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***NOISE IMPACT STUDY FOR THE  
SOUTH PIER IMPROVEMENT PROJECT  
BROOKLYN, NEW YORK***

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**April 2008**

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## **1.0 INTRODUCTION AND SUMMARY**

Astoria Generating Company, L.P., a US Power Gen company, proposes to add a GE LMS 100 Gas Turbine Generator to the existing Gowanus Generating Station in Brooklyn, New York. The project is known as the South Pier Improvement Project (SPIP, or the Project). The proposed site consists of an earthen pier on the waterfront of Brooklyn, New York, near the Gowanus Expressway (I-278). The entrance to the site is at 2<sup>nd</sup> Avenue and 29<sup>th</sup> Street. This report discusses existing and proposed sound sources and the potential effects on sound levels in the surrounding community. The Project is located directly south of the existing Gowanus Generating Station, and is bordered on the north by the existing plant, on the west by the East River, on the east by the Gowanus Expressway, and on the south by a large warehouse and industrial area. The closest residences are about one quarter mile away to the east, across the Gowanus Expressway. The major new sound sources from the Project will be the combustion turbine power block, exhaust stack, fin-fan cooler and gas compressor. The power block will have an acoustical enclosure, silencers will be used on the turbine air inlet and stack exhaust, and a noise barrier wall to the extent required, will be built along portions of the site perimeter. While the new generating unit is designed to provide power at peak periods of electrical demand, it could operate at any time of day.

The steps in this study were: (1) to establish ambient sound levels near the Project site through a combination of baseline monitoring and acoustic modeling; (2) to acoustically model future conditions with the new generating unit; and (3) to compare the Project operational sounds to the limits in the NYS DEC Program Policy Guideline DEP-00-1, "Assessing and Mitigating Noise Impacts," the City of New York Noise Ordinances and Zoning Resolution, and the City Environmental Quality Review (CEQR) Technical Manual Chapter 3R. Ambient sound levels at residential receivers near the Project are relatively high but typical for a busy urban area near a major highway with busy local roadways and industrial activity. The Cadna-A acoustic model, based on International Standard ISO 9613-2, was used to calculate the sound levels from existing turbine units and the proposed Project at the property line and nearest residential receivers.

The study results reveal that with the noise mitigation detailed in Section 5.0, maximum sound levels from the Project will comply with all regulatory noise limits and guidelines established by New York State and New York City.

## **2.0 ACOUSTIC CONCEPTS**

Noise is defined as "unwanted sound", which implies sound pressure levels that are annoying or disrupt activities people are engaged in. The human sense of hearing is subjective and highly variable between individuals. Noise regulations and guidelines set quantitative limits to the sound pressure level (measured with sound analyzers and predicted with computer models) in order to protect people from sound exposures that most would judge to be annoying or disruptive.

The loudness of a sound is dependent on the radiated energy of the sound source and the propagation and attenuation characteristics of the air. The standard unit of sound pressure level ( $L_p$ ) is the decibel (dB), a logarithmic scale formed by taking 20 times the  $\log_{10}$  of a ratio of two pressures: the measured sound pressure divided by a reference sound pressure. The decibel level scale conveniently compresses the range of audible sound pressures, which span 12 orders of magnitude, into an easy to use scale spanning 0 to 120 dB. Airborne sound is referenced to 20 micro-Pascals<sup>1</sup> (20  $\mu\text{Pa}$ ), which corresponds to 0 dB and the threshold of hearing.

The acoustic energy level of a source is its sound power level ( $L_w$ ), and  $L_w$  is also measured on a decibel scale, where the reference power is  $10^{-12}$  Watts. The sound power level (e.g.,  $L_w$  of 110 dBA re  $10^{-12}$  W) is the same at any distance since it represents the energy intensity of a source. Thus,  $L_w$  values do not have reference distances. By contrast, a sound pressure level (e.g.  $L_p$  of 81 dBA re 20  $\mu\text{Pa}$  at 50 m) must have a reference distance. Sound power levels are typically greater than 100 dBA in value and the large  $L_w$  numbers should not be confused with the sound pressure levels we hear.

Sound metrics are used to quantify sound pressure levels and to describe a sound's loudness, duration, and tonal character. A commonly used descriptor is the A-weighted decibel (dBA). The A-weighting scale attempts to approximate the human ear's sensitivity to certain frequencies by

emphasizing the middle frequencies and de-emphasizing the lower and higher frequency sounds. The decibel is a logarithmic unit of measure of sound, meaning that a 10-decibel change in the sound level roughly corresponds to a doubling or halving of perceived loudness. A 3-dBA change in the noise level is generally defined as being just perceptible to the human ear. Table 1 provides the subjective effect of different changes in sound levels.

**TABLE 1**

**SUBJECTIVE EFFECT OF CHANGES IN SOUND PRESSURE LEVELS**

Change in Sound Level	Apparent Change in Loudness
3 dB	Just perceptible
5 dB	Noticeable
10 dB	Twice (or half) as loud

Reference: American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), 1989 ASHRAE Handbook—Fundamentals, Atlanta, Georgia, 1989.

The following measures of sound pressure level are based on the A-weighted decibel and are typically used when evaluating sound measurement data.

**L<sub>eq</sub>**, or Equivalent Level, is the steady-state sound level during a given amount of time that has the same acoustic energy as the fluctuating noise levels during that same period. This metric is commonly referred to as the average sound level. **L<sub>dn</sub>**, or Day-Night Level, is a 24-hour **L<sub>eq</sub>** sound level with a 10-dBA penalty added to the hours between 10 p.m. and 7 a.m.

**L<sub>max</sub>**, or Maximum Level, represents the maximum sound level during a given time period.

**L<sub>n</sub>**, or "n" Percentile Level, is the statistical representation of time-varying sound levels. This metric indicates that over a given time period, the fluctuating noise level was equal to or greater than the stated level for "n" percent of the time. Commonly used percentiles include the **L<sub>10</sub>** and the **L<sub>90</sub>**.

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<sup>1</sup> A micro-Pascal is 10<sup>-6</sup> Newton/meter<sup>2</sup>.

The **L<sub>90</sub>**, or background level, is the sound level exceeded 90 percent of the time and represents sound levels heard during the quietest 10 percent of the time. The **L<sub>10</sub>** defines the peaks of the intermittent noise sources and is commonly referred to as the intrusive sound level.

Sound pressure level measurements typically include the analysis and breakdown of the sound spectrum into its various frequency components to determine tonal characteristics. The unit of measure of frequency is the Hertz (Hz), a measure of the cycles per second of sound waves. A total of eleven octave bands are used to define the frequency spectrum from 16 Hz to 16,000 Hz that approximates the range of audible sound.

The acoustic environment in an urban area such as the Project site in Brooklyn results from numerous sources. Existing sources contributing to this environment include motor vehicle traffic on the Gowanus Expressway and other local roads, the existing 542-MW Gowanus Generating Station (when operating), the NYPA 79.9-MW Generating Station to the east at 23<sup>rd</sup> Street and 3<sup>rd</sup> Avenue, trucking activities for nearby warehouses, other industrial activity, and aircraft flying overhead. Typical sound levels associated with various activities and environments are presented in Table 2.

**TABLE 2**  
**COMMON SOUND LEVELS**

Activity	dBA
Threshold of pain	130
Chipping on metal	120
Loud rock band	110
Jack hammer	100
Jet airliner ½ mile away	95
Threshold of hearing damage	90
Freeway traffic - downtown streets	80
Urban residential area	70
Normal conversation	60
Normal Suburban Area	50
Quiet suburban area	40
Rural area	30
Wilderness area	25
Threshold of audibility	0

Reference: U.S. EPA, Information on levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, Publication EPA-550/9-74-004, 1974; and Charles M. Salter Associates, inc., Acoustics, Architecture, Engineering and the Environment, Wm. Stout Publisher, 1998.

### **3.0 NOISE REGULATIONS AND GUIDELINES**

#### **3.1 New York State Noise Guideline**

The NYS DEC uses a noise guideline document<sup>2</sup> to assess noise impacts under the SEQR process and the criteria suggested in the guideline are in addition to any local code requirements. The Guideline mentions the EPA residential guideline of 55 dBA for the day-night ( $L_{dn}$ ) sound level (including existing sound sources) and states “the addition of any noise source in a non-industrial setting should not raise the ambient noise level above a maximum of 65 dBA.” Existing  $L_{dn}$  levels in non-industrial areas near the project site are already above 65 dBA (see section 4.1). The NYS DEC noise guideline also recommends that the increase in the existing  $L_{dn}$  level not exceed 6 dBA in non-industrial settings. The closest non-industrial receivers are the MDC Prison (Location #2) and residences along 27<sup>th</sup> Street (Locations #2 and #3); see Figure 1 in Section 4. The  $L_{dn}$  is a 24-hour energy-average level with a 10-dBA penalty for nighttime hours (10 p.m. to 7 a.m.). The existing  $L_{dn}$  sound levels in the vicinity of the Project site include sound from the existing Gowanus Generating Station and other previously mentioned sources. The determination of those levels is discussed in Section 4.

#### **3.2 New York City Noise Ordinances**

A new City of New York Noise Code took effect on July 1, 2007. Title 24, Chapter 2 of the NYC Administrative Code now regulates sound by the land use of receiving property, not its zoning designation. There are two separate regulations that apply to the Project operation: (1) Absolute octave band limits at residential and commercial property, and (2) Incremental limits for all off-site locations. These provisions do not apply to construction noise.

