nationalgrid

Clay – DeWitt Line 3 & Clay – Teall Line 10 Rebuild & Reconductor Project

Supplement to Replacement Noise Study (Replacement Appendix F to the Application)

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TECHNICAL REPORT

Title: Supplemental Noise Impact Assessment Results Based on 65 dBA Transformer Noise Guarantee

Project: National Grid - Cicero Substation - DPW Site
Location: Cicero, NY
Prepared For: EDR
Prepared By: David M. Hessler, P.E.
Revision: 0
Issue Date: August 5, 2016
Reference No: TM-2011-071916-0 Supplemental Addendum

Attachments: **Plot 1-1** Facility Sound Emission Contours
Table T-2011-070815-A Transformer Sound Power Level Derivation

1.0 Introduction

At the request of the New York Department of Public Service the sound emissions from the proposed National Grid Cicero Substation have been recalculated based on the transformer supplier's noise guarantee of 65 dBA at 3 feet. Our current assessment for the new Department of Public Works (DPW) substation site, recently submitted as Report TM-2011-071916-0, assumed a much more conservative performance of 75 dBA at 3 feet based on sound power level estimation algorithms using the MVA rating as the principal input. Although aware of the 65 dBA guarantee, we felt that the best approach to the assessment was to assume the louder performance partly because the manufacturer's noise guarantee lacks any information on the frequency spectrum of the sound, which is of paramount importance with transformer installations.

In general, the assumption that the transformer near field sound level will be 65 dBA and that the frequency spectrum will be about 10 dB lower than our initial estimate in all octave bands leads to substantially lower predicted sound levels at the nearest potentially sensitive noise receptors in the site vicinity and at the property line. However, because no significant noise impacts were already anticipated with the higher source sound level, our conclusion that the project should have no adverse noise impact is only reinforced by this revised analysis. The specific results of the re-evaluation are outlined below.

2.0 Revised Model Results

2.1 A-weighted Sound Levels

The overall, A-weighted sound level contours associated with the substation, assuming a near field sound pressure level of 65 dBA from the transformers, are shown in **Plot 1-1**.

The predicted facility sound levels at the key test/design points are plotted below against the measured levels of existing background noise at those locations.

