Hessler Associates, Inc.
Consultants in Engineering Acoustics

3862 Clifton Manor Place
Suite B
Haymarket, Virginia 20169 USA
Phone: 703-753-1602
Fax: 703-753-1522
Website: www.hesslernoise.com

Report Number 062608-1
Baseline Environmental Noise Survey
Leaf-on Season

Bell Bend Nuclear Power Plant (BBNPP) Project
June 2008

Prepared For:

AREVA NP Inc.
400 Donald Blvd.
Marlborough, MA 01752

Prepared By:
Hessler Associates, Inc.
Consultants in Engineering Acoustics

Principal Consultant:
George F. Hessler Jr., P.E., Bd. Cert. INCE

1.0_Introduction

Hessler Associates has been retained by AREVA NP, Inc. to conduct a baseline environmental noise level measurement survey in the surrounding environs at the Bell Bend Nuclear Power Plant project located near the town of Berwick, Pennsylvania. The site contains two existing PPL nuclear power units, rated at nominal capacities of 1105 and 1111 Mw just to the east of the planned Bell Bend project. An aerial map with topography shading is given on **Figure 1.0.1** that shows the planed Bell Bend expansion area and the selected community noise survey locations 1 through 5.

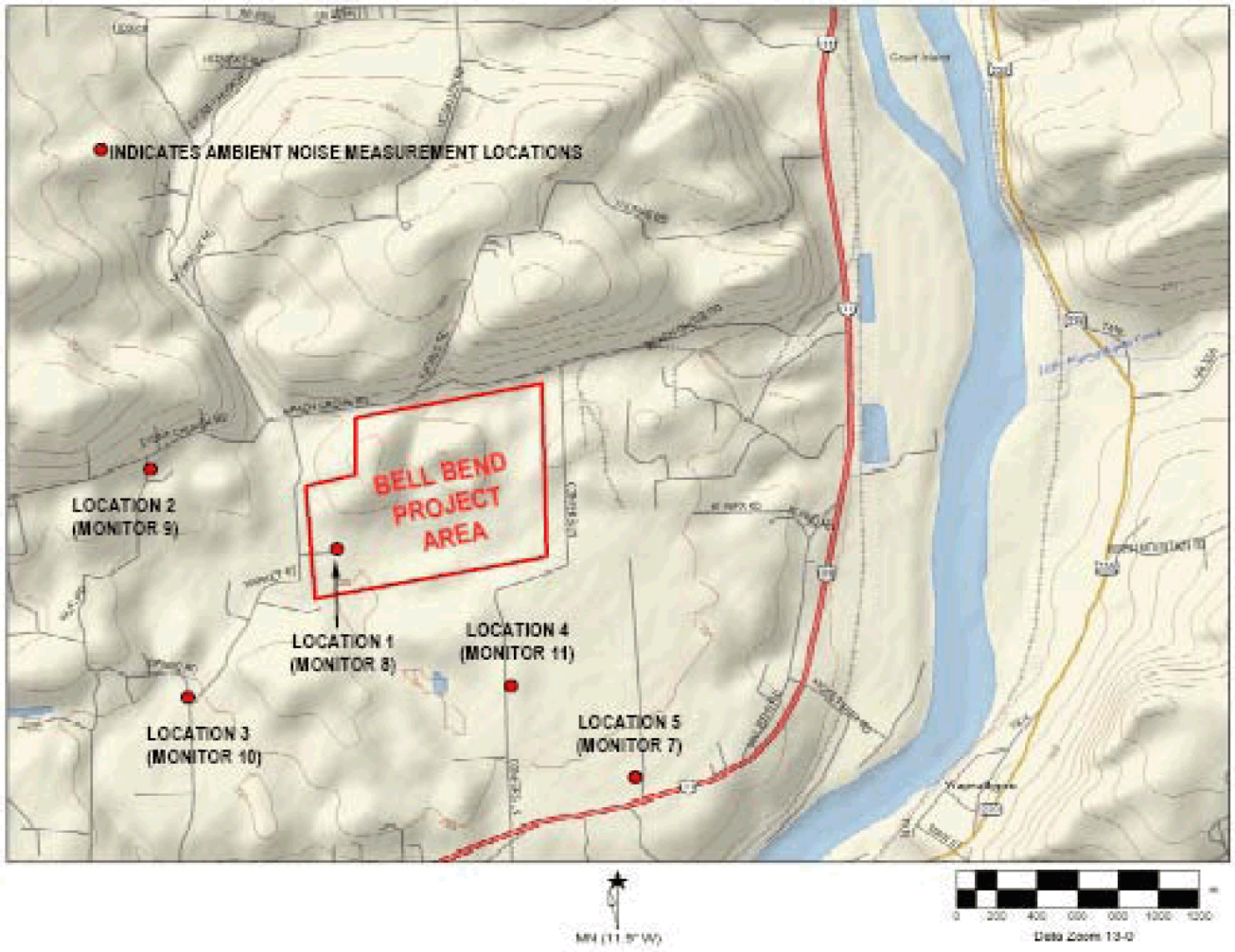

Figure 1.0.1: *Site Map of Bell Bend Project Showing Sound Measurement Locations.*

A *leaf-off* ambient noise survey was completed over a 13 day interval-in March[1] for this site and this report promulgates the results of an identical survey conducted during *leaf-on* seasonal conditions during late May and early June. Measurements are made during leaf-off and leaf-on conditions to detect any contribution from the existing generating facilities, since the excess noise attenuation from dense trees between the plant and community would be different during the two seasons. In addition, potential adverse impact from noise (unwanted sound) is more likely during warmer leaf-on conditions when neighbors are outdoors.

Ambient or existing environmental community noise levels during leaf-on conditions were measured continuously over an 18-day period and are reported as complete days from midnight May 24th through June 10, 2008.

The results of the two surveys covering a combined 31-day measurement period provide a reliable long-term ambient sound level baseline for assessing any noise impact from the planned Bell Bend project.

There are no identified state or local noise ordinances for this project.

2.0_ Executive Summary and Results

