SEATTLE SOUTH DOWNTOWN NOISE STUDY
Noise Analysis

Overview of Noise Terms, Concepts, and Regulations

Noise Principles and Descriptors

Noise is defined as unwanted sound. Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) which is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing, and 120 to 140 dB corresponding to the threshold of pain. The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). All measurements and references in this report to decibels are to A-weighted decibels.

Noise Exposure and Community Noise

An individual's noise exposure is a measure of noise over a period of time. A noise level is a measure of noise at a given instant in time. Community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

These successive additions of sound to the community noise environment vary the community noise level from instant to instant requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

Leq: the energy-equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The L_{eq} is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (e.g., the average noise exposure level for the given time period).

Lmax: the instantaneous maximum noise level for a specified period of time.

L8.3: the noise level that is equaled or exceeded 8.3 percent of the specified time period. The L8.3 is the noise level equaled or exceeded for five minutes in an hour; it is generally similar in level to the Leq.

L10: the noise level that is equaled or exceeded 10 percent of the specified time period. The L10 is generally similar in level to the Leq.

L90: the noise level that is equaled or exceeded 90 percent of the specified time period. The L90 represents the background noise level in most environments.

Leq (h) Hourly A-weighted noise level in decibels (dBA)

Ldn: 24-hour day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

As a general rule, in areas where the noise environment is dominated by traffic, the L_{eq} during the peak-hour is generally equivalent (plus or minus 2 decibels) to the Ldn at that location.

Effects of Noise on People

The effects of noise on people can be placed into three categories:

- subjective effects of annoyance, nuisance, dissatisfaction;
- interference with activities such as speech, sleep, learning; and
- physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience the effects in the last category. There is no completely satisfactory way to measure the subjective effects of noise, or the corresponding reactions of annoyance and dissatisfaction. There is a wide variation in individual thresholds of annoyance, and different tolerances to noise tend to develop based on an individual's past experiences with noise. Figure 1 is an example of the reaction of people to different noise levels.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so called "ambient noise" level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:

- except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived;
- outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- a change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and
- a 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion; hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA.

Noise Attenuation

Stationary point sources of noise attenuate (lessen) at a rate of 6 to 7.5 dBA per doubling of distance from the source, depending on environmental conditions (such as atmospheric conditions and noise barriers, either vegetative or manufactured). Typical "line" sources of noise, such as highways and busy arterial roadways, attenuate at a rate of 3.0 to 4.5 dBA per doubling of distance from the roadway.

Seattle Noise Regulations and Impact Criteria

The City of Seattle limits noise levels at property lines of neighboring properties (City of Seattle Municipal Code 25.08.410). Maximum permissible noise levels apply to a single source of noise and depend on the zoning district of both the source of noise and the receiving property (see Table 1). For example, operational noise from a commercial property may not exceed 60 dBA at the property line of neighboring commercial properties. The 10 dBA nighttime noise level reduction does not apply to areas that are not in a residential district.

Short-term exceedances of the permissible sound level are allowed. The maximum level may be exceeded by 5 dba for a total of 15 minutes, by 10 dBA for a total of 5 minutes, or by 15 dBA for a total of 1.5 minutes during any one-hour period (City of Seattle Municipal Code 25.08). These allowed exceptions are referred to in terms of the percentage of time a certain level is exceeded; an L_{25} is the noise level that is exceeded 15 minutes during an hour. Therefore, the permissible L_{25} would be 5 dBA greater than the values in Table 1, provided that the noise level is below the

permissible level in Table 1 for the remainder of the hour and never exceeds the permissible level by more than 5 dBA. An hourly Leq of approximately 3 dBA higher than the values in Table 1 is equivalent in sound level to the permissible levels including the allowed exceedance. Using this rule, an Leq(h) of 62 dBA corresponds approximately to a noise level of 60 dBA for 45 minutes and 65 dBA for 15 minutes or a noise level of 60 dBA for 58.5 minutes and 75 dBA for 1.5 minutes; therefore, 62 dBA Leq is the equivalent maximum permissible noise level created by a commercial district source and received by a commercial district property (*Washington State Major League Baseball Stadium Project*, Draft EIS, 1996).

Sounds from motor vehicles on public roads, aircraft, trains, and unamplified sounds for public events are exempt from the property line regulations in Table 1. Construction and operation noise from all projects, however, must meet City of Seattle property line regulations. Specific provisions of the Seattle Municipal Code allow construction noise to exceed the levels in Table 1 under certain circumstances. Large equipment may exceed the levels in Table 1 by 25 dBA, and portable equipment may exceed the levels by 20 dBA. Impact equipment, such as pile drivers, are exempt from the sound levels for any 1-hour period between 8:00 a.m. and 5:00 p.m. on weekdays 9:00 a.m. and 5:00 p.m. on weekends.

TABLE 1
CITY OF SEATTLE MAXIMUM PERMISSIBLE NOISE LEVELS (DBA LEQ)

	Residential			
Noise Source	Day	Night[1]	Commercial	Industrial
Residential	55	45	57	60
Commercial	57	47	60	65
Industrial	60	50	65	70

[1]Between 10p.m. and 7 a.m., the maximum permissible noise levels are reduced by 10 dBA for residential receiving properties.

Section 25.08.420 Modifications to maximum permissible sound levels: The maximum permissible sound levels established by his subchapter shall be reduced or increased by the sum of the following:

A. Between the hours of ten p.m. (10:00 p.m.) and seven a.m. (7:00 a.m. on weekdays and between the hours of ten p.m. (10:00 p.m.) and nine a.m. (9:00 a.m.) on weekdays, the levels established by Section 25.08.410 are reduced by 10 dBA where the receiving property lies within a residential district of the City.

B. For any source of sound which is periodic, which has a pure tone component, or which is impulsive and is not measured with an impulse sound level meter, the levels established by this subchapter shall be reduced by five (5) dB(A); provided however, that this five (5) dB(A) penalty for the emission of sound having a pure tone component shall not be imposed on any electrical substation, whether existing or new.

C. For any source of sound which is of short duration, the levels established by this sub-chapter are increased by:

1. Five (5) dB(A) for a total of fifteen (15) minutes in any one (1) hour period; or
2. Ten (10) dB(A) for a total of five (5) minutes in any one (1) hour period; or
3. Fifteen (15) dB(A) for a total of 1.5 minutes in any one (1) hour period.

Section 25.08.425 Construction and equipment operations

A. The maximum permissible sound levels established as measured from the real property of another person or at a distance of fifty feet (50') from the equipment, whichever is greater, may be exceeded between the hours of seven a.m. (7:00 a.m.) and ten p.m. (10:00 p.m.) on weekdays and between the hours of nine a.m. (9:00 a.m.) and ten p.m. (10:00 p.m.) on weekends by no more than the following dBA's for the following types of equipment.:

1. Twenty-five (25) dBA for equipment on construction sites, including but not limited to crawlers, tractors, dozers, rotary drills and augers, loaders, power shovels, cranes, derricks, graders, off-highway trucks, ditchers, trenchers, compactors, compressors, and pneumatic-powered equipment.;

2. Twenty (20) dBA for portable powered equipment used in temporary locations in support of construction activities or used in the maintenance of public facilities including but not limited to chainsaws, log chippers, lawn and garden maintenance equipment, and powered hand tools; or

3. Fifteen (15) dBA for powered equipment used in temporary or periodic maintenance or repair of the grounds and appurtenances of residential property, including but not limited to lawnmowers, powered hand tools, snow-removal equipment, and composters.

