APPENDIX D

LINDBERGH SUBSTATION NOISE IMPACT ASSESSMENT STUDY

NOISE IMPACT ASSESSMENT STUDY

for

PSEG Long Island
Proposed Lindbergh Substation

Town of Hempstead, Nassau County, New York

March 2019

Prepared by:

PS&S Engineering, P.C.
1983 Marcus Avenue
Lake Success, New York 11042

NOISE IMPACT ASSESSMENT STUDY

for

PSEG Long Island
Proposed Lindbergh Substation

TABLE OF CONTENTS

APPENDICES

TABLES

FIGURES

NOISE IMPACT ASSESSMENT STUDY
for
PSEG Long Island
Proposed Lindbergh Substation

EXECUTIVE SUMMARY

PSEG Long Island is proposing to construct the new Lindbergh Substation at the northwest intersection of Perimeter Road and Charles Lindbergh Boulevard in the Hamlet of Uniondale, Town of Hempstead, Nassau County, New York. The Proposed Substation will be located on an approximately 1.7-acre parcel of vacant, undeveloped land that is predominantly comprised of natural vegetation. The Proposed Substation will include the installation of two 69/13kV 33 MVA transformers, two 13kV switchgears, three 69kV gas circuit breakers, four gang-operated disconnect switches, two 69kV circuit switches, four lightning masts, as well as other substation support equipment. An equipment enclosure structure and battery enclosure structure will also be constructed. The proposed Lindbergh Substation is required to assure an adequate and reliable power supply to the surrounding area and to support new developments in the area. Recent engineering studies and analysis by PSEG Long Island have concluded that during peak summer demand, the existing circuits could become overloaded resulting in voltage reductions or service disruption. The Proposed Project will address current needs, provide a more reliable electric supply, and will fulfill future projected loads.

PSEG Long Island requested that PS&S Engineering, PC (PS&S) perform a Noise Impact Assessment Study for the proposed substation to assess its potential noise level impacts at the closest property lines in the project area as compared with the New York State Department of Environmental Conservation (NYSDEC) Noise Policy Guidelines and the Town of Hempstead Noise Code. PS&S completed the requested assessment in accordance with accepted noise level evaluation standards, procedures, requirements, and guidelines, and the assessment included:

- Measurement of existing (ambient background) noise levels at the closest property lines in the project vicinity, and identification and characterization of existing noise source influences in the area. Note there were no residential properties proximate to the proposed Lindbergh Substation;

- Computer propagation modeling of worst case potential future noise level impacts at the nearest property lines based on the proposed placement of two transformer banks operating at maximum capacity; and
- The results of the assessment were then compared to applicable noise standards, guidelines and limits.

Noise Monitoring Results: The existing ambient background daytime noise levels measured at the closest property lines in the vicinity of the project site varied between 62 dBA and 74 dBA, and nighttime ambient background noise levels varied between 56 dBA and 71 dBA, with the major noise influences in the project area being from traffic noise from Charles Lindbergh Boulevard.

Noise Modeling Results & Conclusions: The projected (modeled) noise impact levels at the closest property line receptors based on worst case future noise levels from the planned installation of new transformer banks operating simultaneously at maximum capacity, were 15.3 dBA at the closest affected property line.

The modeled worst case cumulative total noise level impacts from the proposed new transformer banks at the closest property line receptor locations are significantly lower than the existing daytime and nighttime ambient noise levels, and will not result in any perceptible noise increase above existing ambient noise levels.

The modeled future noise impact levels at the closest property line receptor locations are below the NYSDEC Noise Policy Guideline sound-level limit of 65 dBA and will be in compliance with the Town of Hempstead Noise Code.

The results of the Noise Impact Assessment Study therefore concluded that the proposed transformers will result in no change to the existing ambient noise levels at the closest property lines in the project area, and that the proposed transformers will be in compliance with all applicable noise standards and criteria, and all applicable noise code limits.

SECTION 1.0

INTRODUCTION

NOISE IMPACT ASSESSMENT STUDY

for

PSEG Long Island

Proposed Lindbergh Substation

1.0 INTRODUCTION

PSEG Long Island is proposing to construct the new Lindbergh Substation at the northwest intersection of Perimeter Road and Charles Lindbergh Boulevard in the Hamlet of Uniondale, Town of Hempstead, Nassau County, New York. The Proposed Substation will be located on an approximately 1.7-acre parcel of vacant, undeveloped land that is predominantly comprised of natural vegetation. The Proposed Substation will include the installation of two 69/13kV 33 MVA transformers, two 13kV switchgears, three 69kV gas circuit breakers, four gang-operated disconnect switches, two 69kV circuit switches, four lightning masts, as well as other substation support equipment. An equipment enclosure structure and battery enclosure structure will also be constructed. The proposed Lindbergh Substation is required to assure an adequate and reliable power supply to the surrounding area and to support new developments in the area. Recent engineering studies and analysis by PSEG Long Island have concluded that during peak summer demand, the existing circuits could become overloaded resulting in voltage reductions or service disruption. The Proposed Project will address current needs, provide a more reliable electric supply, and will fulfill future projected loads. The dominant land uses immediately adjacent to the Lindbergh Substation is commercial, roadways and Nassau Community College to the north and east.

PSEG Long Island requested that PS&S Engineering, PC (PS&S) perform a Noise Impact Assessment Study for the proposed substation to assess its potential noise level impacts at the closest property lines in the project area as compared with the New York State Department of Environmental Conservation (NYSDEC) Noise Policy Guidelines and the Town of Hempstead Noise Code. PS&S completed the requested assessment which included the measurement of existing (ambient background) noise levels at the closest property lines in the project vicinity, identification and characterization of existing noise source influences in the area, and computer propagation modeling of worst-case potential future noise level impacts at the nearest property lines based on the proposed transformer banks operating at maximum capacity. The results of the assessment were then compared to applicable sound-level guidelines and limits. This Noise Impact Evaluation/Assessment was performed by PS&S in accordance with accepted noise level evaluation standards, procedures, requirements, and guidelines.

SECTION 2.0

NOISE STANDARDS & CRITERIA

2.0 NOISE STANDARDS & CRITERIA

New York State Department of Environmental Conservation Noise Guidelines & Criteria

The New York State Department of Environmental Conservation (NYSDEC) Program Policy Memorandum/Noise Policy Guidelines titled *Assessing and Mitigating Noise Impacts*, provides guidance and criteria on when noise levels due to proposed projects have the potential for adverse impacts and requires review and possible mitigation. This guidance document states that the goal for any operation should be to minimize increases in sound pressure levels (SPL) above existing ambient levels at the chosen point of sound reception, and ideally not exceed the existing ambient noise by more than 6 dBA at the receptor. Noise impact measurements are primarily obtained using the “A-weighted” (dBA) frequency response function because it simulates the response of the human ear to sound levels. The NYSDEC noise policy guidance document also states that SPL increases ranging from 0 to 3 dBA should have no appreciable effect on receptors, and that an SPL increase of 10 dBA, which results in a perceived doubling of loudness, deserves consideration of avoidance and/or mitigation measures in most cases. The NYSDEC guidance also indicates that the addition of any new noise generating equipment in a non-industrial (e.g., residential) setting should not raise the ambient noise level above a maximum of 65 dBA, which is the level that allows for undisturbed speech at a distance of approximately three feet. A copy of the NYSDEC noise policy guidance, “Assessing and Mitigating Noise Impacts” is included in Appendix A.

Town of Hempstead Noise Code

The Town of Hempstead Code regulates the following in relation to operation activities:

The operation of any machinery, equipment, pump, fan, exhaust fan, attic fan, air-conditioning apparatus or similar mechanical device in such a manner as to create an unreasonable noise across a real property boundary. A copy of the Town of Hempstead Noise Code is included in Appendix B.

Nassau County

There are no quantitative noise limits or standards adopted within Nassau County, New York.

SECTION 3.0

EXISTING NOISE LEVELS

3.0 EXISTING NOISE LEVELS

3.1 Noise Monitoring

Existing ambient / background noise levels were measured at five locations in the vicinity of the Lindbergh Substation site on April 17, 2018 during both the daytime (9 am – 10 pm) and nighttime (10 pm – 9 am) periods. These noise monitoring locations were positioned at the closest commercial property line, and also at the property lines of the substation. The locations are shown on Figure 3-1.

PS&S performed the noise monitoring in accordance with accepted sound-level standards, procedures, requirements, and other guidance, and all noise measurements were obtained by a PS&S acoustical professional trained and certified under the Rutgers Noise Technical Assistance Center. The following instrumentation was used by PS&S for this noise monitoring:

- Bruel and Kjaer (B&K) Model 2250 "Precision" Sound Level Meter;
- Bruel and Kjaer Condenser Microphone and Pre-Amp;
- Bruel and Kjaer Wind Screen;
- Bruel and Kjaer Model 4231 Acoustic Calibrator; and
- Kestral Wind Meter.

The monitoring instruments were calibrated before and after the measurement period and operated according to manufacturer's instructions. The certified B&K sound-level meter was set to the "A-weighting" scale and "slow" measurement speed, and the monitored noise level readings were stored in the sound-level meter memory, and this noise level data was then transferred to a computer for compilation and tabulation. The L_{90} statistical monitoring mode was used in this assessment to represent the existing ambient background noise levels which does not include intermittent "Extraneous Sounds"; the L_{90} descriptor is referred to as the residual background ambient noise level because it is the sound-level that is exceeded 90 percent of the time, generally filtering out intermittent "Extraneous Sounds". The residual background ambient noise level is the minimum sound-level reading in the absence of identifiable or intermittent local sources. As a result, extraneous noises such as car horns, car alarms, airplane flyovers, etc. were excluded from the ambient background noise level measurements in accordance with applicable noise measurement procedures and guidelines.

Weather information during the monitoring period was acquired from the local weather service. Temperatures were in the mid-40s degree Fahrenheit; and winds were light and variable, generally between 0 to 5 miles per hour. There was no precipitation during the noise level monitoring. These conditions satisfy the meteorological requirement for the measurement of ambient noise. Information on Noise Fundamentals and general noise-level monitoring procedures are included in Appendix C.

3.2 Noise Monitoring Results

Results of the noise monitoring data collected in the vicinity of the Lindbergh Substation site area is summarized in Table 3-1. daytime ambient background noise levels at the closest property lines in the vicinity of the Substation varied between 62 dBA and 74 dBA, and nighttime ambient background noise levels varied between 56 dBA and 71 dBA. The major noise influences which dominated the ambient background noise environment of lands immediately adjacent to the Lindbergh Substation during the noise monitoring were from traffic noise from Charles Lindbergh Boulevard.

PS&S

1983 MARCUS AVENUE
SUITE C116
LAKE SUCCESS
NEW YORK 11042
PHONE: (516) 512-7300

LINDBERGH SUBSTATION
NOISE MONITORING LOCATIONS
Town of Hempstead
Nassau County, New York

Sources:
Street Segment GDB - National Geospatial Data Asset, 2017
PS&S Designed Site Plan
Nearmap Imagery, April 8, 2018

Drawn By: JF	Scale: 1" = 150'	Project No. 01315.0560
Chk'd By: SS	Date: 6/14/2018	Figure No. 3-1

Path: P:\01315\0584\DWGs\Y-GIS\Maps\Fig3-1_NoiseMonitoringLocs_20180614_01.mxd

Table 3-1

PSEG Long Island LLC
Lindbergh Substation

Noise Monitoring Results (dBA)

MONITORING LOCATION ID	MONITORING LOCATION DESCRIPTION	MEASURED EXISTING NOISE LEVELS Daytime SPL [dBA]	 Nighttime SPL [dBA]
1	Western Property Line of Substation	62	61
2	Northern Property Line of Substation	63	56
3	Eastern Property Line of Substation	63	62
4	Southern Property Line of Substation	74	71
5	Ambient Background at Closet Property Line	65	56

NOTES:

Sound-level measurement data was collected on 4/17/2018.

All sound-level measurements were obtained by a PS&S acoustical professional trained and certified by the Rutgers Noise Technical Assistance Center.