Subjectively, existing facility noise emissions from the operating PP&L facilities were not noticeable at any of the five measurement locations during installation and removal of the noise monitors and while conducting manual measurements during these periods.
The data presented below are the minimum measured hourly levels for each of the eighteen complete measurement days. It is customary in three states (NY, MA and CA) with codified ambient-based procedures to use the minimum ambient level present during facility operational hours. For the proposed project with planned 24/7 operation at this rural environment, the minimum value may occur in any hour of the 24-hour day.

Table 2.0.1 below forms the key finding for this leaf-on study with the minimum daily levels measured by the three most common metrics. The average daily weather conditions for each day is plotted for reference, and conditions were not extreme (such as heavy rain or thunder, etc.) to exclude data for any of the measurement time.

Both PPL units 1 and 2 were fully operational during the survey period.

	DATE AND DAY OF WEEK																	AVERAGE
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	DAILY MINIMUM
LOCATION	SAT	SUN	MON	TUE	WEB	THU	FRI	SAT	SUN	MON	TUE	WEB	THU	FRI	SAT	SUN	MON	TUE	HOURLY LEVEL
	LA50 METRIC MINIMUM HOUR MEASUREMENT																		
1	29	38	37	40	36	37	37	40	38	36	39	41	38	40	37	38	39	38	**38**
2	23	27	26	30	29	31	33	39	36	38	33	41	35	38	37	40	40	36	**34**
3	31	30	32	32	30	35	35	36	34	31	34	35	34	38	37	39	37	37	**34**
4	28	32	33	38	36	33	32	29	29	--	--	--	--	--	--	--	--	--	**31**
5	31	36	35	32	37	35	38	36	37	32	40	41	39	37	34	38	41	39	**37**
	LA90 METRIC MINIMUM HOUR MEASUREMENT																		
1	27	33	34	36	33	33	33	36	35	35	35	36	34	35	32	34	33	33	**34**
2	22	25	24	29	27	28	31	35	31	31	31	36	34	37	35	36	36	35	**31**
3	29	29	30	30	29	32	33	34	32	32	32	32	32	34	33	34	34	34	**32**
4	25	30	29	26	33	31	30	27	26	--	--	--	--	--	--	--	--	--	**29**
5	27	33	33	28	35	33	35	33	35	35	35	38	36	33	31	33	35	33	**33**
	LAeq METRIC MINIMUM HOUR MEASUREMENT																		
1	29	39	38	42	38	37	38	45	42	37	39	42	46	44	43	44	44	41	**40**
2	27	33	28	33	32	33	37	41	40	39	33	42	36	39	38	40	42	38	**36**
3	32	37	33	36	34	36	38	38	41	33	36	41	37	44	42	42	41	42	**38**
4	29	33	35	29	39	41	40	37	33	--	--	--	--	--	--	--	--	--	**35**
5	39	41	39	40	39	41	44	41	42	41	44	45	42	41	38	42	43	44	**41**

