2007-2008
AIRCRAFT NOISE SURVEY
LIVERMORE MUNICIPAL AIRPORT
October-November 2007 and April 2008

BBA Project No. 07-236

Prepared For

The Cities of Livermore and Pleasanton
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Livermore Municipal Airport
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INTRODUCTION

Brown-Buntin Associates, Inc. (BBA) has performed an aircraft noise survey concerning aircraft operations at the Livermore Municipal Airport (LVK). This survey is intended to provide information to the City of Livermore to describe the noise and operational effects of aircraft operations at the airport upon residents of the cities of Livermore and Pleasanton.

In September 2001, BBA prepared a report on aircraft noise levels and altitudes based upon noise measurements and aircraft observations conducted for the City of Pleasanton in 1999 and 2000. This study was conducted with the full cooperation of the City of Livermore and the FAA. The study included long-term noise measurements at four sites in Pleasanton and Livermore; those data are summarized on pages 17 and 18 of this report.

The current survey was divided into two phases to describe aircraft noise during winter and spring conditions. This approach was selected because the use of the airport runways in the winter may differ from the usual warm weather conditions where aircraft generally takeoff and land to the west. This report summarizes the purposes, methods and results of both phases of the survey.

PURPOSES

The purposes of the aircraft noise measurement program were to:

- Describe single event aircraft noise levels in the residential areas near the airport.
- Measure representative Community Noise Equivalent Level (CNEL) values in the residential areas near the airport under known conditions.
- Describe the number and time of day of aircraft noise events.

Numerous studies conducted over the past forty-plus years have demonstrated a link between cumulative airport noise exposure as described by the CNEL metric and compatible land use. All federal agencies, as well as the State of California, have adopted land use compatibility guidelines based on this or a similar, nearly equivalent, metric. These guidelines have established the threshold for the compatibility of noise sensitive land uses to be a CNEL value of 65 dB, which is adopted as part of the California Airport Noise Regulation (California Code of Regulations, Title 21).

In California, the environmental review process required by the California Environmental Quality Act (CEQA) is one tool which can be used by a local jurisdiction to limit the noise exposures of proposed changes in land use. In addition, the California Government Code requires that each city and county adopt a Noise Element of the General Plan, which is intended to provide objective standards for acceptable noise exposure for proposed land uses. The Noise Element is a powerful tool in ensuring compatible land use in the vicinity of an airport, and applies to all new development proposals.

The City of Pleasanton adopted a Noise Element as part of its General Plan adopted August 6, 1996. Where the noise source affecting a proposed residential development is an airport, the

Noise Element states that residential construction should not be allowed in areas where the DNL (L_{dn}) exceeds 65 dB. In addition, the Noise Element states that residential developments should be "strongly discouraged" where the exterior DNL exceeds 55 dB.

If residential uses are allowed where the exterior DNL exceeds 55 dB, the Noise Element states that interior noise levels should be controlled so that maximum noise levels do not exceed 50 dBA in bedrooms or 55 dBA in other rooms. (Note that the single-family interior noise standards of the Noise Element are expressed as maximum noise levels for single events, while the exterior noise level is cited in terms of the DNL, which is a cumulative metric.)

The Pleasanton Noise Element also applies an interior aircraft noise level standard of 45 dB L_{dn} to all multi-family dwellings; this standard is consistent with the State Airport Noise Regulation.

The Pleasanton Noise Element includes a general provision which indicates that a noise environment of 60 dB DNL or less is "Normally Acceptable" for residential and other noise sensitive land uses, including schools. A noise environment of 60 dB to 75 dB DNL is considered to be "Conditionally Acceptable" for such uses, which means that the "specified land use may be permitted only after detailed analysis of the noise reduction requirements, and needed noise insulations features included in the design".

In the vicinity of the Livermore Airport, the City of Pleasanton has implemented specific provisions relating to airport noise for projects located within the Stoneridge Drive Specific Plan, which was adopted in October 1989. The Specific Plan required that a noise monitoring study be performed prior to development of new homes east of the then-proposed school site (near Mohr School). The purpose of that study was to plot the location of the 55 dB DNL contour for Livermore Airport. The Specific Plan further required that future residential uses within the 55 dB DNL would be required to be designed to meet single event interior noise levels of 50 dBA in bedrooms and 55 dBA in other rooms. These noise standards were derived from the Noise Element of the General Plan.

The City of Livermore has also adopted a Noise Element. Chapter 4 of the Livermore Noise Element contains Noise Level Guidelines for different land uses. A noise exposure up to 60 dB DNL is considered "normally acceptable" for residential construction. A noise exposure up to 70 dB L_{dn} is considered to be "conditionally acceptable" for residential construction, which requires that new construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made, and needed noise insulation features included in the design. The Noise Element does not differentiate between airports and other noise sources.

To control land use in the vicinity of the Livermore Municipal Airport, the City of Livermore developed, and currently implements, the Airport Protection Area (APA) described in the discussion of the Airport Land Use Commission.

METHODS

The methods used for the noise survey included single event and cumulative noise measurements at a total of twelve locations in the vicinity of the airport. The noise measurement equipment consisted of Larson Davis Model 820 precision integrating sound level meters fitted with Bruel & Kjaer and Larson Davis microphones. This equipment meets all of the standards of the American National Standards Institute (ANSI) for Type 1 sound level measurement systems. The measurement systems were calibrated before use with a Bruel & Kjaer Type 4230 acoustical calibrator recently certified by an accredited laboratory to be consistent with acoustical reference values maintained by the National Bureau of Standards.

All noise measurements were conducted in terms of A-weighted sound pressure levels, in decibels[1] (dB). Each sound level meter continuously samples noise levels at a rate of 32 samples per second. These data are summarized statistically in the system on an hourly basis, and individual noise events exceeding preset thresholds are stored in system memory. Event threshold values were established by BBA staff based upon the need to discriminate aircraft events from background noise levels while ensuring that the maximum number of aircraft noise events could be captured. These units are capable of operating continuously for a measurement period of up to two weeks without attention.

Statistical data presented on an hourly basis include the minimum, maximum and average noise levels, as well as other percentile values. Noise events are stored in memory with the time of day, the Sound Exposure Level (SEL), the maximum level, event duration, the entire event time history, and other parameters. These data are recovered using Larson Davis software that allows further data processing. Specifically, the software allows event discrimination based upon the maximum noise level, the event duration, the difference between A-weighted and linear peak levels, and the relative symmetry of the event time history. The software then provides a listing of noise events which are presumed to be created by aircraft operations.

The long-term noise monitoring was performed from October 29 to November 7, 2007, and April 15 to April 23, 2008. The noise monitoring units for long-term measurements in each phase were placed in four locations in the communities adjacent to the airport, and in one location near the west end of Runway 25R. The sites were selected on the basis of proximity to the airport and the willingness of individuals to allow placement of the units on their property. For the second phase, three of the sites were relocated by up to about 200 feet from the sites used in Phase 1 of noise measurements, since the previous homeowners were not available. The new Phase 2 sites were numbered sites 9, 10 and 11, and the locations are near to Sites 3, 1 and 2 in the Phase 1 measurement period, respectively.

In addition, BBA staff operated a sound level meter at or near all four of the long-term measurement locations for about 4 hours each on October 30-31, 2007 and April 22-23, 2008, to obtain additional data describing aircraft noise levels and the locations of aircraft overflights. Site 12 was added to sites 6, 7 and 8 that were employed for the winter measurement period.

[1] Refer to Appendix A for definitions of acoustical terms used in this report.

Weather conditions during Phase 1 included mild days (60 to 70 degrees Fahrenheit) with occasional fog. Weather conditions during Phase 2 included mild, clear days (60 to 70 degrees Fahrenheit).

The noise monitoring units were programmed on site to ensure that aircraft noise events would be captured in system memory to the maximum practical extent, without interference from extraneous noise sources, such as traffic. The noise monitoring sites used for both monitoring periods are shown by Figures 1, 2 and 3, and are described below.

Site 1: 1386 Arlington Road, Livermore. This home is located between the approach flight paths to Runways 25L and 25R, about 0.7 nautical miles from the east end of Runway 25R. Aircraft approaching Runways 25L and 25R pass nearly overhead. The long-term monitoring unit was placed in the back yard. The event threshold was set to 65 dBA.

Site 2: 1322 Le Havre Circle, Livermore. This home is located between the approach flight paths to Runways 25L and 25R, about 1.2 nautical miles from the east end of Runway 25R. Many aircraft approaching Runways 25L and 25R pass nearly overhead, though some arrivals turn to runway heading between this site and the airport. The long-term monitoring unit was placed in the back yard. The event threshold was set to 60 dBA.

Site 3: 3318 Vermont Street, Pleasanton. This home is located about 1.25 nautical miles from the start of takeoff roll on Runway 7L. Aircraft departing on Runways 25L and 25R may pass over this site, and aircraft turning to either the north or south may be audible. The approach flight paths to Runway 7L may be directly overhead. The long-term monitoring unit was placed in the back yard. The event threshold was set to 65 dBA.

Site 4: 2849 Chocolate Street, Pleasanton. This home is located between the approach flight paths to Runways 7L and 7R, about 1.2 nautical miles from the west end of Runway 7L. Aircraft approaching Runways 7L and 7R may pass nearly overhead. The long-term monitoring unit was placed in the front yard. The event threshold was set to 60 dBA.

Site 5: Livermore Municipal Airport. The long-term noise monitoring unit was placed at the north edge of the taxiway about 1200 feet east of the west end of Runway 7L/25R. Aircraft departing on Runway 25R created noise events at this location. It was intended that the records of noise events would be used to count departures and to match noise events at Sites 9 and 4 to departures on Runway 25R. The event threshold was set to 65 dBA.

Site 6: York Street and Arlington Road, Livermore. This short-term measurement site is near Sites 2 and 10, and is located between the approach flight paths to Runways 25L and 25R, about 0.7 nautical miles from the east end of Runway 25R. Aircraft approaching Runway 25L pass nearly overhead. The sound level meter was placed along the sidewalk. The event threshold was established manually.

Site 7: East End of Staples Ranch Drive. This short-term measurement site is about 2 nautical miles west of the start of takeoff roll on Runways 25R, near Sites 3 and 9. Aircraft departing on Runways 25L and 25R may pass over this site, and aircraft turning to either the north or south may be audible. The event threshold was established manually.

Site 8: Al Coffodio Park, Livermore. This short-term measurement site is located near Sites 1 and 11, and lies between the approach flight paths to Runways 25L and 25R, about 1.2 nautical miles from the east end of Runway 25R. Many aircraft approaching Runways 25L and 25R pass nearly overhead, though some arrivals turn to runway heading between this site and the airport. The sound level meter was placed at the west sidewalk of the park. The event threshold was established manually.

Site 9: 3310 Vermont Street, Pleasanton. This home is located about 1.25 nautical miles from the start of takeoff roll on Runway 7L. Aircraft departing on Runways 25L and 25R may pass over this site, and aircraft turning to either the north or south may be audible. The approach flight paths to Runway 7L may be directly overhead. The long-term monitoring unit was placed in the back yard. The event threshold was set to 60 dBA.

Site 10: 1397 Arlington Road, Livermore. This home is located between the approach flight paths to Runways 25L and 25R, about 0.7 nautical miles from the east end of Runway 25R. Aircraft approaching Runways 25L and 25R pass directly overhead. The long-term monitoring unit was placed in the back yard. The event threshold was set to 60 dBA.

Site 11: 1380 Le Havre Circle, Livermore. This home is located between the approach flight paths to Runways 25L and 25R, about 1.2 nautical miles from the east end of Runway 25R. Many aircraft approaching Runways 25L and 25R pass nearly overhead, though some arrivals turn to runway heading between this site and the airport. The long-term monitoring unit was placed in the back yard. The event threshold was set to 60 dBA.

Site 12: East End of Stoneridge Drive, Pleasanton. This short-term measurement site is about 2 nautical miles west of the start of takeoff roll on Runways 25R, near Site 4. Aircraft departing on Runways 25L and 25R may pass over this site, and aircraft turning to either the north or south may be audible. The event threshold was established manually.

Cumulative aircraft noise levels and identification of presumed aircraft noise events were calculated using the Larson Davis Airport Noise Monitoring software package. This software allows the user to establish weighting factors for the maximum noise level, event duration, event time history, and frequency content. BBA's experience using this software at several other airports has provided some basic assumptions which reasonably separate aircraft and community noise events.

BBA has prepared software to correlate noise events at Site 5 (at the airport) with noise events at Sites 3 and 4. The relationships between the times of noise event onset at each site may be

established from aircraft observations at Site 5 and noise events at Sites 3, 4 and 9. However, during the winter measurement session, the sound level meter at Site 5 malfunctioned, and no matching data were available for Phase 1. The BBA noise event matching software was used in Phase 2 as a check on the reasonableness of the aircraft noise event discrimination of the Larson Davis software at those two sites, and was also used to estimate the percentage of aircraft departure that turned to the north or south before reaching the residential areas west of the Airport.

This and other aircraft noise analyses prepared for the City of Pleasanton in 1999 using the BBA event matching software indicated that the Larson Davis software aircraft noise determinations probably included some non-aircraft noise events. For this survey, BBA assumed that the numbers of aircraft noise events presumed by the Larson Davis software would provide a worst-case measure of aircraft noise levels. These numbers are described below as the "presumed" numbers of operations, and the associated noise levels are described as "presumed" aircraft noise levels.

The numbers of presumed aircraft noise events per day were compared to the reported daily operations at Livermore Municipal Airport, and to historical airport operations data, to assess the relative traffic volume during the sample period.

Figure 1
Aircraft Noise Measurement Sites
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Figure 2
Aircraft Noise Measurement Sites
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Figure 3
Aircraft Noise Measurement Sites
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

RESULTS

Cumulative Noise Levels

The measured daily aircraft and overall CNEL values at each long-term monitoring site are listed in Tables I and II. The "presumed" aircraft noise level values in Table I were calculated by the Larson Davis software by separating likely aircraft noise events from other noise. The values in Table II were calculated from the total exposure (all noise events plus all background noise) at each site.

TABLE I
PRESUMED AIRCRAFT NOISE LEVELS
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Date	Aircraft CNEL, dB						
	Site 1	**Site 2**	**Site 3**	**Site 4**	**Site 9**	**Site 10**	**Site 11**
Tuesday October 30	53.7	55.5	48.4	48.8	--	--	--
Wednesday October 31	53.4	51.2	44.9	46.3	--	--	--
Thursday November 1	53.1	51.2	49.3	49.1	--	--	--
Friday November 2	53.5	50.3	51.5	52.8	--	--	--
Saturday November 3	53.9	58.0	49.5	49.9	--	--	--
Sunday November 4	54.2	52.0	47.0	47.9	--	--	--
Monday November 5	54.9	52.6	49.7	55.0	--	--	--
Tuesday November 6	53.7	47.7	51.9	52.8	--	--	--
Wednesday April 16	--	--	--	49.8	51.9	61.1	54.8
Thursday April 17	--	--	--	51.7	51.6	53.6	54.5
Friday April 18	--	--	--	49.0	57.8	58.4	54.8
Saturday April 19	--	--	--	47.3	48.4	62.4	54.7
Sunday April 20	--	--	--	51.8	53.5	54.5	57.4
Monday April 21	--	--	--	54.2	50.8	57.1	56.6
Tuesday April 22	--	--	--	49.8	50.2	53.8	52.7
Energy Average:	**53.8**	**53.4**	**49.5**	**51.1**	**53.1**	**58.5**	**55.3**

TABLE II
OVERALL NOISE LEVELS
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Date	Total CNEL, dB						
	Site 1	**Site 2**	**Site 3**	**Site 4**	**Site 9**	**Site 10**	**Site 11**
Tuesday October 30	59.4	59.1	53.1	53.4	--	--	--
Wednesday October 31	58.2	57.8	53.2	51.8	--	--	--
Thursday November 1	59.1	57.6	56.4	53.3	--	--	--
Friday November 2	62.8	61.7	60.6	57.4	--	--	--
Saturday November 3	61.5	62.2	61.3	57.0	--	--	--
Sunday November 4	61.2	60.4	58.1	55.1	--	--	--
Monday November 5	62.9	61.9	58.1	58.3	--	--	--
Tuesday November 6	60.1	57.4	58.0	55.4	--	--	--
Wednesday April 16	--	--	--	57.8	59.9	64.0	60.0
Thursday April 17	--	--	--	58.6	59.5	62.2	60.5
Friday April 18	--	--	--	58.0	60.4	62.1	58.7
Saturday April 19	--	--	--	54.8	54.2	65.3	58.7
Sunday April 20	--	--	--	55.9	56.5	58.5	59.9
Monday April 21	--	--	--	57.8	54.0	60.1	58.6
Tuesday April 22	--	--	--	54.8	54.4	57.1	56.1
Energy Average:	**60.9**	**60.2**	**58.2**	**56.4**	**57.8**	**62.1**	**59.1**

The presumed daily aircraft-caused CNEL values measured at the long-term sites were less than 65 dB CNEL. The overall daily CNEL values presented in Table II are higher than the aircraft-only CNEL values shown in Table I, and the overall level exceeded 65 dB CNEL on only one occasion. This means that the measured aircraft noise levels, as well as the overall noise levels, were well within the annual average standard of 65 dB CNEL that is applied by the California Airport Noise Regulation.

Hourly noise level statistical data for each of the long-term noise measurement sites are graphically presented in Appendix B. These data represent the total noise exposure, and include the average (L_{eq}) and maximum hourly noise levels, as well as the levels exceeded 50% (L_{50}) and 90% (L_{90}) of the time. The L_{50} value represents the median noise level, and the L_{90} value is representative of the background noise level (See Appendix A).

Single Event Noise Levels

Single event noise measurements were conducted in terms of the instantaneous maximum noise level (Lmax) and the Sound Exposure Level (SEL), which represents the sum of all of the noise energy that occurred during the noise event. There are no state or federal standards for acceptable Lmax or SEL values. In general, there is a potential for speech interference when maximum noise levels exceed 60 dB, and there is a potential for awakenings when outdoor SEL values reach about 80 dB.

The measurement results and the numbers of observed events are summarized in Table III. (See Figures 1 and 2 for the site locations.) These data show the relative noise levels of the different categories of aircraft types observed in the field. Many flights during the measurement periods consisted of touch-and-go operations by small single-engine aircraft. These aircraft operations are typically very quiet, especially for arrivals. During operations from east to west, touch-and-go aircraft typically do not fly over residential areas in Pleasanton, and turn to runway heading between Sites 1 and 2. As a result, these operations usually do not produce noise levels exceeding the fixed event thresholds at Sites 2, 3, 4, 9 or 11.

The single event noise measurement and observation information collected on the field data sheets is presented as Appendix C.

TABLE III
MEAN MEASURED SINGLE EVENT NOISE LEVELS
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Aircraft Type	Site 6			Site 7			Site 8			Site 12*		
	SEL, dB	Lmax, dB	No. of Events	SEL, dB	Lmax, dB	No. of Events	SEL, dB	Lmax, dB	No. of Events	SEL, dB	Lmax, dB	No. of Events
Single Prop	79.2	66.8	64	75.3	63.5	21	78.4	61.2	27	77.6	68.0	3
Single Turboprop	--	--	0	--	--	0	87.7	79.8	2	--	--	0
Twin Prop	84.9	77.4	10	84.4	69.6	4	78.1	67.2	2	77.4	70.1	1
Twin Turboprop	91.5	85.7	1	77.2	68.7	2	83.5	75.0	2	74.1	63.2	1
Jet	86.4	78.8	2	88.9	73.2	5	83.5	75.4	2	87.6	78.3	2
Helicopter	--	--	0	76.8	67.0	1	--	--	0	--	--	0

Note: Not all observed events produced noise levels exceeding the event thresholds.
* - Includes two events logged at Site 4 in October 2007

To the extent that they were observed (at Sites 7 and 12), jet aircraft departures occurring near Pleasanton produced noticeably higher noise levels than other aircraft types. Although jet aircraft comprise a relatively small percentage of overall operations at LVK, their contribution to the total noise exposure as described by CNEL is relatively large.

Aircraft Operations

The numbers of daily operations during the measurement periods were obtained from the FAA Tower, and are listed in Table IV. Note that operations include both takeoffs and landings. The total numbers of takeoffs or landings are provided in this table to allow comparison to the numbers of presumed aircraft noise events per day in Table V. On a typical day, a given noise monitoring site would be exposed to either takeoffs or landings, not both.

TABLE IV
DAILY AIRCRAFT OPERATIONS REPORTED BY THE FAA TOWER
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Date	Airport Operations	Takeoffs or Landings
Tuesday October 30	535	268
Wednesday October 31	395	198
Thursday Nov. 1	428	214
Friday Nov. 2	639	320
Saturday Nov. 3	634	317
Sunday Nov. 4	522	261
Monday Nov. 5	565	283
Tuesday Nov. 6	511	256
Wednesday April 16	502	251
Thursday April 17	519	260
Friday April 18	469	235
Saturday April 19	207	104
Sunday April 20	497	249
Monday April 21	425	213
Tuesday April 22	349	175
Average:	**480**	**240**

The daily numbers of presumed aircraft noise events at each of the long-term noise measurement sites are presented in Table V. These values may be compared to the total numbers of takeoffs or landings presented in Table IV. On a typical day, a given noise monitoring site would be exposed to either takeoffs or landings, not both.

TABLE V
DAILY NUMBERS OF PRESUMED AIRCRAFT NOISE EVENTS
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Date	Presumed Aircraft Noise Events							
	Site 1	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 9**	**Site 10**	**Site 11**
Tuesday October 30	80	108	48	44	No data	--	--	--
Wednesday October 31	75	50	43	47	No data	--	--	--
Thursday Nov. 1	88	73	58	50	No data	--	--	--
Friday Nov. 2	137	104	86	78	No data	--	--	--
Saturday Nov. 3	130	98	118	78	No data	--	--	--
Sunday Nov. 4	106	100	55	51	No data	--	--	--
Monday Nov. 5	125	102	65	74	No data	--	--	--
Tuesday Nov. 6	83	43	74	61	No data	--	--	--
Wednesday April 16	--	--	--	92	260	140	182	163
Thursday April 17	--	--	--	127	236	124	163	149
Friday April 18	--	--	--	113	241	173	175	153
Saturday April 19	--	--	--	62	249	48	303	112
Sunday April 20	--	--	--	76	254	97	206	120
Monday April 21	--	--	--	82	215	120	179	127
Tuesday April 22	--	--	--	44	202	60	122	69
Average:	**103**	**85**	**68**	**72**	**167**	**109**	**190**	**128**

Not every aircraft passing over a site will trigger a noise event at each measurement site. In most cases, the reason is that the aircraft noise level is very low, so that it cannot be isolated from background noise sources, such as traffic. As a result, fewer aircraft noise events were recorded at any site than the total number of takeoffs or landings that may have passed over the sites.

The numbers of daily operations reported by the FAA during the survey period were also compared to annual average daily operations at the airport. According to the FAA, the average number of daily operations at the Livermore Municipal Airport in the 12-month period from May 1, 2007 to April 30, 2008 was 484. Thus the average number of daily aircraft operations during the two survey periods was approximately equal to the average day in the prior 12 months.

Runway Use

During the measurement periods, Runways 25L and 25R were used most of the time. This means that most arrivals came to the airport from the east, and most departures were to the west. Table VI lists the hours of runway use as recorded by the FAA Tower at LVK. Note that the FAA Tower is open for 14 hours of the day, from 0700 (7 a.m.) to 2100 (9 p.m.) daily.

