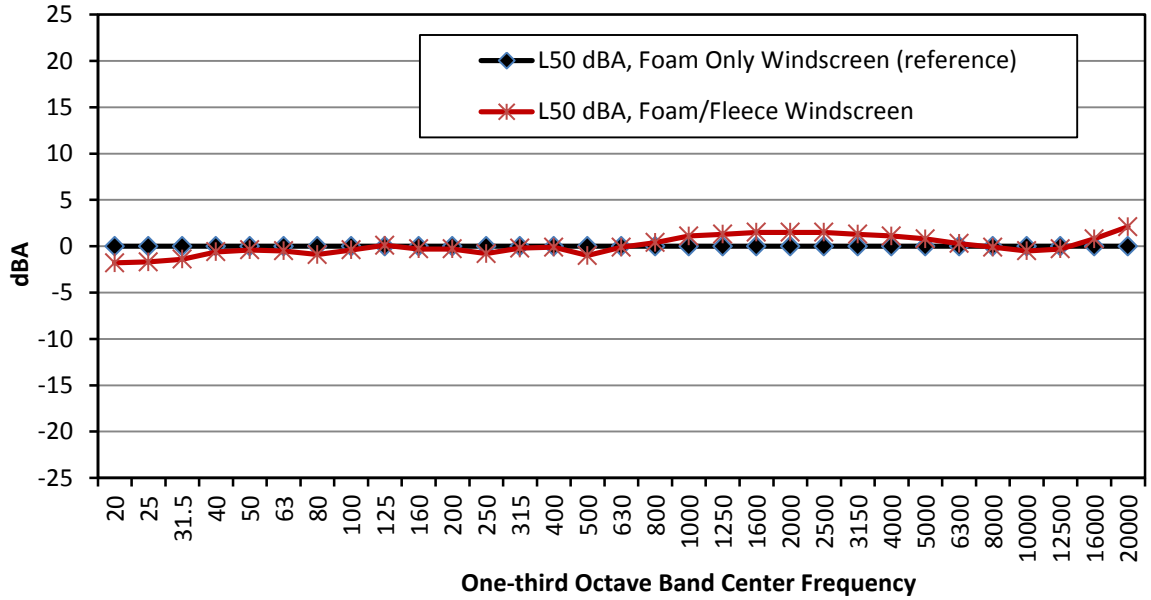

Figure 9. Difference in L_{50} dB levels, 20-20,000 Hz, PAPA101, foam windscreen (reference) and PAPA102, foam/fleece windscreen, April 7-10, 2014 (93 hours).

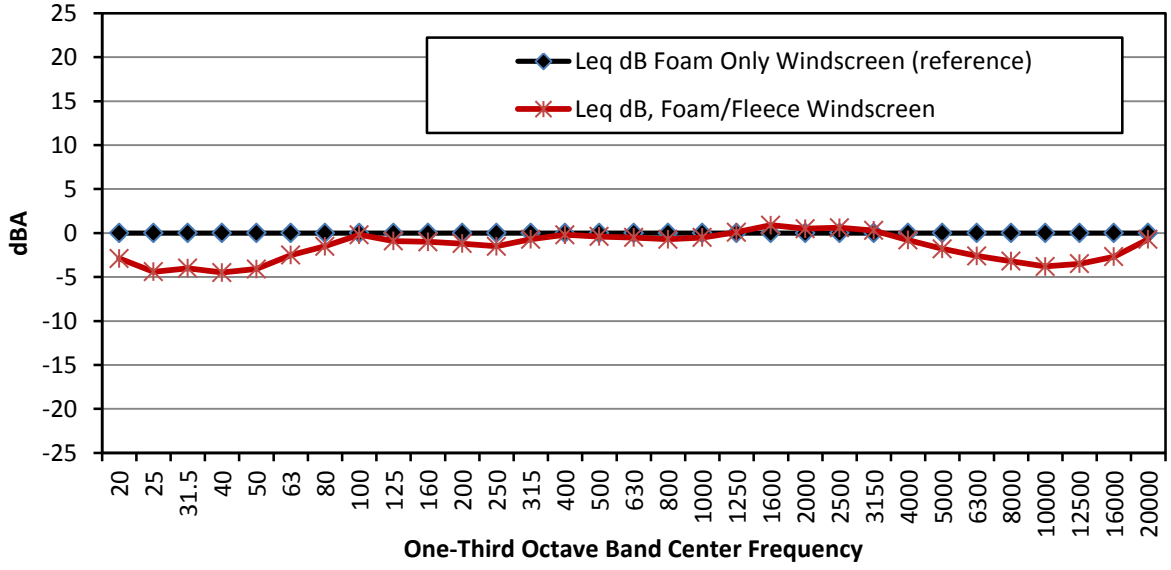

Figure 10. Difference in L_{eq} dB levels, 20-20,000 Hz, PAPA101, foam windscreen (reference) and PAPA102, foam/fleece windscreen, April 7-10, 2014 (93 hours).