AVG. WIND, MPH	7	3	4	6	8	3	2	4	5	3	3	2	2	3	3	4	4	3
DIRECTION	NNW	NW	SW	NNW	N	NNW	ESE	SSW	NNW	NNW	SSW	SE	SSE	S	WNW	NW	WNW	W
PERCIPITATION, IN.	0	0	0	0	0	0	0	0.33	0	0	0.12	0.75	0.08	0	0	0	0	0.31

Table 2.0.1: *Tabulation of daily minimum A-weighted sound levels measured over an 18-day sampling period under leaf-on warm weather conditions.*

3.0_Conclusions

Based on observations during this survey and the leaf-off survey it can be concluded that the existing PPL facilities have no discernable noise impact at the five surrounding measurement locations representing the closest residential land use.

Ambient noise in a residential community varies greatly with time of day and day to day. The levels measured and presented above for this survey are representative for daily minimum baseline sound levels during leaf-on warm weather conditions over an extended time period. The measured sound levels are those typically found in a "Very Quiet Suburban or Rural Area", see Table 4.0.2 on page 8.

The combined results for the leaf-on and off surveys provide long-term baseline ambient sound levels for noise assessment analysis.

4.0_ Definitions and Background Information

Units and Discussion of Sound Levels

The universal measure of sound in decibels used throughout the world is the A-weighted sound level, abbreviated dB(A) or dBA. The overall sound level is defined as the summed level in decibels over the entire *audible* frequency range (for young adults) of approximately 20 to 20,000 cycles/second (Hertz). The A-weighted sound level is a convenient single number to quantify the entire spectrum of a sound. A-weighting is an electronic filter applied to the spectrum that reshapes the spectrum to simulate human hearing response to frequency content. Lower frequency sound is subtracted by the A-weighting filter since humans perceive higher frequencies easier than lower notes. The reshaped or weighted new spectrum is summed over the same audible frequency span and is called the overall A-weighted level. Thus, the A-weighted sound level becomes an excellent single number descriptor for audible sounds.

Reference [2] is an informative and a more detailed reference source for definitions and units used in this report.

Table 4.0.1 below is a scale of common sound levels that have similar character to the sounds created by a well designed power plant and many industrial facilities. These data come from the author's files over many years. All of the sounds are broadband, meaning the spectrum is smooth without sharp peaks or tonal noise. Examples of broadband noise are slow speed airflow from HVAC ducting, rushing water, tree leaf rustling and traffic noise without truck diesel tones. More irritating non-broadband tonal noise examples are an alarm clock, siren, diesel engine or construction noise back-up bells or buzzers.