TABLE VI
PERIODS OF RUNWAY USE REPORTED BY FAA TOWER
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Date	Runways 25L/25R*		Total Time	Runways 7L/7R**		Total Time
	From	To		From	To	
Monday October 29	0700	2100	14 hrs	NOT USED		
Tuesday October 30	0700	2100	14 hrs	NOT USED		
Wednesday October 31	0700	2100	14 hrs	NOT USED		
Thursday November 1	0700	2100	14 hrs	NOT USED		
Friday November 2	0700	1233	5 hrs, 33 mins	1233	1708	4 hrs, 35 mins
	1708	2100	3 hrs, 52 mins			
Saturday November 3	0700	1220	5 hrs, 20 mins	1220	1755	5 hrs, 35 mins
	1755	2100	3 hrs, 5 mins			
Sunday November 4	0700	1053	3 hrs, 53 mins	1053	1653	6 hrs
	1653	2100	4 hrs, 7 mins			
Monday November 5	0700	1316	6 hrs, 16 mins	1316	1539	1 hr, 33 mins
	1539	2100	5 hrs, 11 mins			
Tuesday November 6	0700	2100	14 hrs	NOT USED		
Wednesday November 7	0700	2100	14 hrs	NOT USED		
Wednesday April 16	0700	2100	14 hrs	NOT USED		
Thursday April 17	0700	2100	14 hrs	NOT USED		
Friday April 18	0700	2100	14 hrs	NOT USED		
Saturday April 19	0700	2100	14 hrs	NOT USED		
Sunday April 20	0700	2100	14 hrs	NOT USED		
Monday April 21	0700	2100	14 hrs	NOT USED		
Tuesday April 22	0700	2100	14 hrs	NOT USED		

*- operations from east to west
**- operations from west to east

COMPARISON TO PREVIOUS NOISE STUDIES

In September 2001, BBA prepared an aircraft noise and altitude study based upon noise measurements and aircraft observations conducted for the City of Pleasanton in 1999 and 2000. This study was conducted with the full cooperation of the City of Livermore and the FAA. The study included long-term noise measurements at four sites in Pleasanton and Livermore, as shown by Figure 4, based upon Figure IV-1 of the BBA study. Note that the 1999-2000 measurement Site 4 (1380 LeHavre Circle, Livermore) is identical to Site 11 that was used in April 2008.

Figure 4 also shows the predicted locations of the CNEL contours due to Livermore Municipal Airport operations in 2011, as described by the Airport Protection Area (APA) that was adopted by the Alameda County Airport Land Use Commission in January 1993.

Table VII lists the aircraft-caused CNEL values measured at Sites 1-4 in 1999-2000.

TABLE VII
PRESUMED AIRCRAFT NOISE LEVELS
City of Pleasanton Airport Aircraft Noise Survey
July 1999 and January 2000

Date	Aircraft CNEL, dB			
	Site 1	Site 2	Site 3	Site 4
July 13, 1999	36.2	52.0	48.3	54.1
July 14, 1999	47.5	53.5	52.9	55.2
July 15, 1999	44.1	53.8	50.8	55.7
July 16, 1999	41.4	51.4	50.9	56.3
July 17, 1999	44.3	49.0	49.5	51.1
July 18, 1999	43.3	50.3	47.8	54.6
July 19, 1999	42.8	49.9	50.6	53.0
January 13, 2000	41.2	46.9	49.5	54.5
January 14, 2000	42.8	49.6	50.4	49.7
January 15, 2000	37.4	46.6	44.7	51.4
January 16, 2000	52.3	44.4	40.5	47.7
January 17, 2000	0	39.1	39.5	44.7
January 18, 2000	32.2	52.8	50.7	52.2
January 19, 2000	33.1	46.4	46.9	46.7
January 20, 2000	37.3	48.2	48.7	51.9
January 21, 2000	42.5	49.2	50.5	55.2
January 22, 2000	40.8	44.4	44.3	50.0

TABLE VII PRESUMED AIRCRAFT NOISE LEVELS City of Pleasanton Airport Aircraft Noise Survey July 1999 and January 2000				
Date	**Aircraft CNEL, dB**			
	Site 1	**Site 2**	**Site 3**	**Site 4**
January 23, 2000	34.4	43.9	43.5	44.6
January 24, 2000	23.3	46.5	47.1	48.3
January 25, 2000	36.5	49.3	49.8	51.3
January 26, 2000	37.4	52.0	51.2	51.3
Average:	43.1	49.8	49.1	52.5

The noise measurement data collected at Site 4 in 1999-2000 can be compared directly to the data collected at Site 11 in the 2007-2008 noise survey. Table VIII lists the average measured aircraft-caused daily CNEL values at that location in each noise measurement period. The average measured aircraft CNEL in April 2008 was 2.8 dB higher than the average value in 1999-2000, but was only 0.7 dB higher than the average value measured in July 1999. The variation in measured levels may be within the normal range that is influenced by factors such as flight school activity and weather.

TABLE VIII MEASURED AIRCRAFT NOISE LEVELS 1380 Le Havre Circle, Livermore				
Period	July 1999	January 2000	April 2008	Average
CNEL, dB	54.6	51.0	55.3	53.4

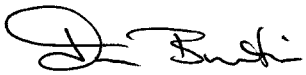
The data presented above and in Table I indicate that the measured aircraft-caused CNEL values in Livermore and Pleasanton in 2007-2008 remain below those projected by the APA for the Year 2011 as shown by Figure 4. Specifically, the current measurement sites 1, 2, 10 and 11 in Livermore are located between the Year 2011 60 dB and 65 dB CNEL contours, which means that one would expect to measure aircraft CNEL values at these sites that are higher than 60 dB. However, the average measured aircraft CNEL values at each of these sites were lower than 60 dB.

In Pleasanton, current measurement sites 3, 4 and 9 are located slightly outside the predicted location of the Year 2011 60 dB CNEL contour shown by Figure 4, which means that one would expect to measure aircraft CNEL values there that are slightly less than 60 dB. In contrast, the average measured aircraft CNEL values at each of these sites were less than 55 dB.

CONCLUSIONS

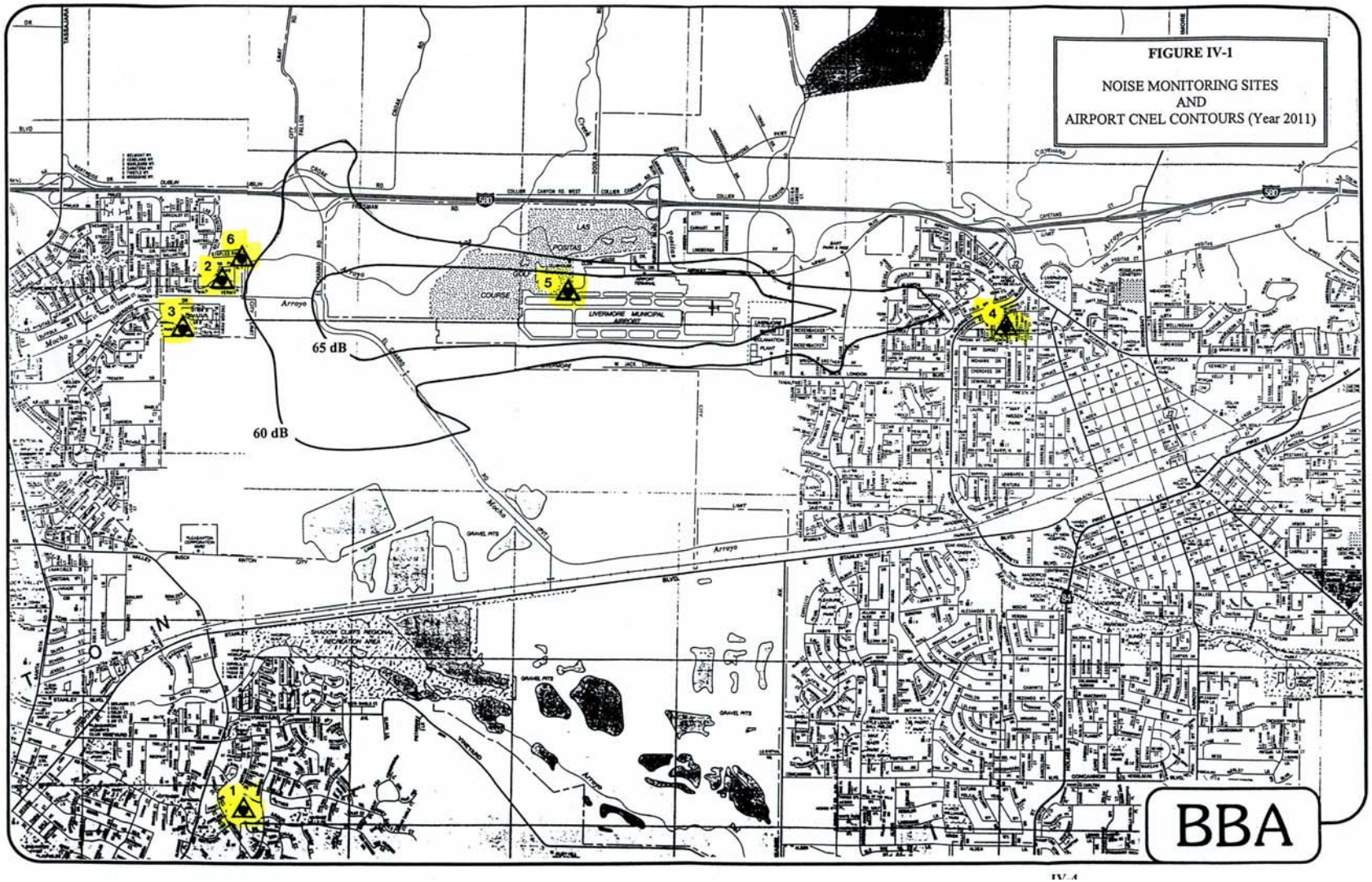
In summary, this aircraft noise survey confirms that the average aircraft noise levels associated with operations at the Livermore Municipal Airport are lower than anticipated in past projections. Those projections predicted that the 60 dB CNEL contour would reach into the West Livermore residential area. However, since sites 1 and 10 are located at the eastern boundary of the Airport, the study data confirmed that the 60 dB CNEL contour has not reached the residential area. In Pleasanton, the predictions were that the 60 dB CNEL contour would approach the westernmost residential area, but measurement sites 3, 4, and 9 at this location captured aircraft-caused CNEL values that were less than 55 dB. Further, the actual aircraft-caused CNEL levels are far below the 65 dB CNEL level of concern as presented in state and federal regulations.

Respectfully submitted,
Brown-Buntin Associates, Inc.



Jim Buntin
Vice President

Figure 4
Noise Monitoring Sites Employed in 1999-2000
And Predicted Airport CNEL Contours for Year 2011



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APPENDIX A

ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

CNEL: Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DNL/L_{dn}: Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq}: Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

NOTE: The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max}: The maximum noise level recorded during a noise event.

L_n: The sound level exceeded "n" percent of the time during a sample interval (L_{90}, L_{50}, L_{10}, etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

NOISE LEVEL REDUCTION (NLR): The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of "noise level reduction" combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

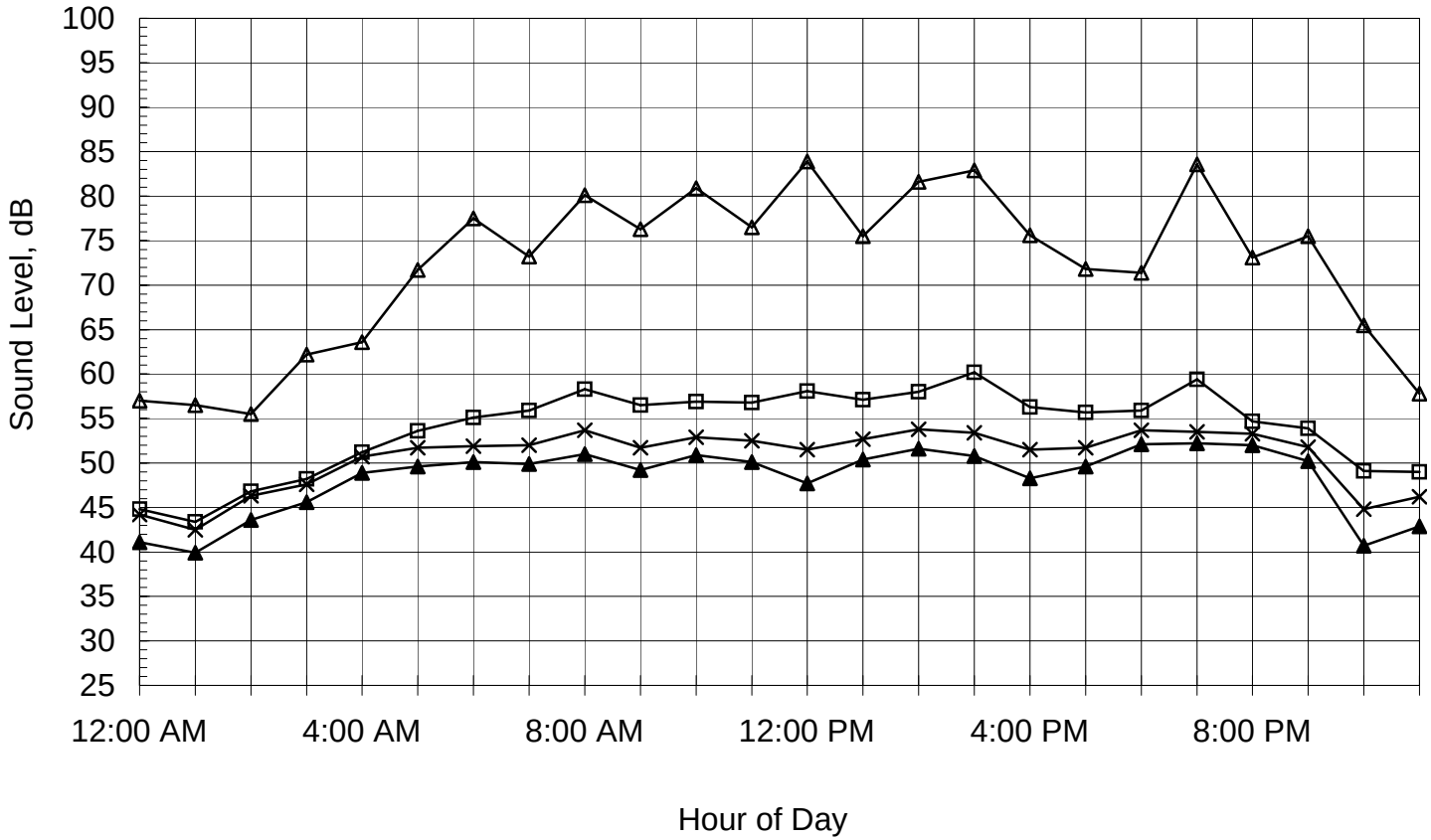
SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION CLASS (STC): The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.