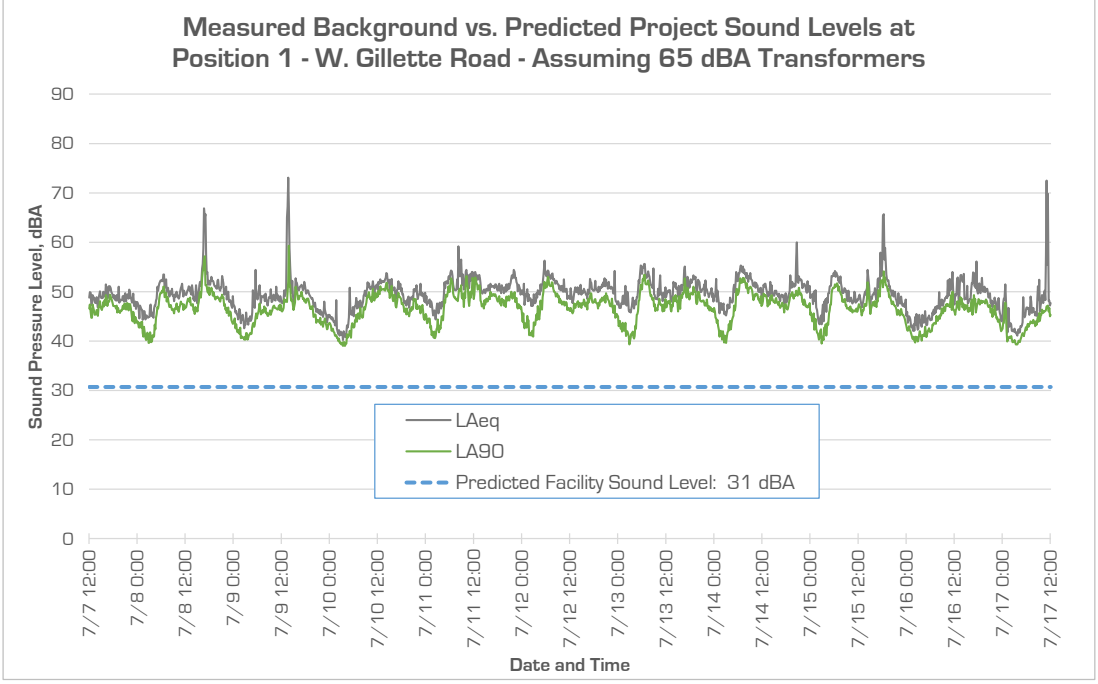


Figure 2.1.1

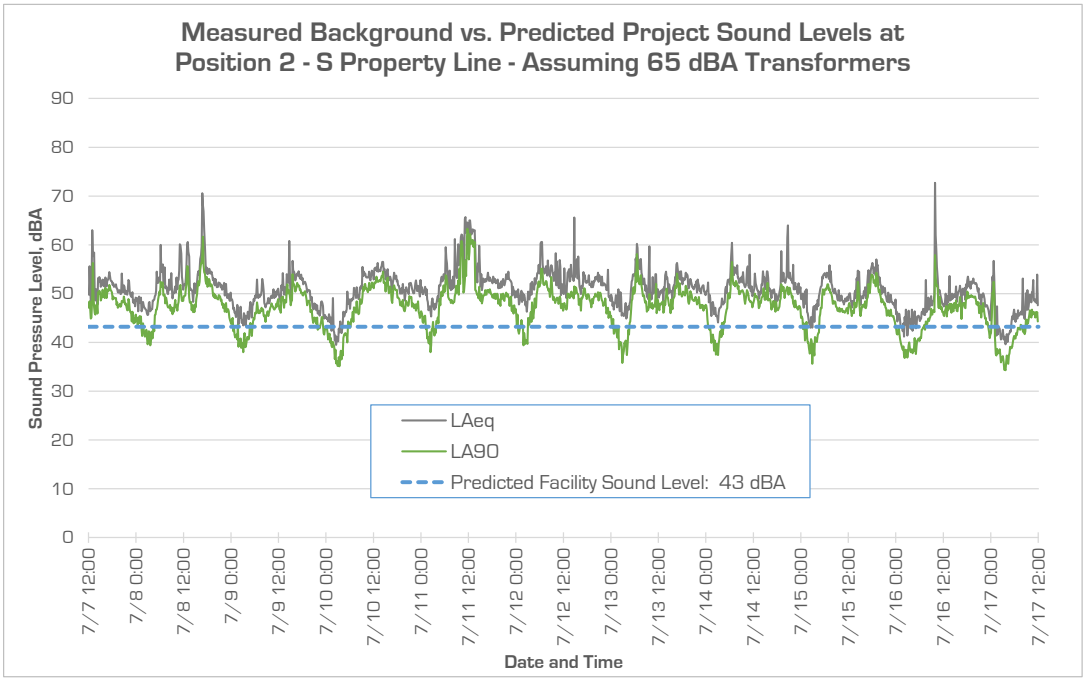


Figure 2.1.2

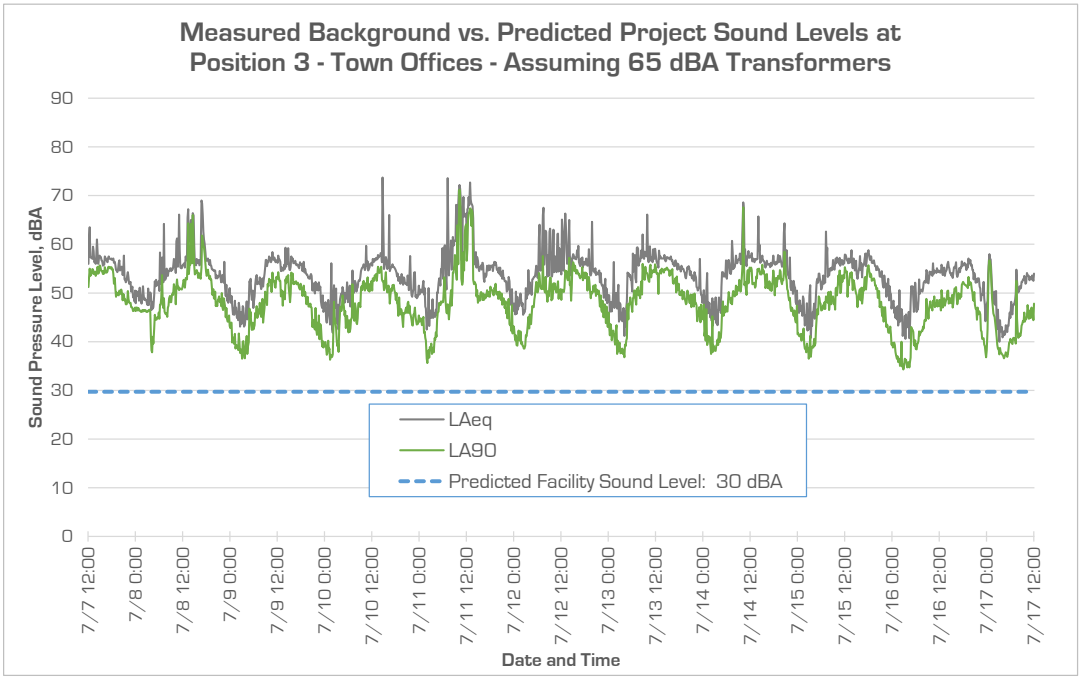


Figure 2.1.3

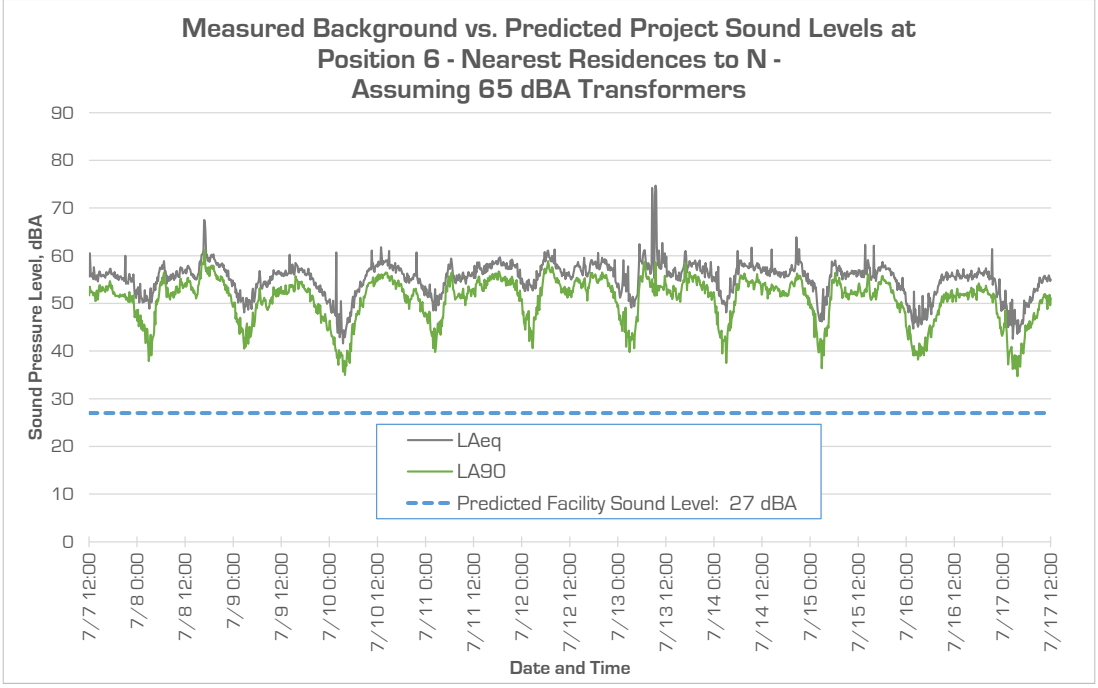


Figure 2.1.4

At every residential receptor point the predicted facility level is significantly below the lowest measured nighttime levels, essentially indicating inaudibility.

At Position 3 (Figure 2.1.2) any potential impact would occur during the day but the project level is now predicted to be well below typical daytime sound levels, which suggests that facility noise will in inconsequently during the day, if audible at all.