TABLE 1
CITY OF SEATTLE MAXIMUM PERMISSIBLE NOISE LEVELS (DBA LEQ)

B. Sounds created by impact types of construction equipment, including but not limited to pavement breakers, piledrivers, jackhammers, sandblasting tools or by other types of equipment or devices which create impulse noise or impact noise or are used as impact equipment, as measured at the property line or fifty feet (50') from the equipment, whichever is greater, many exceed the maximum permissible sound levels established in subsection A of this section in any one (1) hour period between the hours of eight a.m. (8:00 a.m.) and five p.m. (5:00 p.m.) on weekdays and between the hours of nine a.m. (9:00 a.m.) and five p.m. (5:00 p.m.) on weekends, but in no event to exceed the following:

1. Leq ninety (90) dBA continuously;
2. Leq ninety-three (93) dBA for (30) minutes; or
3. Leq ninety-six (96) dBA for fifteen (15) minutes; or
4. Leq ninety-nine (99) dBA for seven and one-half (7 ½) minutes;

Provided that sound levels in excess of Leq ninety-nine (99) dBA are prohibited unless authorized by variance obtained from the Administrator; and provided further that sources producing sound levels less than ninety (90) dBA shall comply with subsection A of this section during those hours not covered by this subsection B.

a. The standard of measurement shall be a one (q) hour Leq. Leq may be measured for times not less than one (1) minute to project an hourly Leq. Reference to one (1) hour is for measurement purposes only and shall not be construed as limiting construction to a one (1) hour period.

b. These subsections A and B shall be reviewed periodically by the City to assure that the sound level limits are technically feasible.

C. Construction activity that exceeds the maximum permissible sound levels established by Section 25.08.410, when measured from the interior of buildings within a commercial district, is prohibited between the hours of eight a.m. (8:00 a.m.) and five p.m. (5:00 p.m.) For the purposes of this subsection C, interior sound levels shall be measured only after every reasonable effort, including but not limited to closing windows and doors, is taken to reduce the impact of the exterior constriction noise.

Source: City of Seattle Municipal Code 25.08, as of March 2007

Residential Land Use Compatibility Guidelines

The review of several background noise reports in Seattle did not identify land use compatibility guidelines for the siting of new residential development. Discussions with the City's Department of Planning and Development indicated that Seattle does not have adopted guidelines that identify outdoor noise levels that would be acceptable for the siting of new residential development. While the Municipal Code noise level limits are a guide, those levels are primarily a limit on noise from "specific" existing noise sources that can be controlled if they exceed certain limits. The Municipal Code noise limits do not explicitly restrict siting uses in locations where the existing ambient noise levels are above the noise limits in the Municipal Code. The ambient noise level includes all existing noise sources (near and far) including many sources the City cannot control such as noise generated by transportation sources (i.e., highways, railroads and airports).

Indoor Residential Noise Levels

Generally, 45 Ldn, dBA is considered to be the acceptable indoor noise level for residences. The Uniform Building Code (which is not the standard used by City of Seattle) requires that interior noise levels due to exterior sources must not exceed an Ldn of 45 dBA in any habitable room. It is assumed that this level allows for normal sleep and day-to-day activities within a residence that is not compromised by the intrusion from outdoor noise. New residences should be designed to achieve this goal. In high-noise environments (generally considered as noise environments above 65 Ldn) in other jurisdictions, site specific noise studies help to determine the level of noise insulation necessary to achieve this goal. The reasoning is that typical construction of homes will reduce noise levels at least 20 dBA (from the outdoor noise level to the indoor noise level) and this reduction will achieve an indoor noise level of 45 Ldn dBA only when outdoor noise levels are below 65 Ldn. Both the Federal Highway Administration (FHWA)

and Federal Aviation Administration (FAA) have programs designed to help achieve indoor and outdoor noise levels consistent with these limits. However, residences near freeways, railroads and airport landing areas are often exposed to outdoor noise levels greater than 65 Ldn and need additional noise insulation to achieve an indoor noise level of 45 Ldn, dBA. Modified wall designs and sound control windows are typically used to achieve increased levels of sound reduction between the outdoor and indoor levels.

Sound Transmission Class (STC) is a widely used rating for how well a building partition attenuates airborne sound. STC ratings are used to rate the noise reduction provided by interior partitions, ceiling/floors, doors, windows, and exterior wall configurations. STC is roughly the noise reduction a partition can provide in decibels (dBA). If the outdoor sound level is 80 dBA, an STC rating of 35 would be required to achieve an indoor sound level of 45 dBA. There are methods available to construct walls to achieve an STC of 35 - 45 and windows can be ordered with STC ratings of 40 - 45.

Outdoor Residential Noise Levels

Outdoor noise levels are more difficult to attenuate because, by definition, outdoor use areas are not enclosed. Outdoor use areas are considered "noise impacted" by FHWA and FAA when levels exceed approximately 65 Ldn. Solid noise fences (barriers) and building orientation can shield outdoor noise levels by a maximum of 10-15 dBA, but in many situations there are no measures to effectively reduce outdoor noise levels (e.g., when a site is surrounded by elevated freeways or beneath airport flight paths). In many cases outdoor noise levels remain above acceptable levels even though indoor noise levels can be mitigated to acceptable level with use of improved building materials and construction methods.

A review of common practices in urban cities in California (San Francisco, Oakland and Sacramento) found that when residences are proposed in very high-noise level urban areas, the focus of the noise mitigation measures is to reduce indoor noise levels to 45 Ldn, dBA. As practicable, noise mitigations are proposed to shield outdoor noise areas (generally decks rather than yards in urban areas) in noisy urban areas, but even if mitigation measures do not reduce the outdoor noise level below 65 Ldn, dBA, projects are approved anyway, as additional mitigation is not practicable.

Purpose of the Noise Study

ESA conducted a noise study in March 2007 of 10 locations in downtown Seattle to determine areas with existing noise environments suitable for residential development. The areas for noise monitoring were selected by Gordon Clowers, an Urban Planner with the City of Seattle Department of Planning and Development. Each area was considered to have hypothetical potential for residential development. The noise measurement locations are shown on **Figure 2**.

Noise Measurements Results

In order to characterize ambient noise conditions at each location, long-term noise measurements were conducted (48-hours measurement) at the ten locations and twenty short-term noise measurement were taken. All the 48-hour, long-term noise measurements were taken beginning at midnight on Tuesday March 6, 2006 and ending at 11:59 pm on Wednesday March 7, 2007. Weather conditions

Metrosonics Model db308 sound level meters were used for the ambient noise level measurements. These precision sound level meters were calibrated to ensure the accuracy of the measurements. The meters were programmed to record the maximum (Lmax), average (Leq), L8.3 and L90 noise levels each hour.

A convenient way to compare the sites is to show them ranked by the Ldn values that were measured during the study. Table 2 shows the rankings with the sites with the best noise environment (quietest sites) ranked at the bottom and the sites with the highest noise levels shown at the top of Table 2.

TABLE 2
RANKING OF SITES BY LDN VALUES

Site Number	Site Location	Average Ldn	Range of Hourly Average Leq
8	1st Avenue & Columbia St.	79	64-85
7	WOSCA Parking Lot	79	66-78
1	Yesler Way & 6th Avenue	78	65-76
2	10th Ave. S. & S. Weller St.	77	65-76
9	S. Washington St. & 1st Ave. S.	76.5	63-82
4	7th Ave. S. & S. Plummer St.	75	63-75
3	8th Ave. S. & S. Lane St.	71	58-71
6	Utah Ave. between Atlantic and Massachusetts	70.5	59-70
5	6th Ave. S. and Airport Way S.	70.5	59-70
10	S. King St. & Rainier Ave. S.	68	56-65

A summary of the noise level measurement results is provided in **Table 3** and graphs of the 24-hour measurements are provided in **Figures 3** through **Figure 21**.

