

**Report Number 080108-1**  
**Estimated Cooling Tower Sound Emissions**  
For the  
**Bell Bend Nuclear Power (BBNPP) Expansion Project**  
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Prepared For:

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**Appendix**

## 1.0\_ Introduction

Hessler Associates has been contracted by AREVA NP, Inc. to develop a noise model for the hyperbolic natural draft cooling towers planned for use at the Bell Bend NPP Expansion project. The circulating water system cooling tower could be a significant source of environmental noise leaving the site. As a result, the modeled noise emissions from the tower are to be compared to baseline ambient sound level measurement results at discreet points of interest measured in previous leaf-on and off ambient surveys. This comparison permits an estimate of subjective response to cooling tower noise at the closest potentially sensitive off-site locations.

It is still early in the project and comprehensive noise design data is not available for the bulk of the plant. Sound emissions from existing natural draft cooling towers have been cataloged from in-situ nuclear plant measurements and prediction algorithms have been developed for source sound power levels for the cooling towers.

## 2.0\_ Executive Summary and Conclusions

Cooling tower noise emissions were estimated at four off-site community locations and one on-site location. The large buffer distances between the towers and potentially sensitive receptors are mostly flat farm fields with the exception of a high ridge to the north that runs east and west. There is no major dense forest coverage between the planned facilities and the closest residential receptors to the west. The estimated cooling tower noise level contours, therefore would be essentially the same during leaf-on and off seasons.

The estimated levels from the cooling towers are tabulated and compared to baseline ambient measurements made during leaf on and off seasons. It is concluded that noise emissions from the planned hyperbolic cooling towers, exclusive of the tower recirculation pumps and all other plant sources, will be imperceptible at most sensitive locations surrounding the plant except for location 4 to the south that is the closest off-site residential location to the planned facility. The tower noise emissions will be perceptible at this location on calm and still days when the ambient sound levels reach minimum levels, but imperceptible at other times of the day and night.

## 3.0\_ Noise Modeling Methodology

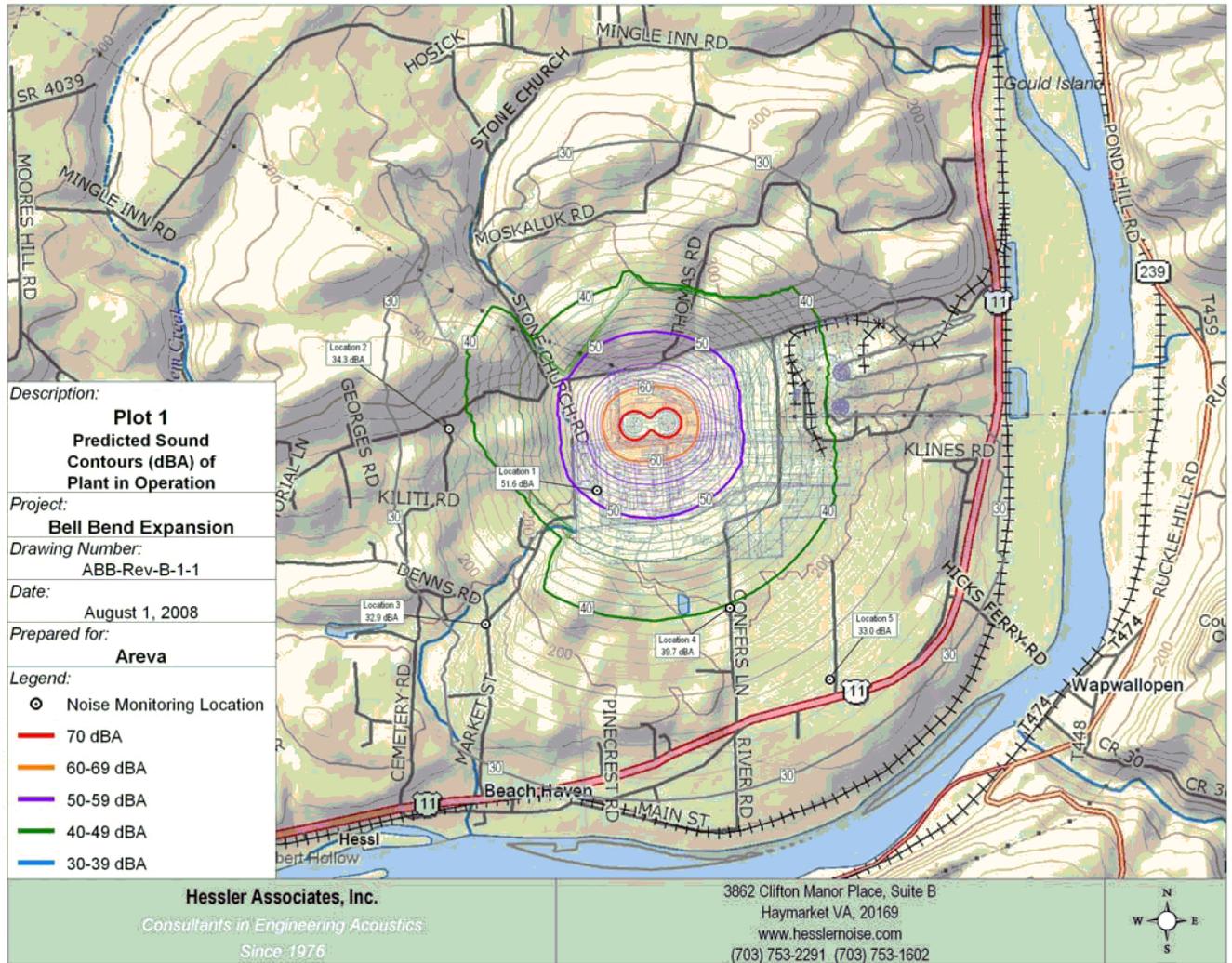
Equal level noise contour plots for the site were calculated using the "CADNA", ver. 3.5.115 noise modeling program developed by DataKustik, GmbH (Munich). This software enables the project and its surroundings, including terrain features, to be realistically modeled in three-dimensions. Sound propagation is calculated in the model in strict accordance with ISO 9613 Part 2<sup>1</sup>. There is no comparable standard in the U.S. This computer model with standard ISO algorithms essentially predicts long term noise emissions under slight downwind conditions at all locations around the facility.