2.2 Octave Band Frequency Content

The model results shown in the contour plot and level vs. time figures above represent the overall, A-weighted sound level from the transformers; however, the principal noise issue with transformers is not the general magnitude of the overall sound level but rather the tonal frequency content created by magnetostriction mainly in the region between 60 and 240 Hz. The modeled octave band frequency content of the substation sound emissions are examined in the figures below relative the average nighttime (10 p.m. to 7 a.m.) L90 background level measured over all 10 nights at Positions 1 and 6, the nearest residences to the site with relatively low levels of ambient noise.

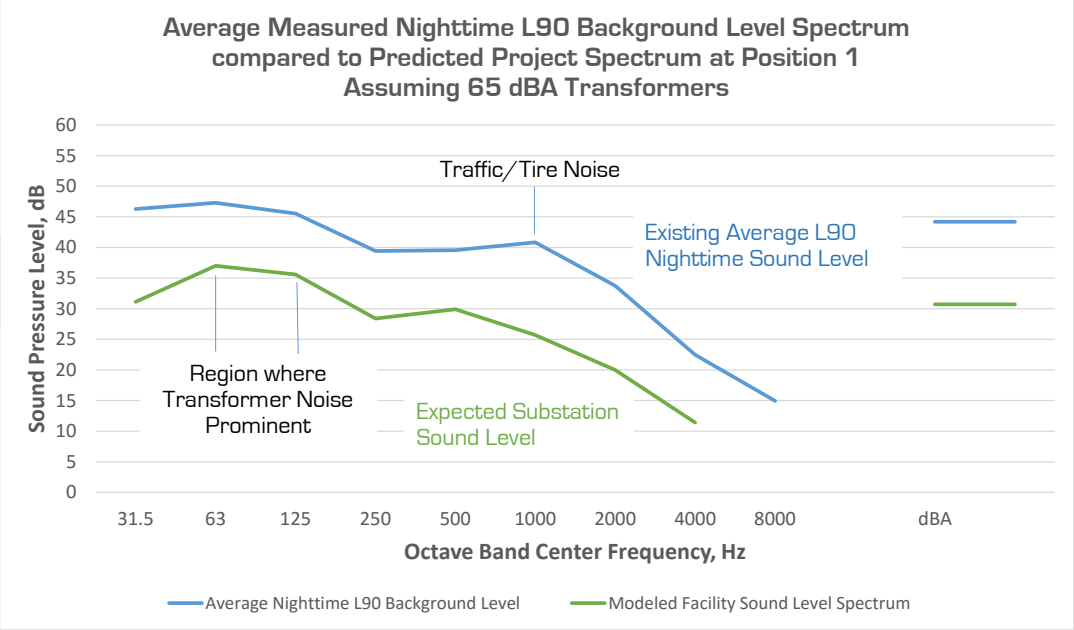


Figure 2.2.1

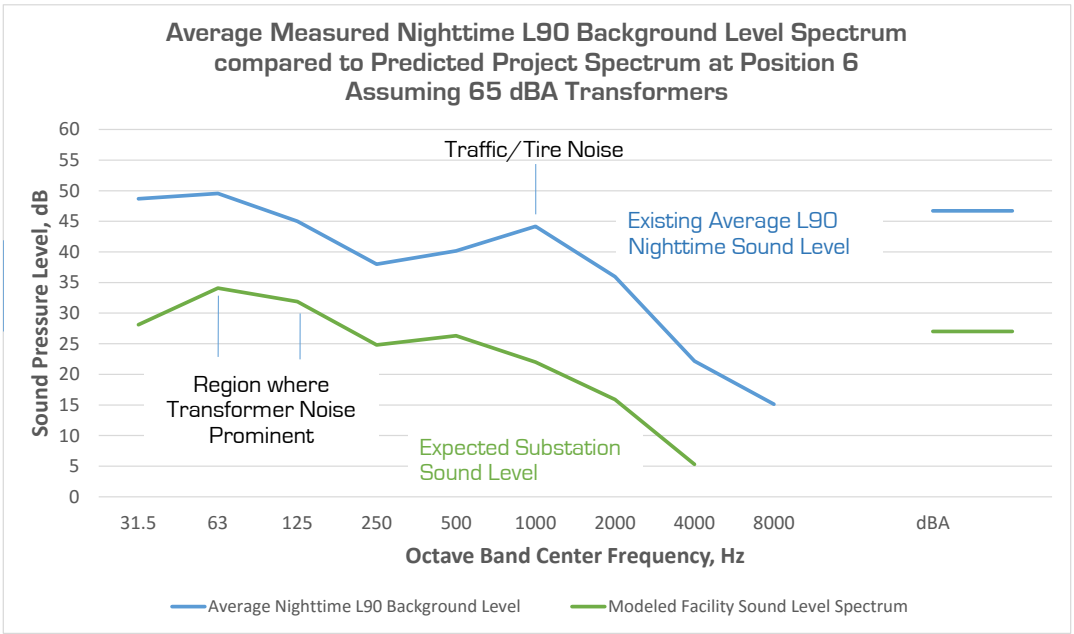


Figure 2.2.2