A certified and calibrated Bruel and Kjaer Model 2250 Type I “Precision” sound-level meter that was equipped with a wind screen and set to the 'slow' measurement speed was used to obtain noise level data.

Daytime monitoring was performed between the Regulated Daytime Period of 9 AM to 10 PM.
Nighttime monitoring was performed between the Regulated Nighttime Period of 10 PM to 9 AM.

SECTION 4.0

NOISE MODELING

4.0 NOISE MODELING

4.1 Introduction

The proposed construction of the Lindbergh Substation is planned to include the placement of two transformer banks. For the noise impact modeling of the new transformers, PS&S used manufacturer's specifications data which indicated a maximum sound pressure level of 60.9 dBA with the transformers operating "fully loaded" with all cooling fans in operation, which is expected to occur only occasionally based on load and temperature, typically only during hot summer days during periods of high power demand. The manufacturer's specification 69/13kV transformer nameplate can be found in Appendix D.

4.2 Assumptions and Model Inputs

The noise impact modeling performed for this assessment assumes that:

- All of the specified transformer equipment is installed;
- The transformers will operate at maximum load with all fans in operation; and
- Existing ambient noise-level measurements, the NYSDEC Noise Policy Guidelines and the Town of Hempstead Noise Code are used as comparisons to the model projections.

4.3 Noise Impact Modeling

An acoustic (sound) propagation model was used to assess compliance of the proposed new transformer equipment based on potential worst-case operating conditions. The sound propagation modeling was performed using the equipment and maximum sound pressure level specifications identified above, at the closest property lines in the project vicinity. Projections of noise impacts from the new transformers were predicted using the nationally recognized SoundPLAN Essential (V. 3.0) three-dimensional acoustic propagation model software (Braunstein and Berndt, GmbH / SoundPLAN LLC, 2013).

The SoundPLAN software calculates noise impacts from multiple noise sources at multiple receivers while accounting for specific site sound radiation patterns and propagation effects of structures. The noise sources are identified in the propagation modeling with x and y coordinates and a relative height above terrain. The new transformer equipment identified in this assessment was modeled as point sources and digitized in a referenced coordinate system based on Site plan dimensions. Modeled receptors were located along the nearest property lines at an average ear level height of 1.5 meters above ground level in accordance with applicable modeling guidance. Existing buildings in the project area were digitized based on actual dimensions and were included in the model calculations (i.e., calculation of diffraction around buildings). Buildings and Structures may modify the noise radiation patterns of equipment, and the SoundPLAN software includes calculations to account for potential sound amplification from reverberation/reflection off exterior building surfaces based on the structure's facade. A reflection loss coefficient is assigned to each building or structure based on the material of the façade, and all structures were conservatively modeled as "minimally absorbent" (default reflection loss of 1 dB). The modeled noise impact levels were then compared to the applicable NYSDEC Noise Policy guidelines and the Town of Hempstead Noise Code.

4.4 Modeling Results

Table 4-1 presents a summary of the noise impact modeling results at the closest property line receptors based on worst case future noise levels from the planned new transformers with all transformer banks operating simultaneously at maximum capacity, and Figure 4-1 provides a printout of the model results. The modeled worst case future noise level results were 15.3 dBA at the closest property line. These modeled worst case cumulative total noise levels from the proposed new transformer equipment at all modeled receptor locations are significantly lower than the existing daytime and nighttime ambient noise levels, and will not result in any recordable (<0.1 dBA increase) or perceptible noise increase above existing ambient noise levels. In addition, the modeled future noise impact levels are well below the NYSDEC Noise Policy Guideline sound-level limit of 65 dBA, and will be in compliance with the Town of Hempstead Noise Code.

Table 4-1

PSEG Long Island
Proposed Lindbergh Substation

Modeled Worst Case Future Noise Impact Levels
at Closest Property Lines

Receptor No.	Receptor Location	Modeled Noise Impact Levels (dBA)	Existing Ambient Background Noise Levels (dBA)	
			Daytime	Nighttime
5	Closest Property Line	15.3	65	56

Sources:
Street Segment GDB - National Geospatial Data Asset, 2017
PS&S Prepared Site Plan
Nearmap Imagery, April 8, 2018

1983 MARCUS AVENUE
SUITE C116
LAKE SUCCESS
NEW YORK 11042
PHONE: (516) 512-7300

LINDBERGH SUBSTATION MODELED/PROJECTED NOISE LEVELS

Town of Hempstead
Nassau County, New York

Drawn By: JF	Scale: 1" = 200'	Project No. 01315.0560
Chk'd By: SS	Date: 6/14/2018	Figure No. 4-1

Path: P:\01315\0584\DWGs\Y-GIS\Maps\Fig4-1_MPNoiseLevels_20180614_01.mxd

SECTION 5.0

SUMMARY AND CONCLUSIONS

5.0 SUMMARY AND CONCLUSIONS

PS&S performed a Noise Impact Assessment Study for the proposed PSEG Long Island Lindbergh Substation for improving electric service reliability in the service area, and which is planned to include the construction of two new transformer banks. The completed Noise Impact Assessment Study included the evaluation of the potential worst-case future noise level impacts of the Substation at the closest property lines in the project area as compared with the New York State Department of Environmental Conservation (NYSDEC) Noise Policy Guidelines and the Town of Hempstead Noise Code. The Impact Assessment included performing measurements of existing ambient background noise levels in the project area, identification and characterization of noise source influences in the area, noise propagation computer modeling of the anticipated worst case future noise level contributions from the planned new transformers, and then comparing the results of the modeling to the applicable NYSDEC Noise Policy Guidelines and measured existing background noise levels and the Town of Hempstead Noise Code.

The conservative assumptions used in the Noise Impact Modeling evaluation included using the worst-case noise level operation (maximum load and cooling fan speed) for the transformers based on the two new transformer banks operating simultaneously at maximum capacity, which typically only occurs during hot summer days during periods of high power demand. During the nighttime period, the transformers will typically operate at less than the maximum load with the cooling fans not operating or operating at less than maximum capacity, and therefore typically have a reduced sound-level impact during the nighttime period.

Conclusions of the Noise Impact Assessment:

- The existing ambient background daytime noise levels measured at the closest property lines in the vicinity of the project site varied between 62 dBA and 74 dBA, and nighttime ambient background noise levels varied between 56 dBA and 71 dBA, with the major noise influences in the project area being from traffic noise from Charles Lindbergh Boulevard.
- The projected (modeled) noise impact levels at the closest property line receptors based on worst case future noise levels from the planned new transformers with both new transformer

banks operating simultaneously at maximum capacity, were 15.3 dBA at the closest property line.

- The modeled worst case cumulative total noise level impacts from the proposed new transformer equipment at the closest property line receptor locations are significantly lower than the existing daytime and nighttime ambient noise levels, and will not result in any recordable (<0.1 dBA increase) or perceptible noise increase above existing ambient noise levels.
- The modeled future noise impact levels at the closest property line receptor locations are well below the NYSDEC Noise Policy Guideline sound-level limit of 65 dBA, and will be in compliance with the Town of Hempstead Noise Code.

It is therefore concluded that the proposed transformers will result in no change to the existing ambient noise levels at the closest property lines in the project area, and that the proposed transformers will be in compliance with all applicable noise standards and criteria, and all applicable noise code limits.

APPENDIX A

NYSDEC Noise Policy Guidance

Assessing and Mitigating Noise Impacts

New York State
Department of Environmental Conservation

PROGRAM POLICY	**Department ID:** **DEP-00-1**	**Program ID:** **n/a**
Issuing Authority: Environmental Conservation Law Articles 3, 8, 23, 27 Name: Jeffrey Sama Title: Director Signature: /S/ Date: 10/6/00	**Originating Unit: Division of Environmental Permits** Office/Division: Environmental Permits Unit: Phone: (518) 402-9167	
Issuance Date: October 6, 2000 Revised: February 2, 2001	Latest Review Date (Office Use):	

Abstract: Facility operations regulated by the Department of Environmental Conservation located in close proximity to other land uses can produce sound that creates significant noise impacts for proximal sound receptors. This policy and guidance presents noise impact assessment methods, examines the circumstances under which sound creates significant noise impacts, and identifies avoidance and mitigative measures to reduce or eliminate noise impacts.

Related References: See references pages 27 and 28.

I. PURPOSE[1]

This policy is intended to provide direction to the staff of the Department of Environmental Conservation for the evaluation of sound levels and characteristics (such as pitch and duration) generated from proposed or existing facilities. This guidance also serves to identify when noise levels may cause a significant environmental impact and gives methods for noise impact assessment, avoidance, and reduction measures. These methods can serve as a reference to applicants preparing environmental assessments in support of an application for a permit. Additionally, this guidance explains the Department's regulatory authority for undertaking noise evaluations and for imposing conditions for noise mitigation measures in the agency's approval

[1] A Program Policy Memorandum is designed to provide guidance and clarify program issues for Division staff to ensure compliance with statutory and regulatory requirements. It provides assistance to New York State Department of Environmental Conservation (DEC) staff and the regulated community in interpreting and applying regulations and statutes to assure that program uniformity is attained throughout the State. Nothing set forth in a Program Policy Memorandum prevents DEC staff from varying from that guidance as specific circumstances may dictate, provided the staff's actions comply with applicable statutory and regulatory requirements. As this guidance document is not a fixed rule, it does not create any enforceable right by any party using the Program Policy Memorandum.

of permits for various types of facilities pursuant to regulatory program regulations and the State Environmental Quality Review Act (SEQR).

II. BACKGROUND

Noise is defined as any loud, discordant or disagreeable sound or sounds. More commonly, in an environmental context, noise is defined simply as unwanted sound. Certain activities inherently produce sound levels or sound characteristics that have the potential to create noise. The sound generated by proposed or existing facilities may become noise due to land use surrounding the facility. When lands adjoining an existing or proposed facility contain residential, commercial, institutional or recreational uses that are proximal to the facility, noise is likely to be a matter of concern to residents or users of adjacent lands.

A. Sources of Noise Generation

The three major categories of noise sources associated with facilities are (1) fixed equipment or process operations; (2) mobile equipment or process operations; and (3) transport movements of products, raw material or waste. The fixed plant may include a very wide range of equipment including: generators; pumps; compressors; crushers of plastics, stone or metal; grinders; screens; conveyers; storage bins; or electrical equipment. Mobile operations may include: drilling; haulage; pug mills; mobile treatment units; and service operations. Transport movements may include truck traffic within the operation, loading and unloading trucks and movement in and out of the facility. Any or all of these activities may be in operation at any one time. Singular or multiple effects of sound generation from these operations may constitute a potential source of noise.

B. Potential for Adverse Impacts

Numerous environmental factors determine the level or perceptibility of sound at a given point of reception. These factors include: distance from the source of sound to receptor; surrounding terrain; ambient sound level; time of day; wind direction; temperature gradient; and relative humidity. The characteristics of a sound are also important determining factors for considering it as noise. The amplitude (loudness), frequency (pitch), impulse patterns and duration of sound all affect the potential for a sound to be a noise. The combination of sound characteristics, environmental factors and the physical and mental sensitivity of a receptor to a sound determine whether or not a sound will be perceived as a noise. This guidance uses these factors in assessing the presence of noise and the significance of its impacts. It relies upon qualitative and quantitative sound evaluation techniques and sound pressure level impact modeling presented in accepted references on the subject.

C. Mitigation

Mitigation refers to actions that will be taken to reduce the effects of noise or the noise levels on a receptor. Adverse noise effects generated by a facility can be avoided or reduced at the point of generation thereby diminishing the effects of the noise at the point of reception. This guidance identifies various mitigation techniques and their proper application either at the source of noise generation or on a facility's property. Alternative construction or operational methods, equipment maintenance, selection of alternative equipment, physical barriers, siting of activities, set backs, and established hours of construction or operation, are among the techniques that can successfully avoid or reduce adverse noise effects.