Recommendations for Future Residential Uses in the Study Area

All of the locations measured have ambient outdoor Ldn levels above normally acceptable levels for residential uses (55 – 65 Ldn, dBA). While some locations in the study area may be able to achieve acceptable outdoor noise levels through setbacks and shielding from barriers and shielding from other structures, many locations would have no practical means to reduce noise to acceptable levels for prospective residential uses at outdoor common areas and decks. Outdoor decks throughout the studied areas would be challenged to have comfortable outdoor noise levels, especially those near Interstate 5 or 90 or Highway 99 and/or those with direct views of those major roads. Outdoor areas are in or near an urban center and the noise levels will continue be representative of a relatively noisy urban environment. Outdoor decks would not likely be locations amenable to quiet conversation or quiet relaxation.

Despite the challenges posed by noisy conditions, the studied areas could be rated as "conditionally acceptable for residential uses" if noise-mitigating features are built into future development. With proper design and building practices, indoor noise levels could achieve the indoor noise goal of 45 Ldn, dBA. In all the locations measured, building partitions with STC ratings of 35-40 would reduce the measured outdoor noise levels to an indoor level of less than 45 Ldn, dBA. If meeting the interior noise goal would depend upon windows being closed, which may be the case in most locations, the design for the structure should also specify a ventilation or air-conditioning system that would maintain a habitable interior environment without relying on open-window ventilation in warm weather periods.

TABLE 3
EXISTING NOISE ENVIRONMENTS AT PROJECT LOCATION

Location	Time Period	Leq (dB)	Noise Sources
Site 1: Yesler Way & 6th Ave. 115' from the center of Yesler Way; 40' from the center of 6th Ave.	24 hour CNEL measurements were: Tuesday: 78 Wednesday: 78	Hourly average Leq's ranged from: 65 - 76	Unattended noise measurements do not specifically identify noise sources.
Site 1: Yesler Way & 6th Ave.	10 Minutes 3/06/07 16:32	5-minute Leq's 72, 67	Bus on Yesler 72 dBA Helicopter 78 dBA Freeway 67 dBA Plane 68 dBA
Site 1: Yesler Way & 6th Ave.	5 Minutes 3/08/07 11:13	5-minute Leq 71	Train Horn 71 dBA Freeway 70 – 73 dBA
Site 2: 10th Ave. S & S Weller St. 25' from center of 10th; 50' from center of Weller	24 hour CNEL measurements were: Tuesday: 76 Wednesday: 78	Hourly average Leq's ranged from: 65 - 76	Unattended noise measurements do not specifically identify noise sources.
Site 2: 10th Ave. S & S Weller St.	5 Minutes 3/06/07 16:55	5-minute Leq 72	Freeway 70 – 74 dBA
Site 2: 10th Ave. S & S Weller St.	5 Minutes 3/08/07 10:42	5-minute Leq 71	Traffic 68 dBA Trucks 69 – 73 dBA Siren 71 dBA Plane < 71 dBA
Site 3: 8th Ave. S & S Lane St. 25' from center of Lane; 75' from center of 8th Ave. S	24 hour CNEL measurements were: Tuesday: 71 Wednesday: 71	Hourly average Leq's ranged from: 58 - 71	Unattended noise measurements do not specifically identify noise sources.
Site 3: 8th Ave. S & S Lane St.	5 Minutes 3/06/07 17:34	5-minute Leq 64	Plane 66 dBA Traffic on Freeway (slow during rush hour)

TABLE 3
EXISTING NOISE ENVIRONMENTS AT PROJECT LOCATION

Location	Time Period	Leq (dB)	Noise Sources
Site 3: 8th Ave. S & S Lane St.	5 Minutes 3/08/07 10:29	5-minute Leq 67	Freeway 64 – 67 dBA Street Traffic 65 dBA Truck 73 dBA Plane < 65 dBA
Site 4: 7th Ave. S & S. Plummer St. 90' from center of S Plummer St; 25' from center of 7th Ave. S	24 hour CNEL measurements were: Tuesday: 75 Wednesday: 75	Hourly average Leq's ranged from: 63 - 75	Unattended noise measurements do not specifically identify noise sources.
Site 4: 7th Ave. S & S. Plummer St.	5 Minutes 3/06/07 17:47	5-minute Leq 67	Planes 66 – 68 dBA Train horn – 66 dBA Traffic on Freeway is constant (I-5 and I-90) 64 dBA
Site 4: 7th Ave. S & S. Plummer St.	5 Minutes 3/08/07 9:56	5-minute Leq 69	Train Horn 70 – 74 dBA Freeway 68 – 70 dBA Street Traffic 70 – 71 dBA
Site 5: 6th Ave. S & Airport Way. S. 200' from center of 6th Ave; 50' from center of Airport Way S	24 hour CNEL measurements were: Tuesday: 70 Wednesday: 71	Hourly average Leq's ranged from: 59 - 70	Unattended noise measurements do not specifically identify noise sources.
Site 5: 6th Ave. S & Airport Way S.	10 Minutes 3/06/07 18:03	5-minute Leq's 70, 67	Tow Truck Train horn Helicopters Traffic on Freeway
Site 5: 6th Ave. S & Airport Way S.	5 Minutes 3/08/07 10:11	5-minute Leq 66	Back up beep 71 dBA Plane 65 dBA Truck on Freeway 71 dBA Background 63 dBA
Site 6: Utah Ave. S. mid-block between Atlantic St. and Mass. St. 20' from center of Utah Ave.	24 hour CNEL measurements were: Tuesday: 70 Wednesday: 71	Hourly average Leq's ranged from: 59 – 70	Unattended noise measurements do not specifically identify noise sources.
Site 6: Utah Ave. S mid-block	5 Minutes 3/06/07 18:22	5-minute Leq 65	Airplanes, Train Horn 65 dBA
Site 6: Utah Ave. S mid-block	5 Minutes 3/07/07 8:05	5-minute Leq 68	Train horn 70 – 73 dBA Steady Traffic Rain
Site 6: Utah Ave. S mid-block	5 Minutes 3/08/07 9:41	5-minute Leq 67.3	Traffic 67 dBA, Trucks 70.5 dBA Train horns Siren 73 dBA Background 65 – 66 dBA