These figures show that the frequency spectrum of the substation in the 60 to 120 Hz region of the spectrum associated with transformer tones is well below the average nighttime background levels at both positions. This means that the transformers in general and their tonal sound emissions in

particular are expected to be insignificant relative to the existing environmental sound level in the lower frequencies.

The following figure shows the projected project sound level at Position 3 outside the town offices relative to the average daytime spectrum. Again the project level is substantially below the background and therefore inconsequential.

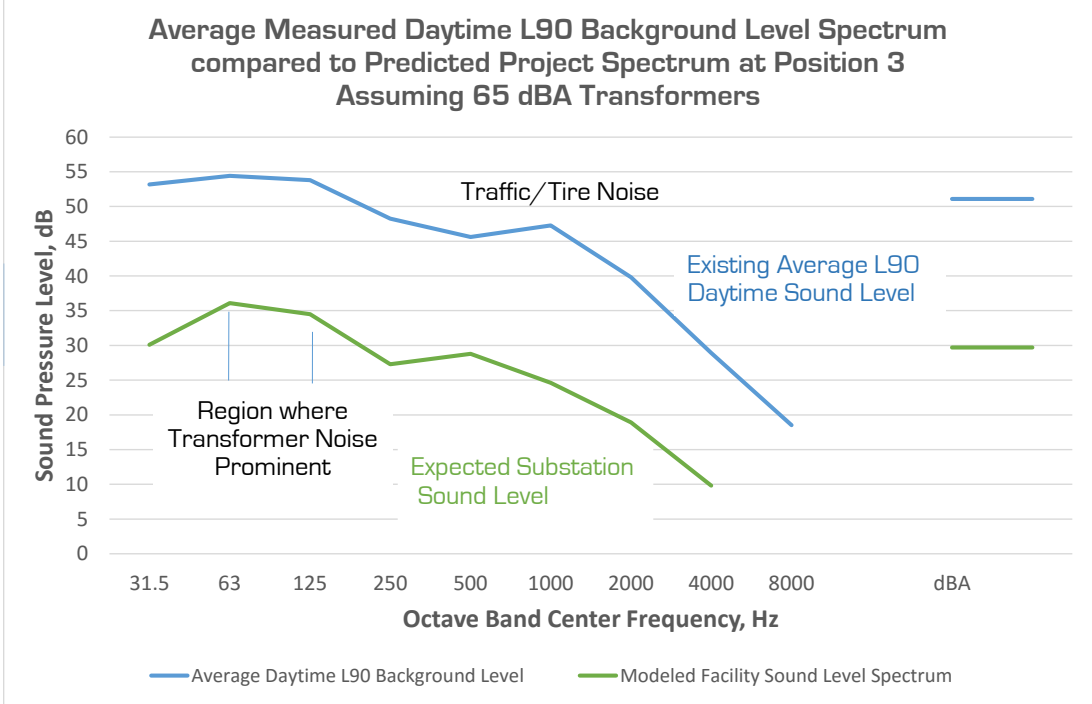


Figure 2.2.3

2.3 CNR Analysis

Another assessment approach that uses the frequency spectrum of the source and the background to evaluate potentially intrusive noise and predict community reaction is the modified Composite Noise Rating (CNR) method.