Appendix E. Influence of Microphone Height, 1.5 m v. 0.3 m, on dB Data.

In order to test the influence of microphone height on decibel data, we collected data simultaneously using two LD 831 sound level meters. One system had the microphone at 1.5 m and the other system had the microphone at 0.3 m. We compared the L_{eq}, L_{10}, L_{50}, L_{90}, L_{min} and L_{max} dBA metrics for 1 hour on March 13, 2013 (prior to deployment in Wyoming). All metrics of the 1.5 m microphone were slightly higher than metrics of the 0.3 m microphone (Table 92).

Table 94. Influence of microphone height (1.5 m versus 0.3 m) on dBA metrics, March 13, 2013, 1200 hour.

	Mic at 1.5 m	Mic at 0.3 m	Difference.
Date	20130313	20130313	
Hour	1200	1200	
Leq	41.0	38.4	2.6
L10	37.5	36.0	1.5
L50	29.3	28.8	0.5
L90	26.4	25.3	1.1
Lmin	25.0	24.0	1.0
Lmax	73.7	68.9	4.8

Appendix F. Acoustic Primer.

Basic Acoustics

Acoustics is the science of sound. *Sound* can be defined as a pressure variation in air or other media that is within the hearing range of a given species. This pressure variation has two components: amplitude and frequency.

Frequency is the number of times per second that the sine wave of sound repeats itself. It is expressed in cycles per second, or Hertz (Hz). The frequency of a sound determines the tone of a sound (e.g., most aircraft are low frequencies, and most bird calls are high frequencies). Different species of animals hear sounds over a wide range of frequencies. For humans with normal hearing, this range is 20 Hz to 20,000 Hz. Some animals hear better at low frequencies, others at very high frequencies. However, all animals can hear a wide range of frequencies, thus several sounds can be heard at the same time (NPS 2005).

Amplitude is the relative strength of sound waves, which we perceive as loudness or volume. Amplitude is measured in decibels (dB), which refer to the sound pressure level or intensity. The lower threshold of human hearing is 0 dB. Moderate levels of sound (a normal speaking voice, for example) are less than 60 dB. Decibels work on a logarithmic scale, so an increase of 10 dB causes a doubling of perceived loudness and represents a ten-fold increase in sound level (Crocker, 1997).

The acoustical environment is made up of many sounds, and the way animals experience the acoustical environment depends on interactions between the *frequencies* and *amplitudes* of all the sounds. Sound levels are often adjusted (*weighted*) to match the hearing abilities of a given animal. Humans with normal hearing can hear frequencies between 20 Hz and 20,000 Hz, and amplitude as low as 0 dB at 1,000 Hz. Sound levels adjusted for human hearing are expressed as dBA. In Figure 14, sound level thresholds by frequency for humans and some bird species are shown (Fay 1988). We do not have such data for Greater Sage-grouse, but it is likely that thresholds by frequency are similar to other birds.

Appendix F. Acoustic Primer (cont.).