The octave band limits in Section 24-232 are summarized in Table 3 and apply to residential/commercial property as measured inside a room with the windows open. They are equivalent to broadband limits of 45 dBA for residential use and 49 dBA for commercial use. A 5-

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<sup>2</sup> NYS DEC, “Assessing and Mitigating Noise Impacts,” Program Policy Guideline DEP-00-1, February 2, 2001.

dBA reduction is assumed for the building shell, which represents an open window configuration<sup>3</sup>. While the term “commercial use” is not defined in Section 24-232, this report assumes the commercial limit applies to retail establishments and not to the heavy industrial area near the Project site. The study has conservatively treated the Metropolitan Detention Center (MDC) on 29<sup>th</sup> Street as a residential use since it contains dwelling units. NYC DEP was unable to confirm this interpretation. Since the windows of a prison cell are closed, a 15 dB reduction is applied to each of the octave band sound levels predicted for the MDC.

The incremental limits in Section 24-218 prohibit an increase in the “ambient sound level” of 7 dBA or more during the nighttime hours of 10 p.m. to 7 a.m. at any receiving property. Ambient sound is defined in Section 24-203 as the total sound level “at a location that exists” excluding “extraneous sounds”, which are defined as “intense, intermittent” sounds. Although the Noise Code assigns no sound metric to the term “ambient sound,” the standard convention in acoustical assessment is to represent this condition as the average ( $L_{eq}$ ) sound level. The existing  $L_{eq}$  sound levels in the vicinity of the Project site include sound from the existing Gowanus Generating Station and from other sources. The determination of those levels is discussed in Section 4.

In addition to the City of New York Noise Code Regulations, the City also has a zoning regulation, established by the New York City Department of City Planning. Sections 42-213 and 214 of the City’s Zoning Resolution set regulatory limits on octave band sound levels from operation of the Project “at any point on or beyond any lot line.” The decibel limits are for the whole octave bands from 31 Hertz (Hz) to 16,000 Hz are shown in Table 4. The numerical limits depend on the zoning of the receiving property. The Project site is in an M3-1 zone. To the east the zoning of land is M1-2D and M1-1D.

The City Environmental Quality Review (CEQR) Manual Chapter 3R (Noise) also sets impact thresholds using the intrusive noise level ( $L_{10}$ ) measured day and night. Generally any new activity should not increase the ambient  $L_{10}$  level by 3 dBA or more at sensitive (non-industrial) receptors.

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<sup>3</sup> NYS DEC, “Assessing and Mitigating Noise Impacts,” Program Policy Guideline DEP-00-1, February 2, 2001.

**TABLE 3**

**NYC NOISE CODE SECTION 24-232  
OCTAVE BAND LIMITS (dB)**

<b>Octave Band (Hz)</b>	<b>Limits for Residential Property Receiver</b>	<b>Limits for Commercial Property Receiver</b>
31.5	70	74
63	61	64
125	53	56
250	46	50
500	40	45
1 k	36	41
2 k	34	39
4 k	33	38
8 k	32	37

**TABLE 4**

**NYC ZONING RESOLUTION SECTIONS 42-213 & 214  
OCTAVE BAND LIMITS (dB)**

<b>Octave Band (Hz)</b>	<b>Limits for an M3-1District</b>	<b>Limits for an M2-1 District</b>	<b>Limits for an M1-1D or 2D District</b>
31.5	80	79	79
63	80	79	79
125	75	75	74
250	70	68	66
500	64	62	59
1 k	58	56	53
2 k	53	51	47
4 k	49	47	41
8 k	46	44	39

Source: City Planning Commission and City Planning Department, Sections 42-213 and 214.

## **4.0 DETERMINATION OF AMBIENT SOUND LEVELS**

The determination of ambient sound levels was a three-step process. First, baseline sound level measurements were made that did not include the sound from the existing Gowanus Generating Station. The Generating Station normally operates at times of peak power demand, conditions that cannot be precisely predicted in advance. Second, sound source monitoring was conducted near individual gas turbine units at Gowanus Generating Station during a short-term reliability test to provide data that allowed the sound power level for the existing units to be calculated. Third, acoustic modeling was performed to add to the ambient sound levels the sound from four gas turbine units (out of 32 existing units) at the Gowanus Generating Station, representing typical operating conditions.

### **4.1 Baseline Sound Level Measurements**

Land use in the vicinity of the Project site is largely industrial, with the closest sensitive receivers being a prison, the Metropolitan Detention Center (MDC), on 29<sup>th</sup> Street to the south of the facility, a residence at the corner of 27<sup>th</sup> Street and 3<sup>rd</sup> Avenue to the southeast of the site, and a residential building to the southeast at 27<sup>th</sup> Street and 5<sup>th</sup> Avenue. In addition, a receptor location was stationed at the property line at the edge of the SPIP site (Location #1). Figure 1 shows the Project site and the four locations where baseline sound level measurements were made:

1. South Property Line at edge of pier
2. MDC Prison, Ground Floor
3. Residence at 27<sup>th</sup> Street and 3<sup>rd</sup> Avenue
4. Residence at 27<sup>th</sup> Street and 5<sup>th</sup> Avenue

Daytime sound level measurements were made on Thursday, February 7<sup>th</sup>, 2008 from 10:00 a.m. to 10:00 p.m. and nighttime measurements were taken on Friday, February 8<sup>th</sup> from midnight until 2:00 a.m. During the sound level monitoring program, the sources of ambient sound were predominantly roadway traffic on the Gowanus Highway (I-278), 3<sup>rd</sup> Avenue, and other local roads, aircraft passing overhead, natural sounds (birds), and a slight background sound from the existing, adjacent Con Edison electric substation at one location. The Gowanus Generating Station was not

operating at the time of the baseline measurements. The weather conditions during the field monitoring were conducive to accurate sound monitoring. The temperatures were 25-40°F, the skies were mostly cloudy, there was no precipitation, and the winds were very light to moderate (0 to 8 mph).

Both broadband (dBA) and full octave band sound level measurements were made with a CEL Model 490 sound level analyzer. The full octave band frequency analysis was performed on the eleven octave bands spanning 16 to 16,000 Hertz. A time-integrated statistical analysis of the data was also performed to obtain the 24-hour day-night ( $L_{dn}$ ) sound level. The  $L_{dn}$  was calculated from  $L_{eq}$  values obtained at each location during 5 time periods: mid-morning, mid-day, evening rush hour, late evening, and late night.

The CEL 490 model is equipped with a model CEL 250 1/2" precision condenser microphone and has an operating range of 5 dB to 140 dB and an overall frequency range of 3.5 Hz to 20 kHz. This meter meets or exceeds all requirements set forth in the ANSI S1.4-1983 Standards for a Type 1 (high precision) analyzer. Prior to any measurements, and at the conclusion of monitoring, the sound analyzer was calibrated with an ANSI Type 1 calibrator that has accuracy traceable to the National Institute of Standards and Technology (NIST). During all measurements, the CEL 490 was tripod mounted at approximately five feet above the ground in open areas away from vertical reflecting surfaces. All data were downloaded to a computer, following the measurement session for the purposes of storage and analysis. Data records are summarized in Appendix B.

The results of the baseline measurements are presented in Table 5. Maximum sound levels ( $L_{max}$ ) range from 85.5 to 96.5 dBA, intrusive sound levels ( $L_{10}$ ) range from 60.8 to 74.7 dBA, and background ( $L_{90}$ ) sound levels range from 55.0 to 67.6 dBA. Average ( $L_{eq}$ ) sound levels are between 59.7 and 72.2 dBA. The calculated  $L_{dn}$  levels for the four monitoring locations range from 64.7 to 77.3 dBA. These are typical levels for a busy urban area near a major highway, with busy roadways and industrial activities. The highest background ( $L_{90}$ ) sound levels were recorded at Location #3, the residence on the corner of 27<sup>th</sup> Street and 3<sup>rd</sup> Avenue, due to its proximity to the Gowanus Expressway. The lowest background ( $L_{90}$ ) sound levels were measured at Location #4, the residence at the corner of 27<sup>th</sup> Street and 5<sup>th</sup> Avenue.

**TABLE 5**

**BASELINE SOUND LEVELS THAT EXCLUDE  
THE EXISTING GOWANUS GENERATING STATION  
FEBRUARY 7-8, 2008**

<b>Location</b>	<b>Maximum L<sub>max</sub> (dBA)</b>	<b>Intrusive L<sub>10</sub> (dBA)</b>	<b>Average L<sub>eq</sub> (dBA)</b>	<b>Background L<sub>90</sub> (dBA)</b>	<b>Day-Night L<sub>dn</sub> (dBA)</b>
#1 – South Property Line at Wharf’s Edge	89.5	60.8	59.7	56.1	64.7
#2 – MDC Prison, Ground Floor	85.5	67.1	65.2	62.0	71.5
#3 - Residence at 27 <sup>th</sup> Street and 3 <sup>rd</sup> Ave.	96.5	74.7	72.2	67.6	77.3
#4 – Residence at 27 <sup>th</sup> Street and 5 <sup>th</sup> Ave.	87.5	70.4	67.4	55.0	72.3

#### **4.2 Sound Power Level of Existing Gas Turbine Units**

Sound source monitoring was performed in close proximity to two of the units during their scheduled reliability testing on the early morning of February 7<sup>th</sup>, 2008 using the CEL 490 sound analyzer described above. The monitoring data were analyzed using ANSI Method S12.56-1999<sup>4</sup> to obtain full octave band sound power levels for the existing generating units. The calculated sound power for each existing turbine generating unit was calculated to be  $L_w = 115$  dBA re  $10^{-12}$  W, with lower levels of 109 dBA re  $10^{-12}$  W along the unit sides (Northwest-Southeast axis) and 114 dBA re  $10^{-12}$  W to the Northeast.