Figure B-1: Measured Hourly Noise Levels

LVK Site 1

October 30, 2007

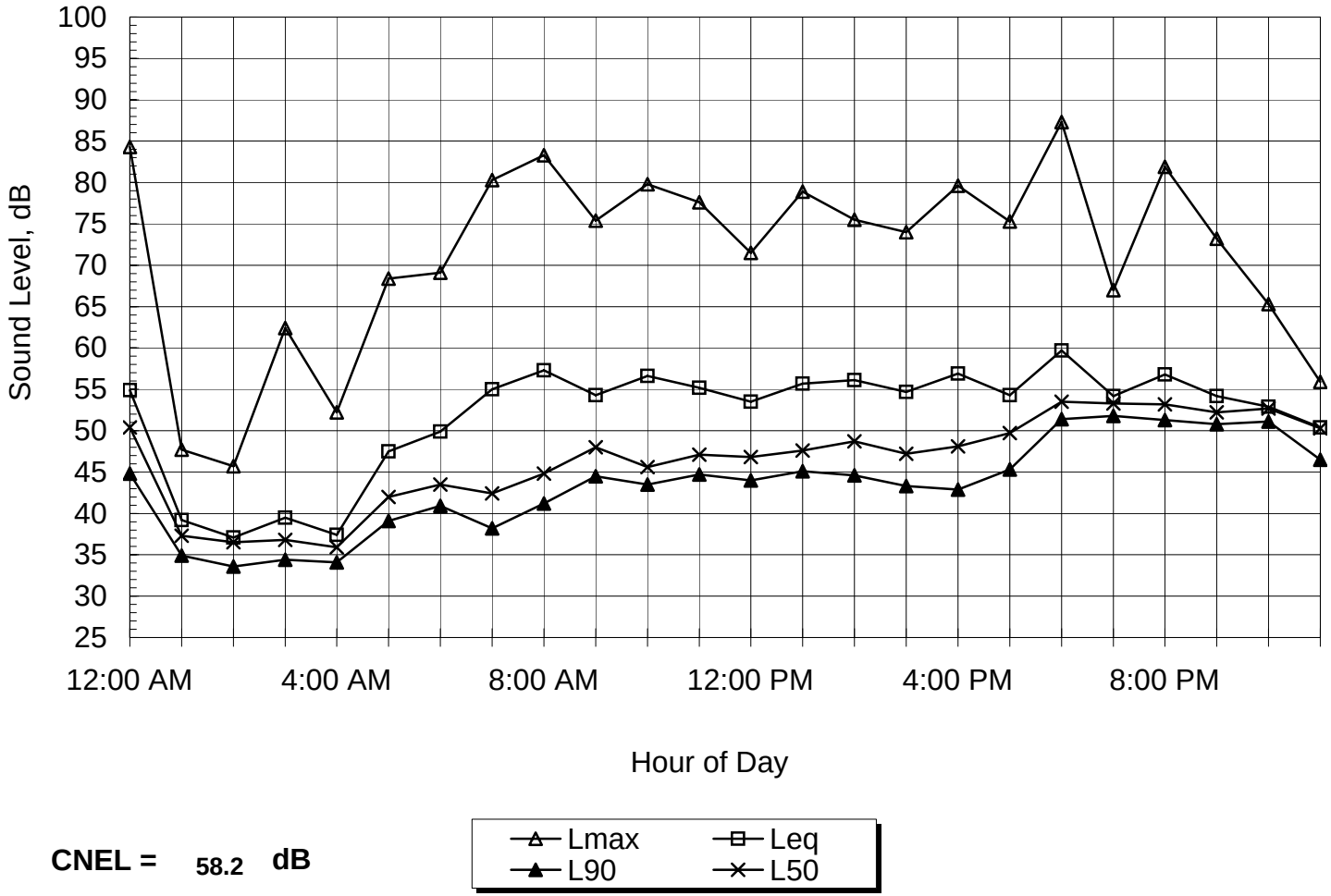


CNEL = 59.4 dB

Figure B-2: Measured Hourly Noise Levels

LVK Site 1

October 31, 2007

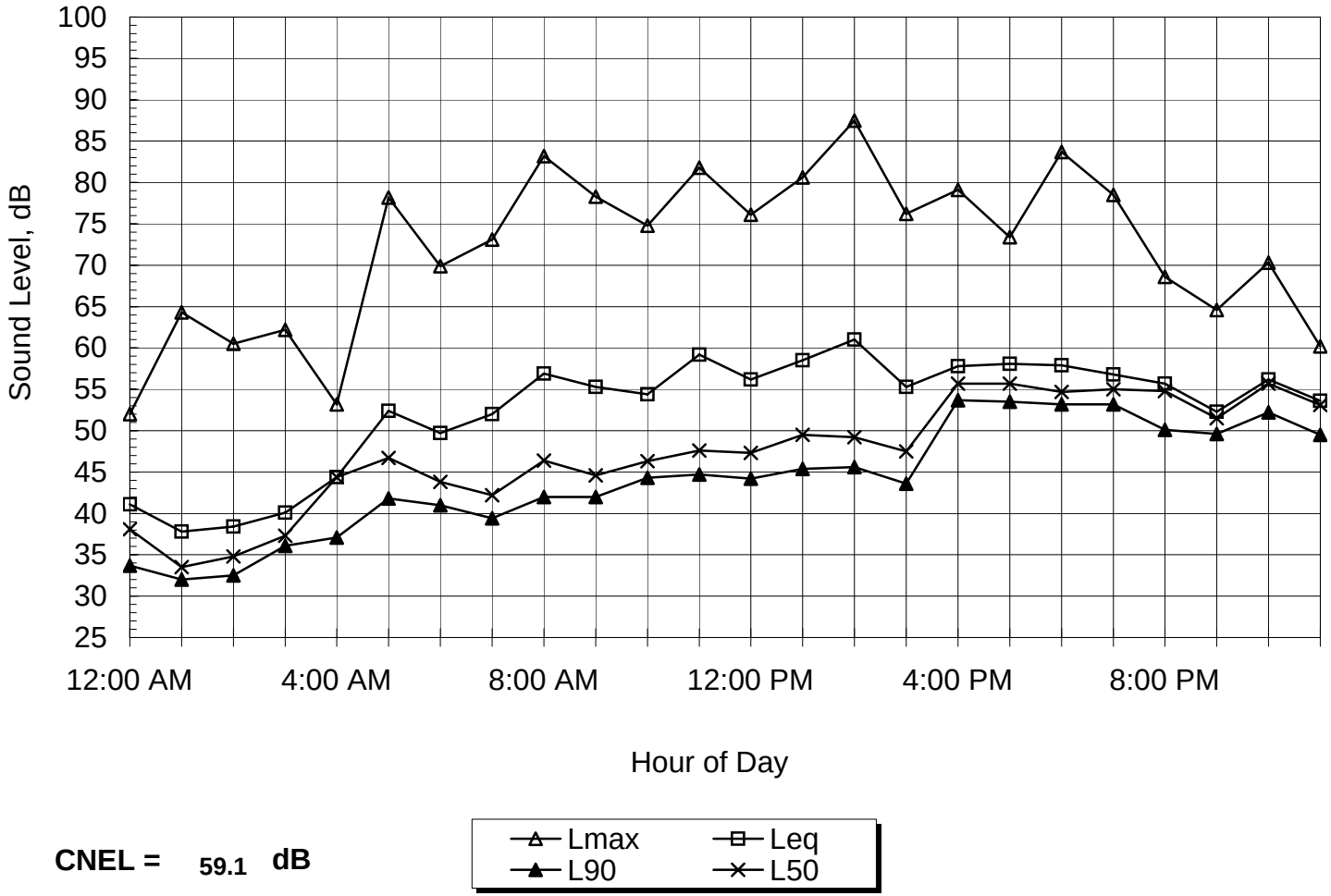


CNEL = 58.2 dB

Figure B-3: Measured Hourly Noise Levels

LVK Site 1

November 1, 2007

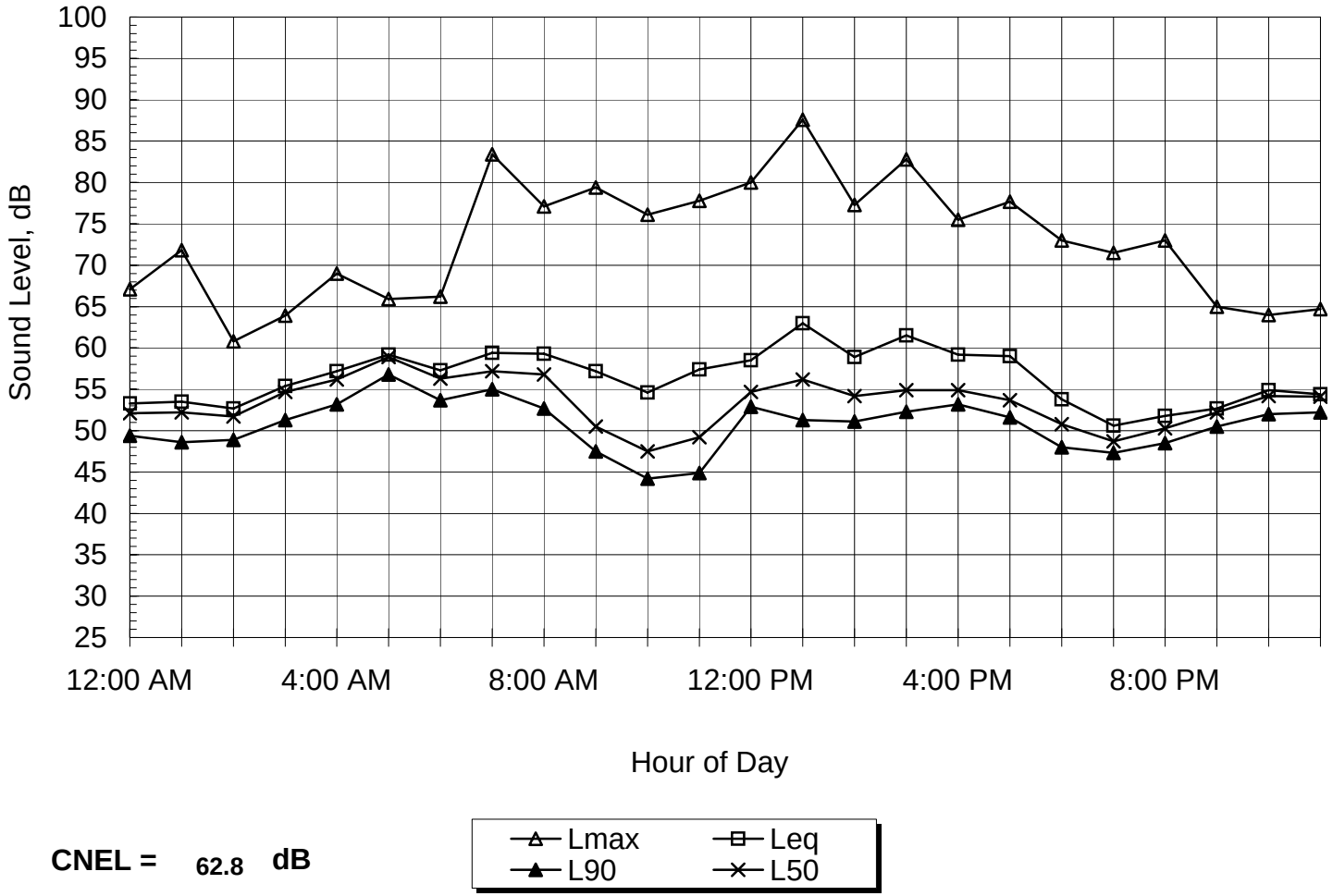


CNEL = 59.1 dB

Figure B-4: Measured Hourly Noise Levels

LVK Site 1

November 2, 2007

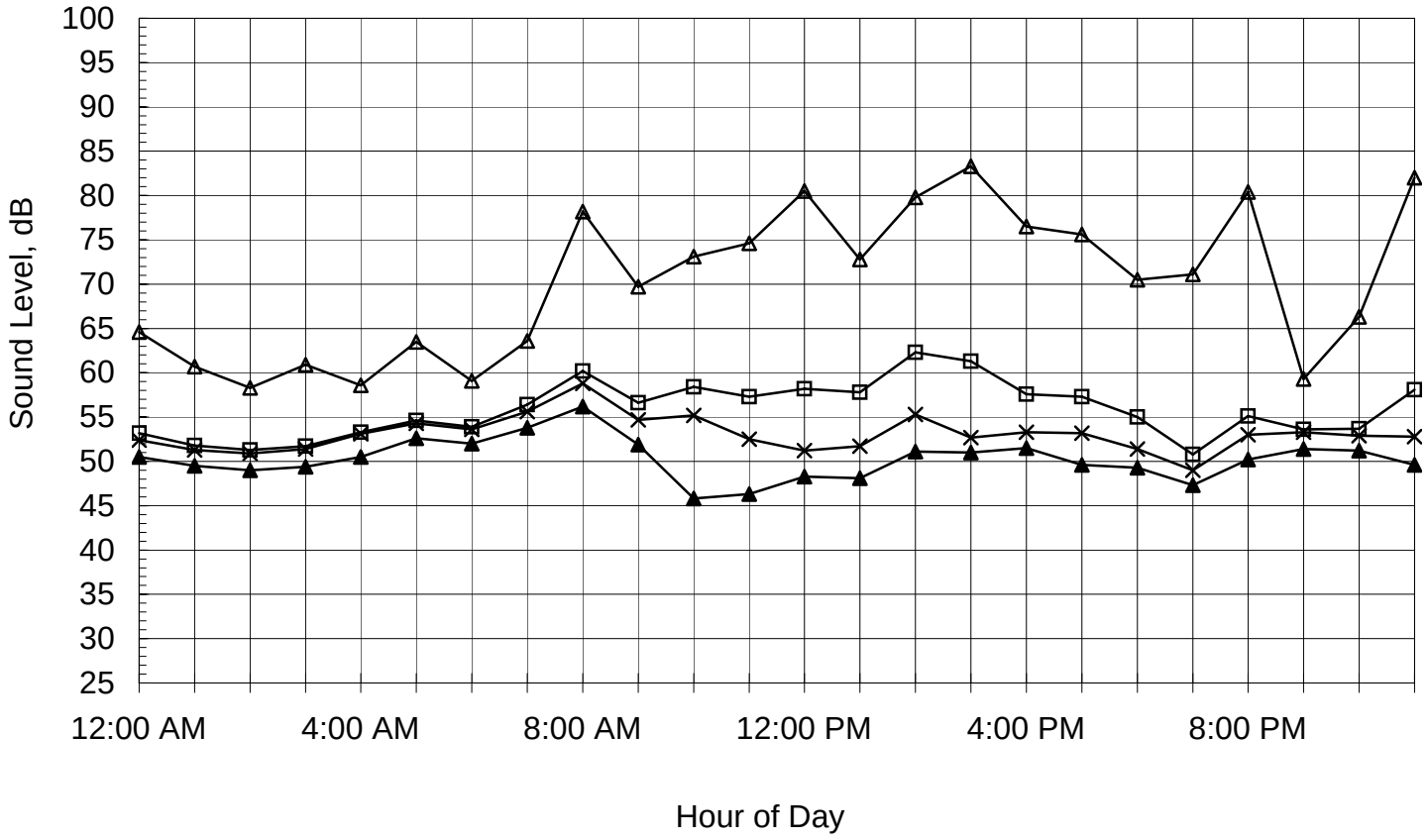


CNEL = 62.8 dB

Figure B-5: Measured Hourly Noise Levels

LVK Site 1

November 3, 2007

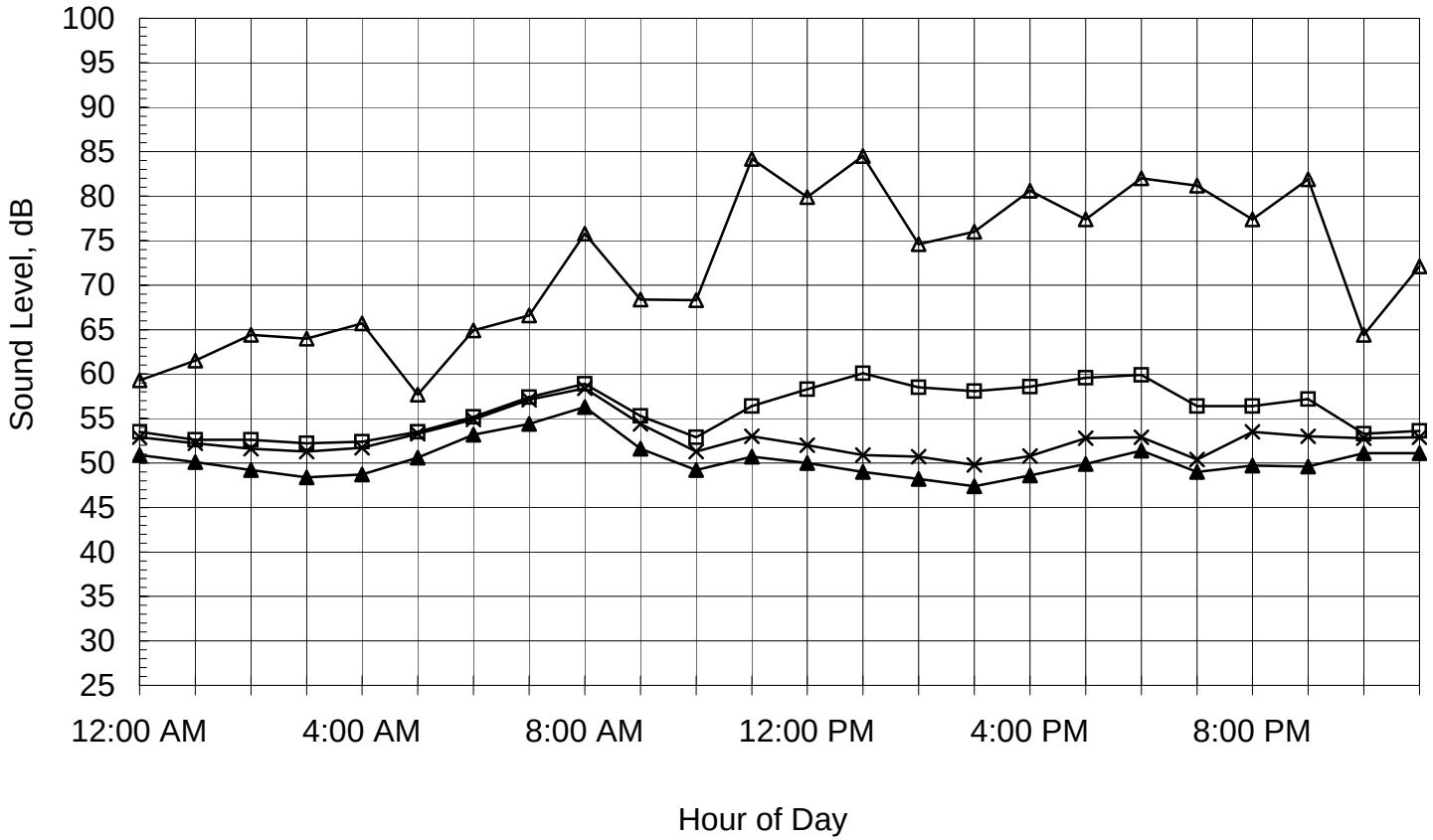


CNEL = 61.5 dB

Figure B-6: Measured Hourly Noise Levels

LVK Site 1

November 4, 2007

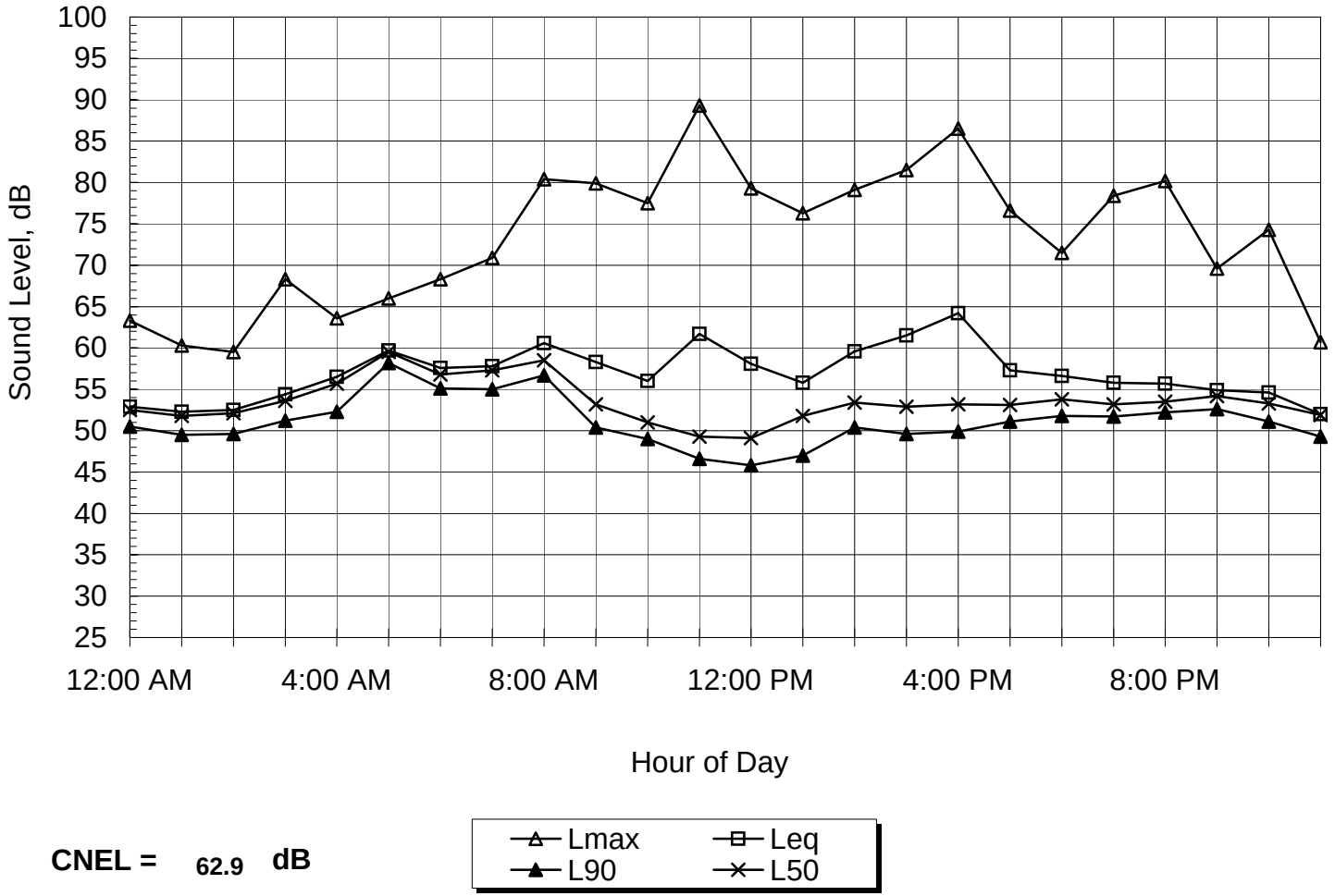


CNEL = 61.2 dB

Figure B-7: Measured Hourly Noise Levels

LVK Site 1

November 5, 2007

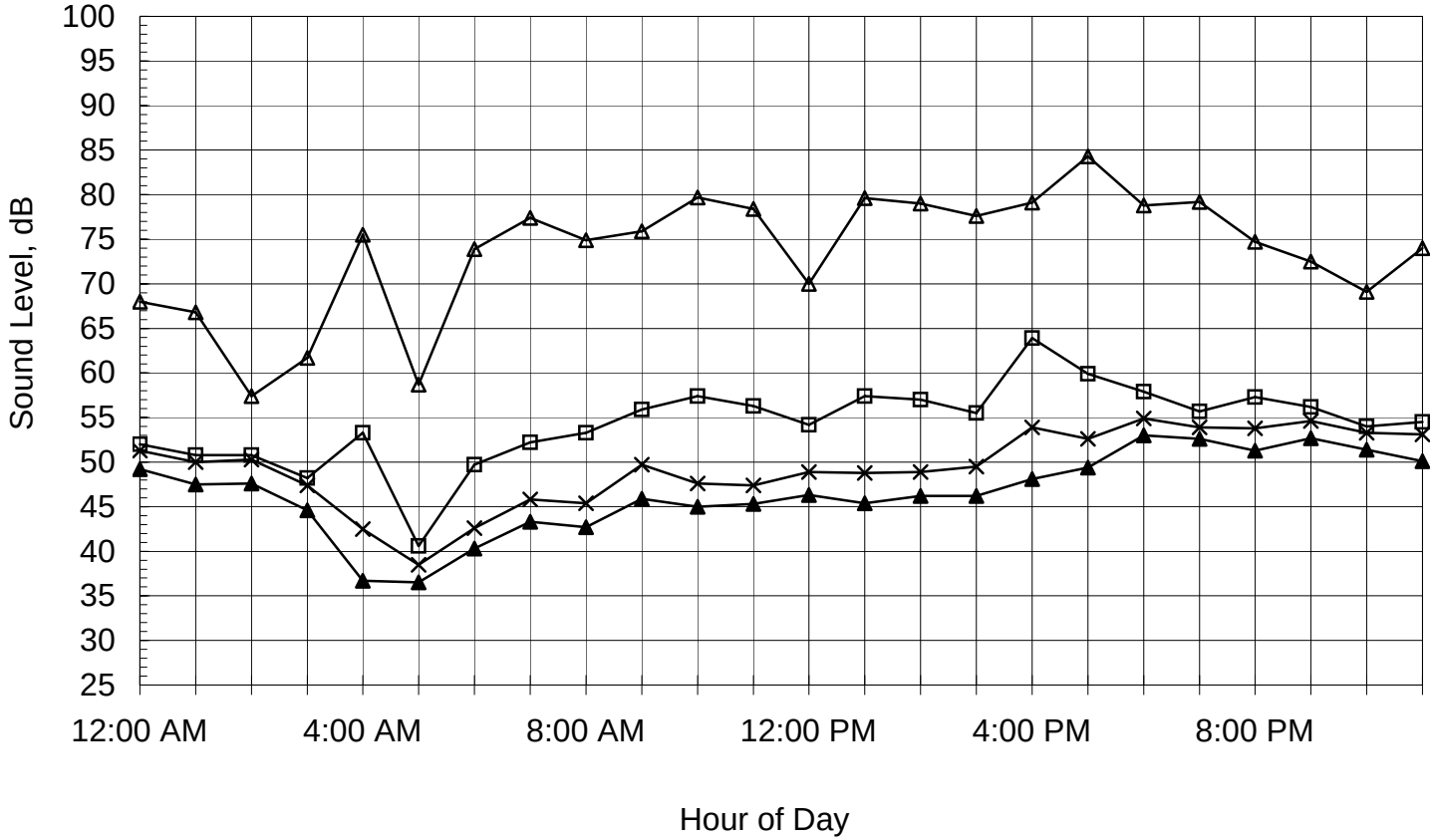