TABLE 3
EXISTING NOISE ENVIRONMENTS AT PROJECT LOCATION

Location	Time Period	Leq (dB)	Noise Sources
Site 7: WOSCA Parking Lot Center of Parking Lot - 90' east of 99 viaduct structure. West of Qwest Field	24 hour CNEL measurements were: Tuesday: 79 Wednesday: 79	Hourly average Leq's ranged from: 66 - 78	Unattended noise measurements do not specifically identify noise sources.
Site 7: WOSCA Parking Lot	5 Minutes 3/07/07 8:24	5-minute Leq 77	Traffic noise 75 dBA Rain
Site 7: WOSCA Parking Lot	5 Minutes 3/08/07 9:24	5-minute Leq 76	Traffic 73 – 78 dBA Train horn audible
Site 8: 1st Ave. & Columbia St. 75' South of Columbia St; 25 ' from center of 1st Ave. Near 4-way stoplight	24 hour CNEL measurements were: Tuesday: 80 Wednesday: 78	Hourly average Leq's ranged from: 64 - 85	Unattended noise measurements do not specifically identify noise sources.
Site 8: 1st Ave. & Columbia St.	5 Minutes 3/07/07 8:57	5-minute Leq 72	Street Traffic 70 – 75
Site 8: 1st Ave. & Columbia St.	5 Minutes 3/08/07 9:02	5-minute Leq 70	Traffic 73 dBA Background 66 dBA Bus on Columbia 77 dBA
Site 9: S Washington St. & 1st Ave. S 20' from center of Washington; 120' from center of 1st Ave.; 240' from viaduct structure	24 hour CNEL measurements were: Tuesday: 76 Wednesday: 77	Hourly average Leq's ranged from: 63 - 82	Unattended noise measurements do not specifically identify noise sources.
Site 9: S Washington St. & 1st Ave. S	5 Minutes 3/07/07 8:43	5-minute Leq 70	Mainly Traffic from viaduct. Also steady traffic on 1st Ave.
Site 9: S Washington St. & 1st Ave. S	5 Minutes 3/08/07 8:46	5-minute Leq 71	Traffic 72 dBA from Viaduct and local traffic on Washington
Site 10: S King St. & Rainier Ave. S 40' from center of S. King St; 180' from center of Rainier Ave.	24 hour CNEL measurements were: Tuesday: 68 Adjusted last half of day; meter malfunction	Hourly average Leq's ranged from: 56 - 65	Unattended noise measurements do not specifically identify noise sources.
Site 10: S King St. & Rainier Ave. S	5 Minutes 3/06/07 17:14	5-minute Leq 61	Planes (4) 65 – 67 dBA Many plants overhead – 4 in 10 minutes – on flight path
Site 10: S King St. & Rainier Ave. S	5 Minutes 3/08/07 10:55	5-minute Leq 65	Planes (2) 65 dBA Street Traffic Rainier 61 – 65 dBA Freeway 99 to south causes background of 60 dBA