The first step in the evaluation process is to plot the octave band frequency spectrum of the predicted project-only sound level at points of interest against a set of curves that generally map the perceptibility of the noise as a function of frequency. Figure 2.3.1 below shows the predicted project sound level spectra at the three most critical receptor points:

- DP-1 The nearest residences to the south
- DP-3 The town offices

- DP-6 The nearest residences to the north

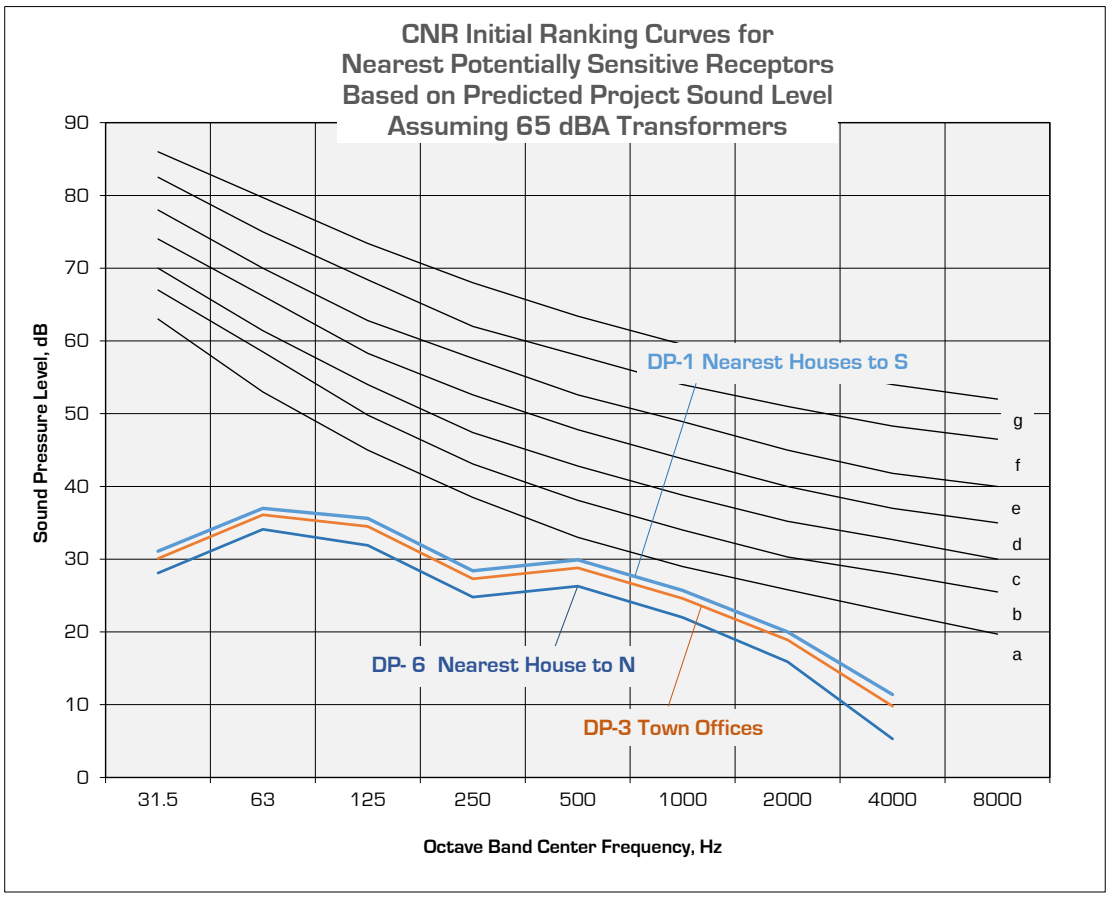


Figure 2.3.1

The initial ranking for all design points is "**a**".

All other correction factors and inputs would remain the same as in Section 4.3.3 of the original report. Table 2.3.1 summarizes all these factors based on the revised model calculations and gives the final rankings for the three most critical receptor points around the site.

Table 2.3.1
Summary of Correction Factors and Final Rating

Correction	Correction Factor		
	DP-1	DP-3	DP-6
Initial Rating based on Model Prediction	**a**	**a**	**a**
Background Correction	-1	-2	-2
Temporal/Seasonal Correction	0	0	0
Character Correction	+1	+1	+1
Exposure and Attitude	0	0	0
Net Correction	**0**	**-1**	**-1**
Final Rating	**A**	**<A**	**<A**

The nominal meaning of these final ratings is given in the chart below.