D. Decision Making

When an assessment of the potential for adverse noise impacts indicates the need for noise mitigation, it is preferred that specifications for such measures be incorporated in a noise analysis and in the applicant's work or operational plan necessary for a complete application. Presenting a plan that incorporates effective noise mitigation provisions facilitates the Department's technical and environmental review and minimizes or negates the imposition of permit conditions by the Department. Adherence to these plans becomes a condition of a permit.

Noise avoidance and mitigation measures may also be imposed directly as conditions of permit issuance. This guidance will review the statutory authority under which the Department can require the mitigation of noise effects.

III. POLICY

In the review of an application for a permit, the Department of Environmental Conservation is to evaluate the potential for adverse impacts of sound generated and emanating to receptors outside of the facility or property. When a sound level evaluation indicates that receptors may experience sound levels or characteristics that produce significant noise impacts or impairment of property use, the Department is to require the permittee or applicant to employ reasonable and necessary measures to either eliminate or mitigate adverse noise effects. Options to be used to fulfill this guidance should be implemented within the existing regulatory and environmental review framework of the agency.

Regulatory authority for assessing and controlling noise effects are contained in both SEQR and specific Department program regulations. Specific regulatory references are as follows:

Section 3-0301(1)(i) of the Environmental Conservation Law (ECL) states that the commissioner shall have the power to: "i. Provide for prevention and abatement of all water, land and air pollution including but not limited to that related to particulates, gases, dust, vapors, noise, radiation, odor, nutrients and heated liquids."

To comply with Article 8 of the ECL and 6 NYCRR Part 617, State Environmental Quality Review Act, consideration of all relevant environmental issues must be undertaken in making a determination of environmental significance. Noise impact potential is one of many potential issues for consideration in a SEQR review.

Environmental Conservation Law (ECL) Article 23, Title 27, Mined Land Reclamation Law (MLRL), requires applicants for permits to prepare and submit a mined land use plan to the Department for approval. The plan must describe, "the applicant's mining method and measures to be taken to minimize adverse environmental impacts resulting from the mining operation." The provisions to be incorporated in a Mined Land Use Plan, as specified in 6 NYCRR Section 422.2, include the control of noise as a component of the plan.

The solid waste regulations at 6 NYCRR Subdivision 360-1.14(p), establish A-weighted decibel levels that are not to be exceeded at the property line of a facility.

The Division of Air Resources has regulations in 6 NYCRR Parts 450 through 454 that regulate the allowable sound level limits on certain motor vehicles. The statutory authority for these regulations is found in the New York State Vehicle and Traffic Law, Article 10, Section 386.

This guidance does not supercede any local noise ordinances or regulations.

IV. RESPONSIBILITY

The environmental analyst, acting as project manager for the review of applications for permits or permit modifications and working in concert with the program specialist, is responsible for ensuring that sound generation and noise emanating from proposed or existing facilities are properly evaluated. For new permits or significantly modified permits, there should be a determination as to the potential for noise impacts, and establishment of the requirements for noise impact assessment to be included in the application for permit. Where the Department is lead agency, the analyst is responsible for making a determination of significance pursuant to SEQR with respect to potential noise impacts and include documentation for such determination.

Where impacts are to be avoided or reduced through mitigation measures, the analyst, or where there are program requirements to address noise, the program specialist, should determine the effectiveness and feasibility of those measures and ensure that the permit conditions contain specific details for such measures. It should also be determined if additional measures to control noise are to be imposed as a condition of permitting. Appropriate permit language for the permit conditions should be developed by the program specialist and the analyst. The results of noise impact evaluations and the effectiveness of mitigation measures shall be incorporated into SEQR documents and, where necessary, permit conditions shall be placed in final permits to ensure effective noise control.

When it is determined that potential noise effects, as well as other issues, warrant evaluation of impacts and mitigation measures in a Draft Environmental Impact Statement (EIS) prepared pursuant to SEQR, the environmental analyst with the Division of Environmental Permits assumes responsibility for determining the level of evaluation needed to assess sound level generation, noise effects, and mitigation needs and feasibility.

For existing facilities, the program specialist will determine the need for additional mitigation measures to control noise effects either in response to complaints or other changes in circumstances such as new noise from existing facilities or a change in land-use proximal to the facility.

The applicant or their agent, in preparing an application for a permit and supporting documentation, is responsible for assessing the potential noise impacts on area receptors. When potential adverse noise impacts are identified, the applicant should incorporate noise avoidance and reduction measures in the construction or operating plans. The applicant's submittal should also assess the effectiveness of proposed mitigation measures in eliminating adverse noise reception. Where noise effects are determined to be a reason in support of a SEQR positive declaration, the applicant shall assess noise impacts, avoidance, and mitigation measures in a Draft EIS using methodologies acceptable to this Department.

V. PROCEDURE

The intent of this section is to: introduce terms related to noise analyses; describe some of the various methods used to determine the impacts of sound pressure levels on receptors; identify some of the various attenuators of noise; and list some of the mitigative techniques that can be used to reduce the effects of noise on a receptor. At the end of the section three levels of analysis are described. The first level determines the potential for adverse noise impacts based on noise characteristics and sound pressure increases solely on noise attenuation over distance between the source and receptor of the noise. The second level factors other considerations such as topography and noise abatement measures in determining if adverse noise impacts will occur. The third level evaluates noise abatement alternatives and their effectiveness in avoiding or reducing noise impacts.

The environmental effects of sound and human perceptions of sound can be described in terms of four characteristics:

1. Sound Pressure Level (SPL may also be designated by the symbol L_p) or perceived loudness is expressed in decibels (dB) or A-weighted decibel scale dB(A) which is weighted towards those portions of the frequency spectrum, between 20 and 20,000 Hertz, to which the human ear is most sensitive. Both measure sound pressure in the atmosphere.
2. Frequency (perceived as pitch), the rate at which a sound source vibrates or makes the air vibrate.
3. Duration i.e., recurring fluctuation in sound pressure or tone at an interval; sharp or startling noise at recurring interval; the temporal nature (continuous vs. intermittent) of sound.
4. Pure tone which is comprised of a single frequency. Pure tones are relatively rare in nature but, if they do occur, they can be extremely annoying.

Another term, related to the average of the sound energy over time, is the Equivalent Sound Level or $L_{eq.}$ The L_{eq} integrates fluctuating sound levels over a period of time to express them as a steady state sound level. As an example, if two sounds are measured and one sound has twice the energy but lasts half as long, the two sounds would be characterized as having the same equivalent sound level. Equivalent Sound Level is considered to be directly related to the effects of sound on people since it expresses the equivalent magnitude of the sound as a function of frequency of occurrence and time. By its derivation L_{eq} does not express the maximum nor minimum SPLs that may occur in a given time period. These maximum and minimum SPLs should be given in the noise analysis. The time interval over which the L_{eq} is measured should always be given. It is generally shown as a parenthetic; $L_{eq\ (8)}$ would indicate that the sound had been measured for a period of eight hours.

Equivalent Sound Level (L_{eq}) correlates well and can be combined with other types of noise analyses such as Composite Noise Rating, Community Noise Equivalent Level and day-night noise levels characterized by L_{dn} where an $L_{eq(24)}$ is measured and 10 dBA is added to all noise levels measured between 10 pm and 7 am. These different types of noise analyses basically combine noise measurements into measures of cumulative noise exposure and may weight noise occurring at different times by adding decibels to the actual decibel level. Some of these analyses require more complex noise analysis than is mentioned in this guidance. They may be used in a noise analyses prepared for projects.

Designations for sound levels may also be shown as $L_{(10)}$ or $L_{(90)}$ in a noise analysis. These designations refer to the sound pressure level (SPL) that is exceeded for 10% of the time over which the sound is measured, in the case of $L_{(10)}$, and 90% of the time, in the case of $L_{(90)}$. For example, an $L_{(90)}$ of 70 dB(A) means that 70 dB(A) is exceeded for 90% the time for which the measurement was taken.

A. Environmental Setting and Effects on Noise Levels

1. Sound Level Reduction Over Distance - It is important to have an understanding of the way noise decreases with distance. The decrease in sound level from any single noise source normally follows the "inverse square law." That is, SPL changes in inverse proportion to the square of the distance from the sound source. At distances greater than 50 feet from a sound source, every doubling of the distance produces a 6 dB reduction in the sound. Therefore, a sound level of 70 dB at 50 feet would have a sound level of approximately 64 dB at 100 feet. At 200 feet sound from the same source would be perceived at a level of approximately 58 dB.

2. Additive Effects of Multiple Sound Sources - The total sound pressure created by multiple sound sources does not create a mathematical additive effect. Below Table A is given to assist you in calculating combined noise sources. For instance, two proximal noise sources that are 70 dBA each do not have a combined noise level of 140 dBA. In this case the combined noise level is 73 dBA. Since the difference between the two sound levels is 0 dB, Table A tells us to add 3 dB to the sound level to compensate for the additive effects of the sound. To find the cumulative SPL assess the SPLs starting with the two lowest readings and work up to the difference between the two highest readings. For several pieces of equipment, operating at one

time, calculate the difference first between the two lowest SPLs, check Table A and add the appropriate number of decibels to the higher of the two sound levels. Next, take the sound level that was calculated using Table A and subtract the next lowest sound level to be considered for the operation. Consult Table A again for the additive effect and add this to the higher of the two sound levels. Follow this process until all the sound levels are accounted for. As an example, let us say that an area for a new facility is being cleared. The equipment to be used is: two chainsaws, one operating at 57 dBA and one at 60 dBA; a front end loader at 80 dBA; and a truck at 78 dBA. Start with the two lowest sound levels: 60 dBA - 57 dBA = 3 dBA difference. Consulting the chart add 2 dBA to the higher sound level. The cumulative SPL of the two chainsaws is 62 dBA. Next, subtract 62 dBA from 78 dBA. 78 dBA - 62 dBA = 16 dBA. In this case, 0 dBA is added to the higher level so we end up with 78 dBA. Lastly, subtract 78 dBA from the 80 dBA. 80 dBA - 78 dBA = 2 dBA a difference of 2 dBA adds 2 dBA to the higher SPL or 82 dBA. The SPL from these four pieces of equipment operating simultaneously is 82 dBA.

Table A

Approximate Addition of Sound Levels

Difference Between Two Sound Levels	Add to the Higher of the Two Sound Levels
1 dB or less	3 dB
2 to 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0 dB

(USEPA, Protective Noise Levels, 1978)

3. Temperature and Humidity - Sound energy is absorbed in the air as a function of temperature, humidity and the frequency of the sound. This attenuation can be up to 2 dB over 1,000 feet. Such attenuation is short term and, since it occurs over a great distance, should not be considered in calculations. Higher temperatures tend to increase sound velocity but does

not have an effect on the SPL. Sound waves bend towards cooler temperatures. Temperature inversions may cause temporary problems when cooler air is next to the earth allowing for more distant propagation of sound. Similarly, sound waves will bend towards water when it is cooler than the air and bounce along the highly reflective surface. Consequently large water bodies between the sound source and the receptor may affect noise attenuation over distance.

4. Time of Year - Summer time noises have the greatest potential for causing annoyance because of open windows, outside activities, etc. During the winter people tend to spend more time indoors and have the windows closed. In general, building walls and windows that are closed provide a 15 dB reduction in noise levels. Building walls with the windows open allow for only a 5 dB reduction in SPL.

5. Wind - Wind can further reduce the sound heard at a distance if the receptor is upwind of the sound. The action of the wind disperses the sound waves reducing the SPLs upwind. While it is true that sound levels upwind of a noise source will be reduced, receptors downwind of a noise source will not realize an increase in sound level over that experienced at the same distance without a wind. This dispels the common belief that sound levels are increased downwind due to wind carrying noise.

6. Land forms and structures - In certain circumstances, sound levels can be accentuated or focused by certain features to cause adverse noise impacts at specified locations. At a hard rock mine, curved quarry walls may have the potential to cause an amphitheater effect while straight cliffs and quarry walls may cause an echo. Buildings that line streets in cities can cause a canyon effect where sound can be reflected from the building surfaces similar to what might happen in a canyon. Consideration of noise impacts associated with these types of conditions may require specialized expertise to evaluate impact potential and to formulate suitable mitigation techniques.