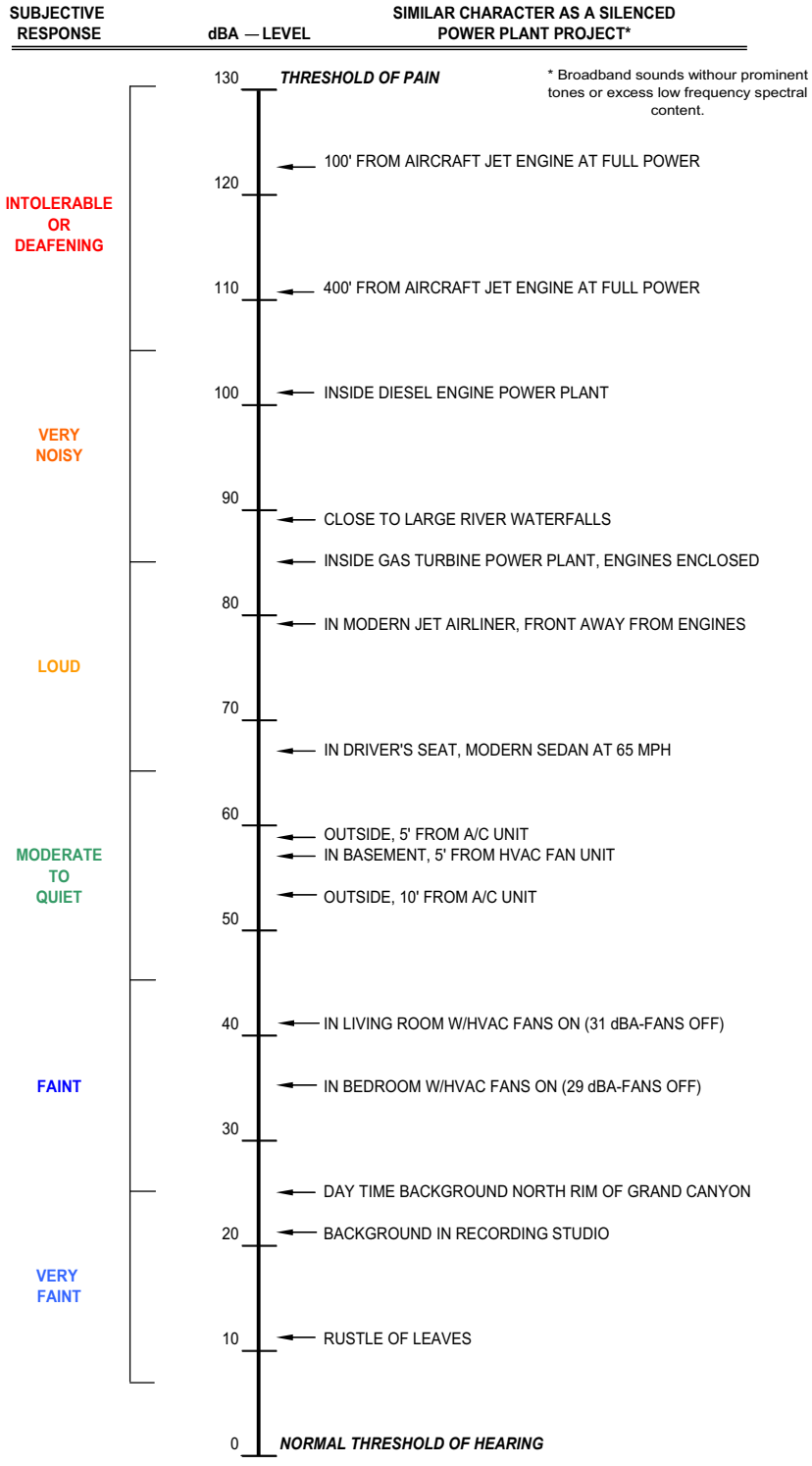

Table 4.0.1: *Table of Common Sounds in A-weighted dBA Units*

The *instantaneous* A-weighted sound level in any residential community varies over any sampling period as sporadic noise events occur. Such events may be passing vehicles, aircraft or rail events, dog barking, tree leaf rustle, song birds, etc. **Figure 4.0.1** below shows the instantaneous level for a 10-minute daytime sample in a quiet rural environment.