<sup>4</sup> American National Standards Institute, ANSI S12.56-1999, Acoustics—Determination of Sound power Levels of Noise Sources Using Sound Pressure, 1999.

### 4.3 Ambient Sound Levels

Acoustic modeling with Cadna-A determined the sound levels from the Gowanus Generating Station with four gas turbine units operating. Cadna-A is a sophisticated 3-D model for sound propagation and attenuation based on International Standard ISO 9613-2.<sup>5</sup> Atmospheric absorption is the process by which sound energy is absorbed by the air and was calculated using ANSI S1.26-1995.<sup>6</sup> Air absorption of sound assumed standard day conditions and is significant at large distances and at high frequencies. ISO 9613-2 was used to calculate propagation and attenuation of sound energy by hemispherical divergence with distance, surface and building reflection, and shielding effects by barriers, buildings, and ground topography. Offsite topography was determined using official USGS digital elevation data for the study area. Four point sources (one centered on each of the four barges) were used to represent the existing units. The Cadna-A model output is provided in Appendix A. The predicted continuous sound levels from the existing Gowanus Generating Station at the four receivers are:

Location #1 = 58.9 dBA  
Location #2 = 39.3 dBA  
Location #3 = 49.7 dBA  
Location #4 = 32.3 dBA

Table 6 presents the ambient sound levels in the vicinity of the Project site including the operation of four gas turbine units at the existing Gowanus Generating Station. The existing Station adds 2.6 dBA to the average ( $L_{eq}$ ) sound levels at the industrial property line Location #1, and adds less than 0.1 dBA to the  $L_{eq}$  at MDC prison Location #2 and the nearest residential receivers at Locations #3 and #4. The operation of the typical number of four gas turbine units at Gowanus Generating Station would not be perceptible at any of the non-industrial receivers (Locations #2 through #4).

Maximum ambient sound levels ( $L_{max}$ ) range from 85.5 to 96.5 dBA, intrusive sound levels ( $L_{10}$ ) range from 63.0 to 74.7 dBA, and background ( $L_{90}$ ) sound levels range from 55.2 to 67.7 dBA.

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<sup>5</sup> International Standard, ISO 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors, -- Part 2 General Method of Calculation.

<sup>6</sup> American National Standards Institute, ANSI S1.26-1995, Method for the Calculation of the Absorption of Sound by the Atmosphere, 1995.

Average ( $L_{eq}$ ) sound levels are between 62.3 and 72.2 dBA. The calculated  $L_{dn}$  levels for the four monitoring locations range from 68.0 to 77.3 dBA. These are typical levels for a busy urban area near a major highway, with busy roadways and industrial activities. The highest background ( $L_{90}$ ) sound levels were recorded at Location #3, the residence on the corner of 27<sup>th</sup> Street and 3<sup>rd</sup> Avenue, due to its proximity to the Gowanus Expressway. The lowest background ( $L_{90}$ ) sound levels were measured at Location #4, the residence at the corner of 27<sup>th</sup> Street and 5<sup>th</sup> Avenue which is approximately 2,700 feet from the site.

**TABLE 6**  
**AMBIENT SOUND LEVELS THAT INCLUDE**  
**THE EXISTING GOWANUS GENERATING STATION**

<b>Location</b>	<b>Maximum <math>L_{max}</math> (dBA)</b>	<b>Intrusive <math>L_{10}</math> (dBA)</b>	<b>Average <math>L_{eq}</math> (dBA)</b>	<b>Background <math>L_{90}</math> (dBA)</b>	<b>Day-Night <math>L_{dn}</math> (dBA)</b>
1 – South Property Line at Wharf’s Edge	89.5	63.0	62.3	60.7	68.0
#2 – MDC Prison, Ground Floor	85.5	67.1	65.2	62.0	71.5
#3 - Residence at 27 <sup>th</sup> Street and 3 <sup>rd</sup> Ave.	96.5	74.7	72.2	67.7	77.3
#4 – Residence at 27 <sup>th</sup> Street and 5 <sup>th</sup> Ave.	87.5	70.4	67.4	55.0	72.3



**Figure 1**  
**Baseline Sound Level Monitoring Locations Near**  
**The US PowerGen Gowanus Generating Station**

## 5.0 OPERATIONAL SOUND LEVELS AND MITIGATION

Future maximum sound levels at the site property boundaries, nearest residences and the nearby MDC prison were determined using the Cadna-A acoustic model assuming simultaneous operation of the new LMS 100 unit and four existing gas turbine units at Gowanus Generating Station. The predicted maximum sound levels are conservative because: 1) The model was instructed to ignore ground and foliage sound absorption; and 2) The acoustic model assumes a ground-based temperature inversion, such as may occur on a calm, clear night when sound propagation is favorable.

The new LMS 100 unit was modeled as two point sources: 1) the power block including the turbine air inlet, ancillaries, SCR, and 2) the stack. Other sound sources included in the model were the fin-fan cooler and gas compressor with its fin-fan cooler. Sound power data were provided by General Electric and GEA Cooling Technology, Inc.

Noise mitigation measures have been planned in the design of the Project to reduce adverse sound effects on the community. The principal noise mitigation measures are:

- High-performance silencers for both the gas turbine air inlets and exhaust stacks.
- The major components of the power block will be contained within an acoustical enclosure.

The initial acoustic modeling results reveal the Project would not fully comply with the noise criteria. Specifically, at Location #1 broadband sound levels would exceed the NYC Noise Code Section 24-218 incremental limit and high-frequency sound would exceed the NYC Zoning Resolution Section 42-213 and 214 octave band limits. Additional mitigation beyond the high performance silencers and acoustic enclosures in the form of, an acoustic enclosure or barrier wall for the gas compressor and its fin-fan cooler, and an 8-foot barrier wall along the south edge of the pier (see Figure 2), is necessary to ensure full compliance. These proposed additional mitigation measures are summarized in Table 7.

**TABLE 7**  
**ADDITIONAL NOISE MITIGATION**  
**REQUIRED FOR REGULATORY COMPLIANCE**

Source Name	Equipment Specification
Gas Compressor and Its Fin-Fan Cooler	Sound Power level (L <sub>w</sub> ) not to exceed 108 dBA
Sound Barrier Wall	8-foot tall, 200-foot long. Starting at the planned “Demineralized Water Tank” and running northwest along the edge of the pier. (See Figure 2)

The acoustical modeling results for the Project with the additional mitigation listed in Table 7 are summarized in Tables 8 through 12 and decibel contours are shown in Figure 3. The predicted maximum operational sound levels for the Project are 62.0 dBA at Location #1 the south property line, 53.5 dBA at Location #2, the MDC prison, and 40.8 dBA at Location #3, the closest residence at 27<sup>th</sup> Street and 3<sup>rd</sup> Avenue. Complete model output is provided in Appendix A.

Table 8 demonstrates that the proposed project will increase day-night (L<sub>dn</sub>) sound levels at the nearest non-industrial locations by no more than 0.1 dBA, a level well below the 6 dBA incremental limit recommended by NYS DEC in its State Noise Guideline. Table 9 shows that octave band sound levels from the Project comply with the NYC Noise Code Section 24-232 residential limits. Table 10 reveals that the Project will increase the ambient (L<sub>eq</sub>) sound level by no more than 3.0 dBA, a level below the 7 dBA incremental limit in the City’s noise regulation Section 24-218. Compliance with the separate octave band limits in the NYC Zoning Resolution Section 42-213 and 214 is confirmed in Table 11. Finally, Table 12 established that the Project will increase the intrusive (L<sub>10</sub>) sound level at the nearest non-industrial locations by no more than 0.1 dBA, a level below the 3 dBA incremental limit recommended by NYC CEQR Chapter 3R guidance. In conclusion, with the noise mitigation detailed in Table 7, the Project will fully comply with all regulatory noise limits and guidelines established by New York State and New York City.

**TABLE 8**

**DEMONSTRATION OF PROJECT COMPLIANCE WITH THE  
NYS DEC PROGRAM POLICY GUIDELINE DEP-00-1 (2/2/2001)  
DAY-NIGHT SOUND LEVEL ( $L_{dn}$ ) GUIDELINE  
FOR NON-INDUSTRIAL LOCATIONS**

<b>Location</b>	<b>Future <math>L_{dn}</math> (dBA)</b>	<b>Ambient <math>L_{dn}</math> (dBA)</b>	<b>Increase in <math>L_{dn}</math> due to Project (dBA)</b>	<b>Guideline for Increase</b>	<b>Complies With Guideline?</b>
#2 – MDC Prison, Ground Floor	71.6	71.5	0.1	$\leq 6$ dBA	Yes
#3 - Residence at 27 <sup>th</sup> Street and 3 <sup>rd</sup> Ave.	77.3	77.3	0.0	$\leq 6$ dBA	Yes
#4 – Residence at 27 <sup>th</sup> Street and 5 <sup>th</sup> Ave.	72.3	72.3	0.0	$\leq 6$ dBA	Yes

**TABLE 9**

**DEMONSTRATION OF PROJECT COMPLIANCE WITH  
THE NYC NOISE CODE SECTION 24-232  
OCTAVE BAND SOUND LEVELS REGULATION**

<b>Octave Band</b>	<b>Residential Limit, dB</b>	<b>Loc. #2<sup>1</sup> Level, dB</b>	<b>Loc. #3<sup>2</sup> Level, dB</b>	<b>Loc. #4<sup>2</sup> Level, dB</b>
32 Hz	70	56.8	59.5	55.8
63 Hz	61	52.9	54	52.3
125 Hz	53	47	47.1	46.6
250 Hz	46	41.4	40.8	41.9
500 Hz	40	36.2	32.7	35.7
1000 Hz	36	31.8	24.5	30.3
2000 Hz	34	28.1	17.5	24.2
4000 Hz	33	19.7	5.8	8.1
8000 Hz	32	< 5	< 5	< 5

1. A 15 dBA reduction of sound due to closed windows at the MDC is included in the results, per NYS DEC Noise Guideline.
2. A 5 dBA reduction of sound due to building shielding with open window at the residences is included in the results, per NYS DEC Noise Guideline.