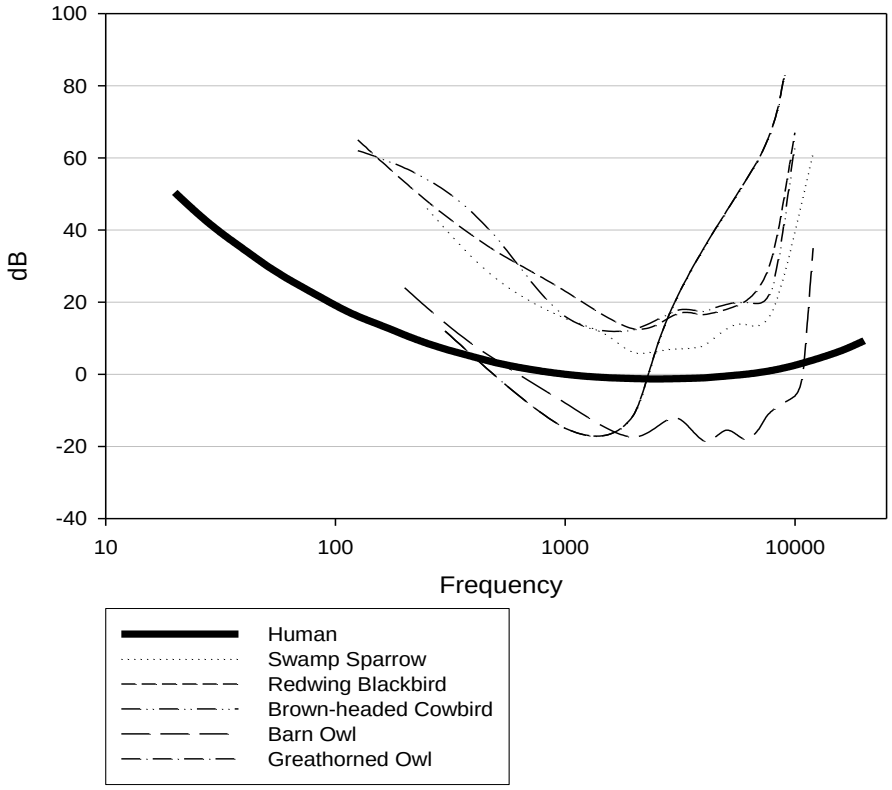

Figure 11. Sound level thresholds by frequency in hearing of humans and bird species.

Visualizing Sounds

Two common methods to visual acoustic data are shown in Figures 15-17. All figures are from recordings at PAPA017 (Oil Road Fork lek). In Figure 15, a 15-second segment of mechanical, Greater Sage-grouse, and coyote sounds is shown. This is called a "spectrogram." The spectrogram plots time along the x-axis and frequency along the y-axis. In this example, only frequencies between 20-5000 Hz are shown. Mechanical sounds are highest at the lower frequencies (<100 Hz), Greater Sage-grouse sounds are highest at frequencies <500 Hz, and coyote sounds dominate at 600 Hz and 1300 Hz. While the Greater Sage-grouse sounds are spread over several frequencies, the coyote sounds are specific to a few frequencies. In Figure 16, a 1-second snapshot of 1/3 octave band data (A-weighted) is shown, with the three sound sources visible at about the same frequencies as in Figure 15 but without as much detail. In this view of a 1-second snapshot, frequency is plotted along the x-axis and amplitude (loudness) is plotted along the y-axis. As in Figure 15, only frequencies between 20-5000 Hz are shown. A more detailed 1-second snapshot is shown in Figure 17. This view shows a narrower band frequency analysis, with finer detail for each frequency. This snapshot corresponds to the 15-second period in Figure 15, with mechanical sounds at about 70 Hz, Greater Sage-grouse sounds at 300-500 Hz, and coyote sounds at about 600 Hz and 1300 Hz.