Consideration of existing noise sources and sound receptors in proximity to a proposed activity can be important considerations even when the activity under review is not a noise source. Topography, vegetation, structures and the relative location of noise receptors and sources to these features are all aspects of the environmental setting that can influence noise impact potential. As such, land alteration may also indirectly create an adverse noise impact where natural land features or manmade features serve as a noise barrier or provide noise attenuation for existing sources of noise, i.e. highway, railroads, manufacturing activity. Removal of these features, i.e. hills, vegetation, large structures or walls, can expose receptors to increased sound pressure levels causing noise problems where none had previously existed.

B. Impact Assessment

1. Factors to Consider

Factors to consider in determining the impact of noise on humans, are as follows:

a. Evaluation of Sound Characteristics

(1) Ambient noise level - A noise can only intrude if it differs in character or SPL from the normal ambient sound. Most objective attempts to assess nuisance noise adopt the technique of comparing the noise with actual ambient sound levels or with some derived criterion.

(2) Future noise level - The ambient noise level plus the noise level from the new or proposed source.

(3) Increase In Sound Pressure Level - A significant factor in determining the annoyance of a noise is Sound Pressure Level (SPL). SPLs are measured in decibels.

(4) Sharp and Startling Noise - These high frequency and high intensity noises can be extremely annoying. When initially evaluating the effects

of noise from an operation, pay particular attention to noises that can be particularly annoying. One such noise is the back-up beepers required to be used on machinery. They definitely catch one's attention as they were meant to do. Continual beeping by machinery can be mitigated (see Section V.C. Mitigation - Best Management Practices). Another impulse noise source that can be very annoying is the exhaust from compressed air machinery. This exhaust is usually released in loud bursts. Compressed air exhaust can also be mitigated if it causes a noise problem by using readily available mufflers or specifically designed enclosures.

(5) Frequency and Tone - Frequency is the rate at which a sound source vibrates or makes the air vibrate. Frequency is measured in Hertz (Hz). Frequency can also be classified as high ("sharp"), low ("dull"), and moderate. Pure tones are rare in nature. Tonal sounds usually consist of pure tones at several frequencies. Pure tones and tonal sounds are discerned more readily by the human ear. Pure tones and tonal sounds are compensated for in sound studies by adding a calculated number of dB(A) to the measured sound pressure.

(6) Percentile of Sound Levels - Fluctuations of SPLs can be expressed as a percentile level designated as $L_{(n)}$ where a given decibel level is exceeded *n* % of the time. A designation of $L_{(10)}$ = 70 dBA means the measured SPLs exceeded 70 dBA 10% of the time. A designation of $L_{(90)}$ = 70 dBA means the measured SPLs were exceeded 90% of the time. $L_{(90)}$ is often used to designate the background noise level.

(7) Expression of Overall Sound - Part of the overall assessment of sound is the *Equivalent Sound Level* (L_{eq}) which assigns a single value of sound level for a period of time in which varying levels of sound are experienced over that time period. The L_{eq} value provides an indication of the effects of sound on people. It is also useful in establishing the ambient sound levels at a potential noise source.

In order to evaluate the above factors in the appropriate context, one must identify the following: 1) appropriate receptor locations for sound level calculation or measurement; 2) ambient sound levels and characteristics at these receptor locations; and 3) the sound pressure increase and characteristics of the sound that represents a significant noise effect at a receptor location.

b. Receptor Locations

Appropriate receptor locations may be either at the property line of the parcel on which the facility is located or at the location of use or inhabitance on adjacent property. The solid waste regulations require the measurements of sound levels be at the property line. The most conservative approach utilizes the property line. The property line should be the point of reference when adjacent land use is proximal to the property line. Reference points at other locations on adjacent properties can be chosen after determining that existing property usage between the property line and the reference point would not be impaired by noise, i.e., property uses are relatively remote from the property line. The location of the facility should be shown on a map in relation to each potential receptor. Any future expansion should be described in a narrative as well as depicted on a map. The map and narrative should also include the distance of the operation to each point of reception including the distance at the point in time when an expanding operation will be closest to the receptors.

c. Thresholds for Significant Sound Pressure Level (SPL) Increase

The goal for any permitted operation should be to minimize increases in sound pressure level above ambient levels at the chosen point of sound reception. Increases ranging from 0-3 dB should have no appreciable effect on receptors. Increases from 3-6 dB may have potential for adverse noise impact only in cases where the most sensitive of receptors are present. Sound pressure increases of more than 6 dB may require a closer analysis of impact potential depending on existing SPLs and the character of surrounding land use and receptors. SPL increases approaching 10 dB result in a perceived doubling of SPL. The perceived doubling of the SPL results from the fact that SPLs are measured on a logarithmic scale. An increase of 10 dB(A) deserves consideration of avoidance and mitigation measures in most cases. The above thresholds as indicators of impact potential should be viewed as guidelines subject to adjustment as appropriate for the specific circumstances one encounters.

Establishing a maximum SPL at the point of reception can be an appropriate approach to addressing potential adverse noise impacts. Noise thresholds are established for solid waste management facilities in the Department's Solid Waste regulations, 6 NYCRR Part 360. Most humans find a sound level of 60 - 70 dB(A) as beginning to create a condition of significant noise effect (EPA 550/9-79-100, November 1978). In general, the EPA's "Protective Noise Levels" guidance found that ambient noise levels # 55 dBA $L_{(dn)}$ was sufficient to protect public health and welfare and, in most cases, did not create an annoyance (EPA 550/9-79-100, November 1978). In non-industrial settings the SPL should probably not exceed ambient noise by more than 6 dB(A) at the receptor. An increase of 6 dB(A) may cause complaints. There may be occasions where an increase in SPLs of greater than 6 dB(A) might be acceptable. The addition of any noise source, in a non-industrial setting, should not raise the ambient noise level above a maximum of 65 dB(A). This would be considered the "upper end" limit since 65 dB(A) allows for undisturbed speech at a distance of approximately three feet. Some outdoor activities can be conducted at a SPL of 65 dB(A). Still lower ambient noise levels may be necessary if there are sensitive receptors nearby. These goals can be attained by using the mitigative techniques outlined in this guidance.

Ambient noise SPLs in industrial or commercial areas may exceed 65 dB(A) with a high end of approximately 79 dB(A) (EPA 550/9-79-100, November 1979). In these instances mitigative measures utilizing best management practices should be used in an effort to ensure that a facility's generated sound levels are at a minimum. The goal in an industrial/commercial area, where ambient SPLs are already at a high level, should be not to exceed the ambient SPL. Remember, if a new source operates at the same noise level as the ambient, then 3 dB(A) must be added to the existing ambient noise level to obtain the future noise level. If the goal is not to raise the future noise levels the new facility would have to operate at 10 dB(A) or more lower than the ambient.(see Table A)

Table B

HUMAN REACTION TO INCREASES IN SOUND PRESSURE LEVEL

Increase in Sound Pressure (dB)	**Human Reaction**
Under 5	Unnoticed to tolerable
5 - 10	Intrusive
10 - 15	Very noticeable
15 - 20	Objectionable
Over 20	Very objectionable to intolerable

(Down and Stocks - 1978)

Impact assessment will vary for specific project reviews, but must consist of certain basic components for all assessments. Additional examination of sound generation and noise reception are necessary, where circumstances warrant. Sound impact evaluation is an incremental process, with four potential outcomes:

- exemption criteria are met and no noise evaluation is required;
- noise impacts are determined to be non-significant (after first-level evaluation);
- noise impacts are identified as a potential issue but can be readily mitigated (after second level evaluation); or
- noise impacts are identified as a significant issue requiring analysis of alternatives as well as mitigation (third level evaluation).

All levels of evaluation may require preparation of a noise analysis. The required scope of noise impact analysis can be rudimentary to rather sophisticated, depending on circumstances and the results obtained from initial levels of evaluation. Recommendations for each level of evaluation are presented below.

2. Situations in Which No Noise Evaluation is Necessary

When certain criteria are satisfied, the need for undertaking a noise impact analysis at any level is eliminated. These criteria are as follows:

a. The site is contained within an area in which local zoning provides for the intended use as a “right of use”. It does not apply to activities that are permissible only after an applicant is granted a special use permit by the local government; and

b. The applicant’s operational plan incorporates appropriate best management practices (BMPs [see Section V.C. Mitigation - Best Management Practices]) for noise control for all facets of the operation.

Where activities may be undertaken as a “right of use”, it is presumed that noise has been addressed in establishing the zoning. Any residual noise that is present following BMP implementation should be considered an inherent component of the activity that has been found acceptable in consideration of the zoning designation of the site.

3. First Level Noise Impact Evaluation

The initial evaluation for most facilities should determine the maximum amount of sound created at a single point in time by multiple activities for the proposed project. All facets of the construction and operation that produce noise should be included such as land clearing activities (chain saw and equipment operation), drilling, equipment operation for excavating, hauling or conveying materials, pile driving, steel work, material processing, product storage and removal. Land clearing and construction may be only temporary noise at the site whereas the ongoing operation of a facility would be considered permanent noise. An analysis may be required for various phases of the construction and operation of the project to assure that adverse noise effects do not occur at any phase.

To calculate the sound generated by equipment operation, one can consult the manufacturers' specifications for sound generation, available for various types of equipment. Another option for calculating the sound to be generated by equipment is to make actual measurements of sound generated by existing similar equipment, elsewhere.

Tables C and D summarize noise measurements from some common equipment used in construction and mining. Table E summarizes the noise level, in decibels (dB[A]), from some common sources. This information can be used to assist Department staff in relating potential noise impacts to sound levels produced by commercial and industrial activities. Use of these tables in the first level of analysis will help determine whether or not noise will be an issue and whether actual measurements should be made to confirm noise levels.

Table C

PROJECTED NOISE LEVELS

Noise Source	Measurements	1,000 feet	2,000 feet	3,000 feet
Primary and secondary crusher	89 dB(A) at 100 ft	69.0 dB(A)	63.0 dB(A)	59.5 dB(A)
Hitachi 501 shovel loading	92 dB(A) at 50 ft	66.0 dB(A)	60.0 dB(A)	56.5 dB(A)
Euclid R-50 pit truck loaded	90 dB(A) at 50 ft	64.0 dB(A)	58.0 dB(A)	54.4 dB(A)
Caterpillar 988 loader	80 dB(A) at 300 ft	69.5 dB(A)	63.5 dB(A)	60.0 dB(A)

(The Aggregate Handbook, 1991)

Table D

Common Equipment Sound Levels

EQUIPMENT	**DECIBEL LEVEL**	**DISTANCE** in feet
Augered earth drill	80	50
Backhoe	83-86	50
Cement mixer	63-71	50
Chain saw cutting trees	75-81	50
Compressor	67	50
Garbage Truck	71-83	50
Jackhammer	82	50
Paving breaker	82	50
Wood Chipper	89	50
Bulldozer	80	50
Grader	85	50
Truck	91	50
Generator	78	50
Rock drill	98	50

(excerpt and derived from Cowan, 1994)

Table E

Sound Source	dB(A)°	Response Criteria
	150	
Carrier Deck Jet Operation	140	
	130	Painfully Loud Limit Amplified Speech
Jet Takeoff (200 feet) Discotheque	120	
Auto Horn (3 feet) Riveting Machine	110	Maximum Vocal Effort
Jet Takeoff (2000 feet) Shout (0.5 feet)	100	
N.Y. Subway Station Heavy Truck (50 feet)	90	Very Annoying Hearing Damage (8 hours, continuous exposure)
Pneumatic Drill (50 feet)	80	Annoying
Freight Train (50 feet) Freeway Traffic (50 feet)	70	Telephone Use Difficult Intrusive
Air Conditioning Unit (20 feet)	60	
Light Auto Traffic (50 feet)	50	Quiet
Living Room Bedroom	40	
Library Soft Whisper (15 feet)	30	Very Quiet
Broadcasting Studio	20	
	10	Just Audible
	0	Threshold of Hearing

(The Aggregate Handbook, 1991)

The sound level at receptor locations should be calculated using the inverse square rule whereby sound is attenuated over distance. Again, each doubling of the distance from the source of a noise decreases the SPL by 6 dB(A) at distances greater than 50 feet. This calculation should first consider the straight line distance between the point of noise generation and the point of noise reception with the presumption that no natural or manmade features exist along the transect between the two points that would further attenuate sound level. Calculations should be performed for each point of reception in all directions being careful to evaluate the worst case noise impact potential by considering activities at the point where they would be closest to a receptor. The sound level calculated for the point of reception should be related to ambient sound levels. Ambient sound levels can be either measured or assumed based on established references for the environmental setting and land use at the point of reception. For estimation purposes, ambient SPLs will vary from approximately 35 dB(A) in a wilderness area to approximately 87 dB(A) in a highly industrial setting. A quiet seemingly serene setting such as rural farm land will be at the lower end of the scale at about 45 dB(A), whereas an urban industrial area will be at the high end of this scale at around 79 dB(A) (EPA 550/9-79-100, November 1978). If there is any concern that levels based on reference values do not accurately reflect ambient SPL, field measurements should be undertaken to determine ambient SPLs.