CNEL = 62.9 dB

Figure B-8: Measured Hourly Noise Levels

LVK Site 1

November 6, 2007

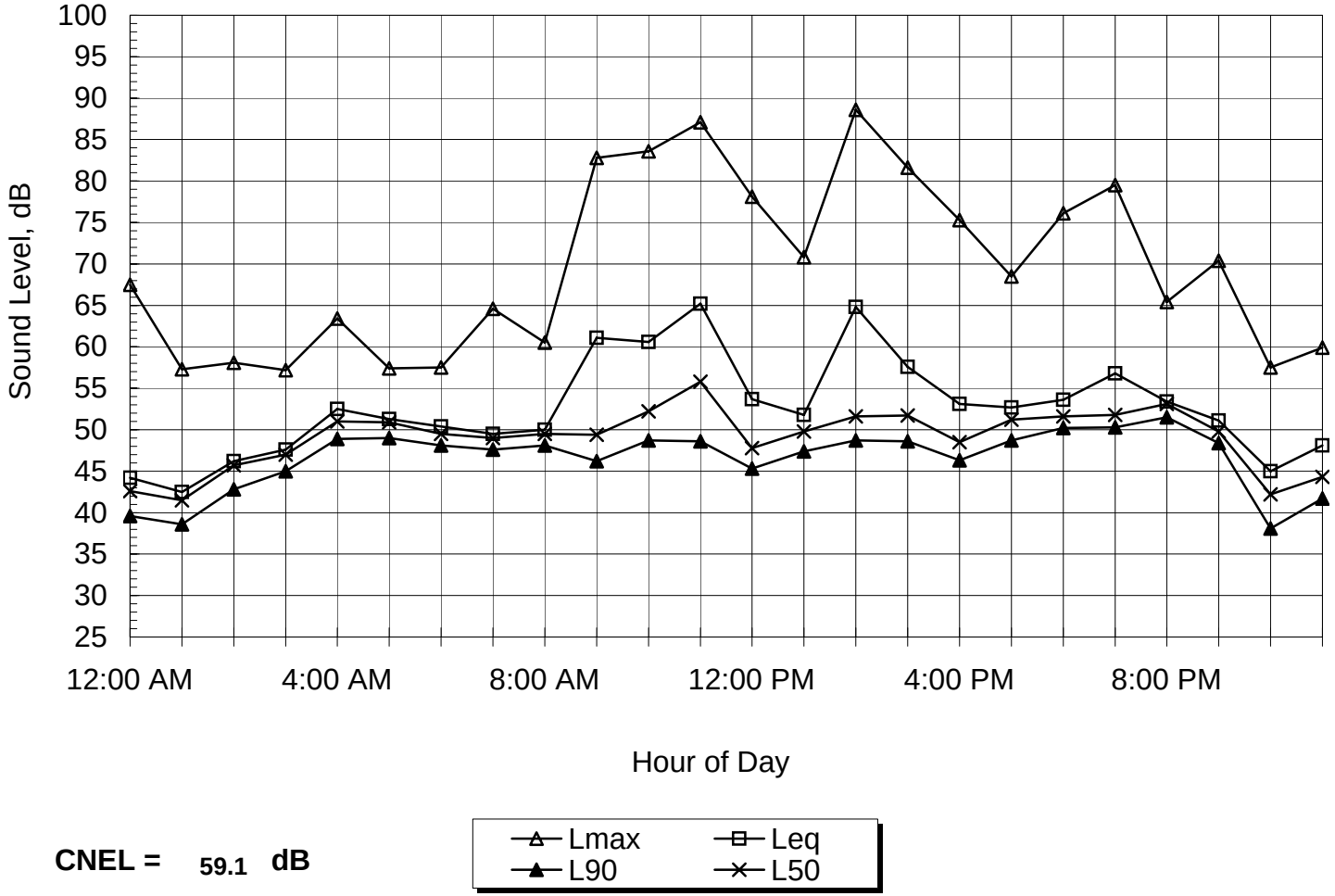


CNEL = 60.1 dB

Figure B-9: Measured Hourly Noise Levels

LVK Site 2

October 30, 2007

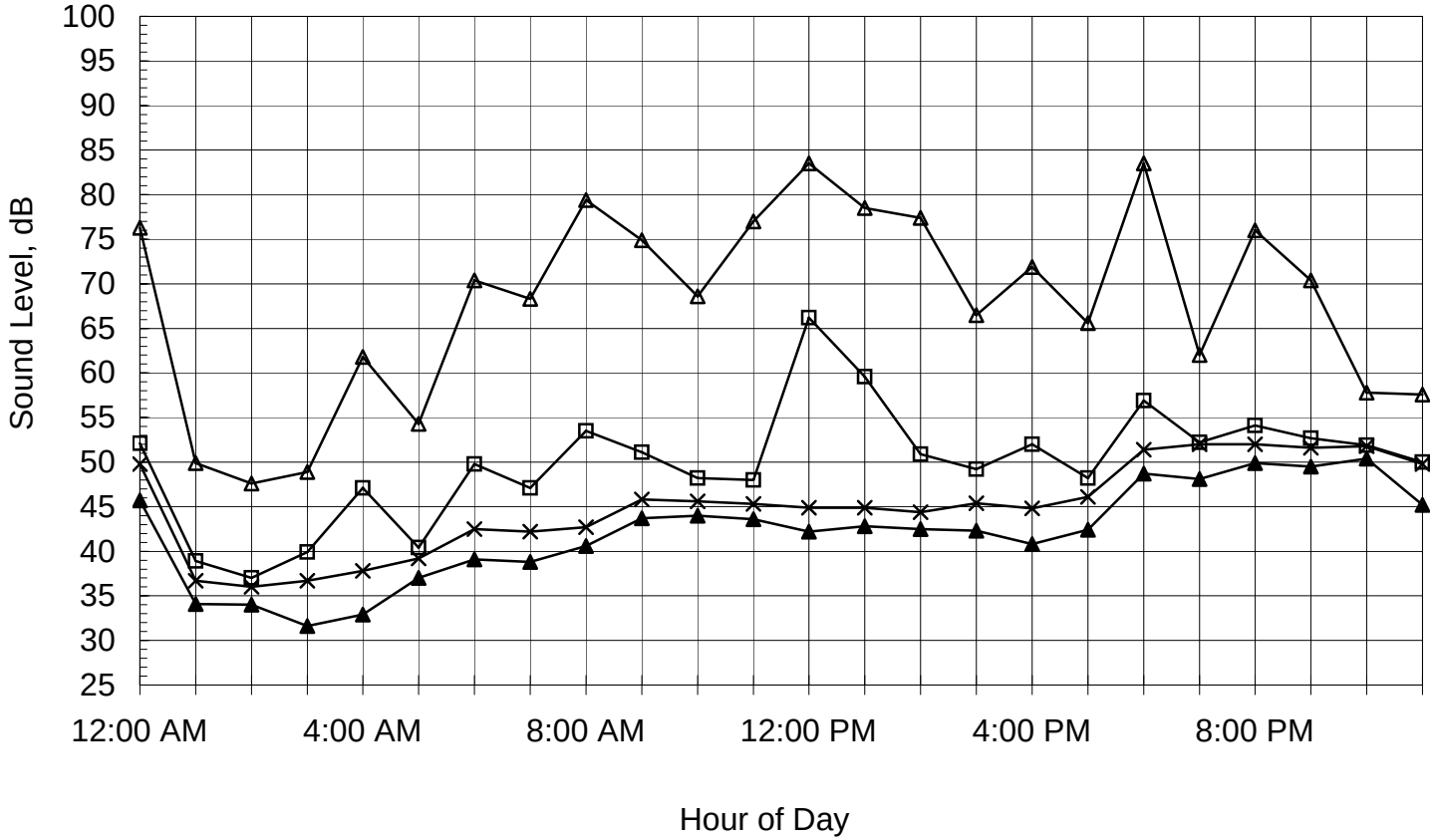


CNEL = 59.1 dB

Figure B-10: Measured Hourly Noise Levels

LVK Site 2

October 31, 2007

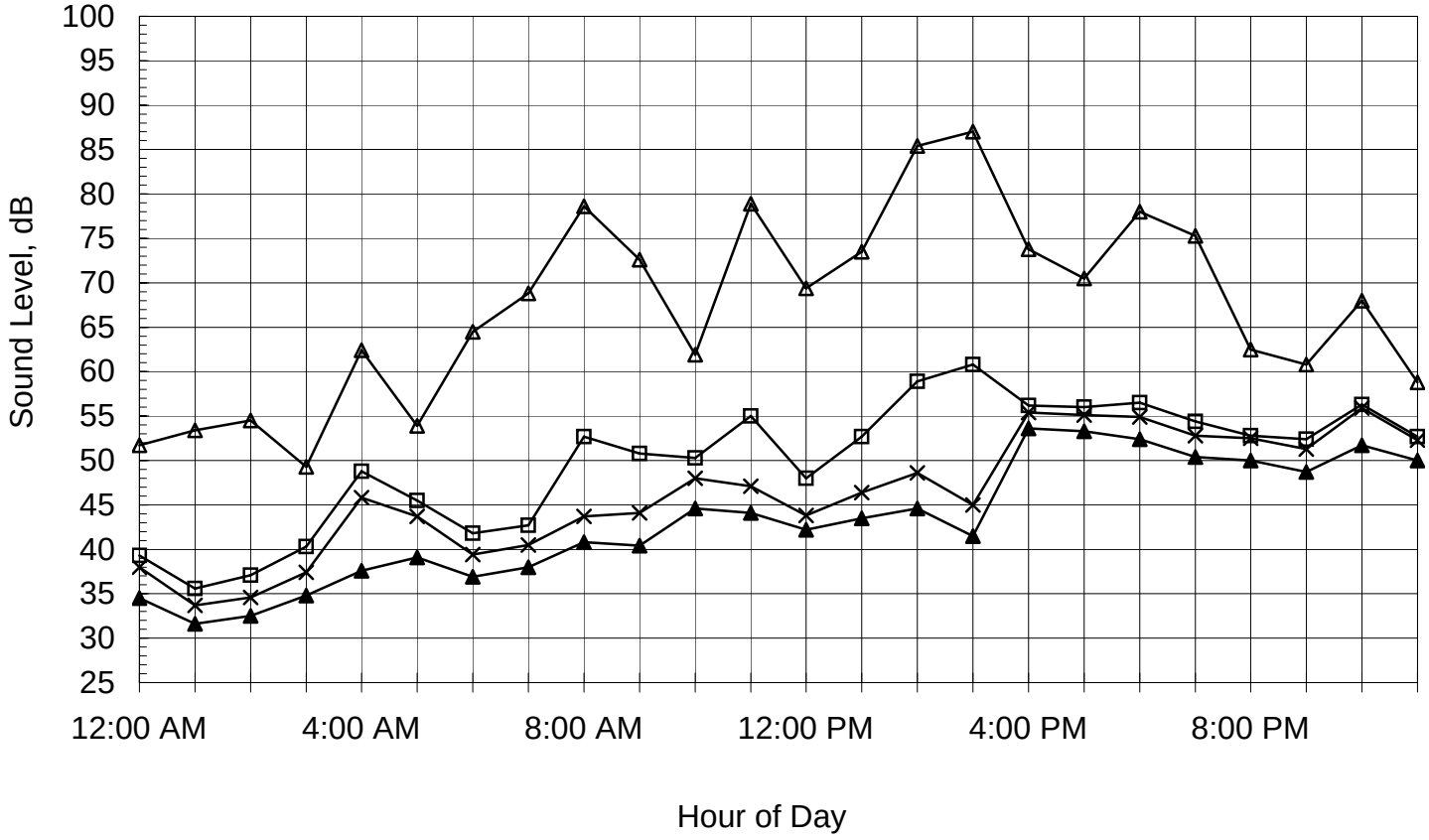


CNEL = 57.8 dB

Figure B-11: Measured Hourly Noise Levels

LVK Site 2

November 1, 2007

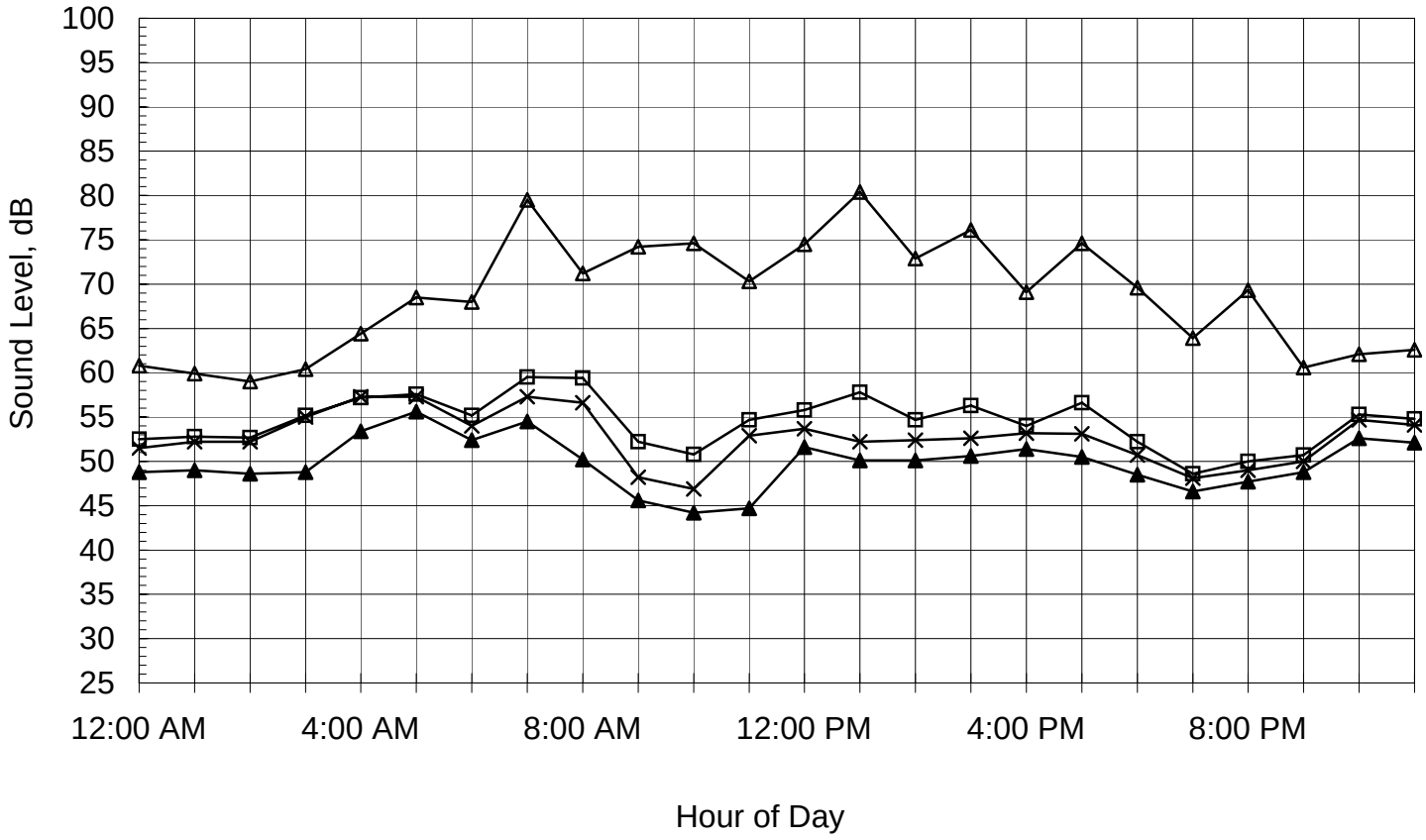


CNEL = 57.6 dB

Figure B-12: Measured Hourly Noise Levels

LVK Site 2

November 2, 2007

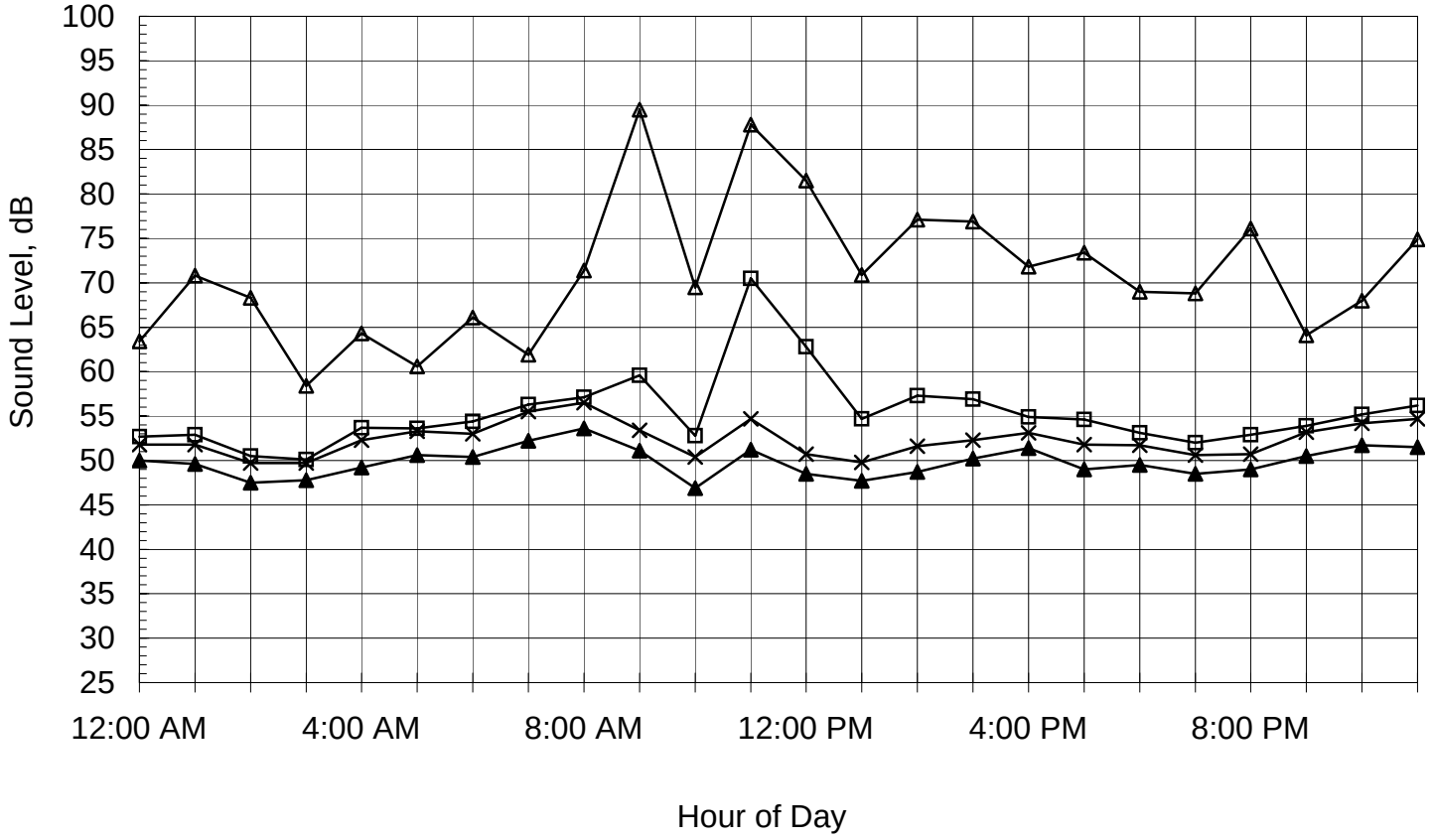


CNEL = 61.7 dB

Figure B-13: Measured Hourly Noise Levels

LVK Site 2

November 3, 2007

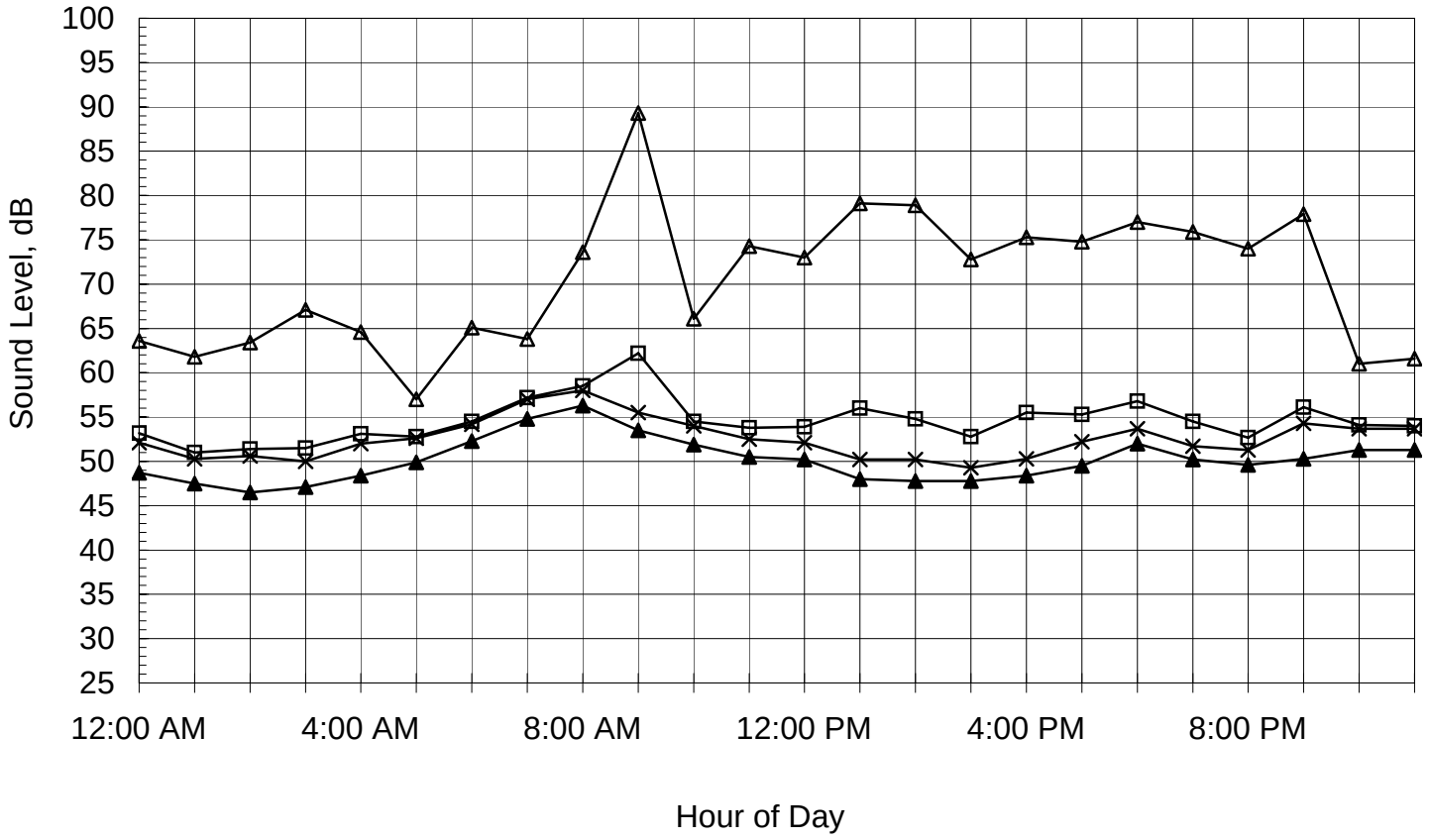


CNEL = 62.2 dB

Figure B-14: Measured Hourly Noise Levels

LVK Site 2

November 4, 2007