**TABLE 10****DEMONSTRATION OF PROJECT COMPLIANCE WITH  
THE NYC NOISE CODE SECTION 24-218  
AVERAGE SOUND LEVEL (L<sub>eq</sub>) REGULATION**

<b>Location</b>	<b>Future L<sub>eq</sub> (dBA)</b>	<b>Ambient L<sub>eq</sub> (dBA)</b>	<b>Increase in L<sub>eq</sub> due to Project (dBA)</b>	<b>Limit for Increase</b>	<b>Complies With Regulation?</b>
#1 – South Property Line at Edge of Pier	65.3	62.3	3.0	<7 dBA	Yes
#2 – MDC Prison, Ground Floor	65.5	65.2	0.3	<7 dBA	Yes
#3 - Residence at 27 <sup>th</sup> Street and 3 <sup>rd</sup> Ave.	72.2	72.2	0.0	<7 dBA	Yes
#4 – Residence at 27 <sup>th</sup> Street and 5 <sup>th</sup> Ave.	67.4	67.4	0.0	<7 dBA	Yes

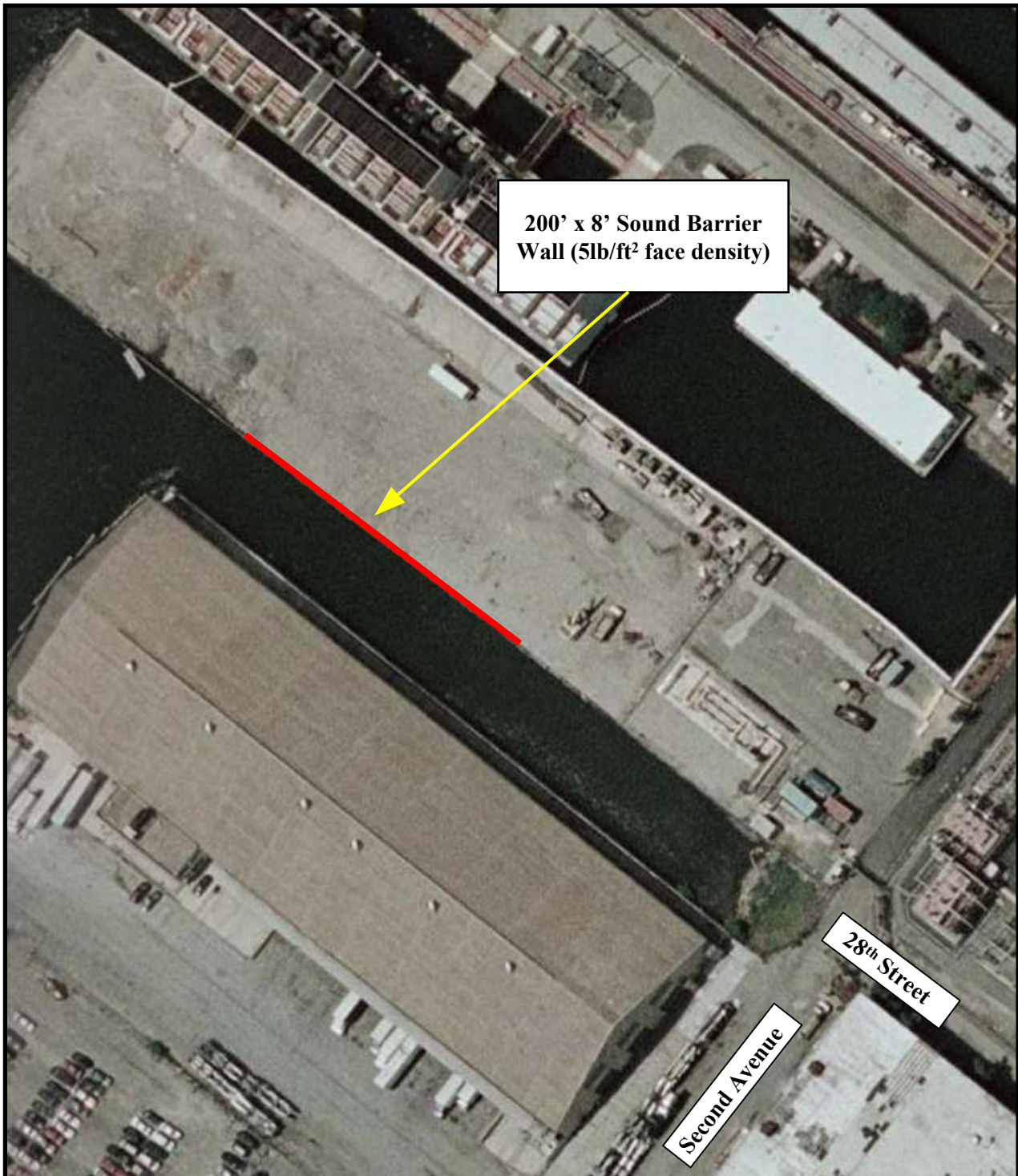
**TABLE 11**

**DEMONSTRATION OF PROJECT COMPLIANCE WITH  
THE NYC ZONING RESOLUTION SECTIONS 42-213 & 214  
OCTAVE BAND SOUND LIMITS**

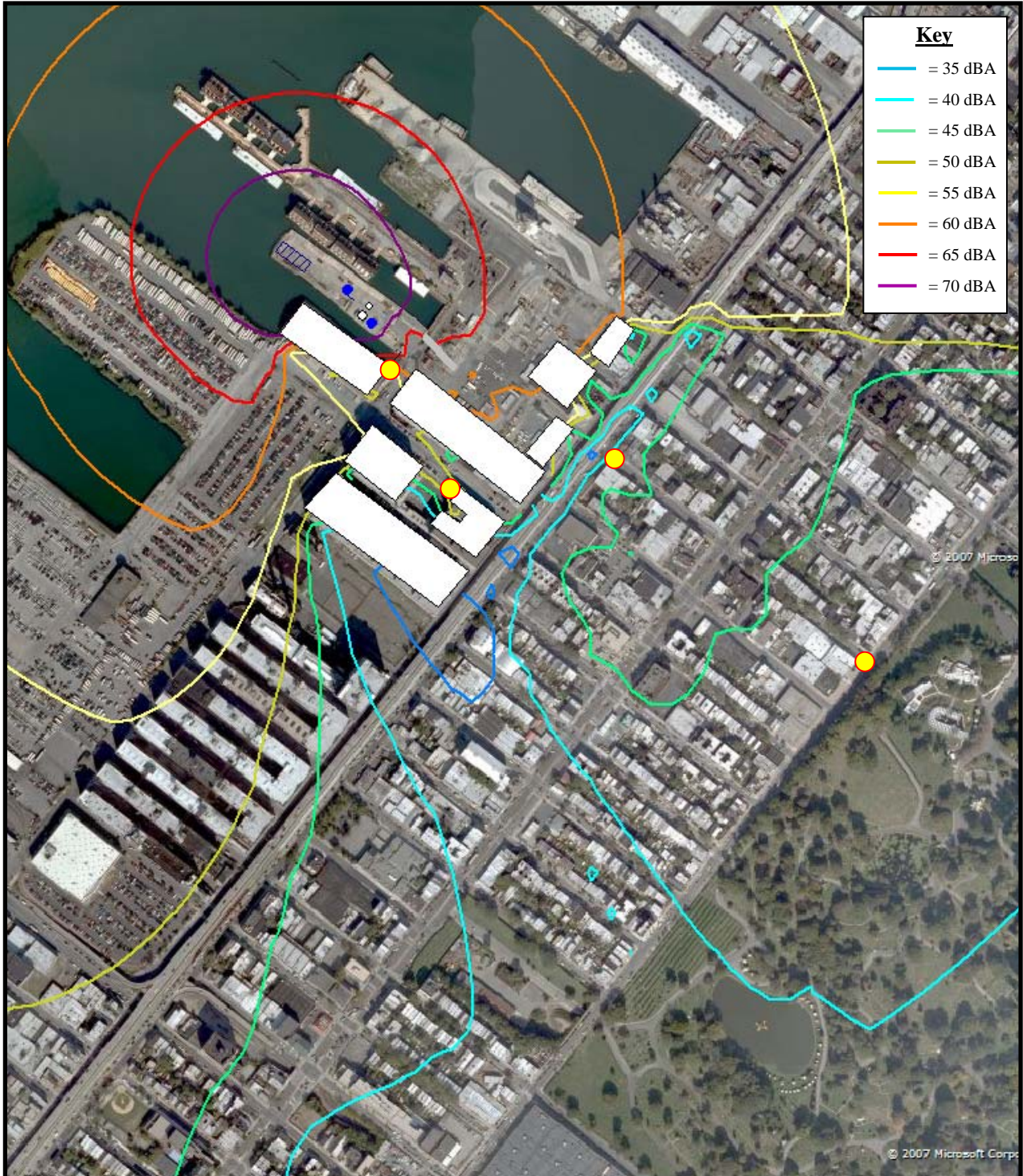
<b>Octave Band (Hz)</b>	<b>Limits for an M3-1 District</b>	<b>Loc. #1 Level, dB</b>	<b>Limits for an M1-1D or 2D District</b>	<b>Loc. #2 Level, dB</b>	<b>Loc. #3 Level, dB</b>	<b>Loc. #4 Level, dB</b>
31.5	80	79.1	79	71.8	64.5	60.8
63	80	76.9	79	67.9	59	57.3
125	75	69.5	74	62	52.1	51.6
250	70	63.7	66	56.4	45.8	46.9
500	64	58.1	59	51.2	37.7	40.7
1 k	58	54.0	53	46.8	29.5	35.5
2 k	53	52.1	47	43.1	22.5	29.2
4 k	49	48.4	41	34.7	10.8	13.1
8 k	46	45.0	39	16.3	< 5	< 5