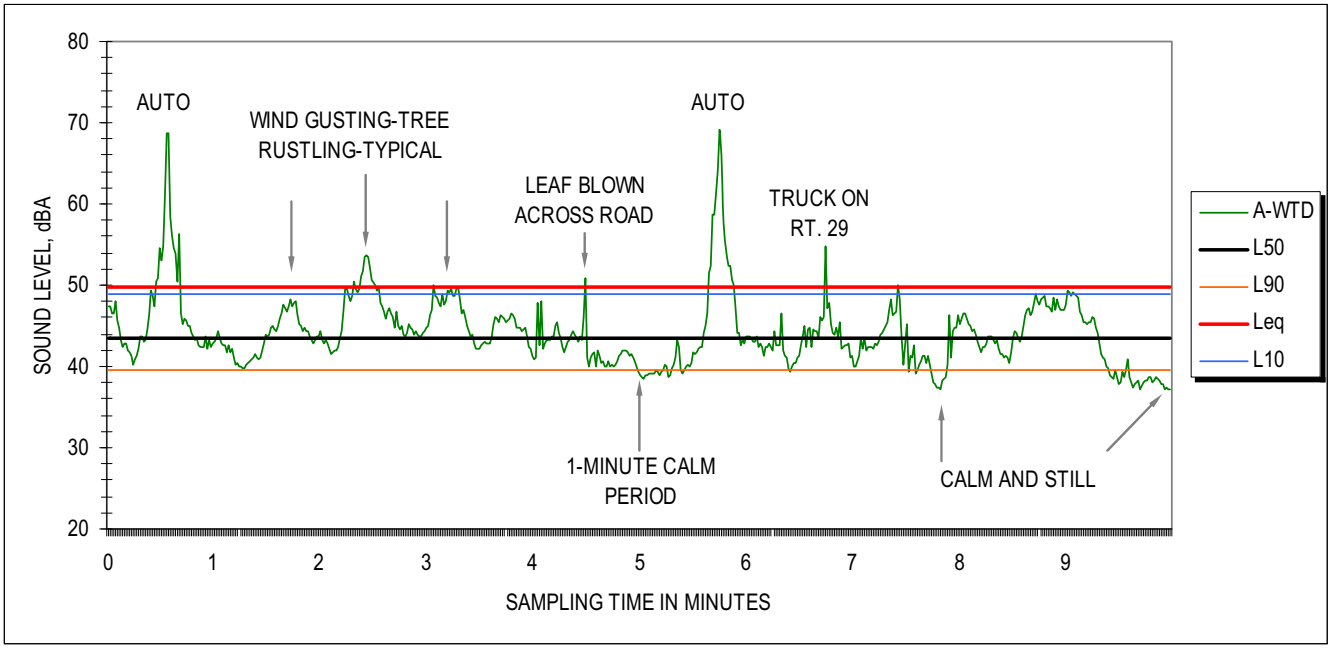

Figure 4.0.1: *Instantaneous sound level plot for a quiet residential environment remote from highways and airports.*

To condense this widely varying data to a more usable form, standard measurement metrics are defined in reference 2. The obvious ones are the minimum, maximum and average levels that occur over the interval. The max and min are the highest and lowest measured instantaneous level during the sampling period. The average, designated Leq is the *equivalent* steady sound level that has the same or equivalent acoustic energy as the actual time varying signal. It can be thought of as the true energy or true pressure average, and is not simply the arithmetic average over the period.

Percentile levels or exceedence levels, designated L_1, L_{10}, L_{50} and L_{90} are statistically derived units over the sampling period. They are the levels exceeded for 1, 10, 50 and 90% of the sampling time. L50 is the mean level where half the time the sound level is higher or lower. Of course, all of these units would be identical if the sound were perfectly steady without any variance with time, i.e., L_{min} would equal L_{max} would equal L_{eq}. etc.

The L_{90} percentile level is often used for evaluating community noise in residential environments. L_{90} is defined in reference 3, pages 5-6 as the "residual" sound level, which is the quasi-steady level that occurs in the absence of all identifiable sporadic sound levels occurring over the interval. The vast majority of all residual sound levels found in communities come from far-away unidentifiable steady levels from traffic and/or industrial sources.

Typical residual daytime levels[3] found throughout the U.S. under calm and still wind conditions are shown in **Table 4.0.2** below:

Typical Residential Area Sound Levels
Daytime Residual Level, dBA, Level Exceeded 90% of the Time, L90

Description	Typical Range	Average
Very Quiet Rural or Remote Area	26 to 30 inclusive	28
Very Quiet Suburban or Rural Area	31 to 35 inclusive	33
Quiet Suburban Residential	36 to 40 inclusive	38
Normal Suburban Residential	41 to 45 inclusive	43
Urban Residential	46 to 50 inclusive	48
Noisy Urban Residential	51 to 55 inclusive	53
Very Noisy Urban Residential	56 to 60 Inclusive	58