Where this evaluation indicates that sound levels at the point of reception will not be perceptible, similar to or only slightly elevated as compared to ambient conditions, no further evaluation is required. When there is an indication from this initial analysis that marginal or significant noise impact may occur, further evaluation is required. In determining the potential for an adverse noise impact, consider not only ambient noise levels, but also the existing land use, and whether or not an increased noise level or the introduction of a discernable sound, that is out of character with existing sounds, will be considered annoying or obtrusive. (see B.1.a Evaluation of Sound Characteristics)

4. Second Level Noise Impact Evaluation

Further refine the evaluation of noise impact potential by factoring in any additional noise attenuation that will be provided by existing natural topography, fabricated structures such as buildings, walls or berms or vegetation located between the point of noise generation and noise reception. This analysis may require consideration of future conditions and the loss of natural noise buffers over time.

Dense vegetation that is at least 100 feet in depth will reduce the sound levels by 3 to 7 dB(A). Evergreens provide a better vegetative screen than deciduous trees. Keep in mind that if a vegetative screen does not currently exist, planting a vegetative screen may require 15 or more years of growth before it becomes effective.

The degree to which topography attenuates noise depends on how close the feature is located to the source or the receptor of the noise. Topography can act as a natural screen. The closer a hill or other barrier is to the noise source or the receptor, the larger the sound shadow will be on the side opposite the noise source. Certain operations such as mining and landfills may be able to use topography to maintain a screen between the operation and receptors as they progress. Mining operations may be able to create screens by opening a mine in the center of the site using and maintaining the pit walls as barriers against sound (Aggregate Handbook, 1991).

If after taking into account all the attenuating features the potential still exists for adverse noise impact, other types of noise analyses or modeling should be used to characterize the source. An Equivalent Sound Level (L_{eq}) analysis or a related type of noise analysis may better define activities or sources that require more mitigation or isolation so that noise emanating from these sources will not cause an adverse impact.

Where it is demonstrated that noise absorbing or deflecting features further attenuate sound reception to a level of no significant increase, no further analysis is necessary. Where it is determined that noise level or the character of the noise may have a significant adverse effect on receptors, other noise mitigation measures should be evaluated in an expanded noise analysis.

5. Third Level - Mitigation Measures

When the above analyses indicate significant noise effects may or will occur, the applicant should evaluate options for implementation of mitigation measures that avoid, or diminish significant noise effects to acceptable levels (see Section V.C. Mitigation - Best Management Practices). Adequate details concerning mitigation measures and an evaluation of the effectiveness of the mitigative measures through additional sound level calculations should be provided in a noise analysis. These calculations are to factor in the noise reduction or avoidance capabilities of the mitigation measures. In circumstances where noise effects cannot readily be reduced to a level of no significance by project design or operational features in the application, the applicant must evaluate alternatives and mitigation measures in an environmental impact statement to avoid or reduce impacts to the maximum extent practicable per the requirements of the State Environmental Quality Review Act (SEQR).

The noise analysis should be part of the application or a supplement to it, and will be part of the SEQR environmental assessment by reference. Duplicative noise analysis information is not required for the permit application and the assessment of impacts under SEQR. A proper analysis can satisfy information needs for both purposes.

C. Mitigation - Best Management Practices (BMP) for Reducing Noise

Various noise abatement techniques are available for reducing frequency of sound, duration of sound or SPLs at receptor locations. The mitigation techniques given below are listed according to what sound characteristic they mitigate.

1. Reduce noise frequency and impulse noise at the source of generation by:

    a. Replacing back-up beepers on machinery with strobe lights (subject to other requirements, e.g., OSHA and Mine Safety and Health Administration, as applicable). This eliminates the most annoying impulse beeping;

    b. Using appropriate mufflers to reduce the frequency of sound on machinery that pulses, such as diesel engines and compressed air machinery;

    c. Changing equipment: using electric motors instead of compressed air driven machinery; using low speed fans in place of high speed fans;

    d. Modifying machinery to reduce noise by using plastic liners, flexible noise control covers, and dampening plates and pads on large sheet metal surfaces; and

2. Reduce noise duration by:

    a. Limiting the number of days of operation, restricting the hours of operation and specifying the time of day and hours of access and egress can abate noise impacts.

    b. Limiting noisier operations to normal work day hours may reduce or eliminate complaints.

    Limiting hours of construction or operation can be an effective tool in reducing potential adverse impacts of noise. The impacts of noise on receptors can be significantly reduced by effectively managing the hours at which the loudest of the operations can take place.

Implementation of hours of operation does not reduce the SPL emanating from a facility. Determining whether or not hours of operation will be effective, mitigation requires consideration of: public safety, for example road construction at night may reduce traffic concerns and facilitate work; duration of the activity, is it a one time event necessary to meet a short term goal or will the activity become an ongoing operation; and surrounding land use, consider what type(s) of land use is proximal to the activity and at what time(s) might a reduction of noise levels be necessary. There may be other factors to consider due to the uniqueness of a given activity or the type of land use adjacent to the activity. Hours of operation should also consider weekend activities and legal holidays that may change the types of land use adjacent to the permitted activity or increase traffic levels in an area.

The best results from using hours of operation as a mitigative measure will be obtained if the hours are negotiated with the owner or operator of the facility. The less noisy aspects of an operation may not have to be subject to the requirements of hours of operation such as preparing, greasing and maintaining machinery for the upcoming day's operation. The more noisy operations can be scheduled to begin when people in the receptor area are less likely to be adversely effected. Hours of operation should be included in the operation plans for a facility that becomes part of the permit, or in the event that there is no operation plan, can be included as a permit condition.

3. Reduce Noise sound pressure levels by:

    a. Increasing the setback distance.
    b. Moving processing equipment during operation further from receptors.
    c. Substituting quieter equipment (<u>example</u> - replacing compressed air fan with an electric fan could result in a 20 dB reduction of noise level).

d. Using mufflers selected to match the type of equipment and air or gas flow on mechanical equipment.
e. Ensuring that equipment is regularly maintained.
f. Enclosing processing equipment in buildings (example - enclosing noisy equipment could result in an 8-10 dB noise level reduction, a 9 inch brick wall can reduce SPL by 45-50 dB).
g. Erecting sound barriers such as screens or berms around the noise generating equipment or near the point of reception. The angle of deflection also increases as the height of a screen or barrier increases. Screens or barriers should be located as close to the noise source or the receptor as possible. The closer the barrier is located to the source or the receptor, the greater the angle of deflection of the sound waves will be creating a larger "sound shadow" on the side opposite the barrier. Stockpiles of raw material or finished product can be an effective sound barrier if strategically placed.
h. phasing operations to preserve natural barriers as long as possible.
i. altering the direction, size, proximity of expanding operations.
j. Designing enclosed facilities to prevent or minimize an SPL increases above ambient levels. This would require a noise analysis and building designed by a qualified engineer that includes adequate ventilation with noise abatement systems on the ventilation system.

Public notification of upcoming loud events can also be used as a form of mitigation although it doesn't fit easily into the categories above. People are less likely to get upset if they know of an upcoming event and know that it will be temporary.

The applicant should demonstrate that the specific mitigation measures proposed will be effective in preventing adverse noise effects on receptors.

D. Decision Making - Conditioning Permits to Limit Noise Impacts

Preferably, the mitigation measures as outlined in the construction and operational plans should be relied upon to mitigate the effects of noise on receptors. The permit should state that the activity will be conducted in accordance with the approved plan. Otherwise, mitigation measures and BMP's can be imposed within specific permit conditions.

It is not the intention of this guidance to require decibel limits to be established for operations where such limits are not required by regulation. There are, however, instances when a decibel limit may be established for an operation to ensure activities do not create unacceptable noise effects, as follows:

1. The review of a draft and final environmental impact statement demonstrates the need for imposition of a decibel limit;
2. A decibel limit is established by the Commissioner's findings after a public hearing has been held on an application;
3. The applicant asks to have a decibel limit to demonstrate the ability to comply; or
4. A program division seeks to establish a decibel limit as a permit condition, when necessary to demonstrate avoidance of unacceptable noise impact.

Ultimately, the final decision must incorporate appropriate measures to minimize or avoid significant noise impacts, as required under SEQR. Any unavoidable adverse effects must be weighed along with other social and economic considerations in deciding whether to approve or deny a permit.

REFERENCES

1) Cowan, James P., Handbook of Environmental Acoustics, Van Nostrand Reinhold, 1994.

2) Down, C.G. and Stocks, J.; Environmental Impact of Mining. Applied Science Publishers Ltd., ISBN 0853347166, 1978.

3) U.S. Dept of Transportation - Federal Highway Administration Office of Research and Development; Highway Noise-A Manual for Highway Noise and Land Use, Nov. 1974.

4) New York State Motor Vehicle Law, Chapter IV, Subchapter E, 450.2, Part 450, "Noise From Heavy Motor Vehicles," 200.701 CN, February 28, 1997.

5) Beranek, L.A. ed., Noise and Vibration Control. Cambridge, MA: Institute of Noise Control Engineering, 1971, pp. 164-174 and 182-191.

6) Barksdale, R.D., editor, 1991. The Aggregate Handbook: National Stone Association (Washington, DC), 1.V.

7) Norman, David K., Wampler , Peter J., Throop, Allen H., Schnitzer, E. Frank, and Roloff, J., 1996. "Best Management Practices for Reclaiming Surface Mines in Washington and Oregon." Oregon Dept. of Geology and Mineral Industries, Open File Report 0-96-2.

8) United States Environmental Protection Agency, Protective Noise Levels, Condensed Version of EPA Levels document, EPA 550/9-79-100, November 1978, Office of Noise Abatement & Control, Washington, D.C.

9) United States Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA 550/9-74-004, March 1974, Office of Noise Abatement and Control, Washington, D.C.

10) City of Davis General Plan, Appendix E Background Information on Environmental Acoustics, November 1996.

11) The Australian National University, “Physics and Psychophysics of Music”, ACAT 1003, David Worrall, http://www.anu.edu.au/ITA/ACAT/drw/PPofM/Intensity2.html, 1998.

12) Danish Wind Turbine Manufacturers Association, Measuring and Calculating Sound Levels, November 18, 1997.

Additional Reading

a. Beranek, Leo L. and Istavan L. Ver, Noise and Vibration Control Engineering, John Wiley & Sons, Inc. New York, 1992.

b. Beranek, Leo L., Noise and Vibration Control, Institute of Noise Control Engineering, Revised Edition, Washington, C.C., 1988.

c. Diehl, George, M., Machinery Acoustics, John Wiley & Sons, New York, 1973.

d. Erwin, J.D., Graf, E. R., Industrial Noise and Vibration Control, Prentice Hall, Englewood Cliffs, New Jersey, 1979.

e. Jensen, Paul, et al, Industrial Noise Control Manual, U.S. Department of Health, Education and Welfare, Public Health Service, Cincinnati, 1978.