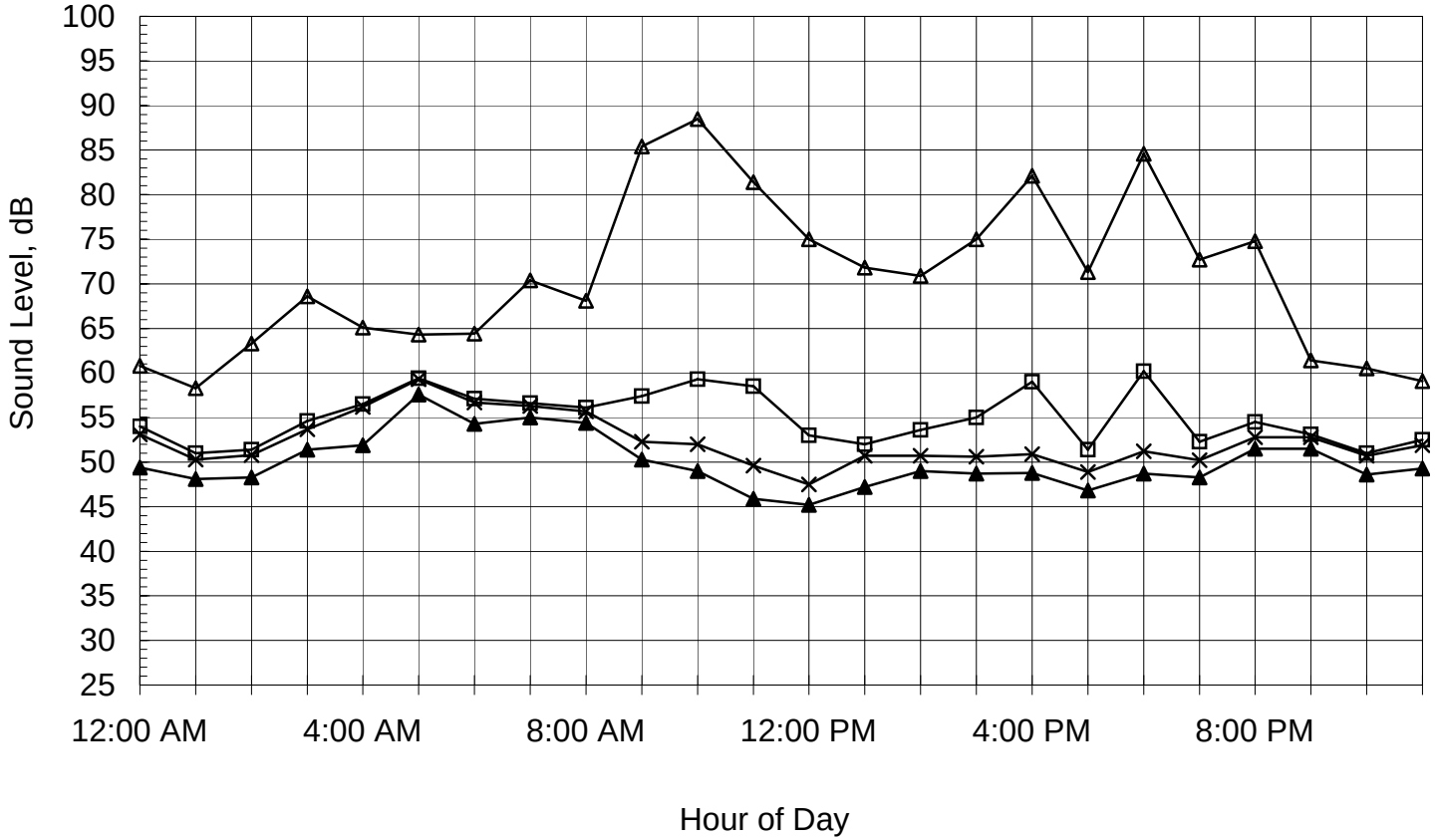


CNEL = 60.4 dB

Figure B-15: Measured Hourly Noise Levels

LVK Site 2

November 5, 2007

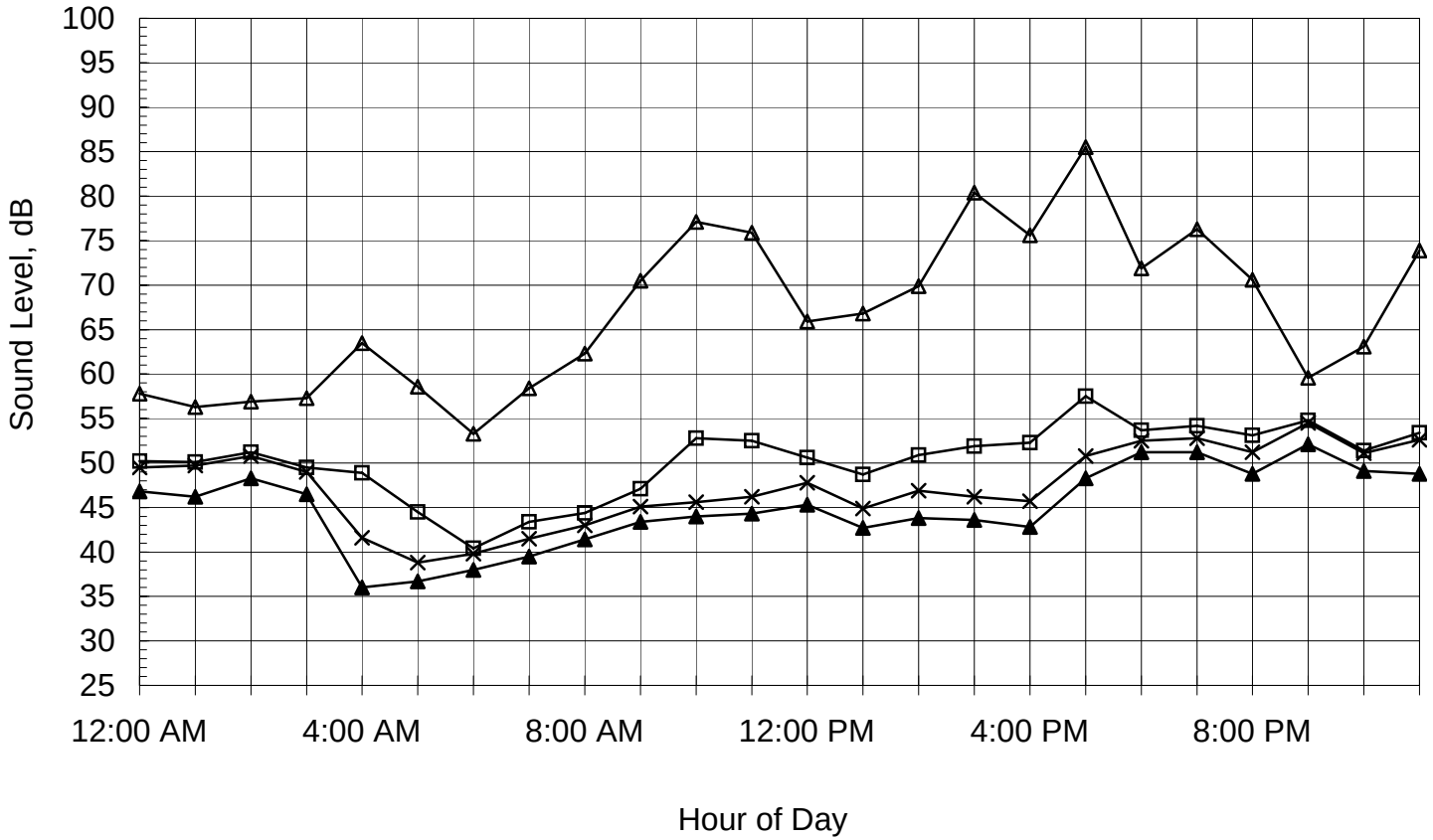


CNEL = 61.9 dB

Figure B-16: Measured Hourly Noise Levels

LVK Site 2

November 6, 2007

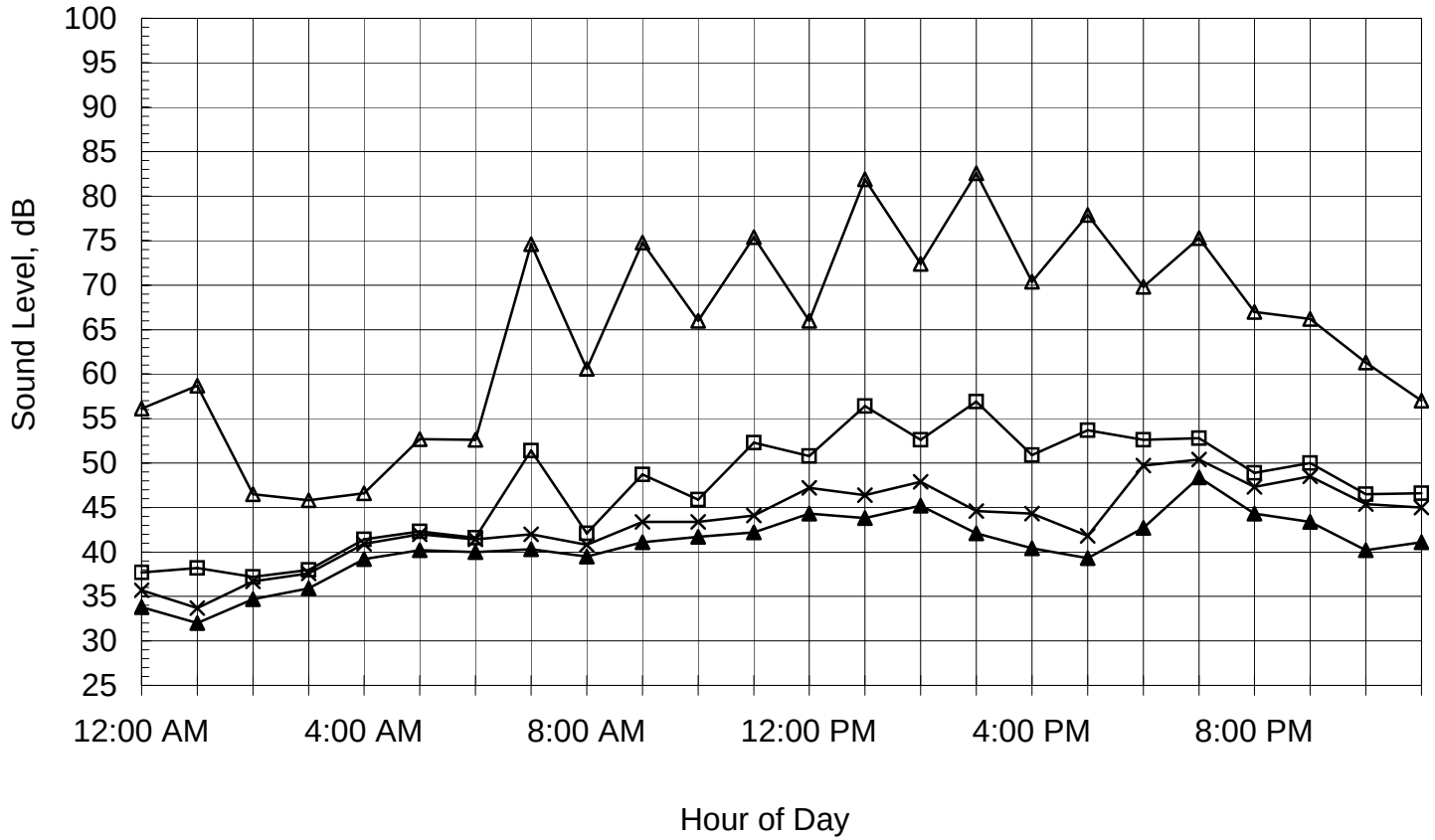


CNEL = 57.4 dB

Figure B-17: Measured Hourly Noise Levels

LVK Site 3

October 30, 2007

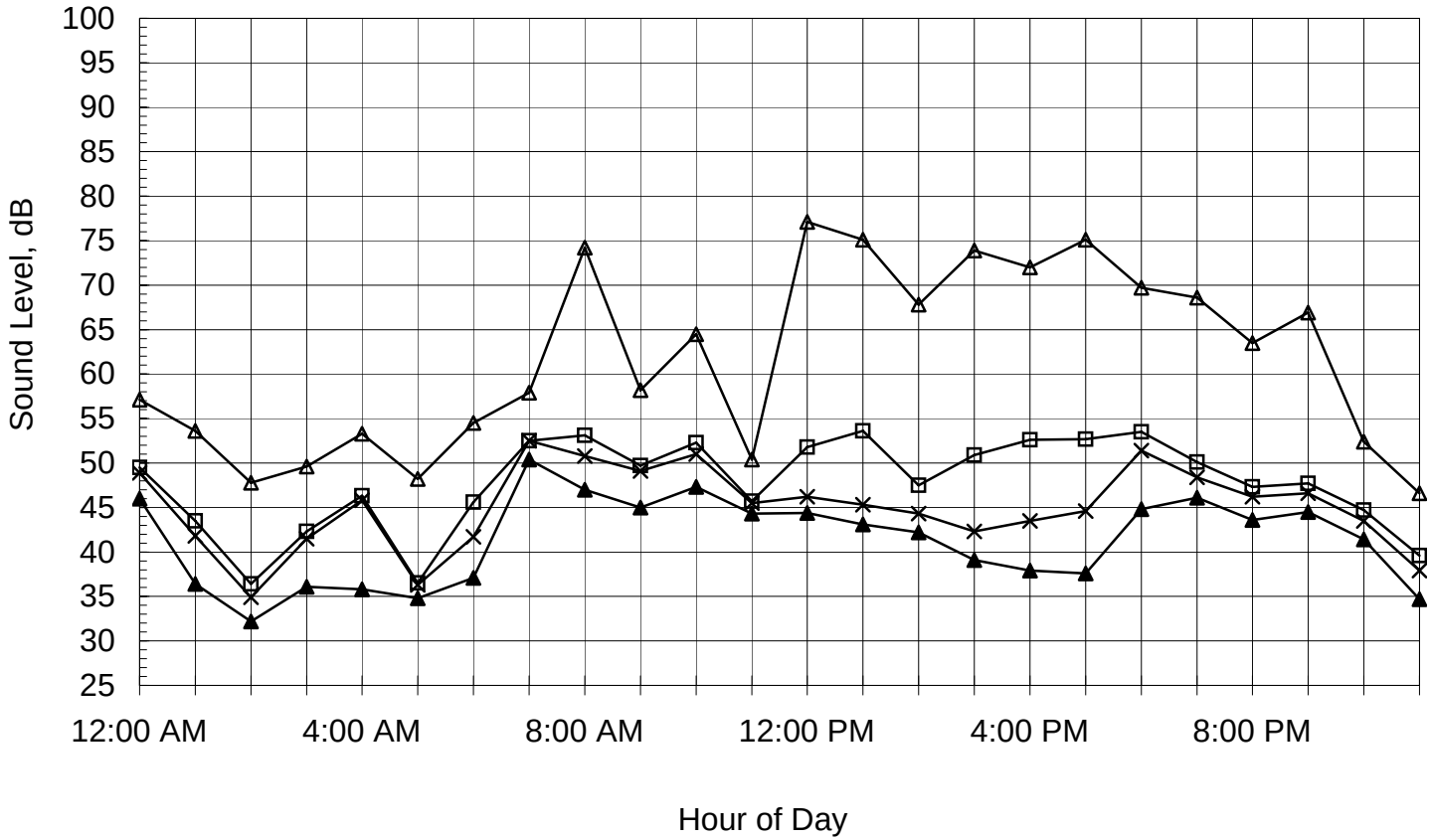


CNEL = 53.1 dB

Figure B-18: Measured Hourly Noise Levels

LVK Site 3

October 31, 2007

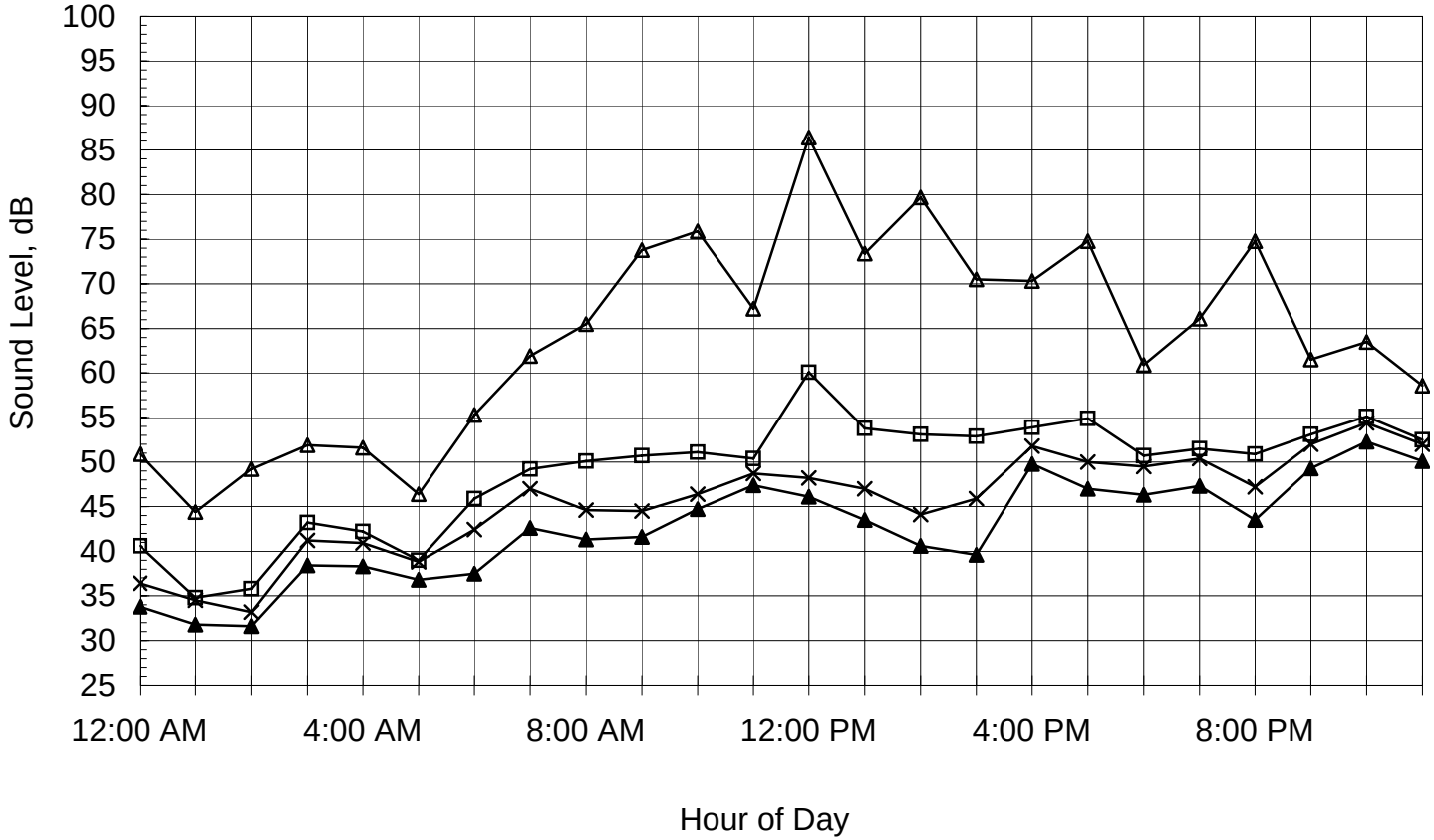


CNEL = 53.2 dB

Figure B-19: Measured Hourly Noise Levels

LVK Site 3

November 1, 2007

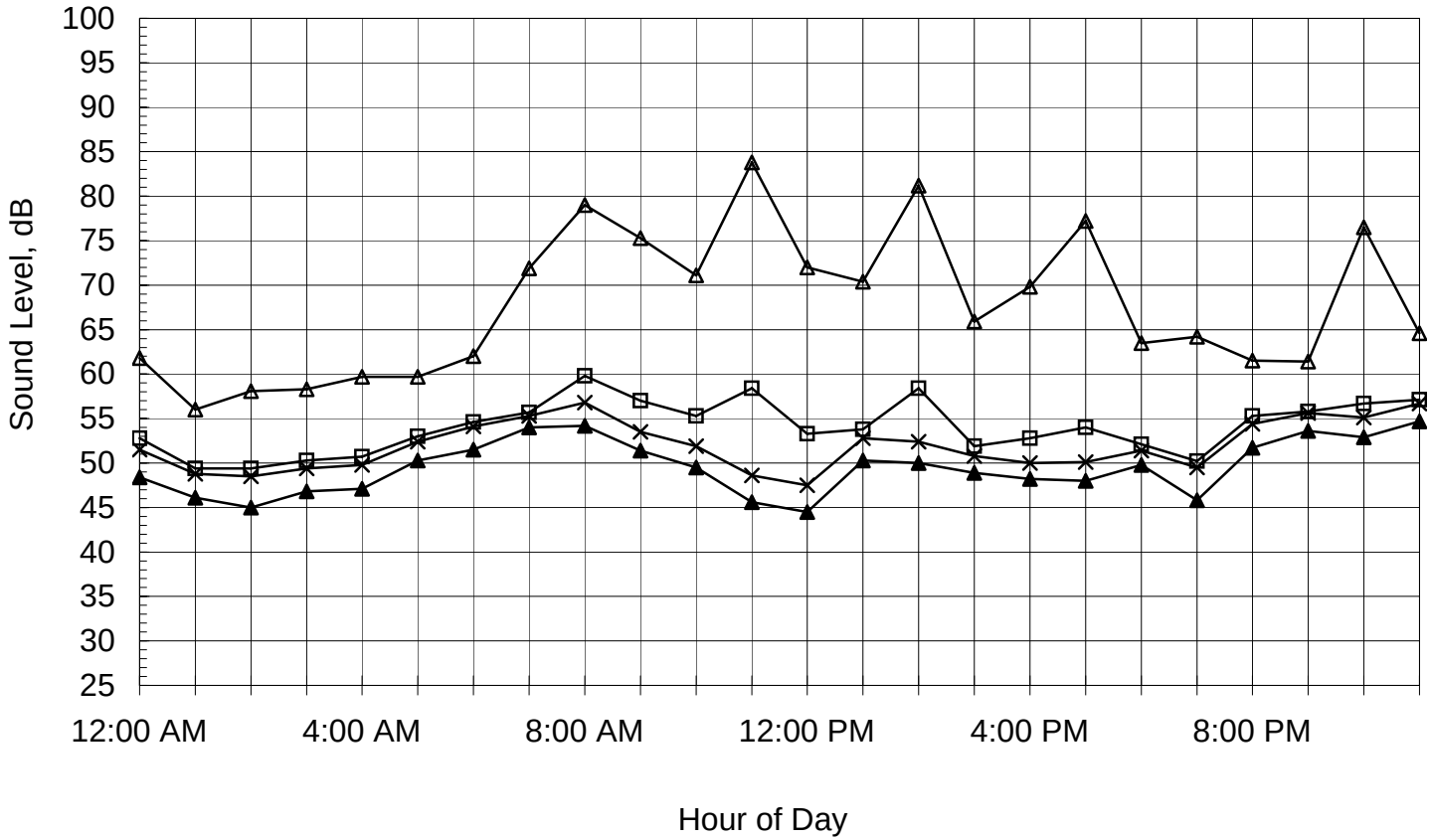


CNEL = 56.3 dB

Figure B-20: Measured Hourly Noise Levels

LVK Site 3

November 2, 2007

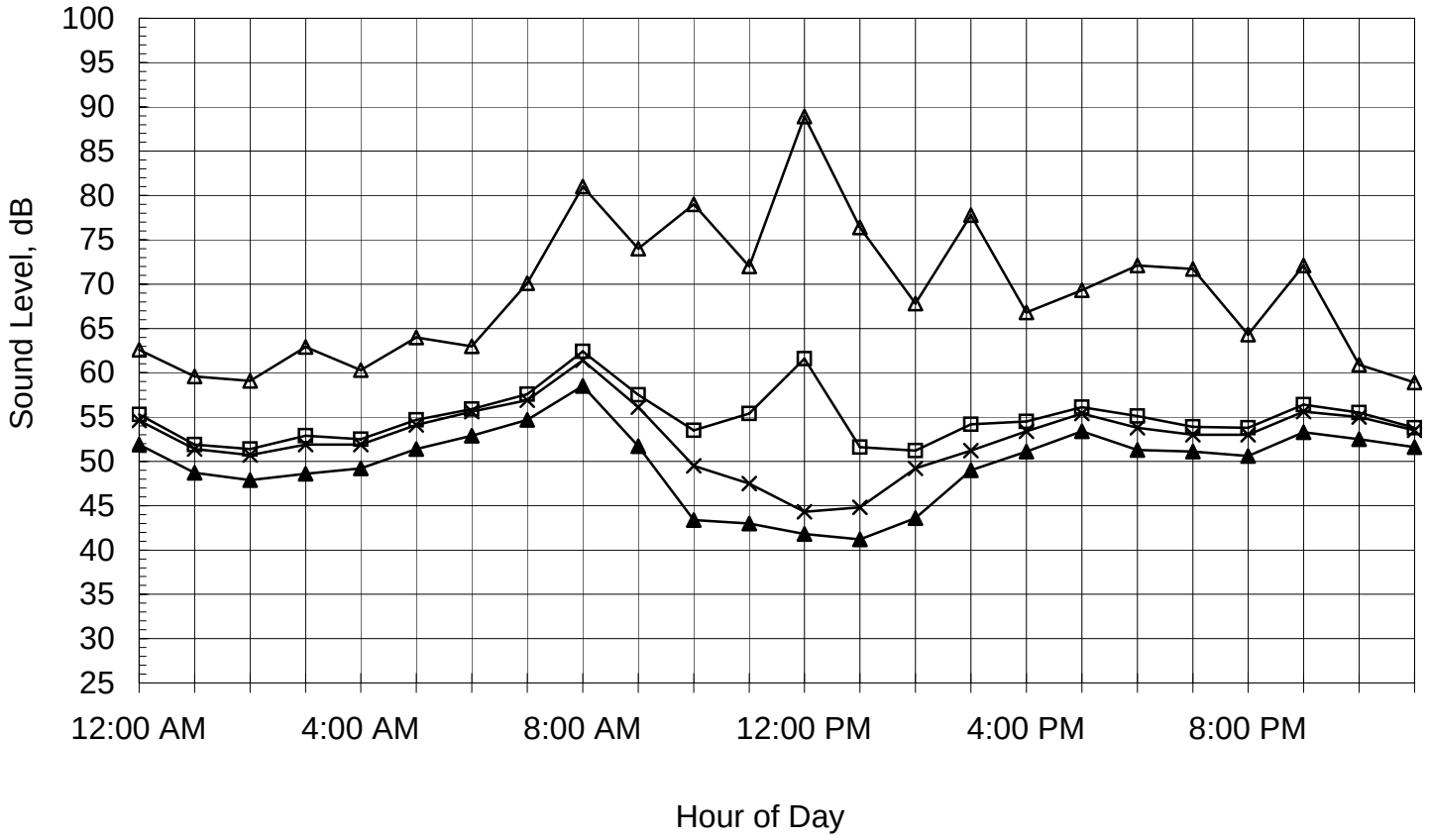


CNEL = 60.6 dB

Figure B-21: Measured Hourly Noise Levels