**TABLE 12****DEMONSTRATION OF PROJECT COMPLIANCE WITH  
THE NYC CEQR CHAPTER 3R INTRUSIVE SOUND LEVEL (L<sub>10</sub>) GUIDELINE  
AT SENSITIVE (NON-INDUSTRIAL) RECEPTORS**

<b>Location</b>	<b>Future L<sub>10</sub> (dBA)</b>	<b>Ambient L<sub>10</sub> (dBA)</b>	<b>Increase in L<sub>10</sub> due to Project (dBA)</b>	<b>Guideline for Increase</b>	<b>Complies With Guideline?</b>
#2 – MDC Prison, Ground Floor	67.2	67.1	0.1	< 3 dBA	Yes
#3 - Residence at 27 <sup>th</sup> Street and 3 <sup>rd</sup> Ave.	74.7	74.7	0.0	< 3 dBA	Yes
#4 – Residence at 27 <sup>th</sup> Street and 5 <sup>th</sup> Ave.	70.4	70.4	0.0	< 3 dBA	Yes



**Figure 2**  
**US PowerGen Site**  
**Proposed Sound Barrier Wall**



**Figure 3**  
**Cadna A Sound Level Results With Mitigation**  
**The US PowerGen Gowanus Generating Station**

## 6.0 CONSTRUCTION NOISE IMPACT AND MITIGATION

The City's new Noise Code (Local Law 113 of 2005) took effect on July 1, 2007 and established new regulations for controlling noise from construction activities. Section 24-220 of the NYC Administrative Code requires that any entity performing construction work in the City "shall adopt and implement a noise mitigation plan for each construction site" in accordance with 15 RCNY Section 28-100, discussed below. Section 24-222 of the NYC Code limits construction work to weekdays between the hours of 7 a.m. and 6 p.m. unless an after-hours work authorization has been obtained from a City agency pursuant to Section 24-223. Section 24-228 of the NYC Code limits sound, other than impulsive sound (e.g., pile driving), from a construction site to no more than 85 dBA as measured at the property boundary. US Power Gen will comply with this limit at its property line. The Citywide Construction Noise Mitigation rules (15 RCNY 28-100) require that a Construction Noise Mitigation Plan be developed prior to the start of construction and conspicuously posted at the construction site. The project will comply with these requirements and all provisions of the Citywide Construction Noise Mitigation rules.

The construction of the Project will require the use of equipment that may be audible from off-site locations. Facility construction will consist of excavation, foundation work, steel erection and installation of Facility equipment, and finishing work. These activities will overlap. Pile driving, generally considered the noisiest construction activity, will be required. The noise levels resulting from construction activities vary greatly depending on factors such as the type of equipment, the specific equipment model, the operations being performed, and the power level of the equipment.

EPA<sup>7</sup> has published data on the average sound levels for typical construction phases of industrial facilities. These sound levels were projected from the acoustic center of the LMS 100 unit to the closest residential neighborhood receptor located at a distance of 1,300 feet using standard hemispherical wave spreading. This calculation very conservatively assumes all construction equipment operating concurrently onsite for the specified construction phase. The results of these calculations are presented in Table 13 and show estimated construction sound levels at the nearest

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<sup>7</sup> EPA PB 206 717, Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances, December, 1971.

residence will be between 50 and 60 dBA, which are below existing ambient sound levels (see Table 5). The construction sound at more distant locations will be less since sound level decreases with distance from the sound source.

**TABLE 13**

**ESTIMATED SOUND LEVELS AT THE CLOSEST RESIDENTIAL RECEPTOR BY CONSTRUCTION PHASE**

<b>Construction Phase</b>	<b>50 Feet from Source (L<sub>eq</sub>)</b>	<b>At Closest Residential Receptor, R1 (L<sub>eq</sub>)</b>
Excavation	89	60
Foundations	78	50
Erection	85	56
Finishing	89	60

Reasonable effort will be made to minimize the impact of noise resulting from construction activities. The mitigation measures outlined below will be incorporated into the construction management guidelines:

- Construction activities that produce significant noise will generally be limited to daytime hours.
- Properly designed engine enclosures and intake silencers will be required.
- Regular equipment maintenance and lubrication will be required.
- All exhaust systems will be in good working order.

As the design of the Project progresses and construction scheduling has been finalized, additional measures can be implemented if required to minimize the effects of construction noise.

## **APPENDIX A**

# **CADNA/A NOISE MODELING RESULTS**

CADNA A PREDICTED DECIBEL LEVELS AT LOCATIONS 1-4

<b>Location #1 - Southwest PL</b>										
Source Name	Day	31.5	63	125	250	500	1000	2000	4000	8000
Stack	56	72.5	65.5	63.5	60.4	54.2	43.9	42.5	38.8	21.5
Gas Compressor	53.9	55	52.7	42.9	35.9	36.8	44.6	49.4	47.4	44.9
LMS 100	55.1	78.9	76.3	66.6	53.5	48.8	42.5	40.1	36.5	29.3
Fin Fan Cooler	57.8	66.4	64.4	63.3	60.2	54.9	52.5	46.8	37.3	21.7
<b>Total All Sources</b>	<b>62</b>	<b>79.1</b>	<b>76.9</b>	<b>69.5</b>	<b>63.7</b>	<b>58.1</b>	<b>54</b>	<b>52.1</b>	<b>48.4</b>	<b>45</b>

<b>Location # 2 - 4th Floor MDC</b>										
Source Name	dBA	31.5	63	125	250	500	1000	2000	4000	8000
Stack	47.7	64.6	57.6	55.6	52.3	45.8	35.2	33	27	0.2
Gas Compressor	33.3	35.6	33.5	23.8	16.6	17.2	24.6	28.6	28.3	13.2
LMS 100	49.5	70.5	67	59	47.9	45.5	41.5	40.4	31.2	12.8
Fin Fan Cooler	50.3	59.6	57.5	56.4	53.2	47.6	44.8	38.3	26.3	1
<b>Total All Sources</b>	<b>54.1</b>	<b>71.8</b>	<b>67.9</b>	<b>62</b>	<b>56.4</b>	<b>51.2</b>	<b>46.8</b>	<b>43.1</b>	<b>34.7</b>	<b>16.3</b>
<b>15 dB reduction</b>		<b>56.8</b>	<b>52.9</b>	<b>47</b>	<b>41.4</b>	<b>36.2</b>	<b>31.8</b>	<b>28.1</b>	<b>19.7</b>	<b>1.3</b>

<b>Location # 3 - 27th St &amp; 3rd Ave</b>										
Source Name	dBA	31.5	63	125	250	500	1000	2000	4000	8000
Stack	37.6	58.9	49.6	46.9	42.7	34.7	21.9	17	6.8	-28.4
Gas Compressor	13.6	31.5	28.4	16.2	6.2	3.6	7.9	8.5	3.7	-18.6
LMS 100	35.3	62.4	57.5	46.5	32.8	27.5	20.7	17.8	5.2	-16.7
Fin Fan Cooler	38	55	51.5	48.4	42.4	33.7	27.8	18	1.8	-30.5
<b>Total All Sources</b>	<b>41.9</b>	<b>64.5</b>	<b>59</b>	<b>52.1</b>	<b>45.8</b>	<b>37.7</b>	<b>29.5</b>	<b>22.5</b>	<b>10.8</b>	<b>-14.3</b>
<b>5 dB reduction</b>		<b>59.5</b>	<b>54</b>	<b>47.1</b>	<b>40.8</b>	<b>32.7</b>	<b>24.5</b>	<b>17.5</b>	<b>5.8</b>	<b>-19.3</b>

CADNA A PREDICTED DECIBEL LEVELS AT LOCATIONS 1-4

<b>Location #4 - 27th St &amp; 5th Ave</b>										
Source Name	dBA	31.5	63	125	250	500	1000	2000	4000	8000
Stack	36.9	53.4	44.7	43.3	42	35.6	23.8	19.5	6.2	-48.3
Gas Compressor	17.7	25.6	23.6	13.4	6.1	5.8	12.1	14	6.4	-36.6
LMS 100	36.7	59.3	56.2	47.2	35.6	32.3	27.3	25.6	9.1	-35.3
Fin Fan Cooler	40.9	51.7	49.7	48.4	44.7	38.2	34.1	25.4	5.7	-48.6
<b>Total All Sources</b>	<b>43.4</b>	<b>60.8</b>	<b>57.3</b>	<b>51.6</b>	<b>46.9</b>	<b>40.7</b>	<b>35.3</b>	<b>29.2</b>	<b>13.1</b>	<b>-32.7</b>
<b>5 dB reduction</b>		<b>55.8</b>	<b>52.3</b>	<b>46.6</b>	<b>41.9</b>	<b>35.7</b>	<b>30.3</b>	<b>24.2</b>	<b>8.1</b>	<b>-37.7</b>

## **APPENDIX B**

### **BASELINE SOUND MONITORING DATA**

US PowerGen Monitoring – Brooklyn, NY – February 7-8, 2008

Neighborhood Monitoring

**Location #1: Property Line**

**Weather: 38° F, 50% Humidity, < 6mph wind, Overcast – mostly cloudy**

-Period results - **Hum from US PowerGen transformers, people coming and going through nearby security gate, activities in surrounding area including backup beepers, loading activities, diesel engine sounds, birds, car horns, stereo.**