APPENDIX B

Town of Hempstead Noise Code

Town of Hempstead, NY
Monday, June 11, 2018

Chapter 144. Unreasonable Noise

Article I. General Provisions

§ 144-1. Definitions.

As used in this Article, the following terms shall have the meanings indicated:

DECIBEL
A unit for measuring the volume of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of sound measured to the reference pressure, which is 20 micropascals or 20 micronewtrons per square meter.

DEMOLITION
Any dismantling, intentional destruction or removal of structures, utilities, public or private right-of-way surfaces or similar property.

NOISE
Any sound which annoys or disturbs humans or which causes or tends to cause an adverse psychological or physiological effect on humans.

NOISE DISTURBANCE
Any sound which either endangers or injures the safety or health of humans or animals or annoys or disturbs a reasonable person of normal sensitivity or endangers or damages property; same as "unreasonable noise."

REAL PROPERTY BOUNDARY
An imaginary line along the ground surface, and its vertical extension, which separates the real property owned by another person, but not including intrabuilding real property divisions.

SOUND
An oscillation in pressure, particle displacement, particle velocity or other physical parameter, in a medium with internal forces that causes compression and rarefaction of that medium. The description of sound may include any characteristic of the sound being described.

UNREASONABLE NOISE
Any sound which either endangers or injures the safety or health of humans or animals or annoys or disturbs a reasonable person of normal sensitivity or endangers or damages property; same as "noise disturbance."

§ 144-2. General prohibitions.

A. It shall be unlawful and an offense against this chapter for any person to unreasonably make, continue or cause to be made or continued any unreasonable noise or noise disturbance.

B. Sound emanating from public speaking and public assembly activities conducted on public property shall be exempt from the provisions of Subsection **A** of this section.

§ 144-3. Specific prohibitions.

Any conduct contributing toward participation in any of the following activities hereby is declared to be offenses against this chapter:

A. The sounding of any horn or signal device on any automobile, motorcycle, truck, bus or other vehicle, except as a warning signal pursuant to the provisions of the Vehicle and Traffic Law of the State of New York.

B. Operating, playing or permitting the operation or playing of any radio, television, phonograph, drum, musical instrument, sound amplifier or similar device which produces, reproduces or amplifies sound in such a manner as to create a noise disturbance across a real property boundary.

C. Owning, possessing or harboring any animal or bird which howls, barks, meows, squawks or makes any other sounds which creates a noise disturbance across a residential real property boundary.

D. The use of any automobile, motorcycle or other vehicle in such a manner as to create a noise disturbance across a residential real property boundary.

E. The blowing of any steam whistle attached to any stationary boiler, except to give notice of the time to begin or stop work or as a warning of danger.

F. The discharge into the open air of the exhaust of any steam engine, stationary internal-combustion engine or motor vehicle, except through a muffler or other sound-dissipative device which effectively will prevent loud or explosive noises therefrom.

G. The erection, including excavating, demolition, alteration or repair, of any building other than between the hours of 7:00 a.m. and 6:00 p.m. on weekdays, except in a case of urgent necessity in the interest of public safety, and then only with a permit from the Department of Buildings, which permit may be renewed for a period of three days or less while the emergency continues.

H. Creating or causing the creation of any sound on any street or public property adjacent to any school, institution of learning or court while the institution or court is in session, or adjacent to any hospital, which unreasonably interferes with the workings of the institution, court or hospital, provided that conspicuous signs are displayed in the area indicating that it is a school, hospital or court area.

I. Loading, unloading, opening, closing or other handling of boxes, crates or other containers in such a manner so as to create unreasonable noise.

J. Offering for sale or selling anything by shouting or outcry or making any other types of shouting or outcry within a residential area, thus creating unreasonable noise across a residential real property boundary.

K. The use of any loudspeaker or amplifier device such that the sound therefrom creates unreasonable noise across a real property boundary.

L. Using any radio apparatus, loudspeaker, public address system or similar device between the hours of 11:00 p.m. and 9:00 a.m. producing sound across a real property boundary. Nothing herein contained shall be construed to prevent the operation of a radio apparatus, loudspeaker, public address system or similar device used in any reasonable manner within any building or structure that does not project sound across a real property boundary.

M. Operating or permitting the operation of any mechanical powered saw, sander, drill, grinder, lawn or garden tool, snowblower or similar device, which creates an unreasonable noise across a real property boundary other than between the hours of 8:00 a.m. and 9:00 p.m. on Saturdays and Sundays, and between the hours of 7:00 a.m. and 9:00 p.m. on Mondays through Fridays.
[Amended 6-20-2017 by L.L. No. 52-2017, effective 6-29-2017]

N. The operation of any machinery, equipment, pump, fan, exhaust fan, attic fan, air-conditioning apparatus or similar mechanical device in such a manner as to create an unreasonable noise across a real property boundary.

O. Burglar or fire alarm.

(1) The installation, maintenance or use of any audible burglar alarm or fire alarm that is not provided with a device that will automatically shut off such alarm after 30 minutes of continuous sound.

(2) Allowing or permitting such burglar alarm or fire alarm to emit sound audible beyond the real property boundaries of the user of said alarm for a continuous period of more than 30 minutes, whether or not said alarm has been equipped with the automatic shutoff device hereinabove required.

APPENDIX C

Environmental Noise Fundamentals

Appendix: Environmental Noise Fundamentals

1.0 Sound / Noise Basics

Sound

Sound is generated when a vibrating object (sound source) creates a physical disturbance that sets the parcels of air or other surrounding medium nearest to it in motion, causing pressure variations that form a series of alternating compression and expansion pressure waves that move or propagate outward away from the source in a spherical pattern.

Sound propagates at different speeds depending on the medium.

- In air sound propagates at a speed of approximately 340m/s;
- In liquids the propagation velocity is greater and in water is approximately 1500 m/s; and
- In solids can be even greater and is 5000 m/s in steel.

Factors that affect how sound is perceived by the human ear include the amplitude or loudness, the frequency, and the duration of the sound, as well as the location of the receiver relative to the source of sound. The sound levels we encounter in daily life vary over a wide range. The lowest sound pressure level the ear can detect is more than a million times less than that of a jet take-off. The audible sound frequency range for young persons is from approximately 20hz to 20,000Hz.The decibel is used as a unit of sound amplitude or loudness and is derived from a comparison sound pressure, in air, with a reference pressure. Broadband sound covers the whole of the audible frequency range and is made up of many tones.

Noise

The terms "sound" and "noise" are often used synonymously Noise is unwanted sound usually composed of a spectrum of many single frequency components, each having its own amplitude. The disturbing effects of noise depend both on the intensity and the frequency of the tones. For example, higher frequencies are often more disturbing than low frequencies. Pure tones can be more disturbing than broadband sound.

Frequency

Noise with distinct tones, for example, noise from fans, compressors, or saws, can be more disturbing than other types of noise. This annoyance factor is not taken into account in a broadband measurement.

A spectral analysis may be needed to identify/assess disturbance. Pure tones can be assessed subjectively, as the human ear is good at detecting tones. Regulations often require an objective measurement of tonal content as well. In practice, this is can be done by octave, 1/3-octave analysis or narrow-band analysis (FFT - Fast Fourier Transform).

***A-Weighting (dBA)* -** Noise measurements are most often taken using the "A-weighted" frequency response function. The A-weighted frequency or dBA scale simulates the response of the human ear to sound levels (particularly low-level sound) and has been given prominence as a means for estimating annoyance caused by noise, for estimating the magnitude of noise-induced hearing damage, in hearing conservation criteria, for speech interference measurements, and in procedures for estimating community reaction to (general broad band) noise (Clayton, et al. 1978; Cheremisinoff, et al. 1977). Sound measurements are often made using the "A" frequency weighting when assessing environmental noise. The Leq or, better, the LAeq (the A-weighted equivalent continuous sound level) is an important parameter.

1.1 Noise Descriptors

There are a number of noise descriptors used to characterize various aspects of noise that take into account the variability of noise levels over time which most environments experience. Various criteria and guidelines used to characterize noise are discussed below. The different descriptors are applicable to different situations. Commonly used descriptors are discussed below.

Equivalent Sound Level (Leq)

The equivalent sound level (Leq) is the value of a steady-state sound which has the same A-weighted sound energy as that contained in the time-varying sound. The Leq is a single sound level value for a desired duration, which includes all of the time-varying sound energy during the measurement period. The U.S. EPA has selected Leq as the best environmental noise descriptor for several reasons, but primarily because it correlates reasonably well with the effects of noise on people, even for wide variations of environmental sound levels and different time exposure patterns. Also, it is easily measurable with available equipment.

Statistical Descriptors

Statistical sound level descriptors such as L_1, L_{10}, L_{50}, and L_{90} are used to represent noise levels that are exceeded 1, 10, 50, and 90 percent of the time, respectively. L_{50}, the Sound Pressure Level (SPL) exceeded 50 percent of the time, provides an indication of the median sound level. L_{90} represents the residual level, or the background noise level without intrusive noises.

Residual Noise Level

Measurement of the residual or background sound level is useful in characterizing a community with respect to noise. The residual sound level is the minimum sound level in the absence of identifiable or intermittent local sources. It is not the absolute minimum sound level during a long observation period, but rather the lowest reading that is reached repeatedly during a given period. The L90 (referred to as the ambient level) is a statistical descriptor, which represents the level that is exceeded 90 percent of the time. Comparisons of data have shown that the L90, measured with a continuous statistical sound meter, and the residual sound level, measured by trained personnel with a sound-level meter, are closely correlated with one another. (Bolt, Beranek, and Neman, Inc. 1978)

Ambient noise is the noise from all sources combined - factory noise, traffic noise, birdsong, running water, etc. Specific noise is the noise from the source under investigation. The specific noise is a component of the ambient noise and can be identified and associated with the specific source.

Day/Night Equivalent Sound Level (Ldn)

The day/night equivalent sound level (Ldn) is the A-weighted equivalent level for a 24-hour period. (U.S. EPA 1974). The Ldn is estimated from the equivalent daytime Ld and nighttime Ln levels with an additional 10 dBA weighting imposed on the equivalent sound levels occurring during nighttime.

The U.S. EPA suggests this descriptor be used to relate noise in residential areas to annoyance caused by interference with speech, sleep and other activity. Based on interpretation of available scientific information, U.S. EPA identified an outdoor Ldn of 55 dBA as a level protective of public health and welfare with an adequate margin of safety, without concern for economic and technical feasibility. (U.S. EPA 1978)

1.2 Noise Standards/Criteria

FHWA Noise Abatement Criteria

The Federal Highway Administration (FHWA) has established noise abatement criteria for motor vehicle noise on roadways (23 CFR 772). These criteria are intended to apply to highway projects, which this is not. However, these criteria can be used as guidance for assessing traffic noise. These criteria represent maximum desirable noise levels for various land-uses and associated human activities, for use in assessing noise levels from roadway traffic. An exterior Leq of 67 dBA is the Noise Abatement Criterion typically used to evaluate noise levels along highways, Activity Category (B), applicable to residential areas. The FHWA Noise Abatement Criterion for areas not considered sensitive receptors, such as manufacturing zones, is an Leq of 72 dBA, Activity Category (C).

Noise sensitivity criteria used by the FHWA for evaluating the significance of noise impacts are presented in Table 1. Generally, a three dBA or smaller change in sound pressure (noise) level would be barely perceptible to most listeners, whereas a ten dBA change is normally perceived as a doubling (or halving) of noise levels. Increases in average or cumulative noise levels of five dBA or more are clearly noticeable. These criteria provide an indication of individual perception of changes in noise levels. A three-dBA increase is commonly used as the threshold for assessing the potential significance of noise impacts.

The Federal Highway Administration (FHWA) has established noise abatement criteria for motor vehicle noise on roadways (23 CFR 772). These criteria are intended to apply to highway projects, which this is not. However, these criteria can be used as guidance for assessing traffic noise. These criteria represent maximum desirable noise levels for various land uses and associated human activities, for use in assessing noise levels from roadway traffic. An exterior Leq of 67 dBA is the Noise Abatement Criterion typically used to evaluate noise levels along highways, Activity Category B) applicable to residential areas. The FHWA Noise Abatement Criterion for areas not considered sensitive receptors, such as manufacturing zones, is an Leq of 72 dBA, Activity Category C).