Table 2.3.2
Final CNR Ratings and Predicted Reactions

Final CNR Rating	Significance
A	No Reaction
B	No Reaction
C	No Reaction to Sporadic Complaints
D	Sporadic Complaints
E	Widespread Complaints or Single Threat of Legal Action
F	Several Threats of Legal Action or Strong Appeals to Local Officials to Stop the Noise
G	Several Threats of Legal Action or Strong Appeals to Local Officials to Stop the Noise
H	Several Threats of Legal Action or Strong Appeals to Local Officials to Stop the Noise
I	Vigrorous Action

The ratings of A or even less than A are consistent with the other assessment approaches in that "no reaction" is anticipated at all of the nearest potentially sensitive receptors.

3.0 Conclusions

Revised model predictions based on the transformer supplier's guaranteed near field sound level of 65 dBA indicate that the overall, A-weighted sound levels from the facility will be well below even the lowest nighttime background levels measured at the nearest residences during the field survey. Consequently, if this performance is realized the project sound emissions should be completely inconsequential at all of the nearest potentially sensitive residential noise receptors.

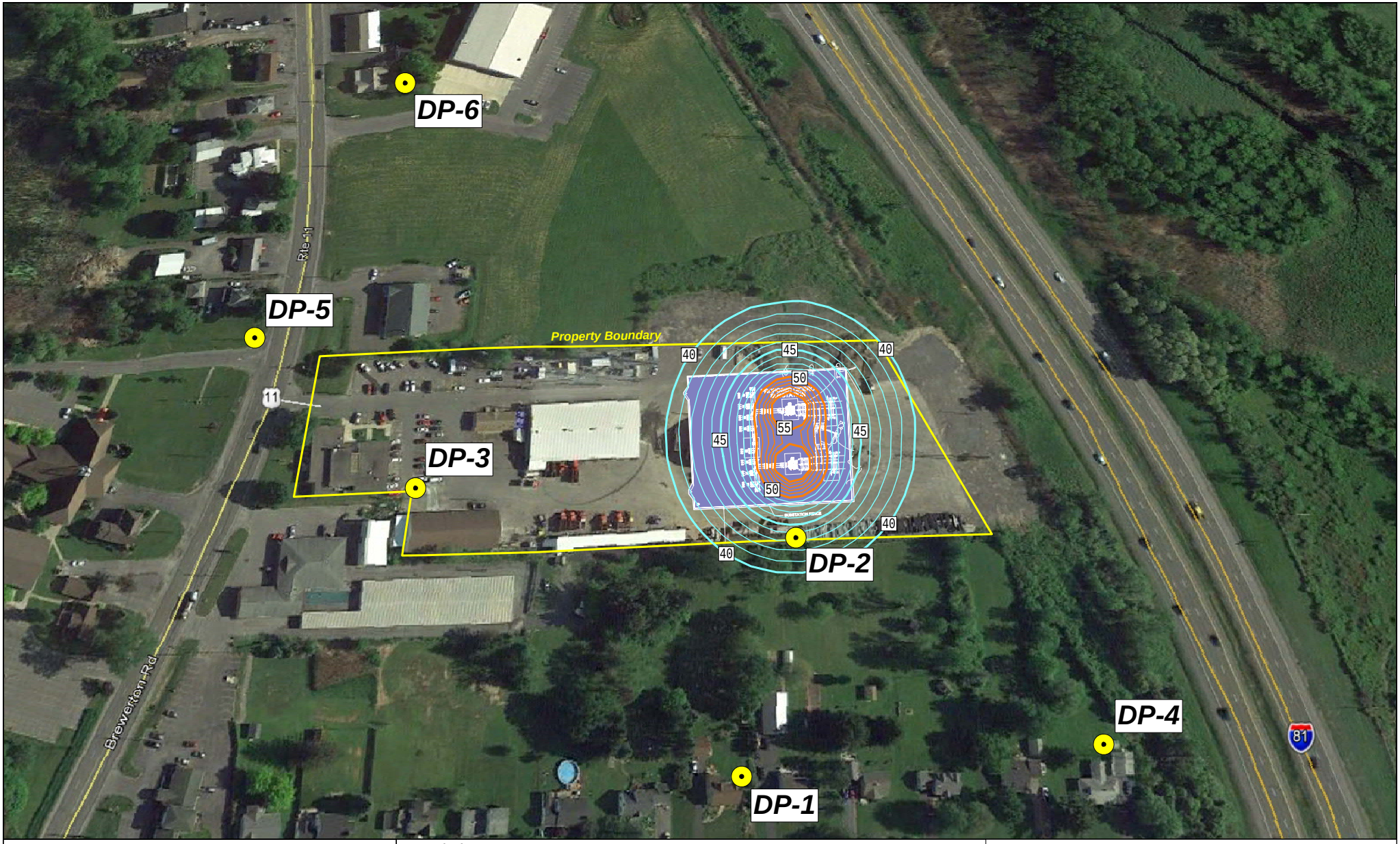
At the town offices and at the southern property line, where the potential for any kind of noise issue only exists during the day, the project sound levels are expected to be substantially below the normal daytime background level and therefore of no concern.