Record start 02/07/2008 10:17:45  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz		Flags	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	73.3	94.1	69.9	75.0	76.0	73.5	72.0
Broadband	C	----	70.8	92.9	67.4	72.8	73.0	71.0	70.0
Broadband	A	----	58.8	89.5	54.7	61.5	61.0	58.0	56.5
16	Z	----	64.7	87.2	52.5	66.2	68.5	65.0	62.0
32	Z	----	65.1	87.1	58.2	67.4	69.0	66.5	64.0
63	Z	----	66.4	93.6	59.0	69.0	69.0	66.0	63.5
125	Z	----	68.2	85.7	61.0	68.0	69.0	67.0	65.5
250	Z	----	57.4	86.3	52.5	60.8	60.5	57.5	55.5
500	Z	----	53.0	87.2	50.4	57.4	57.0	54.0	52.0
1k	Z	----	51.3	84.6	48.3	55.5	56.0	51.5	50.0
2k	Z	----	51.5	84.1	43.8	54.2	53.5	49.0	46.0
4k	Z	----	50.4	75.5	37.4	49.4	50.5	44.0	40.0
8k	Z	----	36.0	68.1	27.0	42.8	45.5	32.5	29.0
16k	Z	----	19.8	53.2	18.9	31.2	33.5	21.0	19.5

- Period results – **Temp = 36° F, wind < 8mph – planes, local traffic, diesel engines + transformer**

Record number 1 : 1  
 Record start 02/07/2008 12:05:11  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz		Flags	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	74.3	97.8	69.7	79.7	82.0	76.5	73.5
Broadband	C	----	70.0	90.2	67.0	74.1	76.5	73.0	71.0
Broadband	A	----	56.0	88.1	54.8	61.8	63.0	61.0	57.5
16	Z	----	66.6	90.8	53.5	70.6	73.0	66.5	61.5
32	Z	----	64.2	85.9	59.2	71.2	75.5	68.0	64.5
63	Z	----	66.4	90.9	59.1	70.9	73.0	69.0	65.0
125	Z	----	65.4	77.7	60.7	67.1	68.5	66.5	65.0
250	Z	----	54.8	70.3	52.5	57.7	59.5	57.0	55.0
500	Z	----	52.7	80.1	50.5	57.5	59.0	57.0	54.0
1k	Z	----	51.1	74.4	48.7	57.7	59.5	57.5	52.5
2k	Z	----	46.3	77.7	45.0	53.8	55.0	53.0	48.0
4k	Z	----	38.9	81.4	37.2	47.9	47.0	44.0	41.0
8k	Z	----	30.2	85.7	27.8	47.8	40.5	35.0	32.0
16k	Z	----	26.0	90.0	20.6	51.4	33.5	28.0	24.5

- Period results - **Temp = 32° F, wind < 8mph, mostly cloudy. Planes, facility loading/operations, transformer hum, hammering.**

Record number 1 : 1  
 Record start 02/07/2008 16:40:05  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	75.7	96.8	67.9	77.2	80.0	74.0	71.5
Broadband	C	----	73.9	92.6	66.2	72.6	74.0	70.5	69.0
Broadband	A	----	58.2	82.7	54.3	61.1	63.5	58.0	56.0
16	Z	----	62.4	86.7	54.1	67.8	70.0	64.5	61.0
32	Z	----	70.8	91.2	56.1	67.6	70.0	65.0	61.5
63	Z	----	71.2	91.3	58.3	69.3	70.0	65.0	62.5
125	Z	----	67.1	80.5	59.3	66.8	68.0	66.5	65.0
250	Z	----	55.7	72.4	52.9	58.9	61.5	57.0	55.5
500	Z	----	53.3	73.2	49.7	57.3	60.5	54.5	52.5
1k	Z	----	54.0	79.1	48.2	56.1	58.5	52.5	50.5
2k	Z	----	49.4	78.0	43.5	53.1	54.5	48.0	45.5
4k	Z	----	41.6	71.4	36.0	49.2	52.0	41.5	38.0
8k	Z	----	31.7	70.2	26.4	43.4	46.0	33.0	29.5
16k	Z	----	23.6	58.7	19.8	32.0	35.0	25.0	21.5

- Period results – **Temp = 28° F, wind < 4mph – Idling diesel engine, transformer hum, backup beepers, planes**

Record number 1 : 1  
 Record start 02/07/2008 20:06:59  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	71.2	85.5	68.7	75.2	78.5	72.0	70.5
Broadband	C	----	69.4	79.9	67.2	73.9	77.5	70.0	69.0
Broadband	A	----	55.9	74.1	54.0	57.9	60.0	56.0	55.0
16	Z	----	62.4	76.6	50.0	63.5	66.5	62.5	58.0
32	Z	----	62.8	74.4	54.2	64.5	67.5	63.0	60.0
63	Z	----	60.7	79.4	56.6	72.6	77.5	63.0	60.5
125	Z	----	68.0	72.5	64.1	68.0	69.0	68.0	67.0
250	Z	----	54.7	77.1	51.2	56.4	57.5	55.5	54.0
500	Z	----	51.2	71.9	48.2	54.1	56.0	52.0	50.0
1k	Z	----	49.4	66.5	46.1	53.0	56.0	49.5	48.0
2k	Z	----	46.5	66.5	40.1	45.7	48.0	43.5	42.0
4k	Z	----	39.5	71.0	32.7	40.7	40.0	35.5	33.5
8k	Z	----	27.8	69.2	21.8	35.6	31.0	25.5	23.0
16k	Z	----	19.0	63.6	18.6	28.0	23.0	20.0	19.0

- Period results – **Temp = 25° F, wind < 4mph, partly cloudy - Transformer, distant highway noise**

Record number 1 : 1  
 Record start 02/08/2008 00:05:22  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	69.1	77.4	68.0	70.5	71.5	70.5	69.5
Broadband	C	----	67.5	73.8	66.8	68.8	69.5	69.0	68.0
Broadband	A	----	55.5	74.0	54.4	56.3	57.0	56.0	55.5
16	Z	----	61.2	72.7	49.8	62.3	65.5	61.0	57.0
32	Z	----	58.2	71.4	53.0	61.2	63.5	60.5	58.0
63	Z	----	60.9	71.8	55.4	60.8	62.5	60.5	58.5
125	Z	----	65.3	69.3	63.3	66.7	67.5	66.5	65.5
250	Z	----	58.7	63.7	56.0	59.0	60.0	59.0	58.0
500	Z	----	51.7	59.3	48.9	52.2	53.0	52.0	51.5
1k	Z	----	49.6	58.6	47.0	50.3	51.0	50.0	49.0
2k	Z	----	42.3	62.3	40.8	43.2	44.0	43.0	42.0
4k	Z	----	34.2	71.2	33.0	38.7	35.5	34.5	34.0
8k	Z	----	22.6	69.1	21.6	35.6	25.0	22.5	22.0
16k	Z	----	19.0	54.3	18.5	23.6	20.0	19.0	18.5

**Location #2 – MDC Prison**

- Period results – **Sounds from highway, local traffic on 3<sup>rd</sup> Ave**

Record start 02/07/2008 10:40:37  
Period time 00:20:00  
Overload occurred No  
Under-range occurred No  
Low battery occurred No  
Pause was used No

Hz		Flags	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	79.1	100.0	68.6	79.7	82.5	77.0	73.0
Broadband	C	----	70.2	89.0	65.1	74.3	77.0	73.0	69.5
Broadband	A	----	62.9	81.0	56.4	65.4	67.5	64.5	61.5
16	Z	----	71.6	95.4	56.5	74.0	77.0	70.5	65.5
32	Z	----	66.4	88.1	59.5	71.9	75.0	69.5	65.5
63	Z	----	64.3	85.3	58.0	69.3	72.0	67.5	63.5
125	Z	----	60.8	84.2	54.5	63.7	65.5	61.5	58.5
250	Z	----	59.5	84.2	53.1	63.0	65.0	61.0	58.0
500	Z	----	58.3	81.7	52.9	62.1	64.0	60.0	57.5
1k	Z	----	60.8	76.6	53.0	62.5	64.5	62.0	59.0
2k	Z	----	53.3	70.6	46.6	56.3	58.5	55.0	52.0
4k	Z	----	41.2	67.7	36.1	47.5	50.0	44.0	41.0
8k	Z	----	29.7	53.4	23.6	35.4	38.5	31.5	27.0
16k	Z	----	24.5	54.8	18.6	27.7	30.0	21.0	19.0

- Period results – **Traffic from highway + 3<sup>rd</sup> Ave dominate, foot traffic, brake squeals, sirens, planes**

Record number 1 : 1  
Record start 02/07/2008 12:28:22  
Period time 00:20:00  
Overload occurred No  
Under-range occurred No  
Low battery occurred No  
Pause was used No

Hz		Flags	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	75.3	95.9	70.1	80.0	83.0	78.0	74.5
Broadband	C	----	70.9	87.1	67.1	76.0	80.0	73.5	70.5
Broadband	A	----	64.6	85.5	58.2	65.6	67.5	65.0	62.5
16	Z	----	66.9	91.5	56.8	73.5	76.5	70.5	66.0
32	Z	----	67.2	88.7	60.4	72.1	75.0	69.5	66.0
63	Z	----	63.3	87.4	58.5	73.7	79.5	68.0	64.5
125	Z	----	61.3	80.6	56.2	65.0	68.5	63.5	60.0
250	Z	----	59.2	77.7	54.2	62.5	65.0	61.5	59.0
500	Z	----	60.7	75.2	53.5	61.7	64.0	60.5	58.0
1k	Z	----	62.3	76.7	54.8	62.8	65.0	62.5	59.5
2k	Z	----	54.2	75.0	49.5	56.5	58.5	55.5	53.0
4k	Z	----	42.0	78.7	39.2	48.4	50.0	45.5	43.0
8k	Z	----	27.7	83.1	24.6	46.5	39.0	34.0	30.0
16k	Z	----	18.6	87.3	18.4	49.8	30.5	22.0	19.5