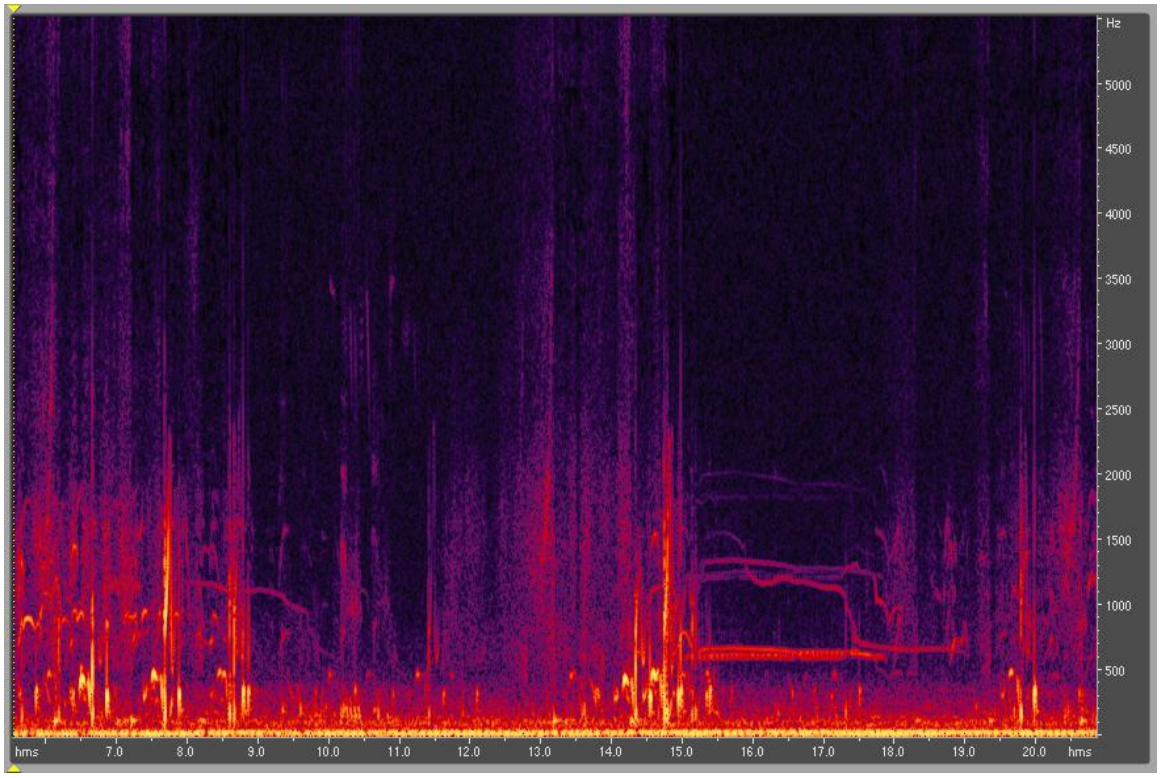

Figure 12. Spectrogram of sounds at PAPA017 (Oil Road Fork lek), with Greater Sage-grouse sounds (20-5,000 Hz), coyote sounds (500-2,000 Hz), and mechanical sounds (<500 Hz).

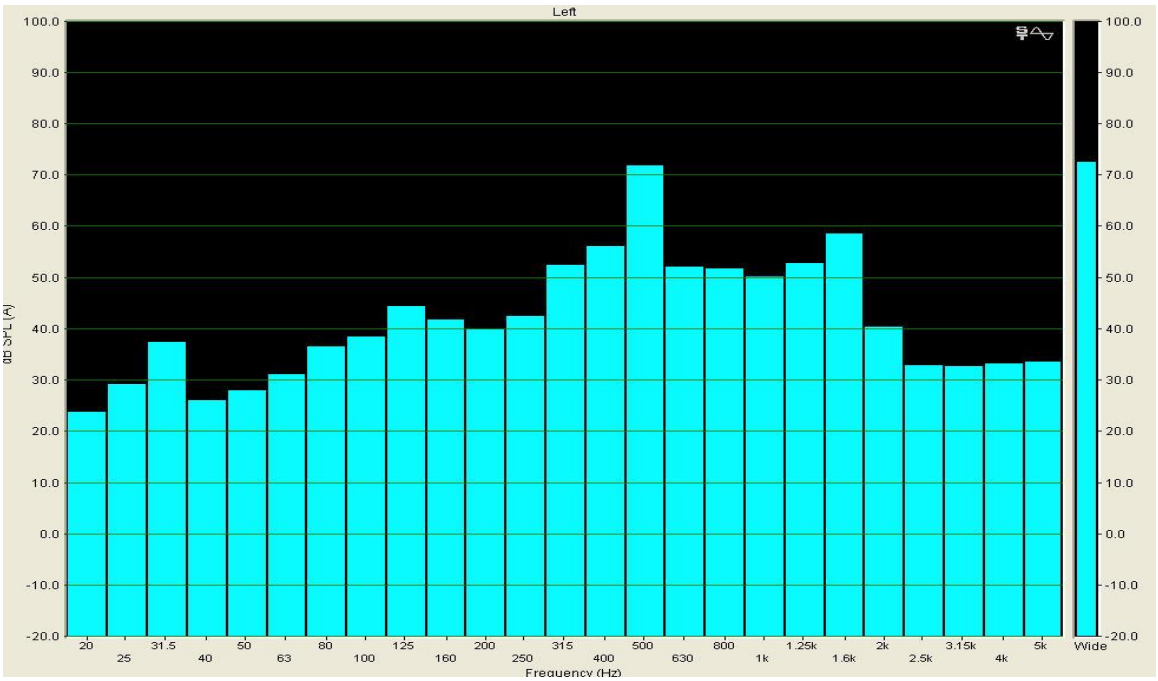

Figure 13. 1-second snapshot sounds at PAPA017 (Oil Road Fork lek), with mechanical sounds, Greater Sage-grouse sounds, and coyote sounds, but with less detail than narrow band analysis.