Table 4.0.2: *Typical Residual Sound levels in Residential Communities.*

5.0_ Methodology

5.1_Instrumentation for Continuous and Manual Measurements

The instantaneous sound level was measured on a continuous and simultaneous basis over the 312-hour period using type 2 precision data loggers programmed to record the metrics discussed in Section 4 above. The meters report the data in hourly intervals. A typical continuous data logger is shown in **Figure 5.0.1** below:

Figure 5.1.1: *Data logger shown in weatherproof case with power supply and remote microphone.*

The loggers were checked for calibration by inserting two independent type 1 precision portable calibrators onto the microphone when each meter was setup and taken down. This calibrates the entire system of microphone, preamplifier and sound level meter (SLM) electronics. The reason for using separate calibrators is to insure accuracy even though each calibrator is checked for accuracy yearly at a NIST certified laboratory. The chance of one being out of calibration is low, but would show up immediately if the proper sensitivity of each did not agree. The start and finish calibrations for this survey are tabulated below:

	START		FINISH	
LOCATION	B&K 4230	Rion NC-73	B&K 4230	Rion NC-73
1	94.0	94.0	93.6	93.8
2	↓	↓	93.6	94.0
3	↓	↓	93.6	94.0
4	↓	↓	93.5	93.6
5	↓	↓	93.5	93.9

Table 5.1.1: *Calibration at start and finish of monitoring period.*

The calibration change was insignificant (<0.5 dBA) at all locations 1 through 5.

In addition to the continuous data loggers, manual measurements were carried out at each location during day time periods with a Rion model NA27 type 1 precision sound level meter (SLM) and 1/3 octave band frequency analyzer. The meters were programmed to run for ten-minute intervals to calculate the average and other statistical metrics described in Section 4 above. Attended measurements allow observations of weather effects and identification of environmental noise sources.

5.2_Monitor Locations

Five monitor locations were chosen after review of the site to visually locate potentially sensitive receptors in all directions around the site. Each location is shown on **Figure 1.0.1**. These residences are the closest to the plant and represent the surrounding residential and farming community.

One monitor was placed in the planned Bell Bend plant area and reasonably close to the existing PPL plant.

All of the remaining monitors were located near residential locations. The monitors were mounted to trees or utility poles at a height of approximately 6 feet above grade.

Locations 2, 3 and 4 are the closest residential receptors to the planned expansion area. Location 5 is on the power line right of way approximately 250 feet from route 11.

The GPS coordinates for each location are given below:

LOCATION	DEGREES	MINUTES	DEGREES	MINUTES
1	N38	58.956	W81	55.717
2	N38	59.372	W81	56.878
3	N38	59.270	W81	56.884
4	N38	59.447	W81	56.055
5	N38	58.828	W81	56.678

6.0_Discussion of Results

6.1_Monitor Measurement Results

Appendix A-1 and A-2 contain graphic plots of the measured hourly data at each location for the entire sampling program. All metrics are plotted for each hour including the minimum and maximum levels, Leq and the statistical metrics of L10, L50 and L90. The maximum levels in each hour represent passing traffic.

To illustrate, **Figure 6.1.1** below is a plot showing the residual LA90 sound level at all locations. The trends are consistent in the five community locations but note the variability from hour to hour. This is expected since the residual sound level in a quiet rural setting is dependent on wind and insect and other natural sources. The cable connecting the processor to microphone became disconnected (raccoons suspected) for monitor 4 on June 2nd resulting in data loss.