- Period results – **Highway traffic, cars coming/going to prison facility, planes, 3<sup>rd</sup> Ave traffic.**

Record number 1 : 1  
 Record start 02/07/2008 17:03:19  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz		Flags	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	78.3	91.0	70.1	78.4	81.0	77.5	74.0
Broadband	C	----	74.3	85.3	67.4	74.1	76.5	73.5	70.5
Broadband	A	----	63.8	75.8	59.3	64.7	66.5	64.0	62.5
16	Z	----	76.2	85.7	57.2	72.0	75.0	70.0	65.5
32	Z	----	72.6	84.6	60.5	70.7	73.5	69.0	65.5
63	Z	----	70.4	83.8	59.6	70.4	73.5	69.0	65.0
125	Z	----	65.4	80.0	56.5	65.2	67.5	64.0	61.0
250	Z	----	60.6	72.3	55.6	61.8	64.0	61.0	59.0
500	Z	----	62.0	75.3	54.7	60.8	63.0	60.0	58.0
1k	Z	----	60.4	75.6	56.1	62.1	64.0	61.5	60.0
2k	Z	----	53.8	68.2	49.4	55.5	57.5	55.0	52.5
4k	Z	----	43.6	63.4	36.9	44.9	47.5	43.0	40.0
8k	Z	----	30.5	58.9	23.3	34.5	36.5	30.0	26.5
16k	Z	----	22.0	54.1	18.6	27.4	28.5	21.5	19.5

- Period results – **Traffic from highway and 3<sup>rd</sup> Ave, planes**

Record number 1 : 1  
 Record start 02/07/2008 20:30:38  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz		Flags	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	71.6	88.9	69.1	75.7	78.0	74.0	72.0
Broadband	C	----	69.5	85.2	65.2	72.8	75.0	71.5	69.5
Broadband	A	----	63.5	76.3	56.7	65.5	67.0	65.0	63.0
16	Z	----	64.2	84.5	53.0	68.9	72.0	66.0	62.0
32	Z	----	64.3	86.7	57.6	68.5	71.0	66.0	63.0
63	Z	----	64.3	85.0	58.5	68.4	71.0	66.0	63.0
125	Z	----	61.4	77.9	56.2	64.2	66.5	63.0	60.5
250	Z	----	59.7	82.0	54.5	62.4	64.0	61.0	59.0
500	Z	----	58.6	72.7	52.7	61.6	63.5	60.5	58.5
1k	Z	----	61.5	71.8	53.7	63.1	64.5	63.0	60.5
2k	Z	----	54.4	69.0	46.5	56.0	57.5	55.5	53.5
4k	Z	----	41.0	62.6	34.4	44.1	46.0	42.0	40.0
8k	Z	----	27.6	60.6	23.3	31.4	33.0	27.5	25.5
16k	Z	----	20.3	42.5	18.4	21.0	22.5	19.0	18.5

- Period results – **Traffic from Highway and 3<sup>rd</sup> Ave, planes, prison facility exhaust fan?**

Record number 1 : 1  
 Record start 02/08/2008 00:28:08  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	72.2	89.4	66.1	74.7	77.0	73.0	70.0
Broadband	C	----	70.0	84.1	63.7	72.1	74.5	70.5	67.5
Broadband	A	----	63.8	73.5	56.4	64.8	67.0	64.0	60.5
16	Z	----	61.6	87.4	51.9	67.9	70.0	64.0	59.5
32	Z	----	67.1	84.0	53.8	67.4	70.0	64.5	61.0
63	Z	----	64.9	84.4	55.7	67.0	70.0	64.5	61.5
125	Z	----	61.0	78.3	55.8	64.9	67.5	63.5	60.5
250	Z	----	59.7	73.5	52.4	61.7	64.0	61.0	57.5
500	Z	----	60.2	73.2	52.0	60.7	63.0	60.0	56.5
1k	Z	----	61.6	72.3	53.1	62.3	64.5	61.5	58.0
2k	Z	----	54.3	65.2	46.5	55.4	58.0	55.0	51.0
4k	Z	----	40.2	64.2	33.8	42.6	44.5	40.5	37.0
8k	Z	----	25.1	50.3	21.6	30.0	32.5	27.5	24.5
16k	Z	----	18.9	43.9	18.5	22.7	24.5	20.5	19.0

**Location #3 – Residence 27<sup>th</sup> Street and 3<sup>rd</sup> Ave**

- Period results - **Traffic on 3<sup>rd</sup> Ave, horns, loading activities, chain sawing, brakes squealing, highway noise**

Record number 1 : 1  
 Record start 02/07/2008 11:06:32  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz		Flags	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	86.1	98.1	78.3	86.8	89.5	85.5	82.5
Broadband	C	----	84.0	97.7	75.9	84.3	87.0	83.0	79.5
Broadband	A	----	71.4	96.2	66.6	74.1	76.0	72.0	69.0
16	Z	----	76.3	96.4	65.2	80.1	83.5	78.0	73.5
32	Z	----	73.8	91.9	67.2	80.1	83.5	78.0	74.0
63	Z	----	82.4	97.3	69.9	81.4	84.0	78.5	75.0
125	Z	----	76.1	96.4	67.2	76.3	78.5	74.0	71.5
250	Z	----	69.7	88.2	63.1	70.8	73.0	69.0	66.0
500	Z	----	66.5	90.4	61.9	69.8	71.5	67.5	65.0
1k	Z	----	68.1	91.9	62.5	69.5	71.5	67.5	65.0
2k	Z	----	62.7	91.0	58.3	67.0	68.5	64.0	61.0
4k	Z	----	56.2	85.7	50.6	61.9	63.5	58.0	54.0
8k	Z	----	47.3	88.1	39.7	58.9	56.5	49.0	44.5
16k	Z	----	36.8	92.3	28.6	60.7	49.0	39.0	34.0

- Period results – **Traffic from highway and 3<sup>rd</sup> Ave, chain sawing**

Record number 1 : 1  
 Record start 02/07/2008 12:52:26  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz		Flags	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	86.6	99.2	76.4	86.1	89.0	85.0	81.5
Broadband	C	----	82.7	95.0	73.6	83.4	86.0	82.0	79.0
Broadband	A	----	73.2	92.0	66.1	73.8	76.0	72.0	69.0
16	Z	----	82.3	94.2	65.7	80.3	83.5	78.5	73.5
32	Z	----	76.3	92.9	64.5	77.9	81.0	75.5	71.5
63	Z	----	74.1	94.4	65.0	80.3	83.5	77.5	73.5
125	Z	----	79.1	92.2	65.4	75.8	78.5	74.0	71.0
250	Z	----	69.3	91.8	62.0	71.9	73.5	69.5	67.0
500	Z	----	68.5	86.8	61.5	69.9	72.0	68.0	65.5
1k	Z	----	69.1	91.6	62.7	69.9	72.5	68.0	65.5
2k	Z	----	65.9	84.5	56.6	66.0	68.5	64.0	59.5
4k	Z	----	60.8	84.9	44.6	59.5	62.5	55.5	50.0
8k	Z	----	55.7	89.2	31.7	55.7	55.0	46.0	39.0
16k	Z	----	47.2	93.5	21.7	57.2	45.0	35.5	29.5

- Period results – Planes, highway noise, 3<sup>rd</sup> Ave and 27<sup>th</sup> street, diesel engines

Record number 1 : 1  
 Record start 02/07/2008 17:28:32  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	86.0	99.6	77.7	85.8	88.5	84.0	81.0
Broadband	C	----	82.1	99.1	74.7	82.7	85.0	80.5	78.0
Broadband	A	----	73.0	96.5	66.7	73.8	75.5	72.5	69.0
16	Z	----	81.4	94.9	66.2	80.4	83.5	78.0	73.5
32	Z	----	74.2	92.1	64.1	76.3	79.0	74.0	70.0
63	Z	----	75.5	97.0	66.6	78.8	81.0	76.0	72.0
125	Z	----	79.1	96.4	66.1	76.4	77.5	73.5	70.5
250	Z	----	71.4	94.7	62.9	72.2	73.0	69.5	67.0
500	Z	----	69.1	86.4	61.9	69.6	71.0	68.0	65.5
1k	Z	----	69.5	91.9	63.2	70.1	72.5	69.0	66.0
2k	Z	----	64.9	93.5	57.6	65.7	68.5	64.0	60.5
4k	Z	----	53.8	81.2	44.5	57.3	59.5	53.0	48.5
8k	Z	----	40.1	85.6	31.5	56.1	51.5	43.0	37.0
16k	Z	----	31.6	89.9	20.5	56.3	42.0	33.5	27.5