Figure 3
Site 1: Yesler Wy. & 6th Ave.
Tuesday March 06, 2007

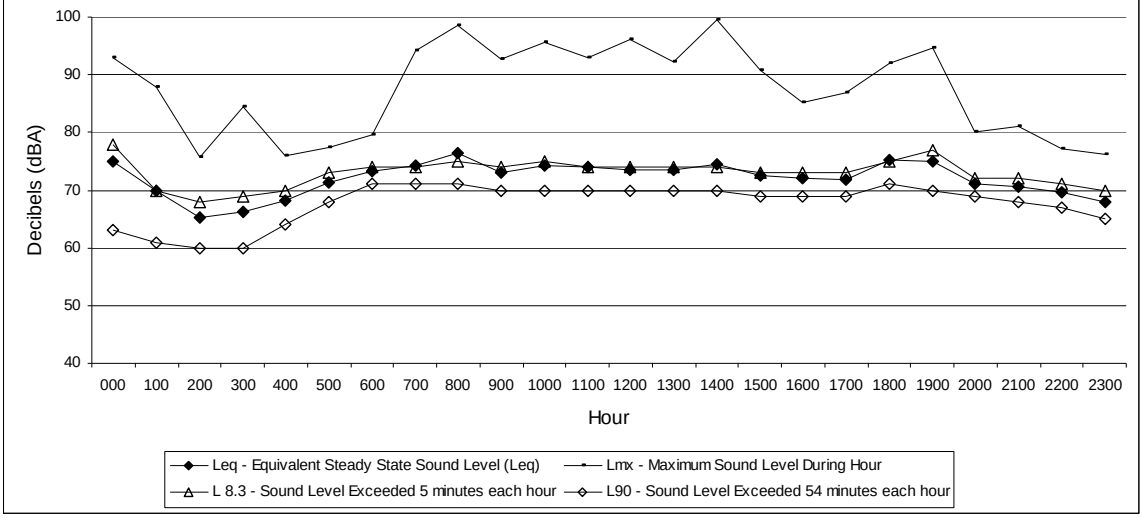

Figure 4
Site 1: Yesler Wy. & 6th Ave.
Wednesday March 07, 2007

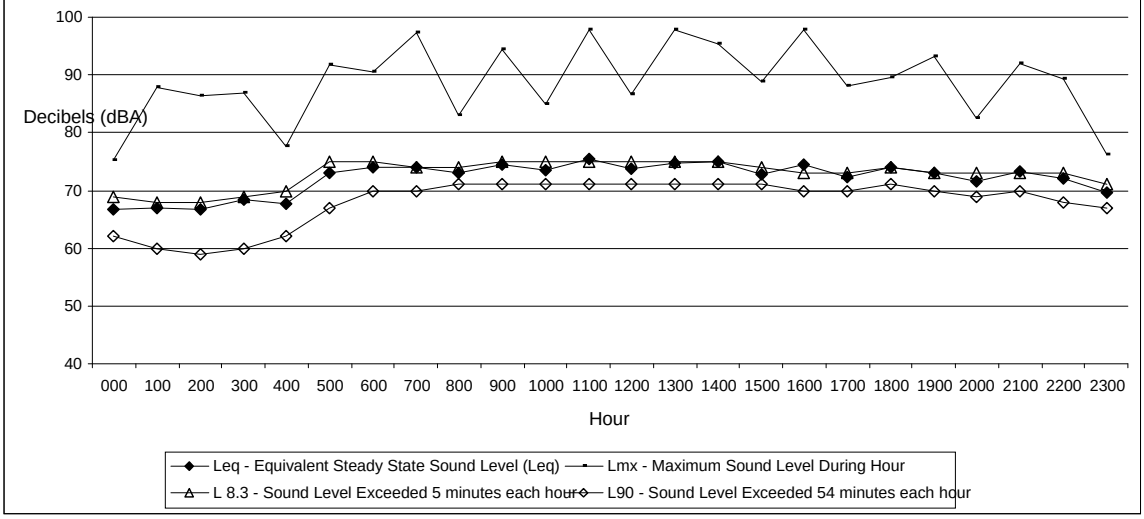

Figure 5
Site 2: 10th Ave. S & S Weller St.
Tuesday March 06, 2007

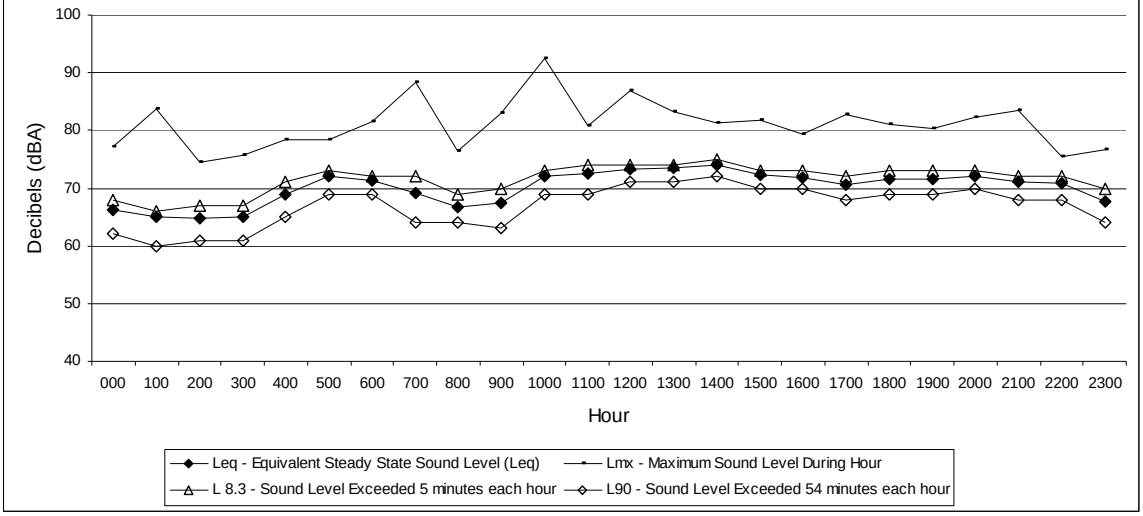

Figure 6
Site 2: 10th Ave. S & S Weller St.
Wednesday March 07, 2007

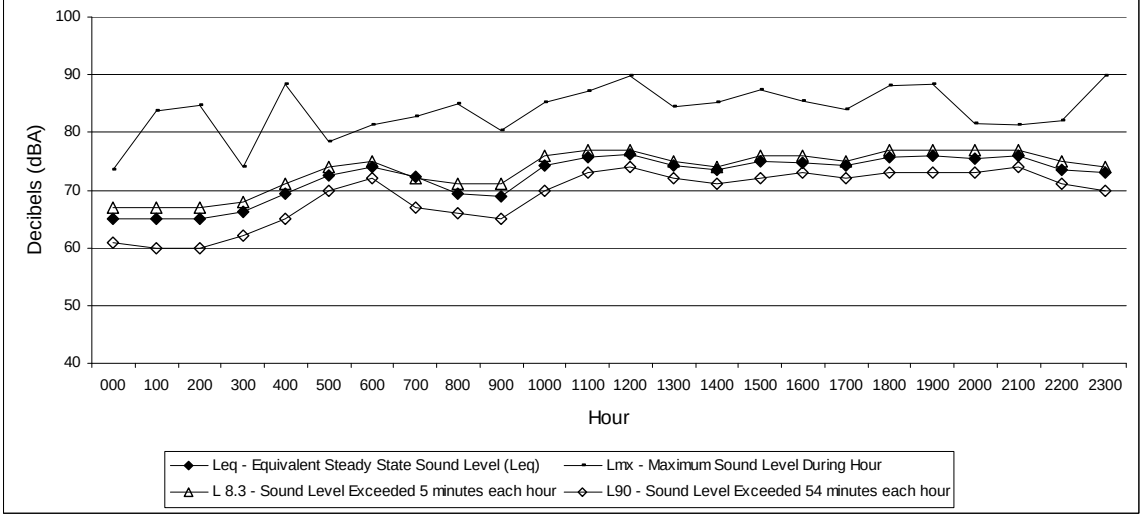

Figure 7
Site 3: 8th Ave. S & S Lane St.
Tuesday March 06, 2007

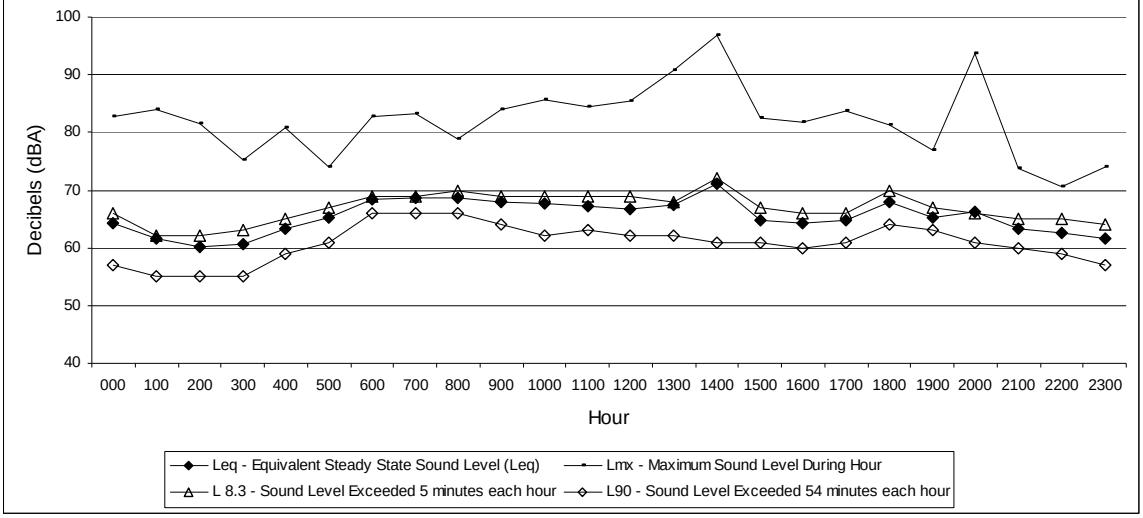

Figure 8
Site 3: 8th Ave. S & S Lane St.
Wednesday March 07, 2007