Since transformers are typically tonal noise sources, the frequency spectrum from the project was evaluated relative to the frequency spectrum of the average nighttime and daytime background levels. This analysis shows that the frequency spectrum of the substation transformers in the key 60 to 120 Hz region of the spectrum will be far below the nighttime background level at the nearest potentially sensitive residences. This means that the transformers in general and their tonal sound emissions in particular are expected to be insignificant, if not inaudible, at all points of potential concern.

This same conclusion was independently reached using the modified CNR assessment methodology, which is also based on the frequency content of the project and background sound levels, but also taking into account other factors, such as the character and duration of the sound.

Since every metric points to inaudibility and no reaction, no noise impact of any kind is expected from the project.

ATTACHMENTS



Project: **Cicero Substation**	*Description:* **Plot 1-1** **Predicted Sound Contours (dBA) of Substation in Operation**	*Legend:* Design Point
Prepared for: **EDR**		
Date: August 5, 2016 / *Drawing #:* MJ-Rev-F-1-2		

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N W E S

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Table: T-2011-070815-A
Title: Model Input Sound Power Level of Substation Transformer
Project: National Grid - Cicero Substation
Revision: A
Date: 1/22/16

Descriptor		Octave Band Center Frequency, Hz 31.5	63	125	250	500	1000	2000	4000	8000	dBA	dBC
1. Sound Power Level Estimate Based on MVA Rating, Assume Standard Core												
115 kV Load Tap Changing Transformer												
Maximum MVA Rating	**40**	MVA									**92.2**	
Standard NEMA Rating		NEMA = 55 +12 log (MVA), per EEI Guide*									**74.2**	
Size Factor (10 log s) Based on MVA											**18.0**	
Frequency Adjustment Factors		-3	3	5	0	0	-6	-11	-16	-23		
Near Field Lp Based on NEMA Rating		71	77	79	74	74	68	63	58	51	**74.6**	
Lw = NEMA Rating Lp + 10 log s + Freq. Adj.		**89**	**95**	**97**	**92**	**92**	**86**	**81**	**76**	**69**	**92.6**	
2. Estimate Sound Power Level Spectrum for Guaranteed 65 dBA Near Field Performance												
Maximum MVA Rating	**40**	MVA									**92.2**	
Standard NEMA Rating		NEMA = 55 +12 log (MVA), per EEI Guide*									**74.2**	
Size Factor (10 log s) Based on MVA											**18.0**	
Frequency Adjustment Factors		-3	3	5	0	0	-6	-11	-16	-23		
Near Field Lp Based on NEMA Rating, Ref.		71	77	79	74	74	68	63	58	51	**74.6**	
Max Near Field Lp Guaranteed, Ref.											**65.0**	
Lw = Gtd Near Field Lp + 10 log s + Freq. Adj.		**80**	**86**	**88**	**83**	**83**	**77**	**72**	**67**	**60**	**83.4**	

* Edison Electric Institute, "Electric Power Plant Environmental Noise Guide", 2nd Ed., BBN, 1984.

Notes:
Lp = Sound Pressure Level, dB re 20 mPa
Lw = Sound Power Level, dB re 1 pW