New York State

The New York State Department of Environmental Conservation (NYSDEC) has published a policy and guidance document titled *Assessing and Mitigating Noise Impacts* (October 6, 2000). This document provides guidance on when noise due to projects has the potential for adverse impacts and requires review and possible mitigation in the absence of local regulations. The NYSDEC guidance indicates that local noise ordinances or regulations are not superceded by NYSDEC guidance. The New York State Guidance Document contains a Table identifying expected human reaction to various increases in sound pressure levels. This Table is included as Table 2 below. The guidance indicates that a noise increase of 10 dBA deserves consideration of avoidance and mitigation measures in most cases. It is further indicated that the addition of a noise source, in a non-industrial setting, should not raise the ambient noise level above a maximum of 65 dBA.

The City Environmental Quality Review (CEQR) Noise Code was adopted to prevent unreasonably loud and disturbing noise.

New Jersey State Noise Standards

The State of New Jersey noise standards (Noise Control Regulations) require that sound from any industrial or commercial operation measured at any residential property line must not exceed a continuous sound level of 65 dBA during the daytime (7:00 a.m. to 10:00 p.m.), or a level of 50 dBA during the nighttime (10:00 p.m. to 7:00 a.m.). These standards also limit continuous sound from any industrial or commercial operation measured at any other commercial property line to 65 dBA (New Jersey Administrative Code 7:29, 2000).

Octave band sound levels have been specified by the State of New Jersey, which limit the sound intensity at residential and commercial property boundary lines (New Jersey Administrative Code 7:29, 1997). An octave band sound level limit requires a noise analysis of sound levels at various frequencies. The sound signal energy can be electronically separated into frequency bands, known as octave bands, each of which covers a 2 to 1 range of frequencies. For example, the effective band for the 1,000 Hz octave band center frequency extends from 710 to 1,420 Hz.

New Jersey Model Noise Ordinance

The Model Noise Ordinance was developed to be adopted, enforced, and adjudicated locally. It is a performance code designed to empower municipalities to respond to noise complaints within their community in a timely manner. The model noise ordinance regulates more sound-source categories than the State's Noise Control Regulations, including residential and multi-use properties. The noise standards in this model noise ordinance are the same as that for the New Jersey State Noise Control Regulations.

Local Municipalities

Local municipalities may have their own noise control code or noise ordinance that may regulate noise more stringently than state standards/criteria. Local noise codes will be considered on a project specific basis.

Table 1 Noise Sensitivity Criteria Decibel Changes and Loudness	
Change (dBA)	**Relative Loudness**
0	Reference
3	Barely perceptible change
5	Readily perceptible change
10	Half or twice as loud
20	1/4 or four times as loud
30	1/8 or eight times as loud

Source: Based on Highway Traffic Noise Analysis and Abatement – Policy and Guidance. (FHWA, June 1995.)

Table 2 HUMAN REACTION TO INCREASES IN SOUND PRESSURE LEVEL	
Increase in Sound Pressure (dB)	**Human Reaction**
Under 5	Unnoticed to tolerable
5 – 10	Intrusive
10 – 15	Very noticeable
15 – 20	Objectionable
Over 20	Very objectionable to intolerable

Source: New York State Department of Environmental Conservation. Assessing and Mitigating Noise Impacts. (NYSDEC October 6, 2000.)

2.0 NOISE MONITORING SURVEY

2.1 Methodology

The following describes the equipment and procedures utilized during this noise survey.

2.2 Equipment

The sound-level meter (SLM) is the conventional instrument used to measure the instantaneous sound-pressure level (SPL), in decibels (dB), of sound energy. The SLM contains a microphone, amplifier, weighting and filter networks, detector networks, and indicators.

An integrating sound-level meter (ISLM) has the capability to compute the long-term root-mean-square (rms) level of time-varying sound energy. The time-averaged, mean square SPL is referred to as the Leq (equivalent constant SPL). The ISLM used for this assessment can compute Leq measurements automatically, providing greater ease and accuracy of Leq determination.

Noise levels were measured and analyzed with a Bruel and Kjaer (B&K) Modular Precision Sound Level Meter Type 2231 and/or a Bruel and Kjaer (B&K) Modular Precision Sound Level Meter Type 2250. A B&K Microphone Type 4189 was used in conjunction with the B&K 2231 and B&K 2250. Both the B&K 2231 and B&K 2250 are Type 1 instruments in accordance with the American National Standards Institute (ANSI), S1.4-1983 Type 1. This instrument can be used to perform a wide range of measurements, take several measurements simultaneously, and automatically store data at the end of a preset time period. The B&K 2231 and 2250 can measure sound levels ranging from 24 to 113 decibels A-weighted (dBA). Measured data can be stored in the instrument memory, which has battery backup, to maintain data integrity. The B&K 2231 and 2250 can be used with modules to enhance the basic functions of the meter.

The B&K 2231 can be used in conjunction with a B&K 1625 Octave Band Filter, to perform octave band measurements. The B&K 1625 Band Pass Filter Set contains 10 active filters with center frequencies from 31.5 Hz to 16 kHz. Each octave filter satisfies requirements of IEC Recommendation R 225-1996, DIN 45651 and ANSI S1, 11-1966 Class II. The total frequency range is from 14 Hz to 28 kHz. The B&K 1625 filter set covers the audio-frequency range with center frequencies arranged according to the preferred frequencies of ISO R266, DIN 45401 and ANSI. 1.6-1960. The B&K 2250 has a software module that allows real-time frequency measurements in 1/1 and 1/3 Octave Bands.

2.3 Calibration

Calibration of the B&K 2231 and/or the B&K 2250 was performed using the B&K Calibrator 4230 and/or B&K 4231. Calibrations of the B&K 2231 and/or B&K 2250 were performed prior to and immediately following noise monitoring.

2.4 Procedures

There are many noise monitoring methodologies available for performing baseline noise monitoring studies. Most consist of various data acquisition and analysis procedures, and also include a high degree of subjectivity (Greenberg, et al. 1979). The approach utilized follows appropriate general guidelines and recommended practices.

Observations are made, during measurement, such as with regard to temperature, wind, relative humidity, cloud cover, and wind induced noises (i.e., leaves rustling, etc.). Atmospheric conditions such as rainfall (precipitation), high humidity (greater than 90 percent), and high wind (greater than around 12 to 15 miles per hour) are avoided during field measurement because of their potential influence to have an adverse effect on noise measurements. A microphone windscreen is utilized (as appropriate) during measurements to minimize potential wind effects.

Nearby buildings and other structures can modify outdoor noise radiation patterns. In addition, specific site conditions and equipment layout can influence sound propagation. To characterize sound levels from a facility requires considering site conditions, facility design, and receptor locations.

2.5 Noise Monitoring Locations

A-Weighted noise measurements are taken at various locations in the vicinity of the equipment/location of concern. Noise monitoring may be performed at a number of different locations; near the noise source along the site perimeter; along adjoining residential property boundaries.

2.6 Sensitive Receptors

Areas or receptors that are considered potentially sensitive to noise include residences, schools, hospitals, and recreational facilities (U.S. Environmental Protection Agency, 1974). Potentially sensitive receptors located near the noise source usually include residential areas near the site. The location of closest residence to the noise source is identified and is commonly a candidate for noise monitoring.

2.7 Other Equipment

A Quest Technologies Q-500 Multi-Function Noise Analyzer (a data-logging dosimeter) is sometimes used for noise monitoring. The Q-500 is a Type 1 instrument in accordance with the American National Standards Institute (ANSI), S1.4-1983 Type 1, and has many of the features of an ISLM. The Q-500 dosimeter can be used to record Leq noise levels in one-minute time history intervals over the course of a 24-hour period. The Q-500 can measure sound levels ranging from 40 to 140 decibels A or C-weighted. The A-weighted (dBA) scale can be utilized with the sound level range set at 40 to 115 decibels. An exchange rate of three (3) was used in conjunction with a slow response. Measured data is stored in the instrument memory, which has battery backup, to maintain data integrity.

Calibration of the Q-500 Multi-Function Noise Analyzer is performed using the QC-20 Calibrator set at 94 dB. Calibrations of the dosimeter are usually performed prior to and following noise monitoring.

3.0 NOISE MODELING

3.1 Noise Modeling Methodology

Noise level contributions due to operation of a particular noise source can be estimated using quantitative techniques (noise modeling). Projected noise levels can be estimated using a noise modeling technique, based on a relationship that expresses noise attenuation as a logarithmic function of receptor distance from the noise source. Noise contribution levels from a noise source can be estimated at selected receptor locations (i.e., noise monitoring locations).

Noise propagation calculations are based on the assumption that, at distances greater than around 50 feet (15 meters) from a source, noise levels are reduced by 6 dB for each doubling of distance away from the noise source (Peterson and Gross 1972). This tends to be a conservative approach, since attenuation due to buildings, barriers, and vegetation are often not taken into account; nor are factors such as relative humidity and wind.

3.2 Modeling Results

Receptor locations can be influenced by many noise sources at the same time but to different degrees, depending on the distances the receptors are from the various noise sources, as well as the magnitude, time and duration of noise from these different noise sources. In a situation with many noise sources, it is sometimes difficult to distinguish which noise sources are influencing a given receptor and what their noise level contributions are.

Noise level estimates of potential contributions from a specific noise source can be made at receptor points (monitoring locations from a noise study or sensitive receptor locations), utilizing the noise propagation techniques discussed above. Approximate distances from each facility component (noise source) to various receptor (property boundary, residential etc.) locations are used in an analysis.

Environmental factors (e.g., any buildings or structures between sources and receptors, buildings, vegetation, etc.) usually are not included in the modeling. These factors could serve to make actual noise levels lower than the modeled estimates.

A noise assessment is usually performed using the noise level estimates for a noise source or measured existing noise levels at the source or similar source. Projected noise, associated with a noise source, can be compared to measured existing noise levels.

4.0 MITIGATION MEASURES

If a review of the noise assessment results suggests that reducing noise levels from existing or proposed new equipment (noise sources) a site may be warranted then mitigation methods should be considered. Mitigation measures to reduce measured or projected noise levels include the following, which may be appropriate for different situations:

- Design considerations – specify "quiet equipment designs" depending on installation and site
- Sound absorption panels barrier panels
- Check/improve installation
- Consider enclosures, buildings, or other structures, isolating equipment, etc.
- Interior wall/window treatments

Retrofit to improve a noise problem after placement can be difficult, and more costly.
The above methods can vary widely in their effectiveness, installation and cost.

Installation of indoor mitigation materials/wall treatments:
Take the obvious steps to seal off all cracks, crevices, and paths where sound could escape. Sound can pass through cracks and every crack will offer sound an escape route. Unless you are thorough in sealing off the entire room, you will not achieve the maximum benefit of sound-proofing materials. Sometimes this can be difficult to accomplish, depending on the number of vents, electrical plugs, windows, doors, and other breaks in the wall. Doors and windows are often overlooked. Make sure that doors and windows fit their frames snuggly and that they form a tight seal.

There must be no loose studs, and the sill plates must really hug the floor. The wallboard must be well fitted and all potential cracks must be caulked. (caulk should be flexible, not rigid, and should not crack when the building settles). Do not put holes in sound walls for outlets or pipes; use surface mount electrical fittings and caulk around any wires that pierce gypsum.

Sound can travel through any medium and it passes through solids better than through air. Sound intensity is reduced in the transition from one material to another, as from the air to a wall and back. The amount of reduction (called the transmission loss) is related to the density of the wall, as long as it doesn't move in response to the sound.

Any motion caused by sound striking one side of the wall will result in sound radiated by the other side, an effect called coupling. If the sound hits a resonant frequency, the wall will boom like a drum. Most isolation techniques are really ways to reduce coupling and prevent resonances.

Mass loaded vinyl (MLV) sound barrier is an effective, relatively inexpensive treatment for airborne noise. For multi-level buildings, mass loaded vinyl can be used as an underlayment beneath the floor. This material can be laid directly on the floor under carpets, between sheets of plywood, or over cement.