- Period results -

Record number 1 : 1  
 Record start 02/07/2008 20:56:33  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	79.2	97.3	72.7	82.8	85.5	81.5	78.5
Broadband	C	----	77.1	90.7	70.4	79.6	82.5	78.5	76.0
Broadband	A	----	71.5	86.0	65.0	71.0	73.0	70.0	68.0
16	Z	----	74.5	96.2	63.0	77.9	80.5	75.5	71.0
32	Z	----	69.4	90.6	59.6	74.0	77.0	71.5	68.0
63	Z	----	72.6	88.2	62.8	74.8	78.0	72.5	69.0
125	Z	----	69.8	88.7	62.6	73.6	76.0	72.0	69.5
250	Z	----	67.2	81.3	59.4	68.9	71.0	68.0	65.5
500	Z	----	65.5	78.1	59.2	67.1	69.5	66.5	64.0
1k	Z	----	68.9	78.0	61.4	67.6	70.0	67.0	64.5
2k	Z	----	64.3	79.3	55.6	62.7	65.5	61.0	59.0
4k	Z	----	53.1	79.1	41.8	53.2	56.0	49.5	46.5
8k	Z	----	43.3	82.9	25.6	49.2	47.0	38.0	33.0
16k	Z	----	32.3	87.1	18.8	50.6	36.0	28.5	22.0

- Period results – **Traffic from highway and 3<sup>rd</sup> Ave, planes, street sweeping**

Record number 1 : 1  
 Record start 02/08/2008 00:52:12  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	82.8	100.8	68.1	82.4	85.5	78.5	74.5
Broadband	C	----	79.3	96.0	66.2	79.1	82.5	75.5	71.5
Broadband	A	----	68.4	85.8	58.4	68.5	71.5	66.5	63.0
16	Z	----	75.9	95.7	57.1	77.7	80.5	73.0	67.5
32	Z	----	73.9	97.7	55.5	75.0	77.0	68.5	63.0
63	Z	----	74.6	90.9	57.9	74.3	77.5	69.5	65.0
125	Z	----	74.9	90.0	59.3	72.9	76.0	69.5	65.5
250	Z	----	67.4	80.3	54.2	68.2	72.0	65.5	61.0
500	Z	----	66.8	76.4	51.4	65.6	69.0	63.0	58.5
1k	Z	----	64.2	75.1	55.8	64.5	67.0	63.0	60.0
2k	Z	----	56.9	75.4	48.6	59.2	62.0	57.0	54.0
4k	Z	----	47.3	79.0	33.7	50.9	53.0	44.5	40.0
8k	Z	----	32.0	83.3	20.5	49.0	43.5	32.0	26.0
16k	Z	----	25.1	87.6	18.5	52.3	34.5	23.5	19.5

**Location #4 – Residence 27<sup>th</sup> Street and 5<sup>th</sup> Ave**

- Period results – **Traffic from 5<sup>th</sup> Ave, planes overhead, some foot traffic, people talking, sirens in distance**

Record number 1 : 1  
 Record start 02/07/2008 11:33:25  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	81.0	111.5	66.9	83.8	85.0	76.5	71.5
Broadband	C	----	79.2	100.4	65.2	78.4	81.5	73.5	69.0
Broadband	A	----	67.2	87.2	56.9	68.7	71.0	64.5	59.0
16	Z	----	65.7	104.4	52.6	76.6	74.5	65.5	60.5
32	Z	----	75.4	100.8	57.7	74.9	76.5	70.0	64.0
63	Z	----	77.7	91.4	58.1	74.2	78.5	69.0	64.0
125	Z	----	62.2	88.9	55.5	70.4	72.5	64.5	60.0
250	Z	----	57.1	90.7	53.1	66.5	68.5	61.5	57.0
500	Z	----	56.8	82.8	52.6	64.4	66.5	60.0	55.5
1k	Z	----	57.3	81.8	52.3	64.0	66.5	60.5	55.5
2k	Z	----	59.7	79.1	45.6	60.5	63.0	56.0	49.0
4k	Z	----	62.9	79.7	35.8	55.8	57.0	49.0	41.0
8k	Z	----	58.4	88.7	27.0	60.1	51.0	41.5	34.0
16k	Z	----	49.1	80.5	19.7	48.9	42.0	31.5	24.0

- Period results – **Traffic from 5<sup>th</sup> Ave dominates. Weather has changed to sunny, little to no wind. Police car w/ siren drove by**

Record number 1 : 1  
 Record start 02/07/2008 13:19:08  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	74.2	100.0	68.4	83.2	86.5	78.5	73.0
Broadband	C	----	72.9	98.0	66.5	81.5	84.5	76.5	71.5
Broadband	A	----	61.5	98.8	54.7	72.4	73.0	65.5	59.0
16	Z	----	61.4	94.9	51.2	71.8	74.5	65.0	60.0
32	Z	----	64.8	93.9	57.9	76.3	80.5	72.0	65.5
63	Z	----	72.6	94.5	60.8	78.2	81.5	73.0	67.5
125	Z	----	62.3	95.4	57.4	75.5	75.0	66.5	62.0
250	Z	----	54.6	87.4	51.2	68.2	70.5	62.5	56.0
500	Z	----	55.1	83.4	50.2	65.7	68.0	61.0	54.5
1k	Z	----	59.3	96.6	50.7	68.9	69.0	61.0	54.5
2k	Z	----	52.8	96.5	45.3	66.2	66.0	57.5	49.5
4k	Z	----	42.9	79.7	36.4	57.2	60.0	50.0	42.0
8k	Z	----	36.4	84.1	25.7	52.4	52.5	42.5	34.0
16k	Z	----	27.2	88.4	19.2	52.6	43.0	32.5	24.5

- Period results – **Traffic on 5<sup>th</sup> Ave dominates, wind has kicked up a bit, foot traffic, squealing brakes**

Record number 1 : 1  
 Record start 02/07/2008 17:55:28  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	72.5	100.9	63.0	80.7	84.5	74.5	69.5
Broadband	C	----	70.8	97.5	61.3	78.9	82.5	72.0	67.0
Broadband	A	----	64.7	83.8	51.6	67.3	70.0	62.0	55.5
16	Z	----	63.9	98.7	47.8	70.8	72.0	63.0	58.5
32	Z	----	68.0	95.2	55.4	74.1	78.5	68.0	62.5
63	Z	----	64.9	97.7	55.8	76.4	79.5	68.0	62.0
125	Z	----	61.4	93.2	53.2	71.4	72.5	63.5	58.5
250	Z	----	61.0	87.9	48.2	67.4	69.5	60.0	55.0
500	Z	----	59.2	81.9	47.2	62.3	65.0	57.5	52.0
1k	Z	----	61.2	78.3	48.4	62.3	65.5	58.0	52.0
2k	Z	----	57.6	77.9	40.0	59.8	62.0	54.0	45.5
4k	Z	----	52.8	78.2	27.9	54.7	55.5	46.0	37.0
8k	Z	----	46.9	80.7	21.8	53.2	49.5	39.0	29.0
16k	Z	----	35.1	85.0	18.8	48.1	40.0	29.5	21.5

- Period results – **Traffic from 5<sup>th</sup> Ave, planes, buses, foot traffic**

Record number 1 : 1  
 Record start 02/07/2008 21:22:53  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	86.4	97.4	61.3	77.1	80.5	70.0	65.5
Broadband	C	----	83.8	96.1	59.4	75.5	79.0	68.0	63.0
Broadband	A	----	67.6	84.9	51.0	65.3	69.0	59.5	53.5
16	Z	----	70.9	89.5	45.9	65.6	67.0	59.0	54.0
32	Z	----	82.5	88.6	51.2	71.5	72.5	62.5	58.0
63	Z	----	82.4	96.4	52.7	72.4	74.0	62.0	58.0
125	Z	----	69.1	94.5	48.8	68.4	69.5	59.5	54.5
250	Z	----	67.4	84.9	46.1	62.8	66.5	57.0	50.5
500	Z	----	64.8	78.9	46.7	61.4	65.0	56.0	50.0
1k	Z	----	62.0	79.5	48.6	61.4	65.5	55.5	51.0
2k	Z	----	55.6	82.8	39.7	57.5	61.0	49.0	42.5
4k	Z	----	48.5	77.1	24.2	51.4	53.0	40.0	31.0
8k	Z	----	53.4	69.0	18.0	45.8	47.5	33.0	23.0
16k	Z	----	67.9	76.7	18.4	52.1	38.0	25.0	19.5

- Period results – **Traffic from 5<sup>th</sup> Ave, planes, buses, highway can be heard in the distance**

Record number 1 : 1  
 Record start 02/08/2008 01:18:10  
 Period time 00:20:00  
 Overload occurred No  
 Under-range occurred No  
 Low battery occurred No  
 Pause was used No

Hz	Flags	dB	dB	dB	dB	dB	dB	dB	dB
Band	Fw	OBPZ	LF	LFmx	LFmn	Leq	LF10.0	LF50.0	LF90.0
Broadband	Z	----	65.7	94.8	58.0	74.3	75.5	63.5	61.0
Broadband	C	----	63.9	94.2	55.9	73.1	74.0	61.0	58.5
Broadband	A	----	51.7	87.5	45.5	63.3	66.5	50.5	48.0
16	Z	----	55.1	90.5	45.0	62.6	62.5	55.5	52.0
32	Z	----	59.0	86.5	49.0	66.3	65.0	57.5	54.5
63	Z	----	60.9	93.3	49.9	69.7	69.0	57.0	54.0
125	Z	----	55.1	91.1	46.4	67.0	63.5	52.5	50.0
250	Z	----	48.9	91.0	42.2	64.6	61.5	48.0	45.0
500	Z	----	47.9	78.5	41.3	57.8	59.5	47.0	44.0
1k	Z	----	49.1	77.8	42.3	58.4	62.0	47.5	45.0
2k	Z	----	42.0	78.5	34.0	55.4	58.0	40.5	36.5
4k	Z	----	29.3	83.0	22.6	51.5	50.0	31.5	24.5
8k	Z	----	22.9	83.0	17.5	50.3	42.0	24.0	18.0
16k	Z	----	19.6	78.5	18.3	44.3	32.5	20.0	18.5