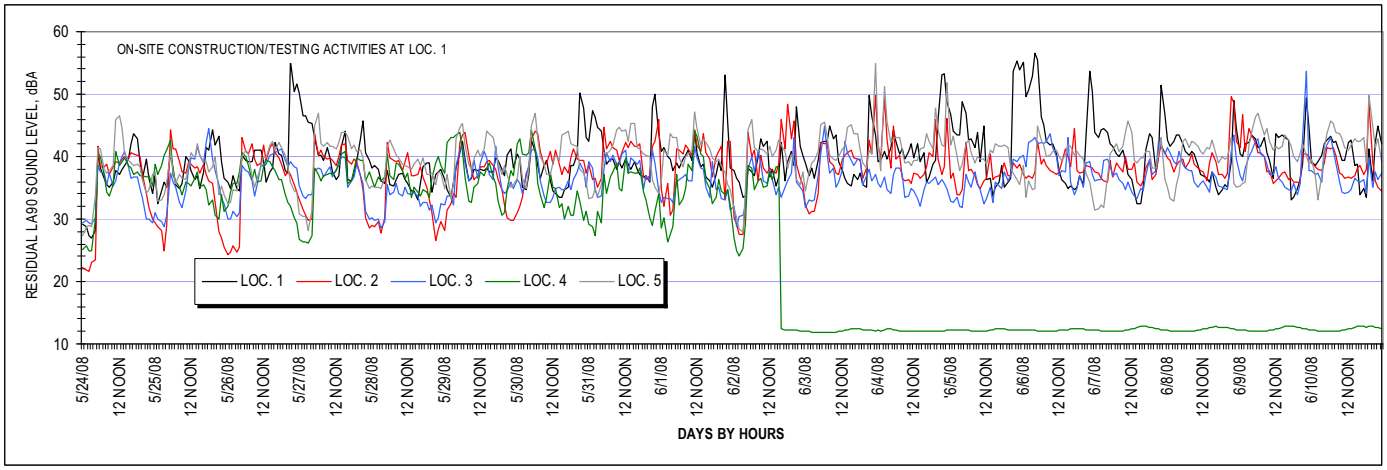

Figure 6.1.1: *Plot of residual LA90 sound level at locations 1 through 5 over the entire sampling period.*

6.2_Attended Measurement Results

Attended 10-minute sampling measurements were carried out to observe sources of environmental sounds and to record the frequency spectrum of the level. **Figure 6.2.1** below shows the measured spectra at all five locations at the start and finish of the monitoring period. Measurement conditions were good during both surveys with mild wind and mostly sunny sky.

Plant noise was essentially absent during both surveys at all locations. Although some very faint plant sound was discernable on the set-up survey only at location 4. High line "crackle" sound was audible at location 5 under the high line.

Figure 6.2.1 below plots the measured spectra at all locations for both surveys.