LVK Site 3

November 3, 2007

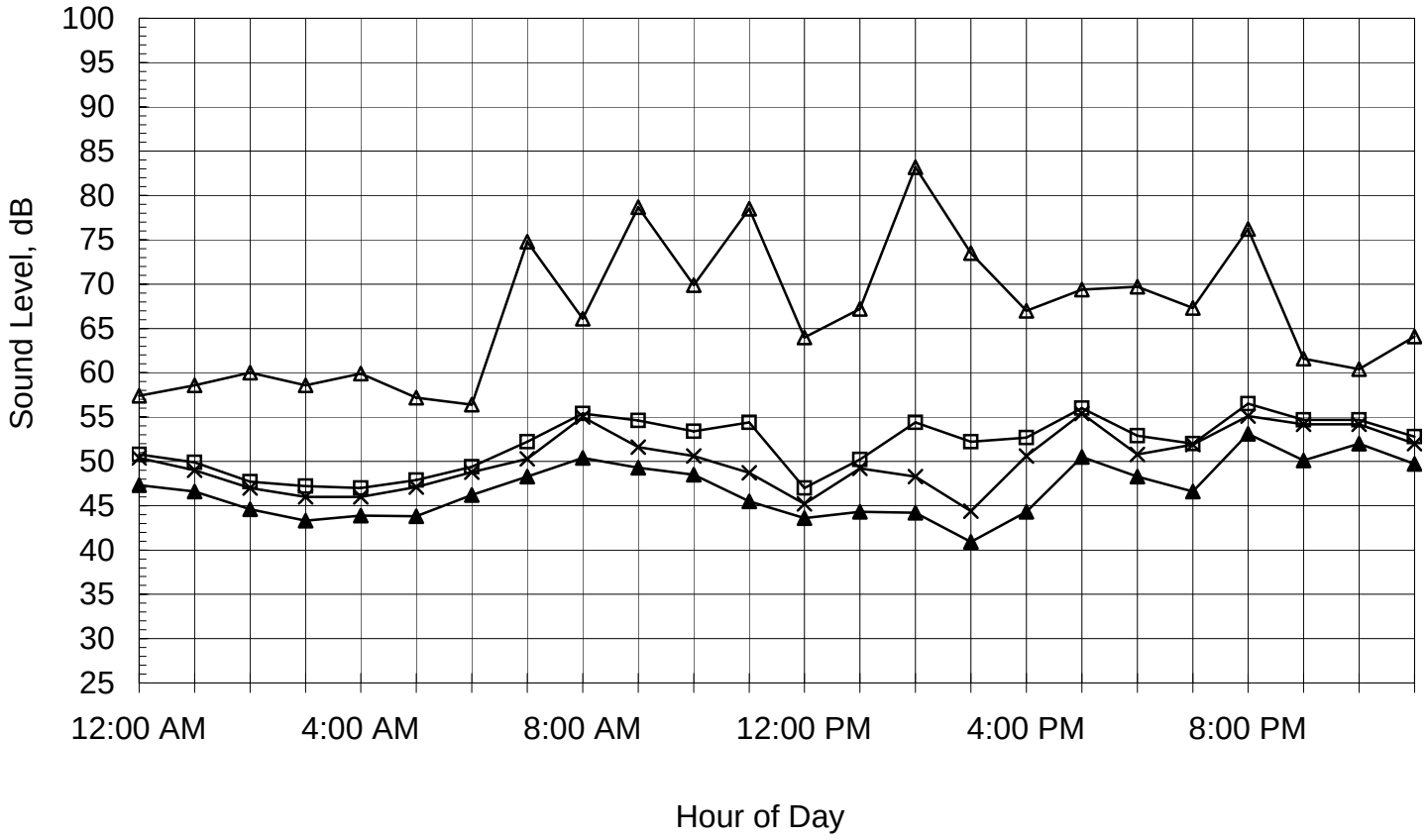


CNEL = 61.3 dB

Figure B-22: Measured Hourly Noise Levels

LVK Site 3

November 4, 2007

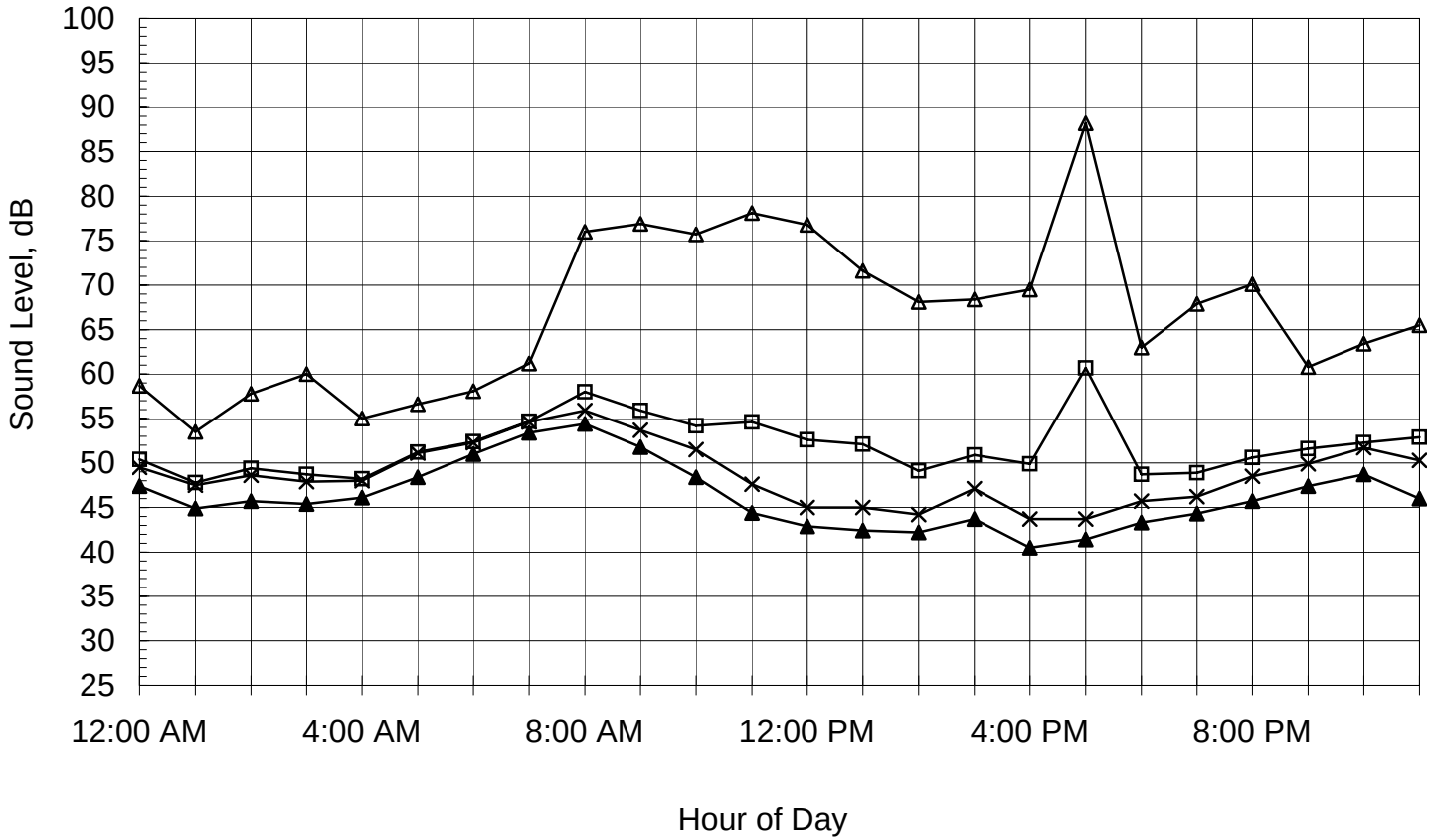


CNEL = 58.1 dB

Figure B-23: Measured Hourly Noise Levels

LVK Site 3

November 5, 2007

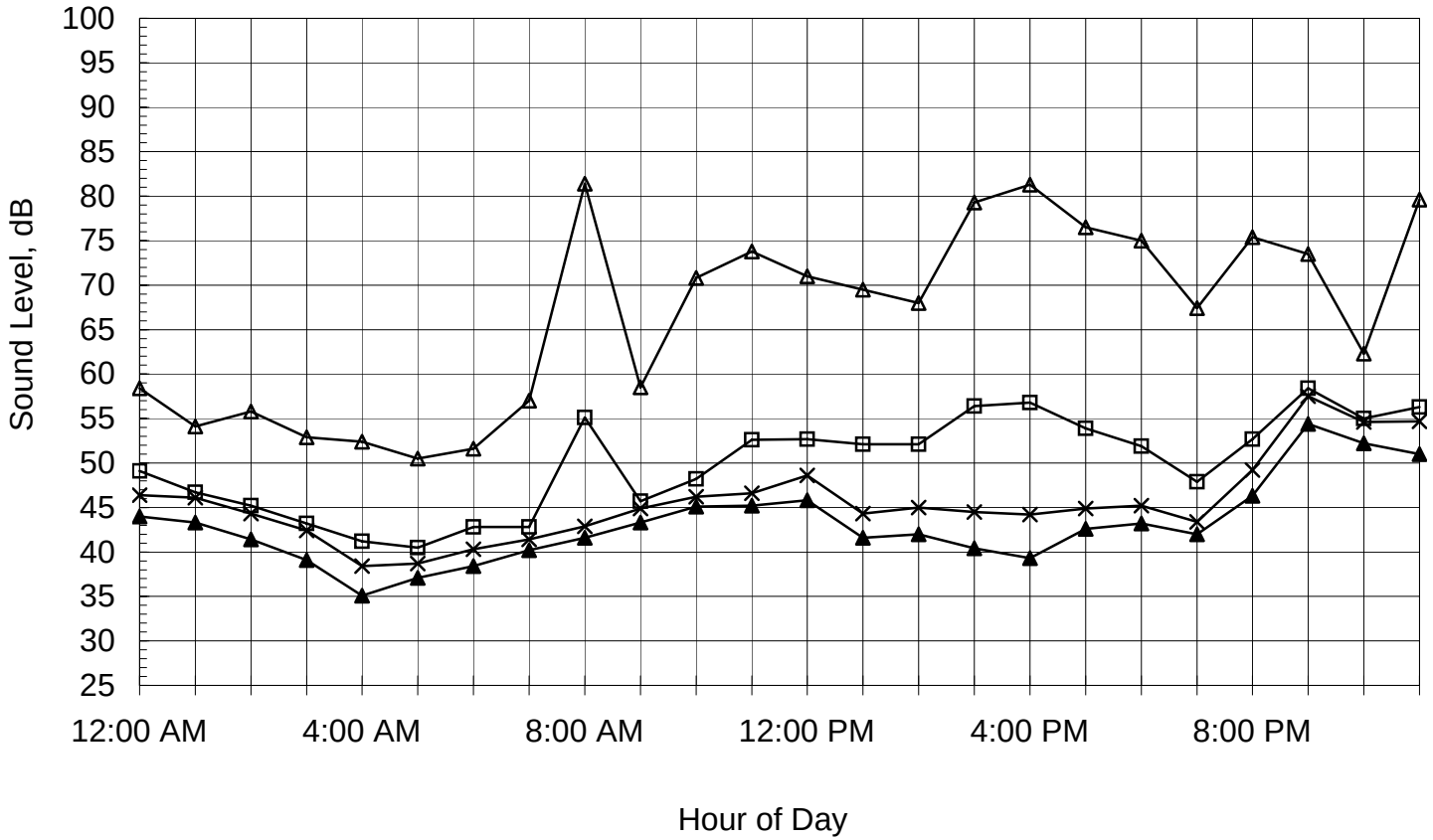


CNEL = 58.1 dB

Figure B-24: Measured Hourly Noise Levels

LVK Site 3

November 6, 2007

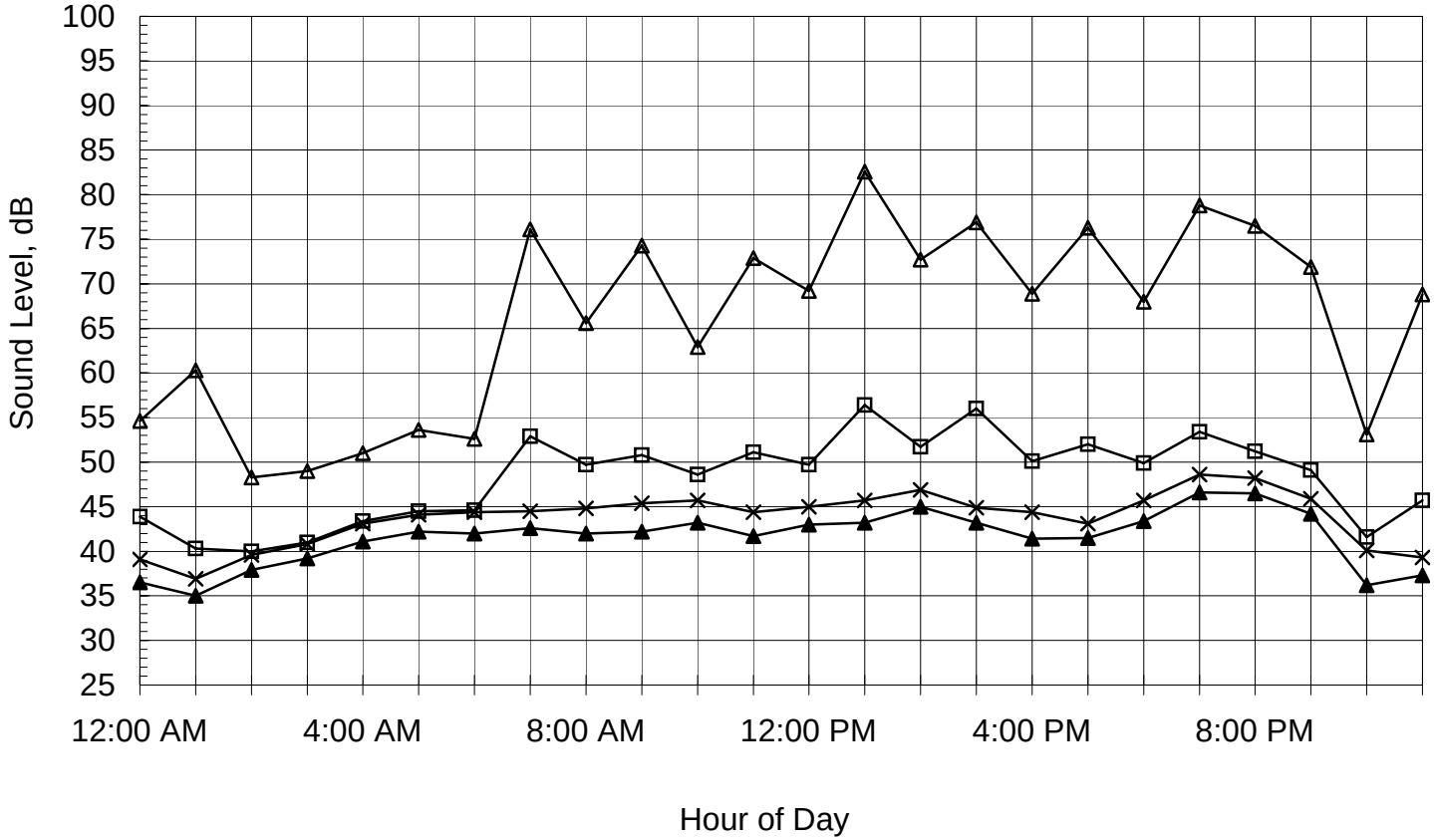


CNEL = 57.9 dB

Figure B-25: Measured Hourly Noise Levels

LVK Site 4

October 30, 2007

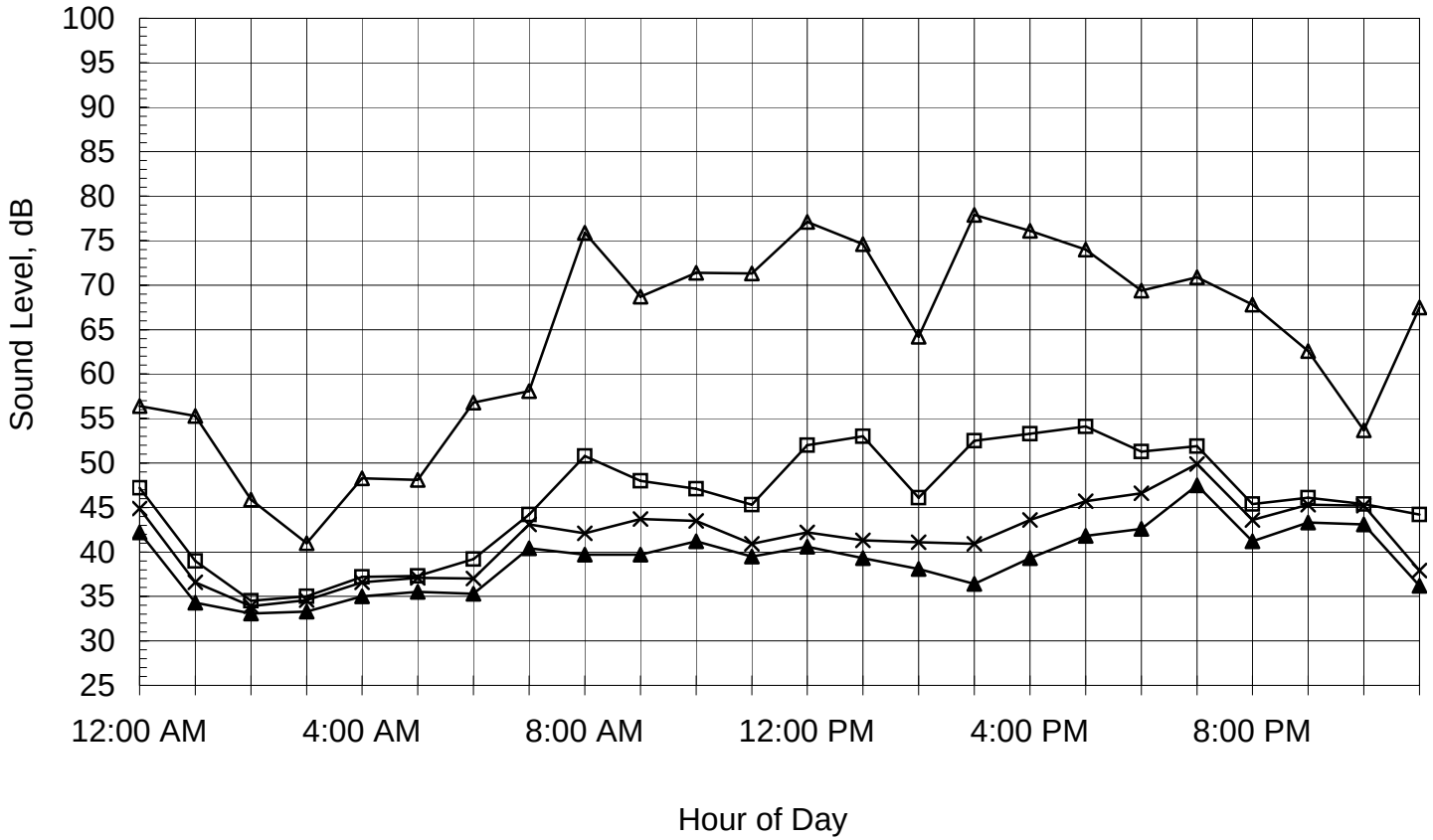


CNEL = 53.4 dB

Figure B-26: Measured Hourly Noise Levels

LVK Site 4

October 31, 2007

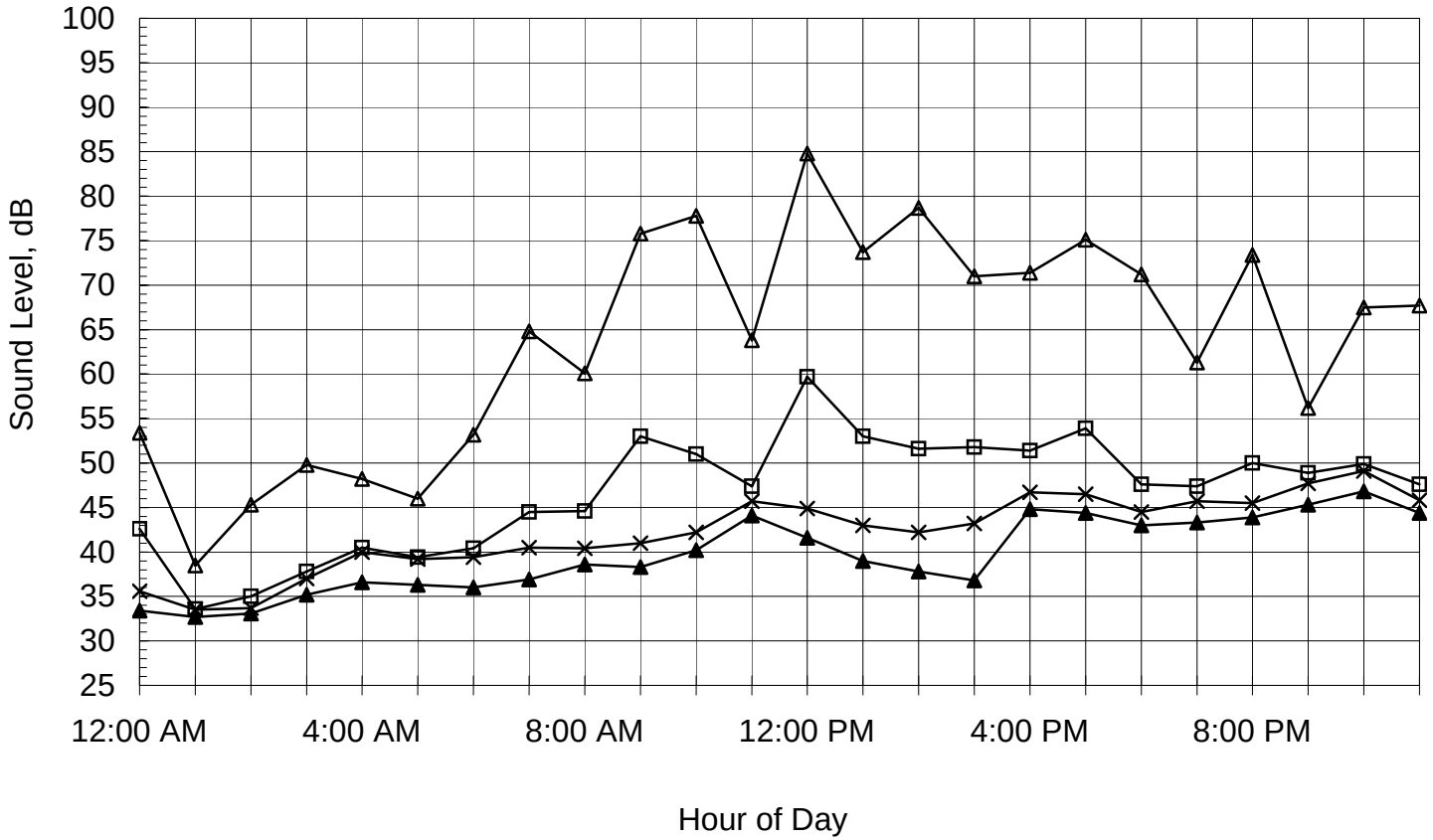


CNEL = 51.8 dB

Figure B-27: Measured Hourly Noise Levels

LVK Site 4

November 1, 2007

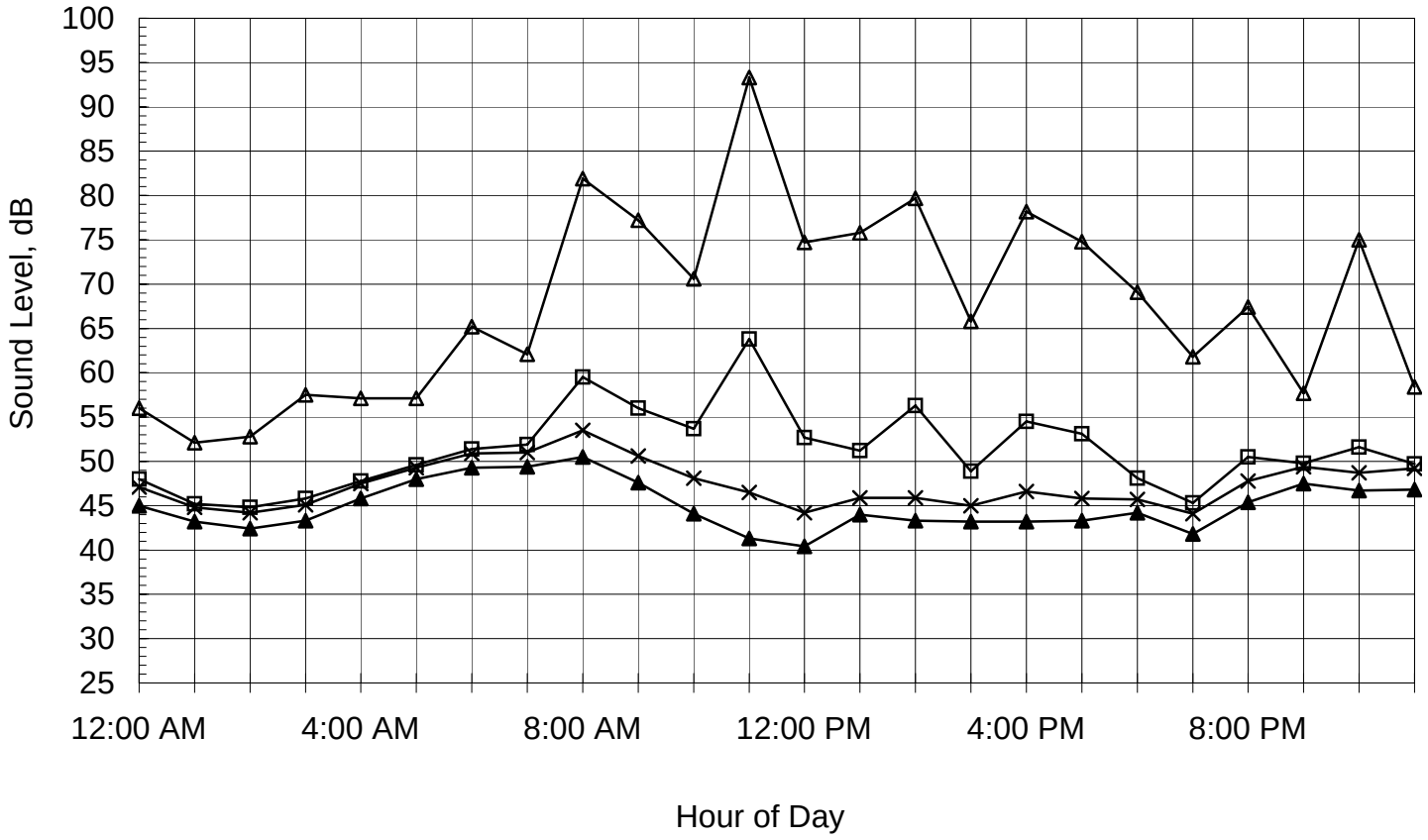


CNEL = 53.3 dB