REFERENCES

Bolt, Beranek, and Newman, Inc. 1978. Electric Power Plant Environmental Noise Guide - Volume I. Edison Electric Institute.

Brüel & Kjær. October 1991. Instruction Manual: Modular Precision Sound Level Meter Type 2231 Plus Statistical Analysis Module BZ7115. Brüel & Kjær. January 1987. Instruction Manual: 1/3 - 1/1 Octave Filter Set Type 1625

Cheremisinoff, P.N. and P.P. Cheremisinoff. 1977. Industrial Noise Control Handbook. Ann Arbor Science Publishers, Inc.

Clayton, G.D. and F.E. Clayton (Editors). 1978. Volume I: General Principles - Patty's Industrial Hygiene and Toxicology, Third Revised Edition. John Wiley & Sons, Inc.

Greenberg, M.R.; G. Belnay; W. Chesanek; N. Nueman; and G. Sheperd. 1979. A Primer on Industrial Environmental Impact. The Center of Urban Policy Research, Rutgers University.

Mayor's Office of Environmental Coordination. December 1993. City Environmental Quality Review Technical Manual. Section 3R: Noise.

(Noise Control Guide 1980)

Peterson, A.P.G. and E.G. Gross. 1972. Handbook of Noise Measurement. General Radio Company.

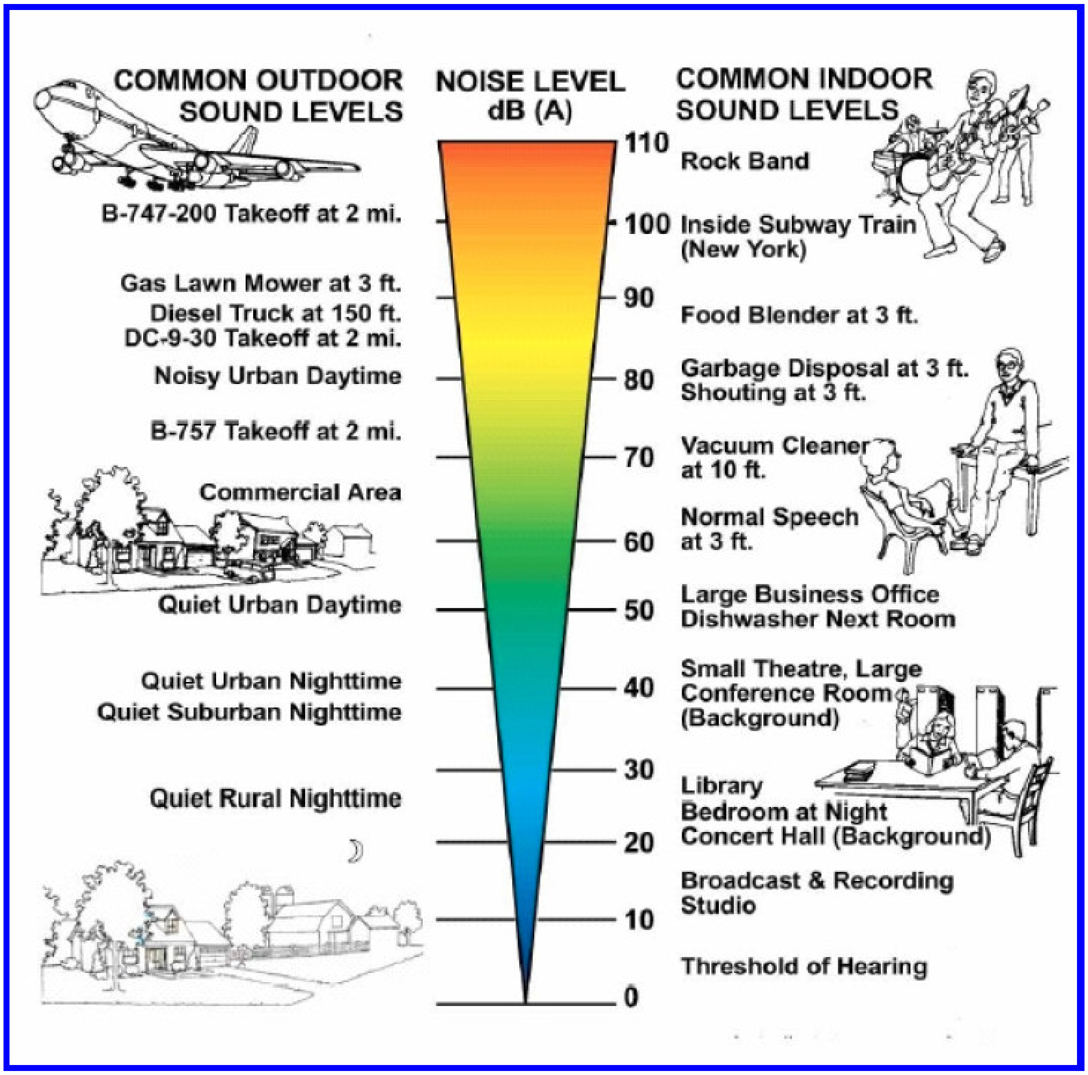
(SOUND BASICS MPCA May 1983 NPC)

U.S. Environmental Protection Agency. 1971. Noise from Construction Equipment. NTID 300.1.

U.S. Environmental Protection Agency. March 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. EPA 550/9-74-004.

U.S. Environmental Protection Agency. November 1978. Protective Noise Levels - Condensed Version of EPA Levels Document. EPA 550/9-79-100.

Common Activities and Typical Sound Levels



This chart shows approximate noise levels that are typically generated by various common outdoor and indoor activities. Note, that, typical noise levels in a residential–commercial urban area ranges from 60 to 70 dBA. Also, indoor sound levels with conversation (normal speech at 3 feet) can range at 60 to 70 dBA.

APPENDIX D

69/13kV Transformer Name Plate

VonRoll Transformers TRANSFORMER PLANT HIGH VOLTAGE LABORATORY	NAME PLATE	Test Report No.: 2527 Page : 3 Type : 13784 Serial No. : 13920/1

Rated power [kVA]: 33000 | Rated Voltage [kV]: 67.65 / 13.8
Frequency [Hz]: 60 | Rated current [A]: 281.6/1381.6

vonRoll
TRANSFORMERS LTD

THREE PHASE TRANSFORMER

TYPE 13784 | SERIAL NO. 13920/1 | NAMEPLATE NO. 921

MONTH JULY | YEAR 2016 | FREQUENCY 60 Hz

16800/22400/28000/33000 KVA CLASS ONAN/ONAF/ONAF/ONAF 65 C TEMPERATURE RISE

67650Y-13800GrdY/7967 (6418D)

INSULATION LEVELS

HIGH VOLTAGE	350KV BIL
LOW VOLTAGE	110KV BIL
TERTIARY	110KV BIL

COOLING CLASS	RATED POWER	RATED CURRENT, A	
		HV	LV
ONAN	16800	143.4	703
ONAF	22400	191.2	937
ONAF	28000	239.0	1171
ONAF	33000	281.6	1381

WEIGHTS:

CORE AND COILS	67200 Lb.
TANK AND FITTINGS	41580 Lb.
OIL (4660gal)	35010 Lb.
TOTAL	143790 Lb.
UNTANKING	74000 Lb.
SHIPPING	93500 Lb.

MAXIMUM SOUND PRESSURE LEVEL

RATING, KVA	16800	28000	33000
SOUND LEVEL, DBA	59.1	60.1	60.9

BUSHING CURRENT TRANSFORMER
MULTI RATIO
CT-1 ACC.CLASS C-800, RTF-2

CURRENT RATIO	TAP	CURRENT RATIO	TAP
150:5	X3-X4	750:5	X2-X4
250:5	X4-X5	1000:5	X2-X5
400:5	X3-X5	1100:5	X1-X3
500:5	X1-X2	1250:5	X1-X4
600:5	X2-X3	1500:5	X1-X5

BUSHING CURRENT TRANSFORMER, MULTI RATIO
CT-2, CT4A ACC. CLASS C-800, RTF-2
CT-4N ACC. CLASS C-400, RTF-2

CURRENT RATIO	TAP	CURRENT RATIO	TAP
300:5	X3-X4	1200:5	X1-X3
400:5	X1-X2	1500:5	X1-X4
500:5	X4-X5	1600:5	X2-X5
800:5	X2-X3	2000:5	X1-X5
1100:5	X2-X4		

DE-ENERGIZED TAP CHANGER		HV WITH LTC ON POS. N	
POS.	CONNECTS	VOLTS	AMPERES AT 33000 KVA
1	6-5	70950	268.5
2	5-7	69300	274.9
3	7-4	67650	281.6
4	4-8	66000	288.7
5	8-3	64350	296.1

LTC ABB TYPE UZFRN 200/600

LOAD TAP CHANGER			RATING kVA	LV WITH DETC ON POS.3	
POS.	CONNECTION			VOLTS	AMPERES
16R	17-19	16-20	33000	15180	1255
15R		15-20		15094	1262
14R		14-20		15008	1270
13R		13-20		14921	1277
12R		12-20		14835	1284
11R		11-20		14749	1292
10R		10-20		14663	1299
9R		9-20		14576	1307
8R		8-20		14490	1315
7R		7-20		14404	1323
6R		6-20		14318	1331
5R		5-20		14231	1339
4R		4-20		14145	1347
3R		3-20		14059	1355
2R		2-20		13973	1364
1R		1-20		13886	1372
N		17-20		13800	1381
NA	17-18				
1L		16-20	32803	13714	
2L		15-20	32596	13628	
3L		14-20	32390	13541	
4L		13-20	32184	13455	
5L		12-20	31978	13369	
6L		11-20	31771	13283	
7L		10-20	31565	13196	
8L		9-20	31359	13110	
9L		8-20	31152	13024	
10L		7-20	30946	12938	
11L		6-20	30740	12851	
12L		5-20	30533	12765	
13L		4-20	30327	12679	
14L		3-20	30121	12593	
15L		2-20	29914	12506	
16L		1-20	29708	12420	

OIL QUANTITIES

MAIN TANK	3983 gal
RADIATORS	310 gal
TAP CHANGER	106 gal
CONSERVATOR AT 25°C	183 gal
TO BE REMOVED (FROM MAIN TANK) UP TO THE CORE	196 gal

IMPEDANCES,%

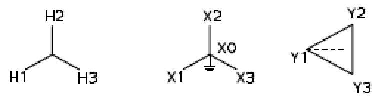
AT 16800KVA, DETC ON POS.3

POS. LTC	16R	N	16L
POSITIVE SEQUENCE HV-LV	9.46	9.20	9.05
ZERO SEQUENCE FROM LV SIDE	9.73	10.52	10.88

CAUTION!

1. BEFORE INSTALLING OR OPERATING READ CAREFULLY THE INSTRUCTION BOOK N#659
2. MAIN TANK PRESSURE WITHSTAND:
   - POSITIVE: 10 PSI,
   - NEGATIVE: FULL VACUUM.
3. CONSERVATOR CAN NOT WITHSTAND FULL VACUUM.
4. TRANSFORMER IS FILLED WITH ASTM D3487 TYPE II INHIBITED OIL. OIL CONTAINS NO DETECTABLE PCB AT THE TIME OF THE MANUFACTURING.
5. THE DE-ENERGIZED TAP CHANGER MUST NOT BE OPERATED WHEN THE TRANSFORMER IS ENERGIZED.
6. CONDUCTOR MATERIAL OF WINDINGS IS COPPER.
7. TERTIARY IS RATED FOR 5.88/ 7.84/9.8/11.55MVA - (ONAN/ONAF/ONAF/ONAF)
8. MAX.CURRENT SEEN BY LTC IS 232.5AMPS.
9. CORE DESIGN IS 3-LEGGED CORE.

PHASE RELATION



PROJECT : PSEG
ORDER No. 4500891457

CATALOG No.0299350719

MANUFACTURED IN RAMAT HASHARON, ISRAEL

Date : 07.24.2016