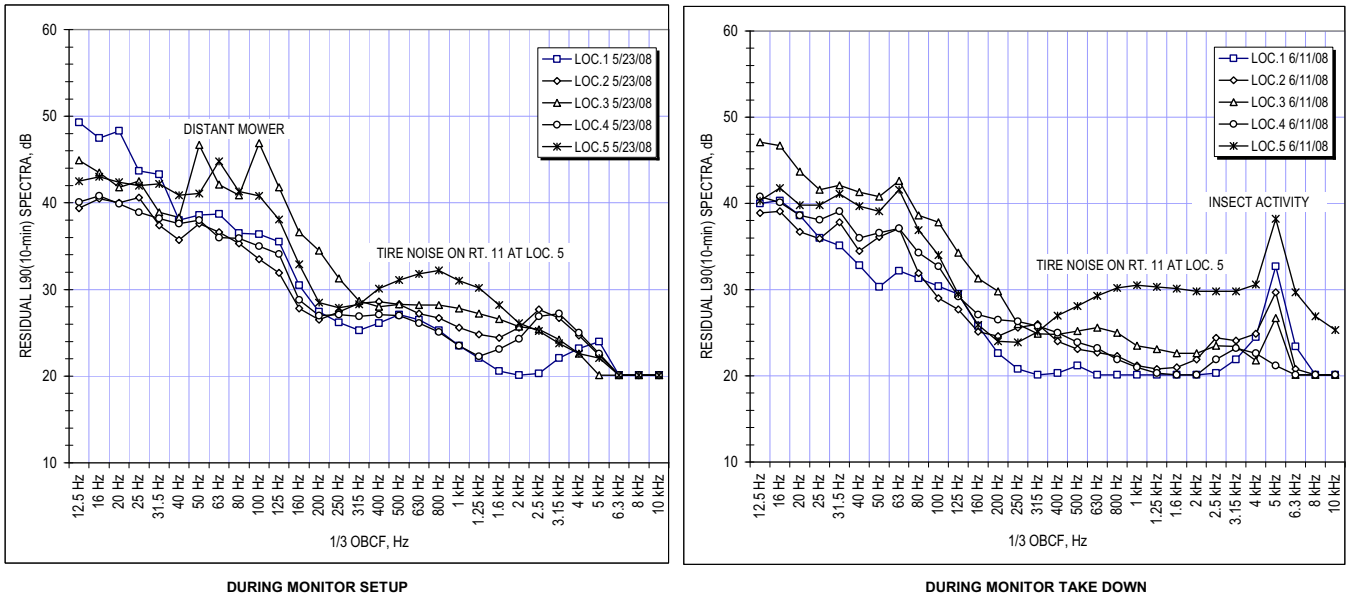

Figure 6.2.1: *One third octave band spectra at five sampling locations on two days at the start and finish of the survey.*

7.0_ Noise Assessment Guidelines

A web search did not turn up any local or county noise ordinances for this site area.

End of Text

8.0_References

[1] Hessler Associates Inc. Report Number 041808-1, *Baseline Environmental Noise Survey – Leaf-off Season*, April 2008

[2] "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", US EPA Report PB-239 429, March 1974

[3] "Community Noise", US EPA Report NTID300.3, Dec. 1971.

TECHNICAL MEMO

Title:	**ADDENDUM 1 TO HAI REPORT 062608-1:** Baseline Environmental Noise Survey, Leaf-on Season
Project:	**BELL BEND NUCLEAR POWER PLANT**
Location:	Berwick, PA
Prepared For:	AREVA NP, Inc.
Prepared By:	George F. Hessler, P.E.
Revision:	0
Issue Date:	August 14, 2008
Reference No:	TM-062608-1
Attachments:	None

Attn. Mr. J. Snooks

Introduction

This addendum adds additional requested measured data to the subject report and forms an integral part of the report. The measured daily 24-hour day/night sound level metric, abbreviated both as DNL and Ldn, was computed from the measured Leq hourly data given in the primary report. DNL must be calculated from 24 hours of measured hourly Leq data because a weighting or penalty factor of 10 dBA must be added for the hours from 10 p.m. to 7 a.m. This accounts for the greater sensitivity to nighttime noise experienced at potentially sensitive receptors.

Results

The following Table summarizes the developed DNL results. The arithmetic average and standard deviation are given for the sampling period at each sampling location. The "log average" is the true pressure average and is calculated by averaging the anti-log of each measured decibel value and converting back into decibels as opposed to directly averaging the decibel quantities. Summations or averaging of Leq based data is usually log averaged. For example, the FAA uses the yearly average DNL to assess aircraft noise in communities.

BBNPP LEAF ON	24-HOUR DAILY DAY/NIGHT SOUND LEVEL (DNL OR Ldn), dBA				
	LOCATION				
DATE	1 (ON-SITE)	2	3	4	5
5/24/2008	54	53	56	51	54
5/25/2008	52	53	57	53	54
5/26/2008	57	57	60	51	53
5/27/2008	57	53	52	52	63
5/28/2008	50	54	58	54	53
5/29/2008	54	54	57	55	56
5/30/2008	55	55	56	56	56
5/31/2008	58	55	55	57	54
6/1/2008	56	56	55	51	56
6/2/2008	54	59	57	57	56
6/3/2008	56	56	63		56
6/4/2008	58	59	60		59
6/5/2008	63	56	58		54
6/6/2008	66	59	64		59
6/7/2008	58	63	63		58
6/8/2008	59	60	63		58
6/9/2008	58	58	65		59
6/10/2008	64	63	66		63
ARITH. AVERAGE	N/A	57	59	54	57
LOG AVERAGE	N/A	56	58	53	57
STD DEV	N/A	2.1	2.7	2.5	2.8

Table 1: *24-hour Day/Night Sound Levels for a 18 Day Sampling Period during Leaf-on Seasonal Conditions at the Proposed Bell Bend Project*

Let me know if I can assist in any other way or answer any questions.

George F. Hessler Jr., Bd. Cert. INCE

George F. Hessler Jr.