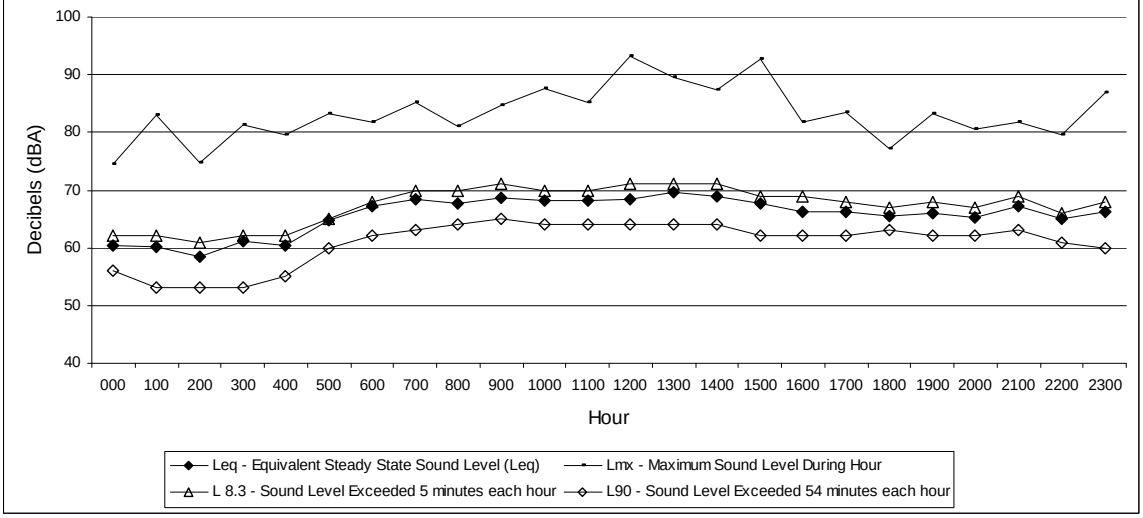

Figure 9
Site 4: 7th Ave. S & S. Plummer St.
Tuesday March 06, 2007

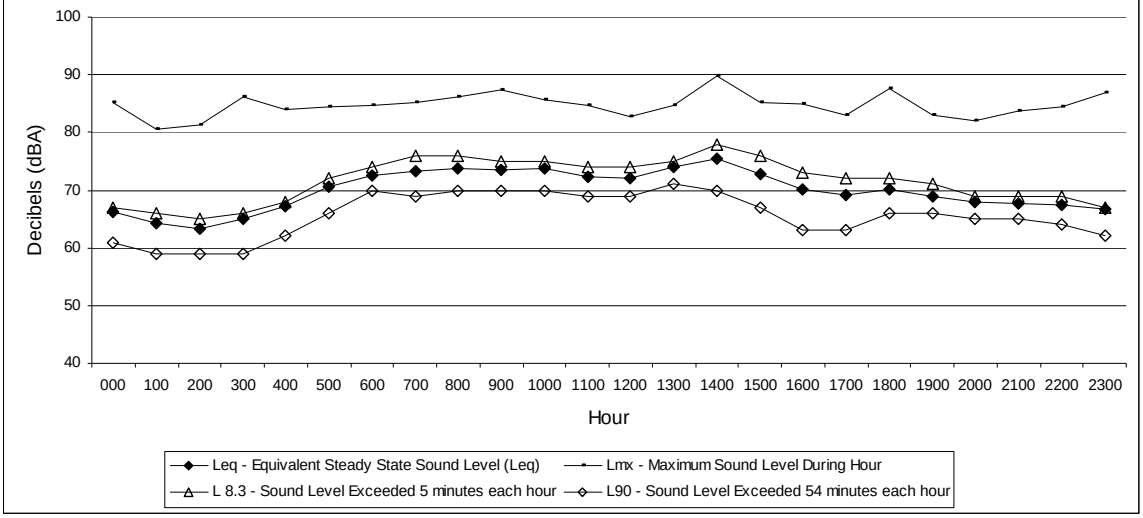

Figure 10
Site 4: 7th Ave. S & S. Plummer St.
Wednesday March 07, 2007

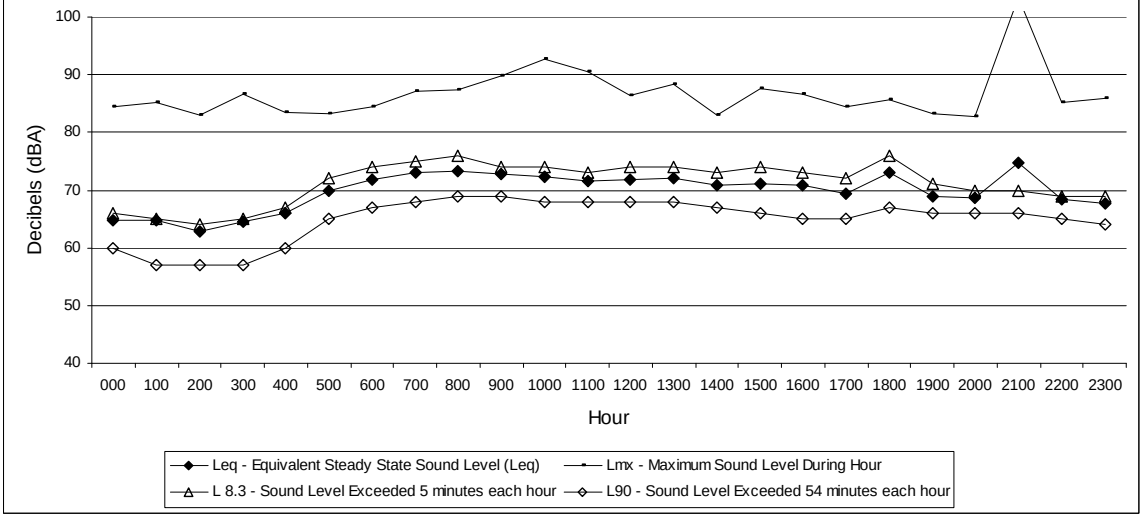

Figure 11
Site 5: 6th Ave. S & Airport Wy. S
Tuesday March 06, 2007

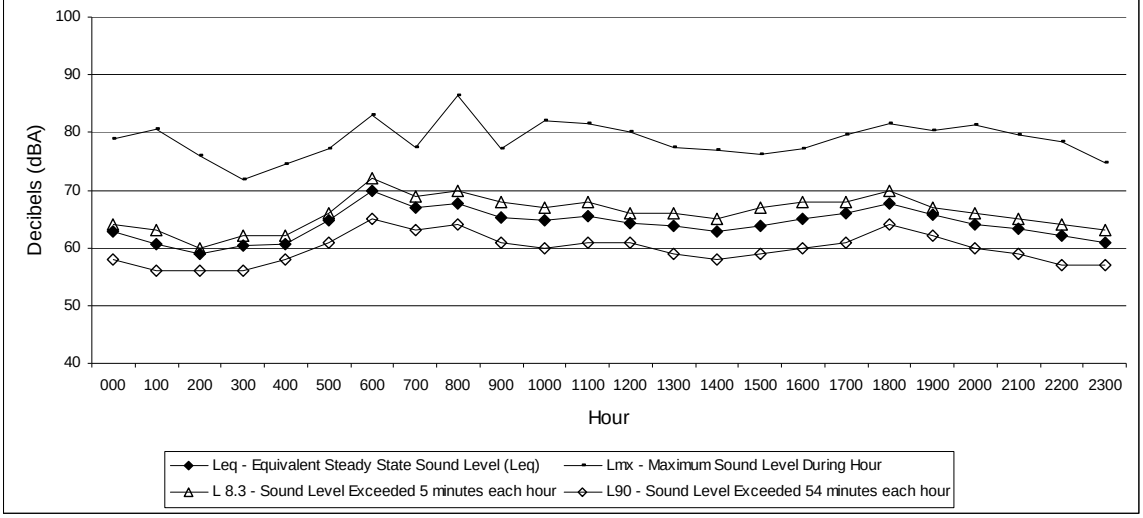

Figure 12
Site 5: 6th Ave. S & Airport Wy. S
Wednesday March 07, 2007

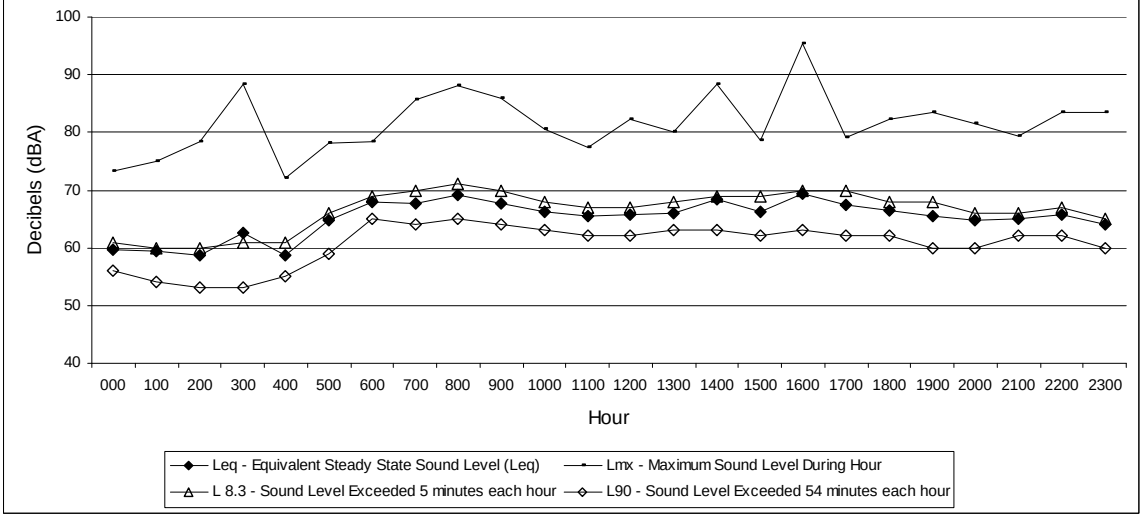

Figure 13
Site 6: Utah Ave. S., between S. Atlantic St. and S. Mass St.
Tuesday March 06, 2007