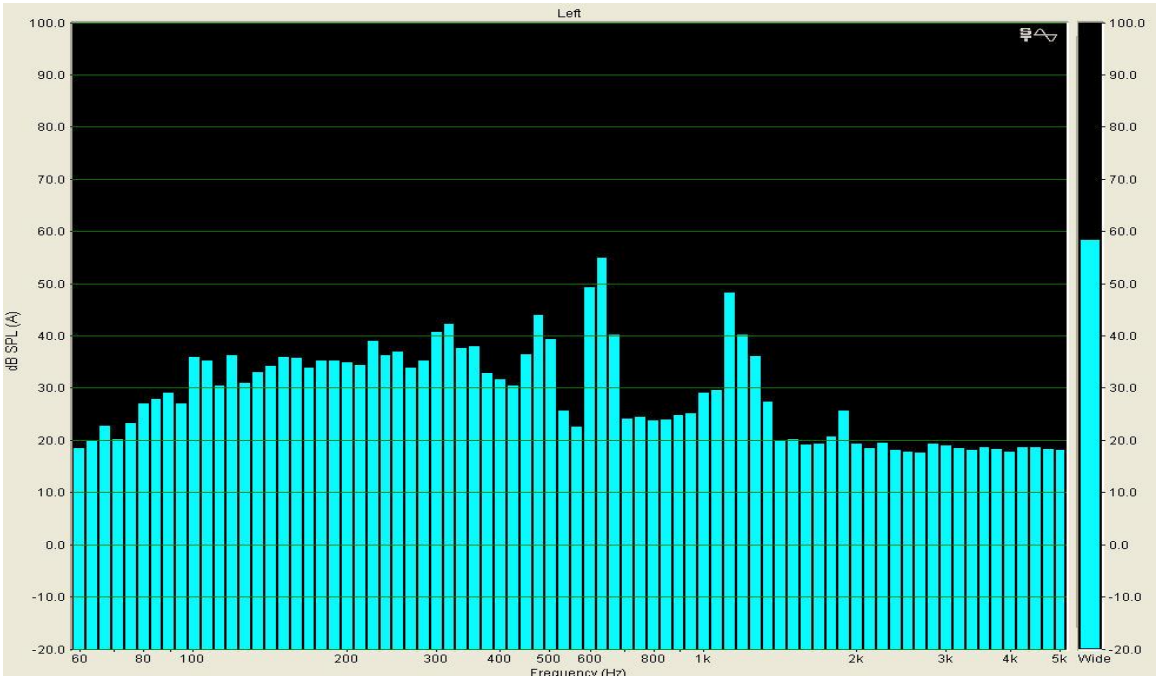

Figure 14. 1-second snapshot of sounds at PAPA017. This view shows a narrower band frequency analysis, with finer detail for each frequency. Mechanical sounds at about 70 Hz, Greater Sage-grouse sounds at 300-500 Hz, and coyote sounds at about 600 Hz and 1300 Hz.

Appendix G. Equipment component list, serial number, and calibration date.

Table 95. Equipment component list, serial number, and calibration date.

SLM LD831 Serial Num.	Calibration Date	PRM831 Serial Num.	Calibration Date	MIC 377B20 Serial Num.	Calibration Date
2201	20130308	12174	20130122	135422	20130122
2258	20130109	19105	20120820	131849	20120820
2544	20130321	23771	20130212	118070	20130212
2573	20120720	19107	20130122	135552	20130122
2661	20121128	19134	20120122	135427	20130122
3140	20130118	23868	20110922	111498	20110922
1304	20110922	0474	20110922	112333	20110922
1308	20110922	0476	20110922	111473	20110922
1311	20110922	0473	20110922	111471	20110922

Calibrators	SN	Calibration Date
B&K 4231	2094637	20100211
B&K 4231	2094432	20100720