Figure B-28: Measured Hourly Noise Levels

LVK Site 4

November 2, 2007

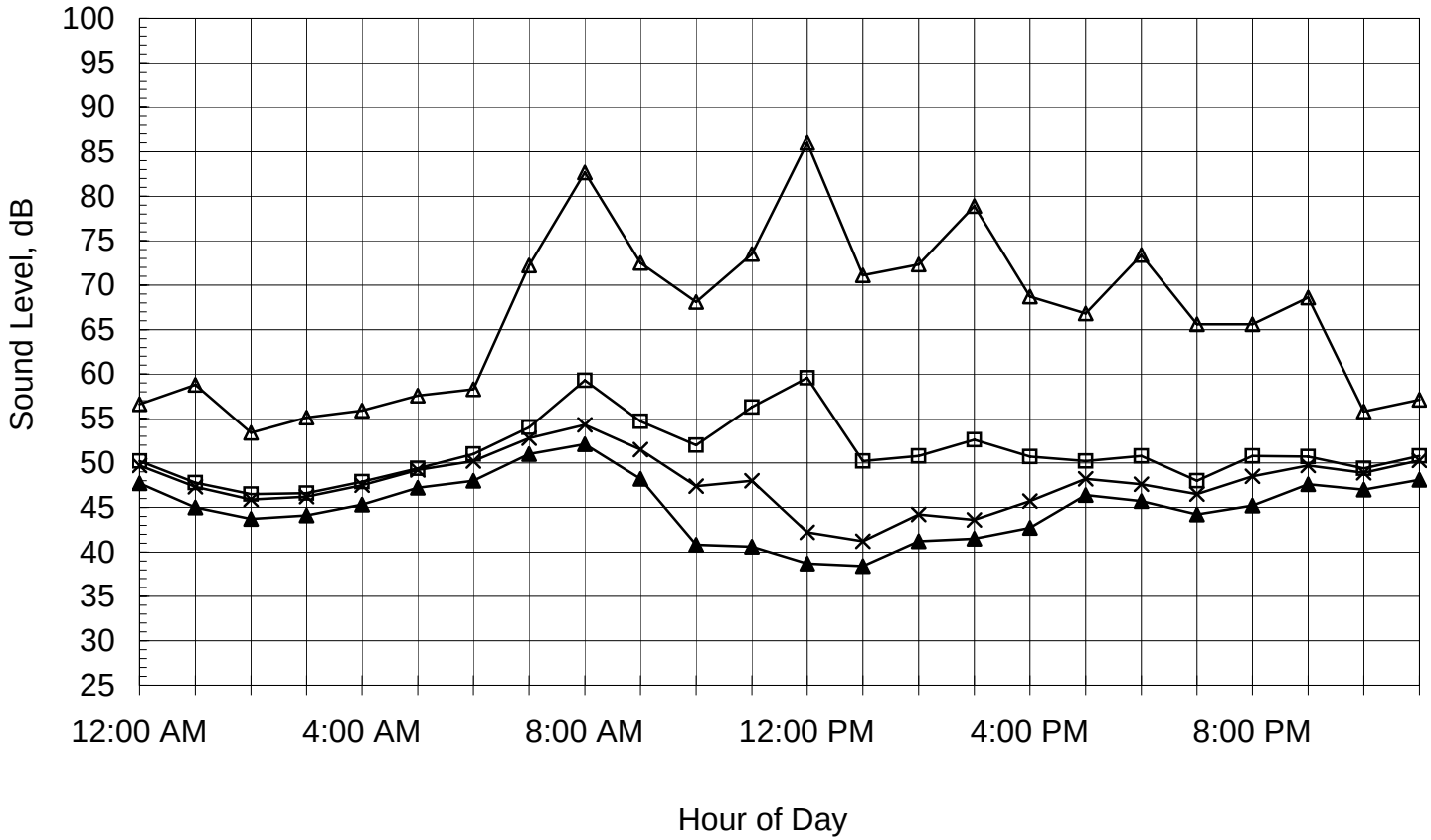


CNEL = 57.4 dB

Figure B-29: Measured Hourly Noise Levels

LVK Site 4

November 3, 2007

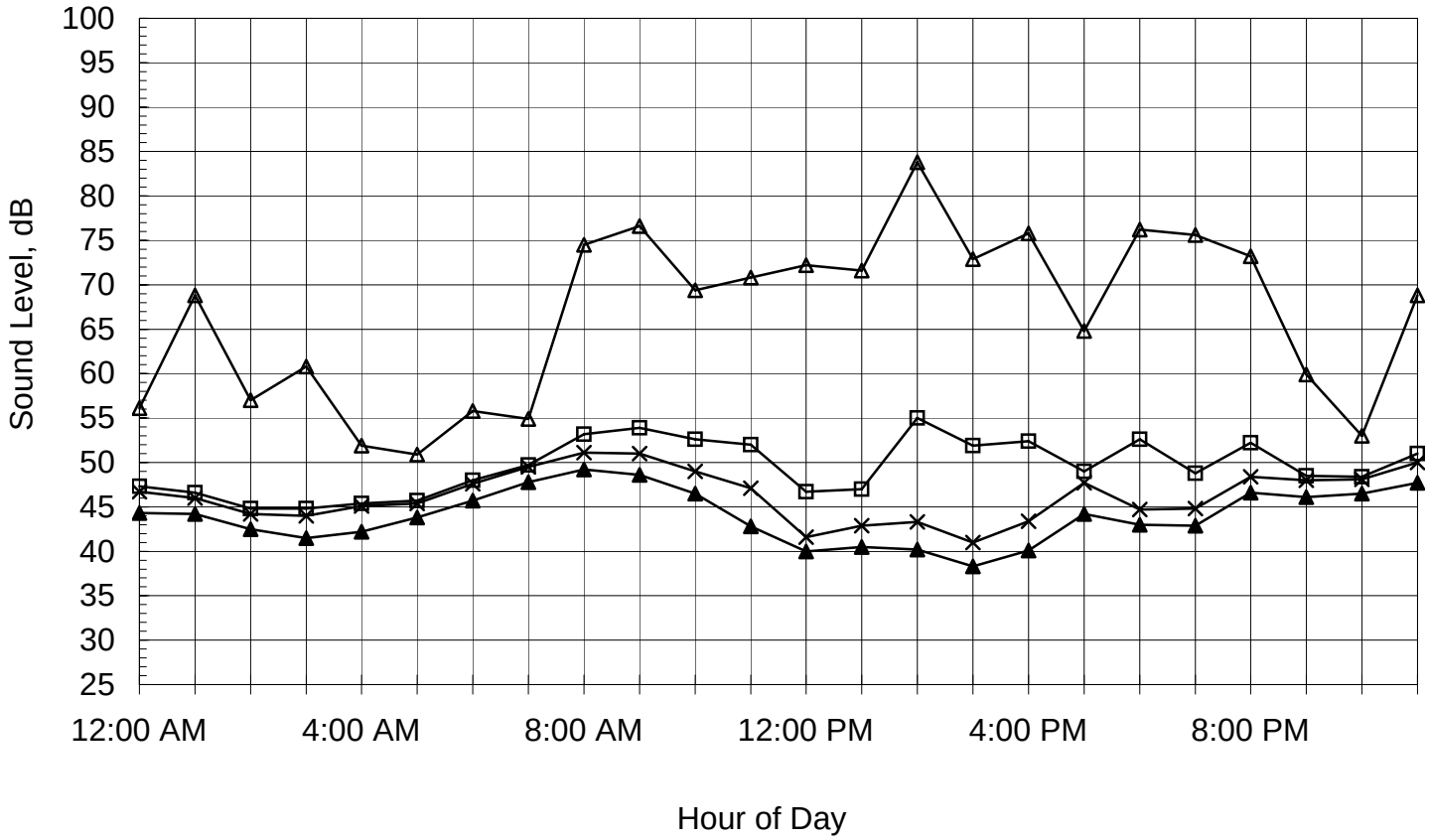


CNEL = 57.0 dB

Figure B-30: Measured Hourly Noise Levels

LVK Site 4

November 4, 2007

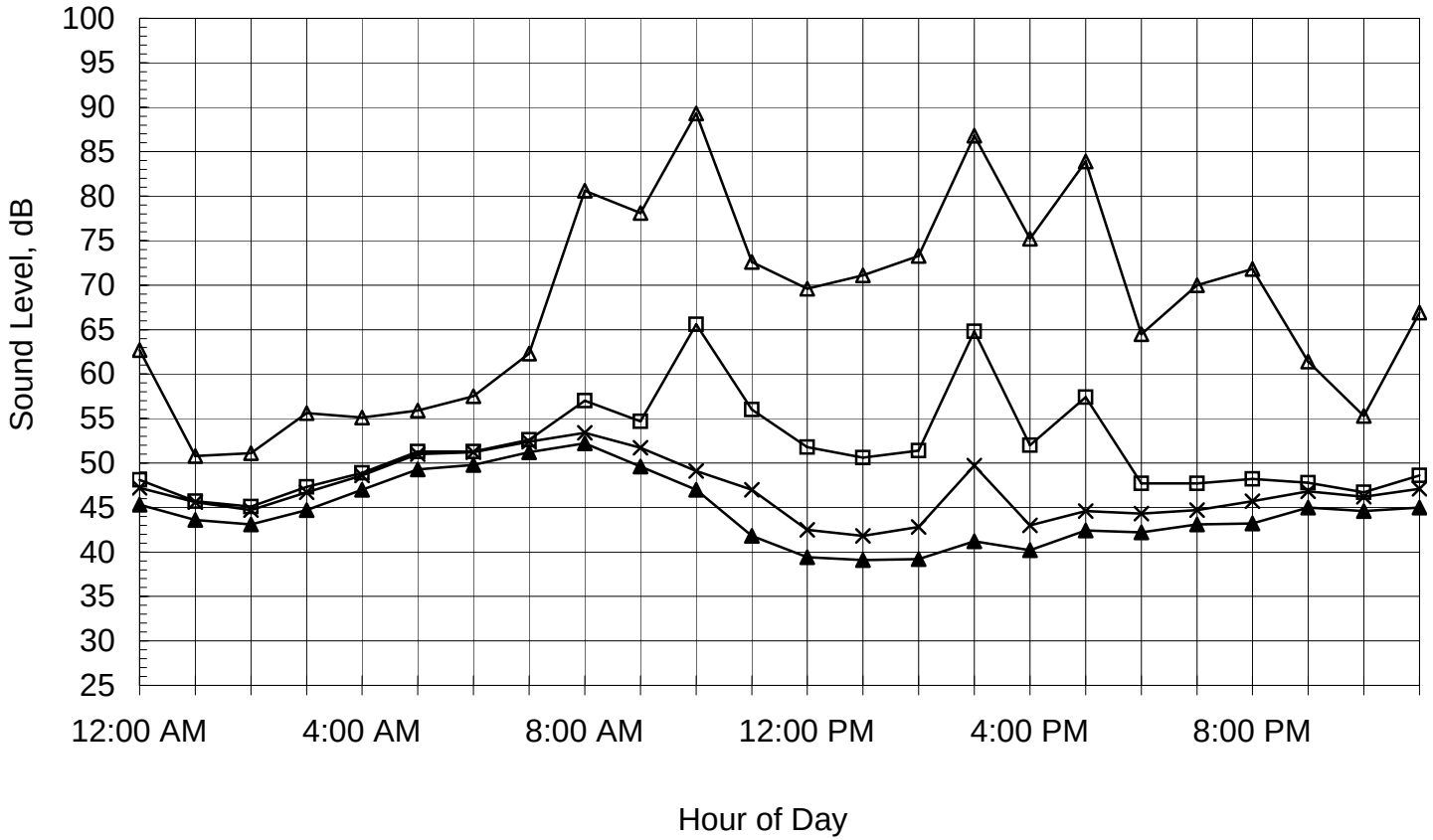


CNEL = 55.1 dB

Figure B-31: Measured Hourly Noise Levels

LVK Site 4

November 5, 2007

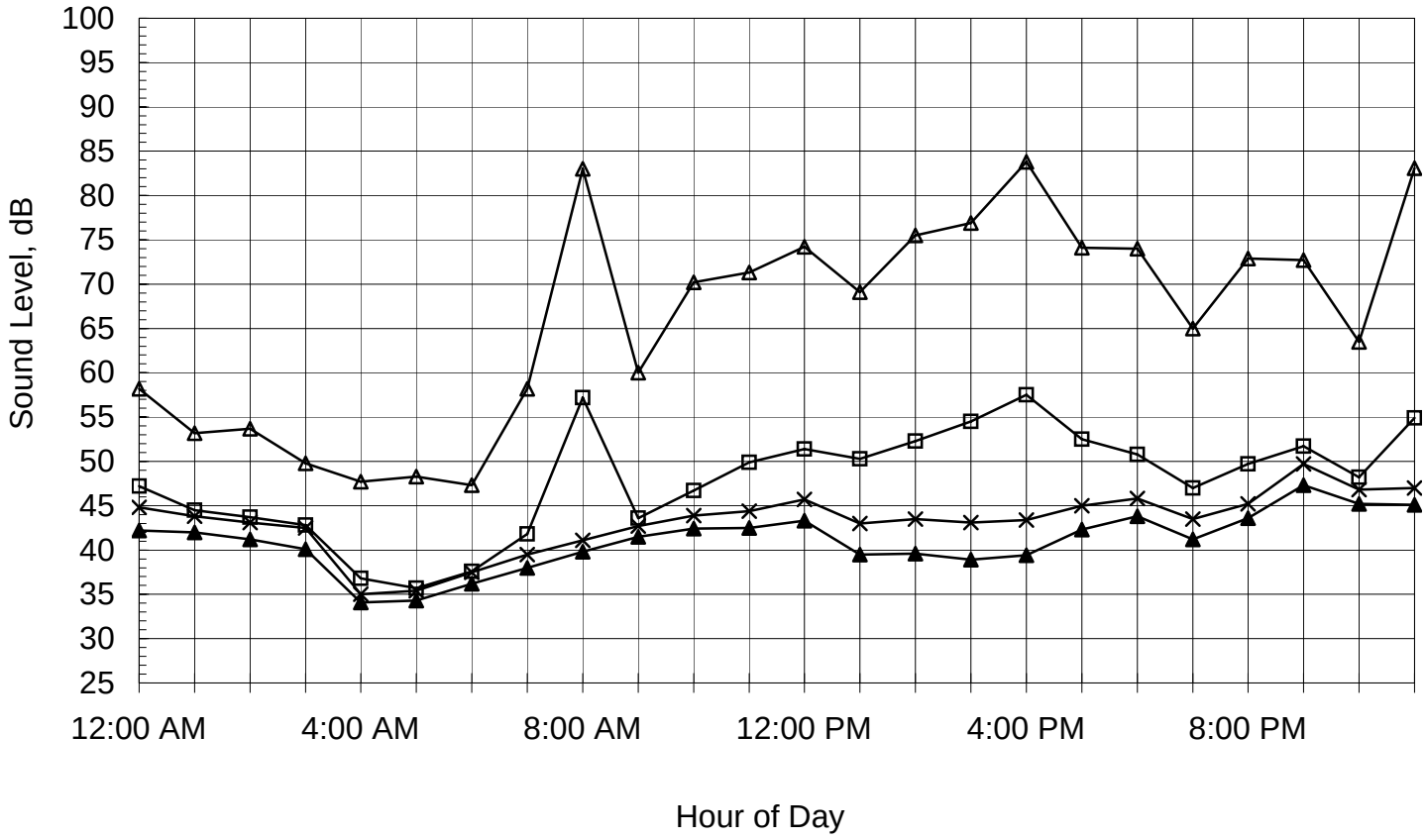


CNEL = 58.3 dB

Figure B-32: Measured Hourly Noise Levels

LVK Site 4

November 6, 2007

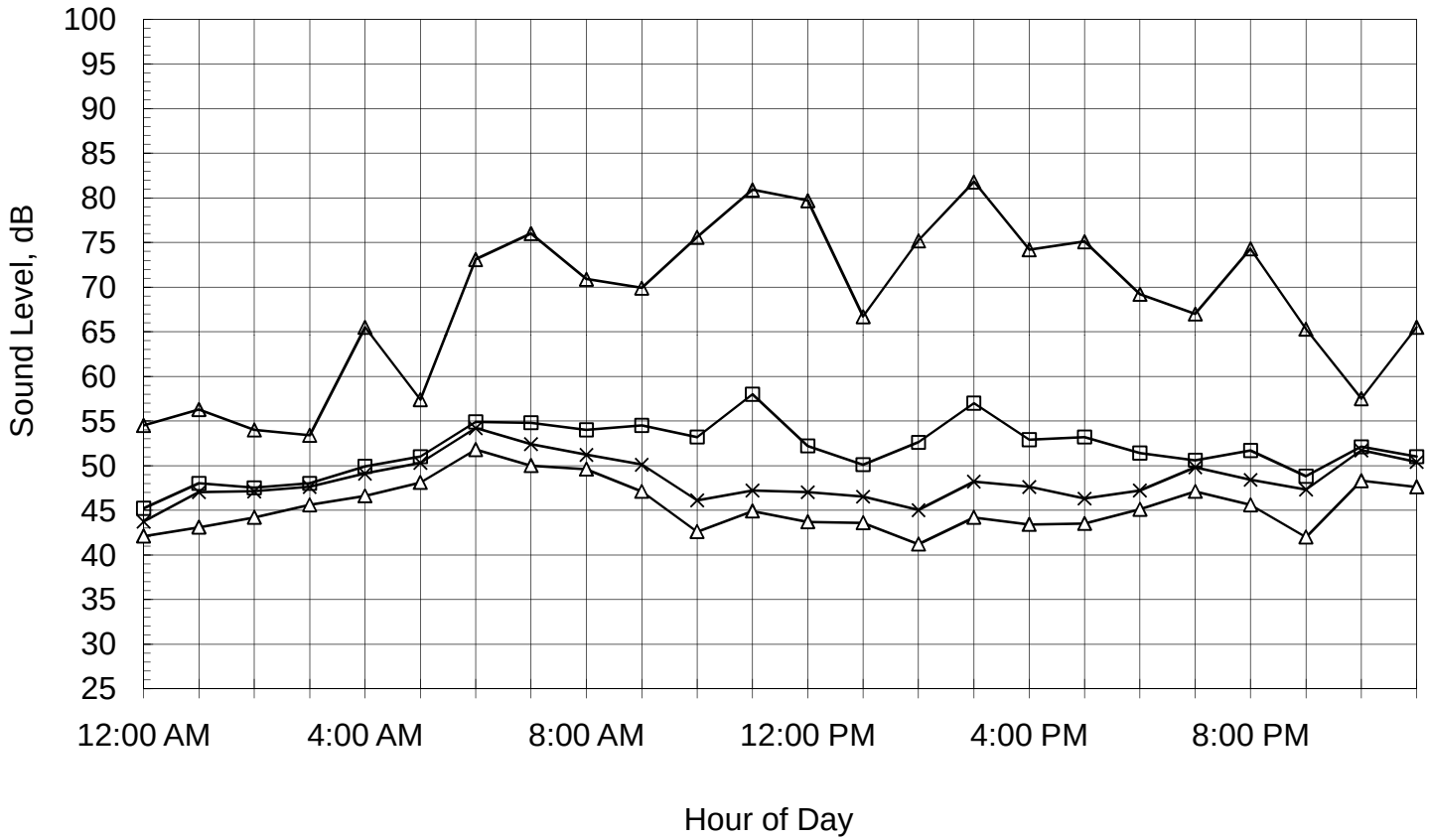


CNEL = 55.4 dB

Figure B-33: Measured Hourly Noise Levels

LVK Site 4

April 16, 2008

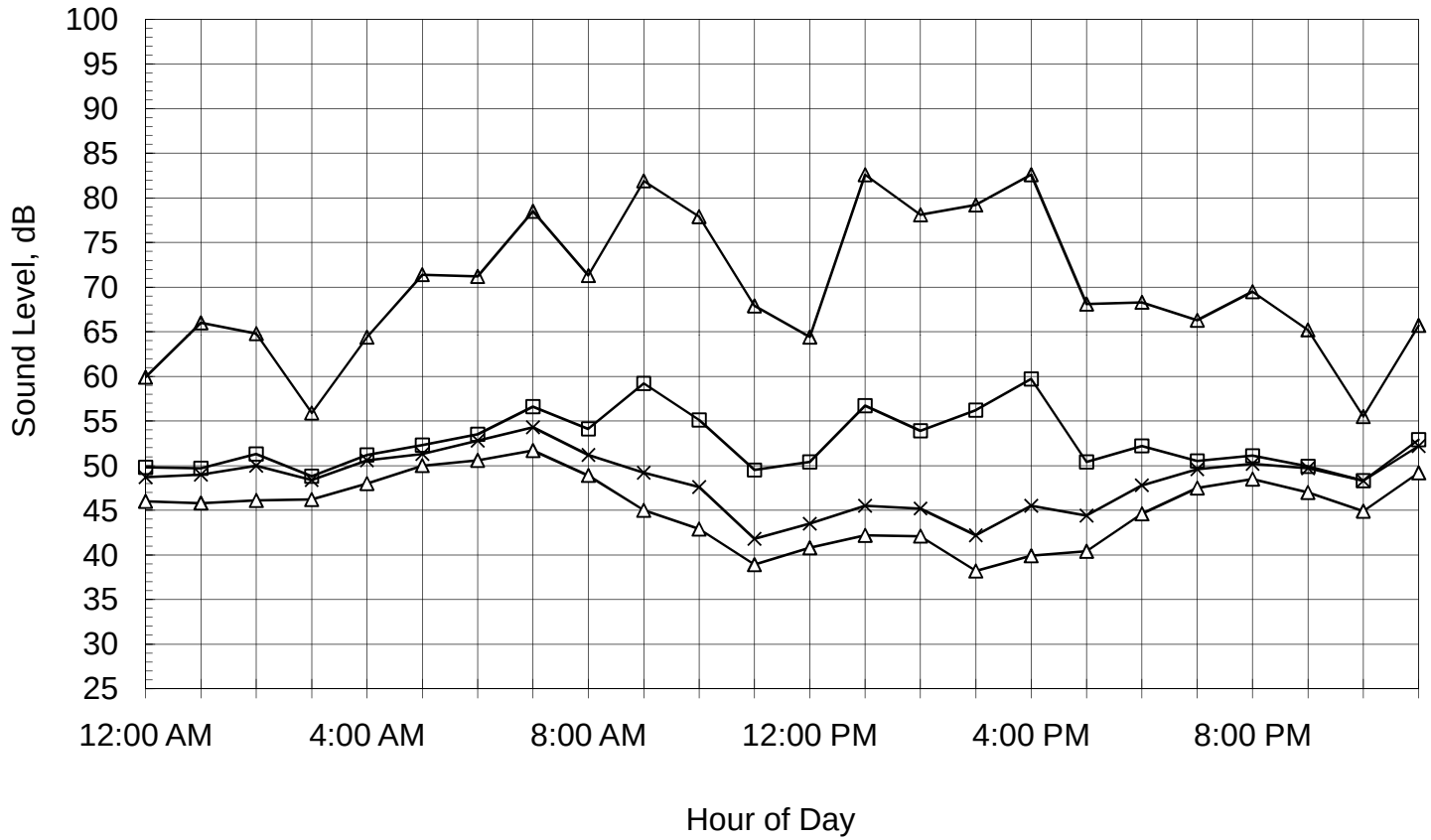


CNEL = 57.8 dB

Figure B-34: Measured Hourly Noise Levels

LVK Site 4

April 17, 2008

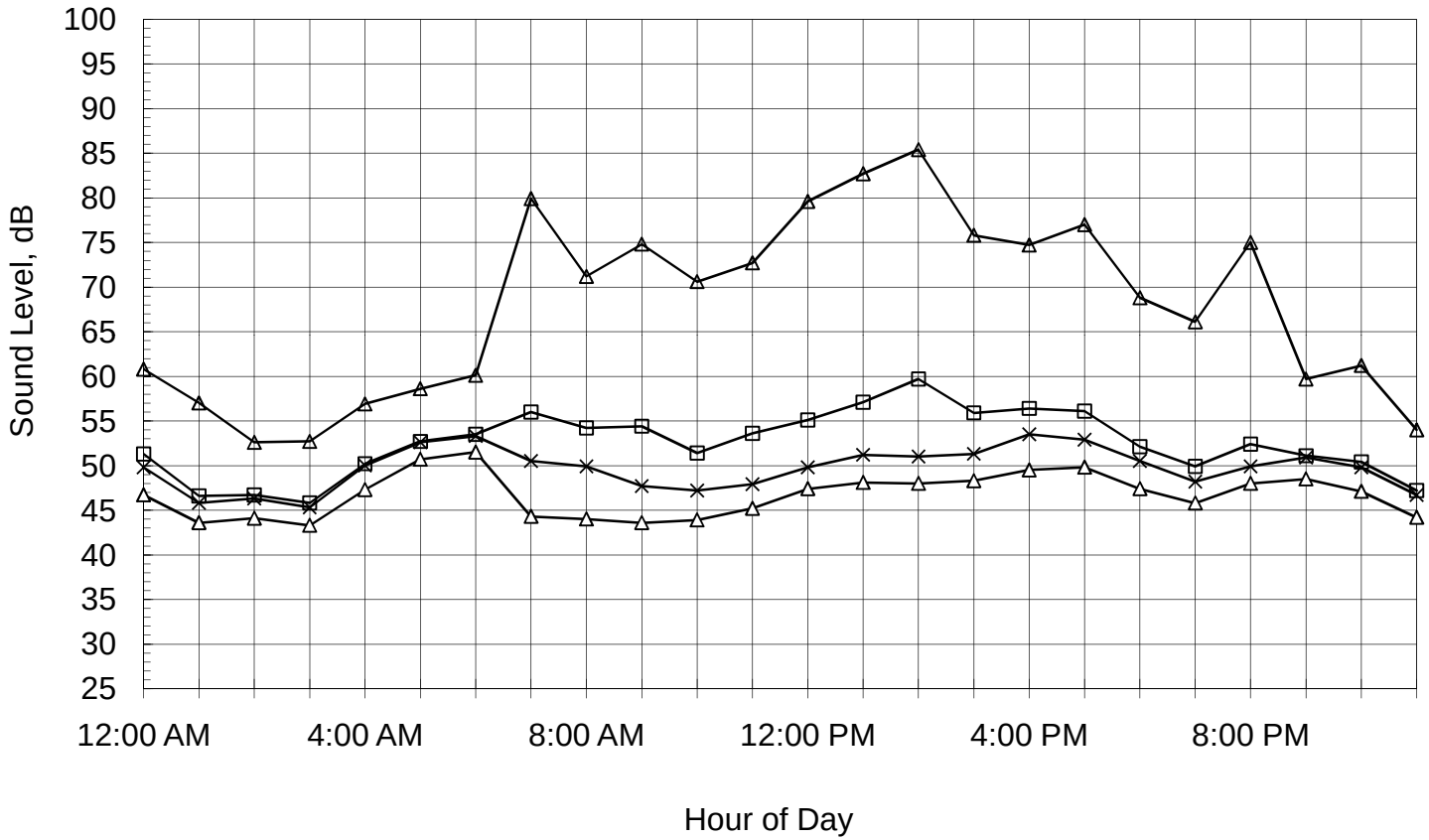