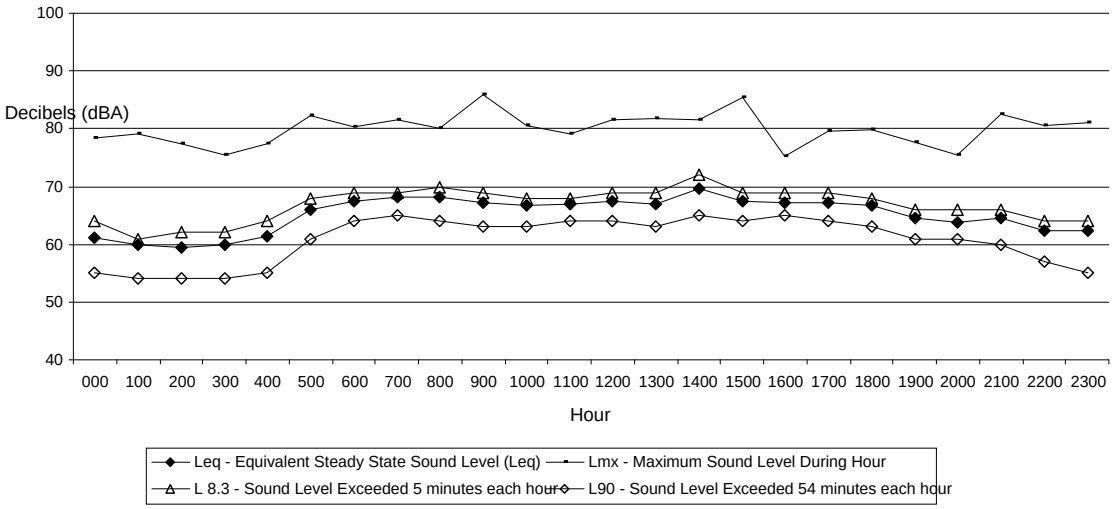

Figure 14
Site 6: Utah Ave. S., between S. Atlantic St. and S. Mass St.
Wednesday March 07, 2007