In general, a three dimensional drawing of the source emitters and the topography of the surrounding area of interest are drawn, and acoustic source strength in sound power level is assigned to each component. In this case the sound power model input was acquired from reference <sup>2</sup>. This information includes the sound power emitted from the low elevation air inlet faces called 'rim noise' and from the high stack top exit termed 'stack noise'. There was no information provided for the water recirculation pumps and lines so the estimated contours exclude any such sources that are considered relatively minor at this stage.



#### 4.0\_ Noise Modeling Results

**Figure 4-1** below depicts the estimated total cooling tower noise levels (rim and stack noise) for two towers operating at a water flow rate of 720,000 gallons per minute each at every location in the vicinity of the Bell Bend and PPL facilities. The contours are cut-off at a level of 30 dBA. This value is the approximate measured residual ambient level from both leaf-on and leaf-off surveys. When an introduced new broadband source, such as cooling tower noise, is equal to the minimum ambient level, cooling tower noise becomes imperceptible. Hence, the 30 dBA contour is the limit of perception or audibility at the site.



**Figure 4.1:** Noise contour plots attributable to natural draft cooling towers.

The labeled receptors 1 through 5 correspond to the ambient sound survey locations reported in references<sup>3,4</sup>. The A-weighted sound levels estimated for the cooling towers at each location are tabulated below on **Table 4.1** and compared to the ambient survey results reported in the references.