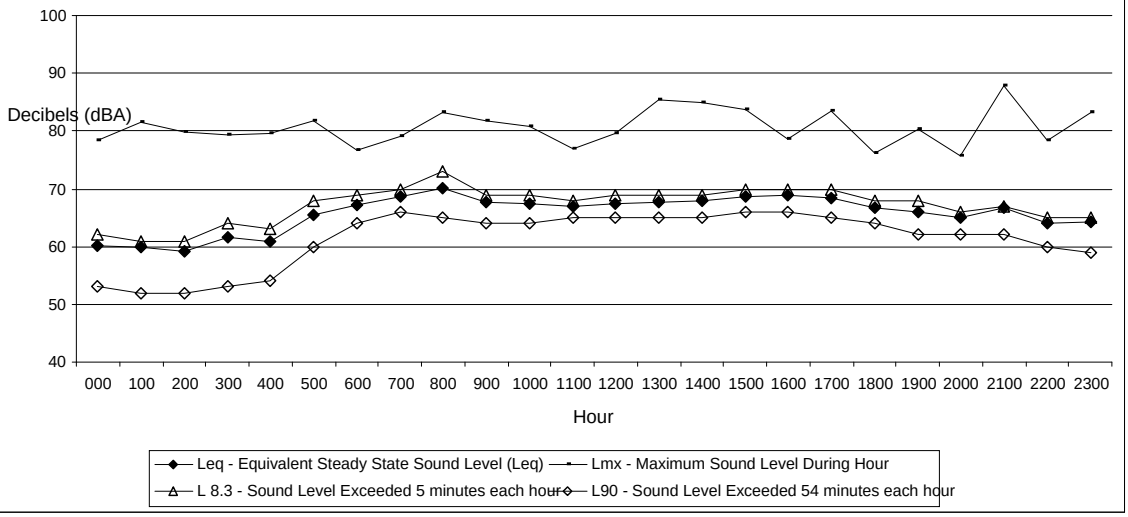

Figure 15
Site 7: In WOSCA property parking lot
Tuesday March 06, 2007

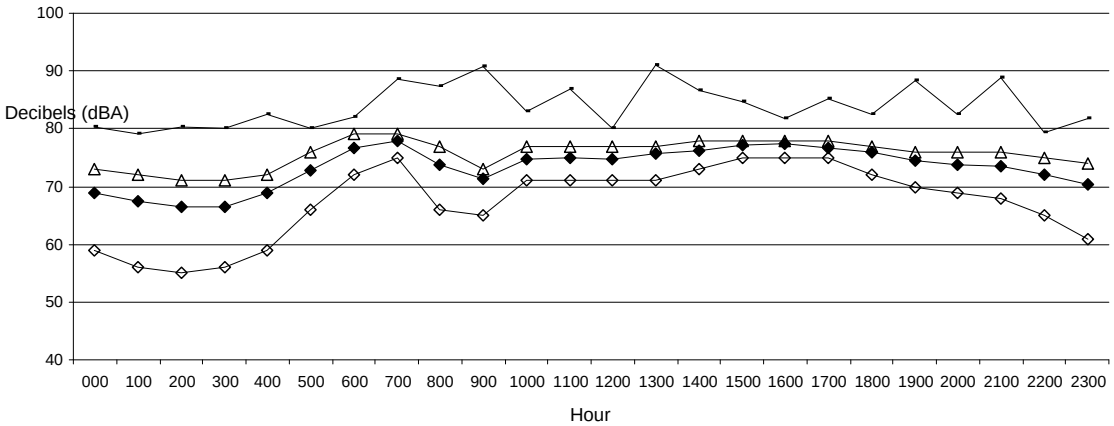

Figure 16
Site 7: In WOSCA property parking lot
Wednesday March 07, 2007

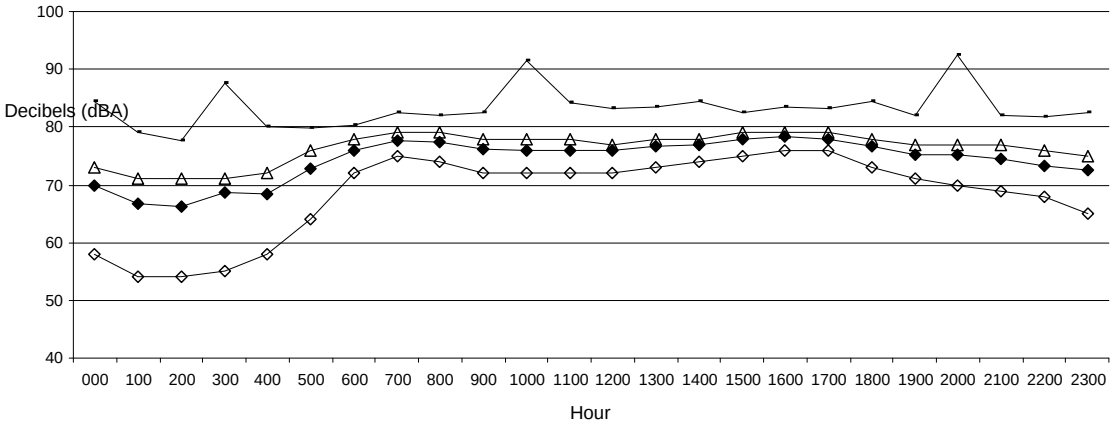

Figure 17
Site 8: 1st Ave. & Columbia St.
Tuesday March 06, 2007

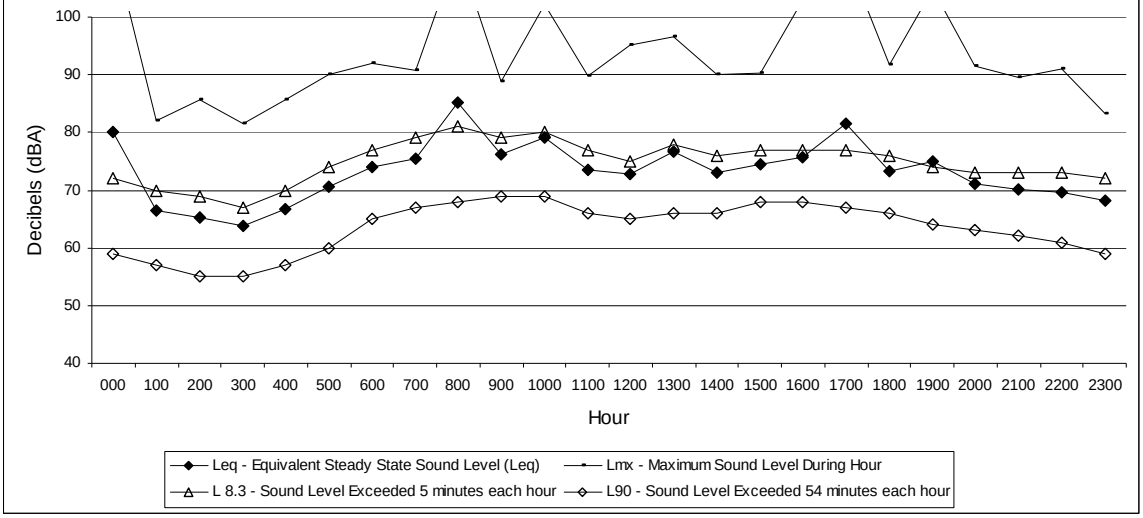

Figure 18
Site 8: 1st Ave. & Columbia St.
Wednesday March 07, 2007

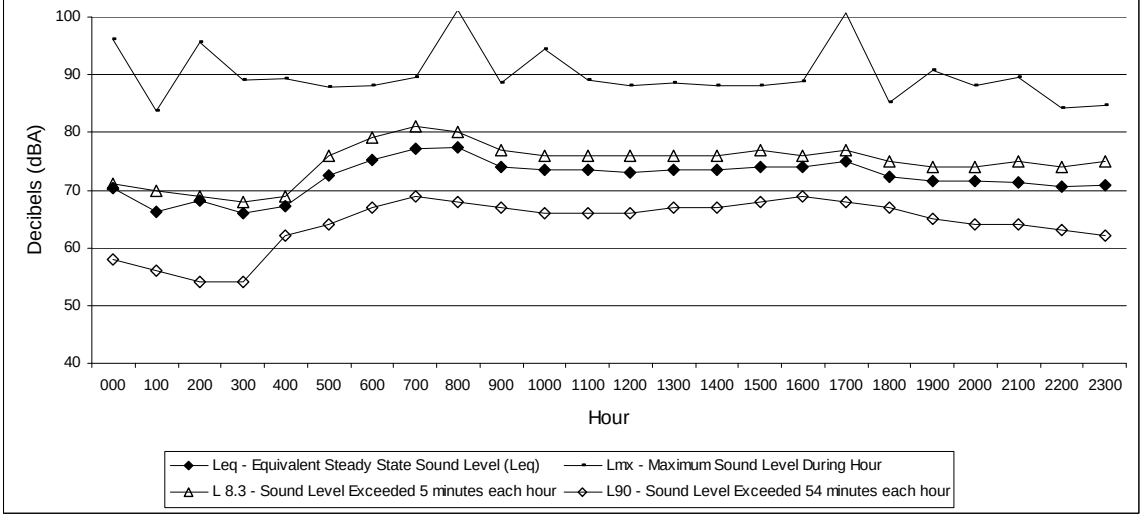

Figure 19
Site 9: S. Washington St. & 1st Ave. S
Tuesday March 06, 2007

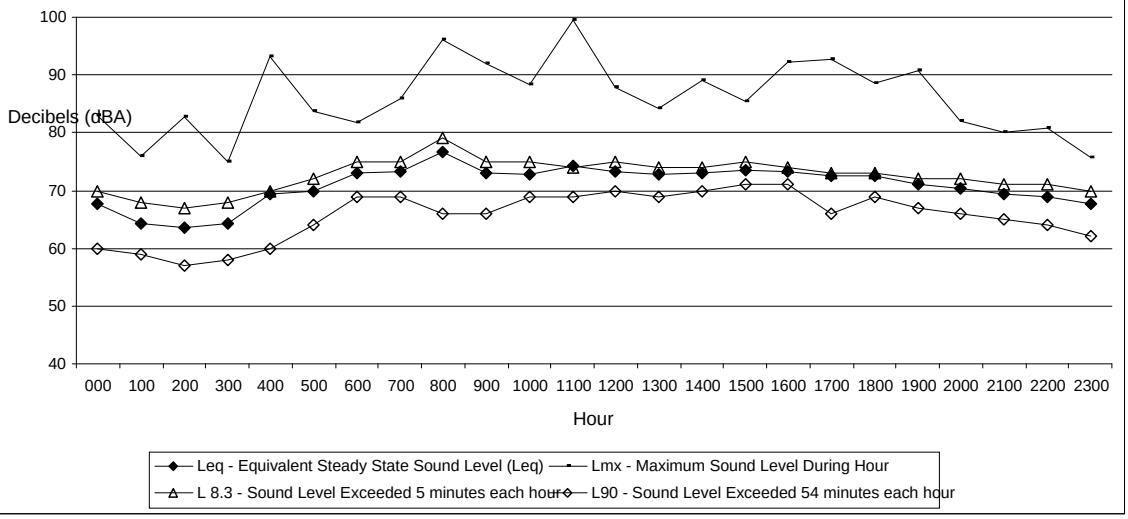

Figure 20
Site 9: S. Washington St. & 1st Ave. S
Wednesday March 07, 2007

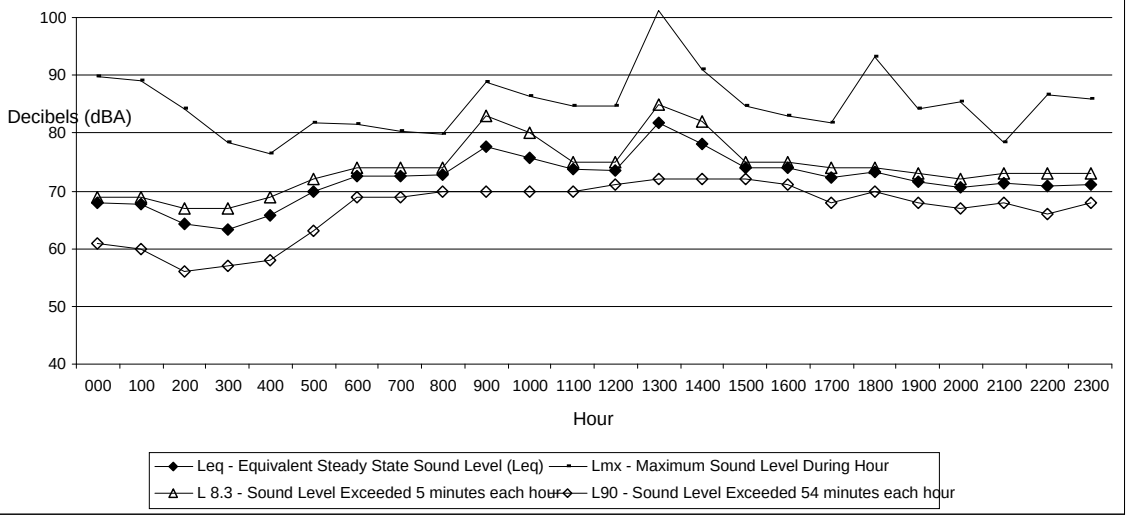

Figure 21
Site 10: S. King St. & Rainier Ave. S
Tuesday March 06, 2007