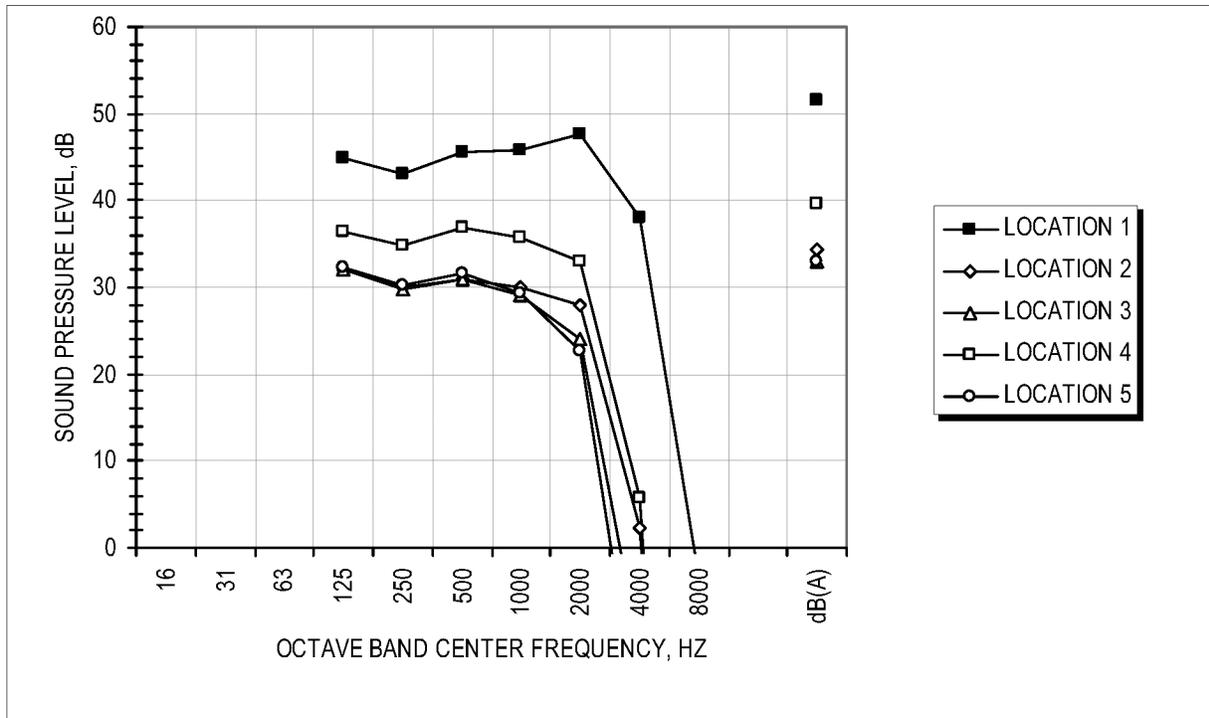
The ambient values shown in the table are the arithmetic average of the daily-minimum hour measured levels over approximately one and one-half week periods. A comparison of the estimated cooling tower noise to the minimum ambient levels show that cooling tower levels are approximately equal or less than the ambient at most locations. The exception is location 4, which is the closest residence to the towers, where cooling tower noise exceeds the minimum ambient.

Subjectively, cooling tower noise would be essentially imperceptible at the off-site receivers except at location 4. Cooling tower noise would be perceptible at this location during quiet periods of the day or night and imperceptible at other times.

LOCATION	ESTIMATED				
	COOLING TOWER LAeq	LEAF-OFF AMBIENT LA50	LEAF-ON AMBIENT LA50	LEAF-OFF AMBIENT LAeq	LEAF-ON AMBIENT LAeq
1 (ON-SITE)	52	N/A	N/A	N/A	N/A
2	34	33	34	35	36
3	33	33	34	36	38
4	40	33	31	36	35
5	33	39	37	53	41

**Table 4.1:** Estimated cooling tower noise in A-weighted levels at four community receptors.

The estimated sound spectra attributable to the cooling towers at the on and off-site locations are plotted below in **Figure 4.2**. Natural draft cooling towers have little low frequency noise, and the peak frequency is shown to be in the 2000 Hz octave band. The source is created by falling water splashing into the basin. Such high frequency noise decays rapidly with distance from the tower.



**Figure 4.2:** Estimated sound spectra at five locations.

End of Text



References:

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<sup>1</sup> ISO 9613, “Acoustics-Attenuation of sound during propagation outdoors-Part 2: General method of calculation (ISO 9613-2:1996), ISO International Organization for Standardization, Switzerland.

<sup>2</sup> Electric Power Plant Environmental Noise Guide, Edison Electric Institute, 2<sup>nd</sup> Edition, Section 4.4.2 Natural Draft Cooling Towers, Table 4.17, Rev. 1984.

<sup>3</sup> Hessler Associates Report Number 041808-1, “Baseline Environmental Noise Survey- Leaf off Season, Bell Bend Nuclear Power Plant (BBNPP)”, April 2008

<sup>4</sup> Hessler Associates Report Number 062608-1, “Baseline Environmental Noise Survey- Leaf on Season, Bell Bend Nuclear Power Plant (BBNPP)”, June 2008