CNEL = 58.6 dB

Figure B-35: Measured Hourly Noise Levels

LVK Site 4

April 18, 2008

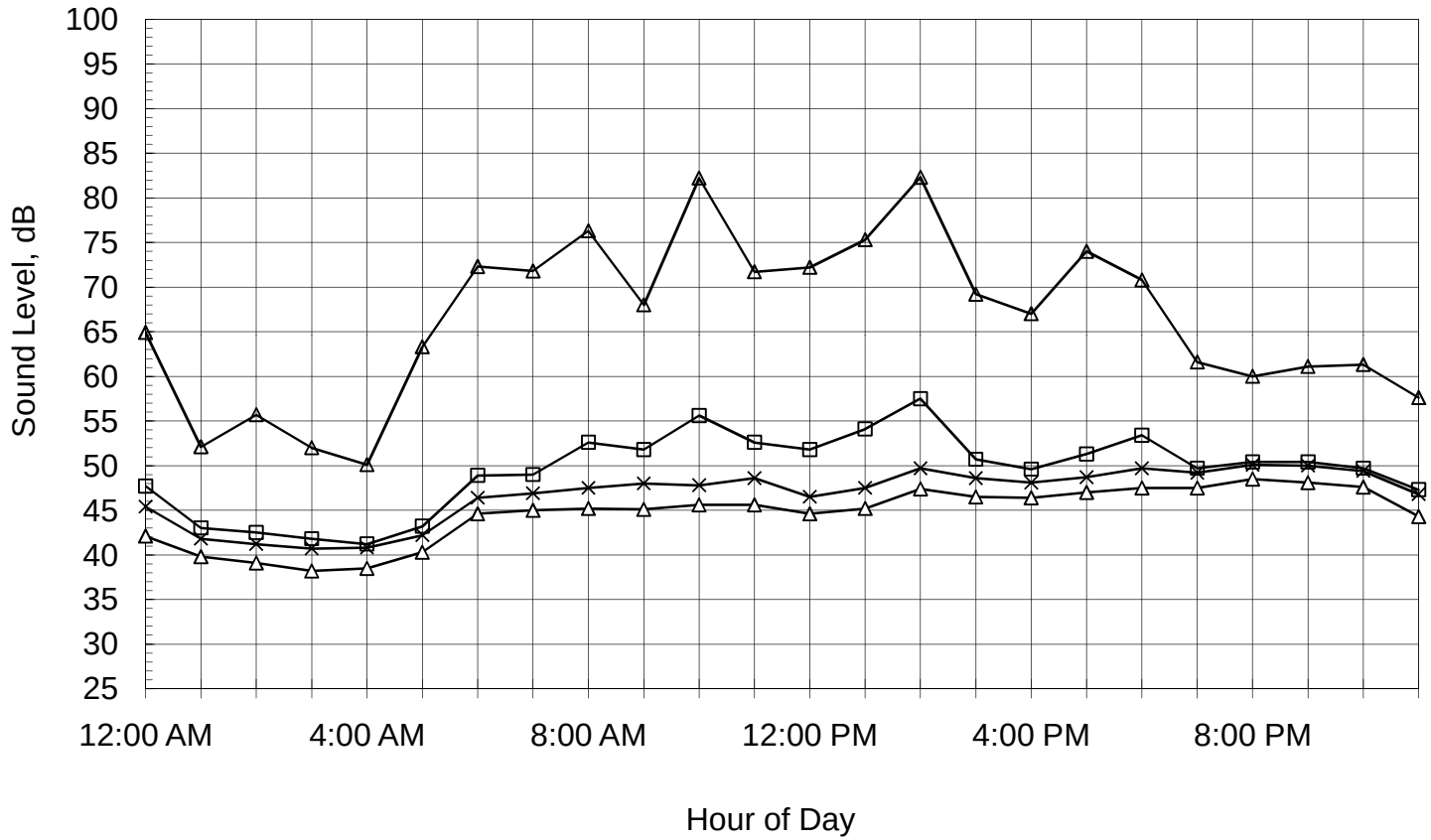


CNEL = 58.0 dB

Figure B-36: Measured Hourly Noise Levels

LVK Site 4

April 19, 2008

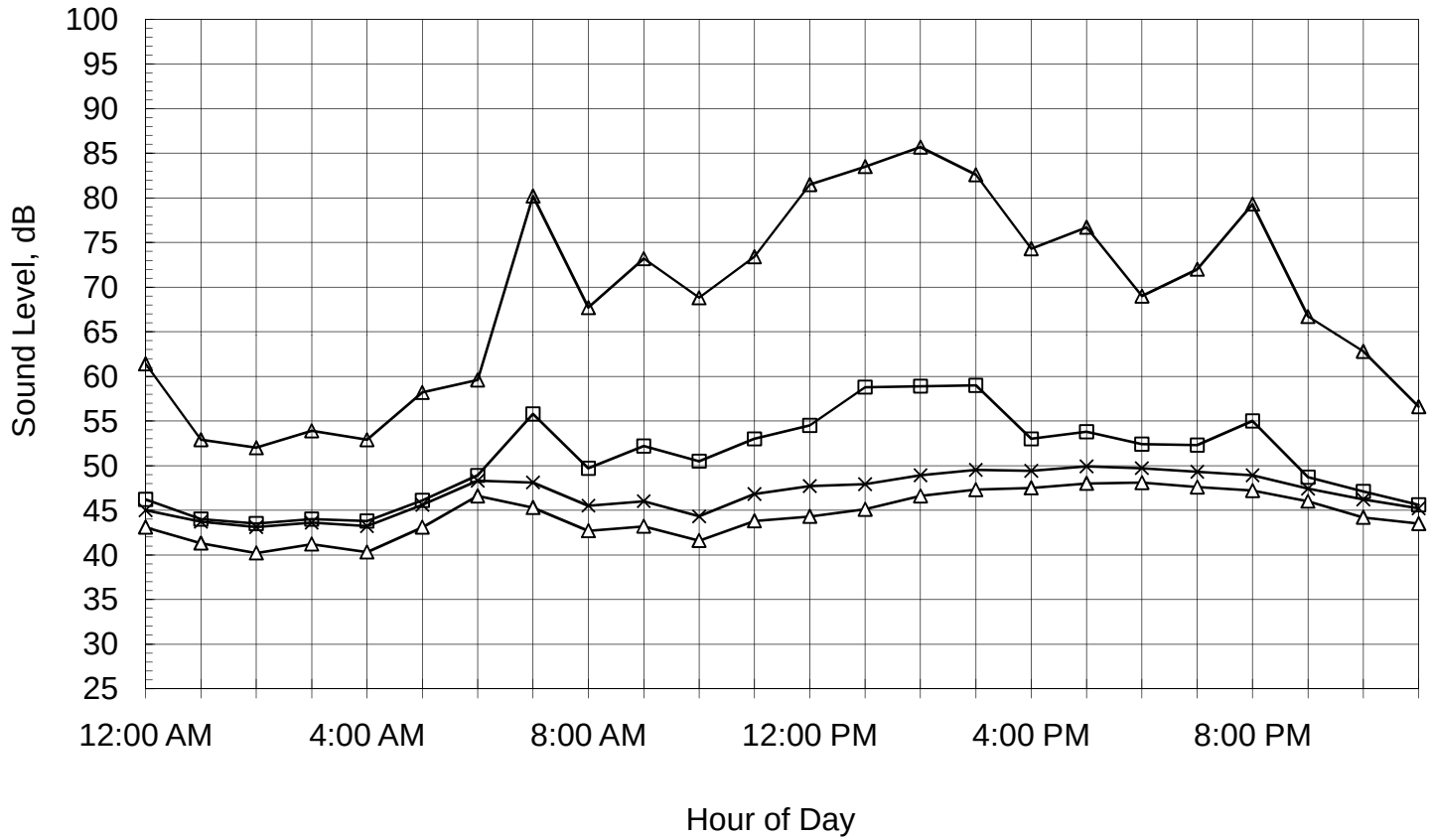


CNEL = 54.7 dB

Figure B-37: Measured Hourly Noise Levels

LVK Site 4

April 20, 2008

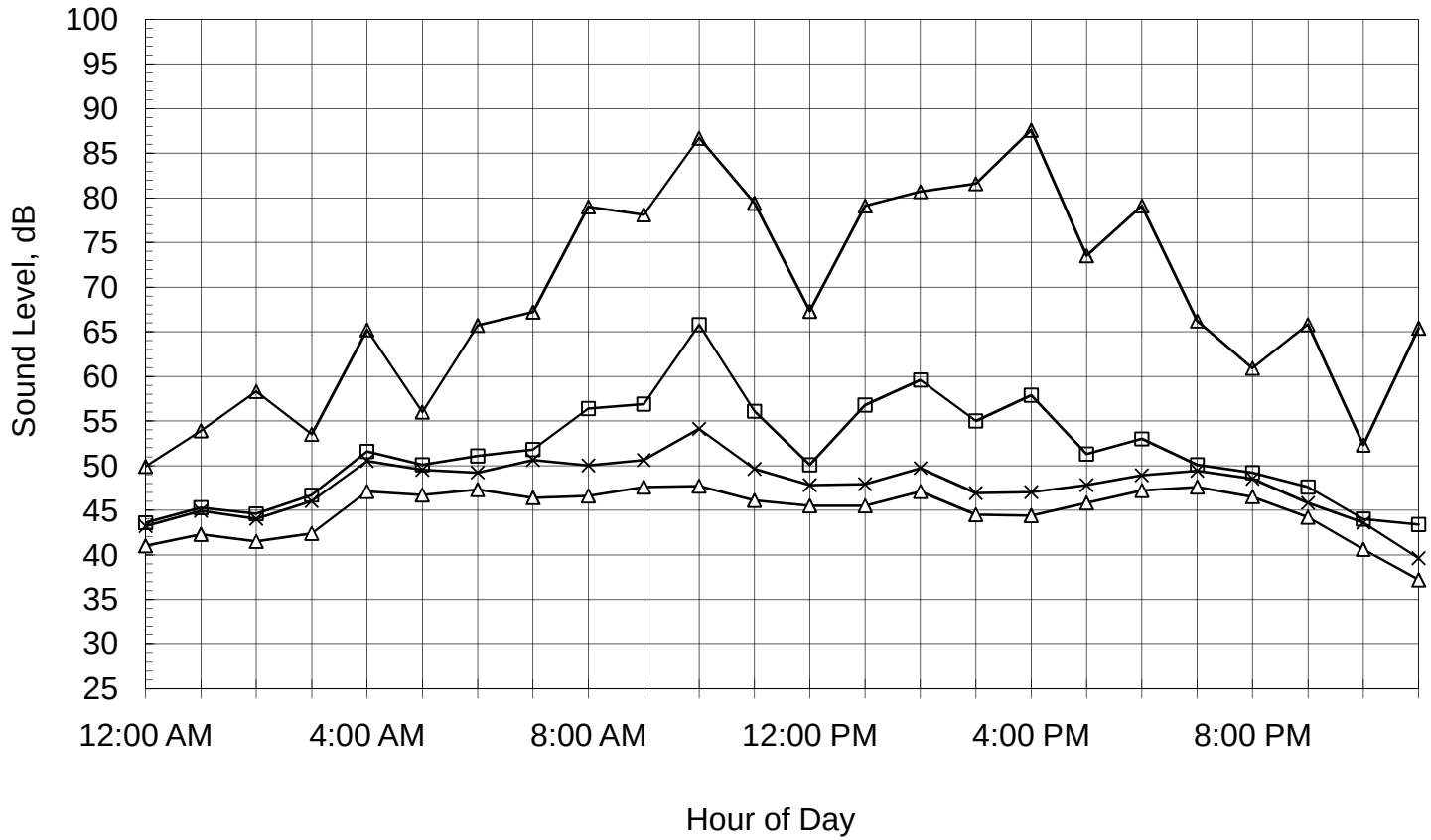


CNEL = 55.9 dB

Figure B-38: Measured Hourly Noise Levels

LVK Site 4

April 21, 2008

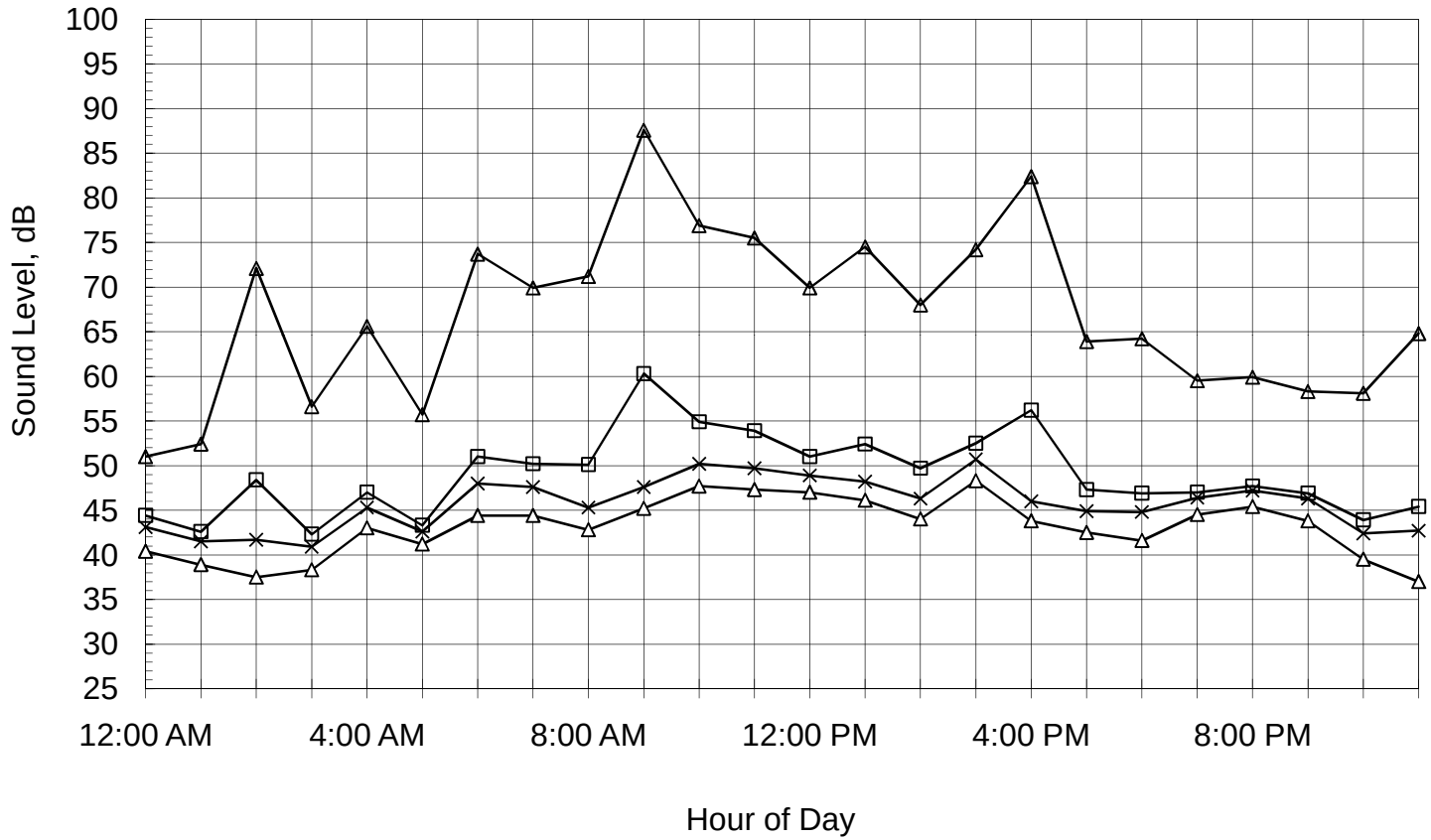


CNEL = 57.8 dB

Figure B-39: Measured Hourly Noise Levels

LVK Site 4

April 22, 2008

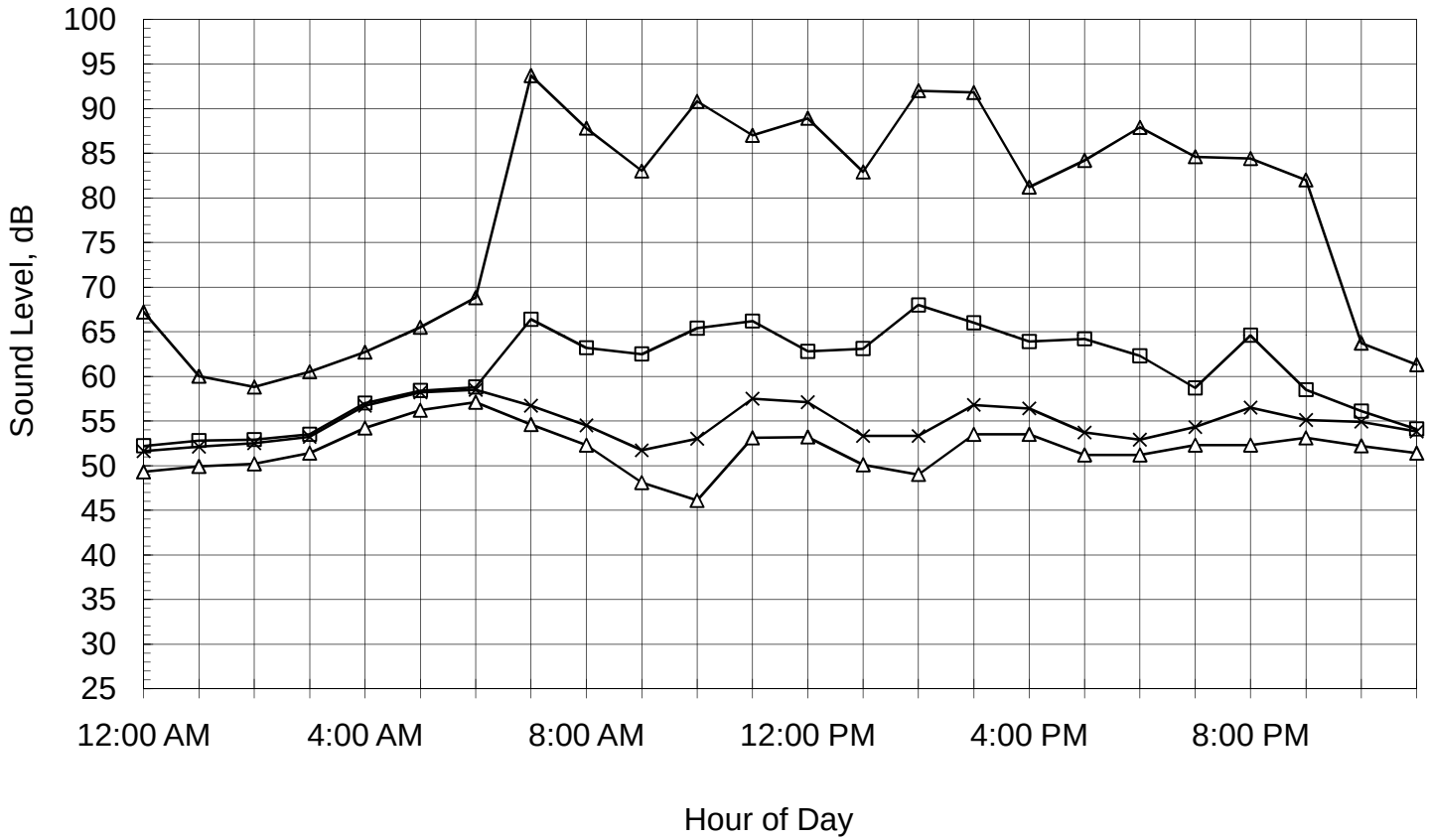


CNEL = 54.8 dB

Figure B-40: Measured Hourly Noise Levels

LVK Site 5

April 16, 2008

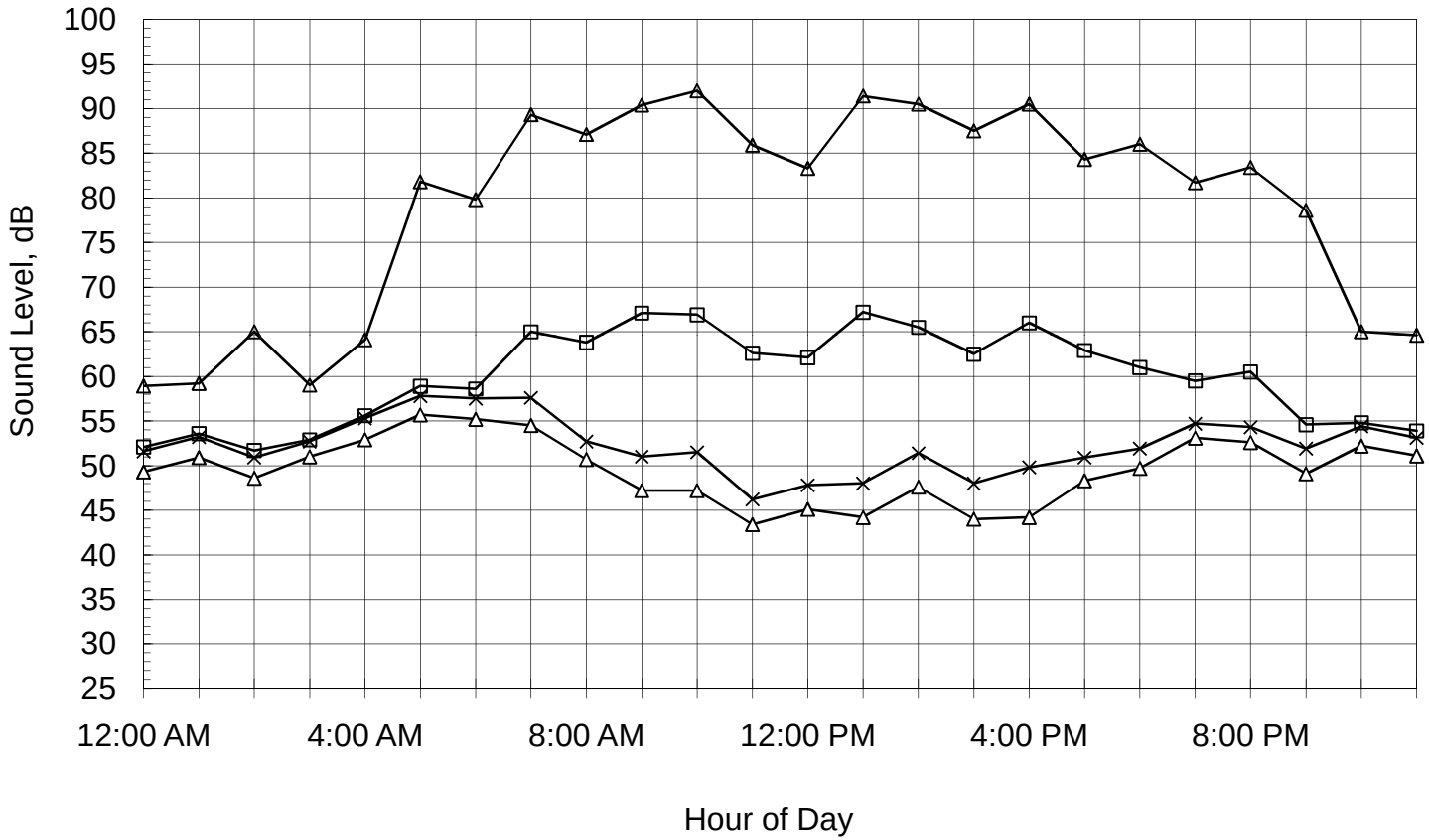


CNEL = 65.4 dB

Figure B-41: Measured Hourly Noise Levels

LVK Site 5

April 17, 2008

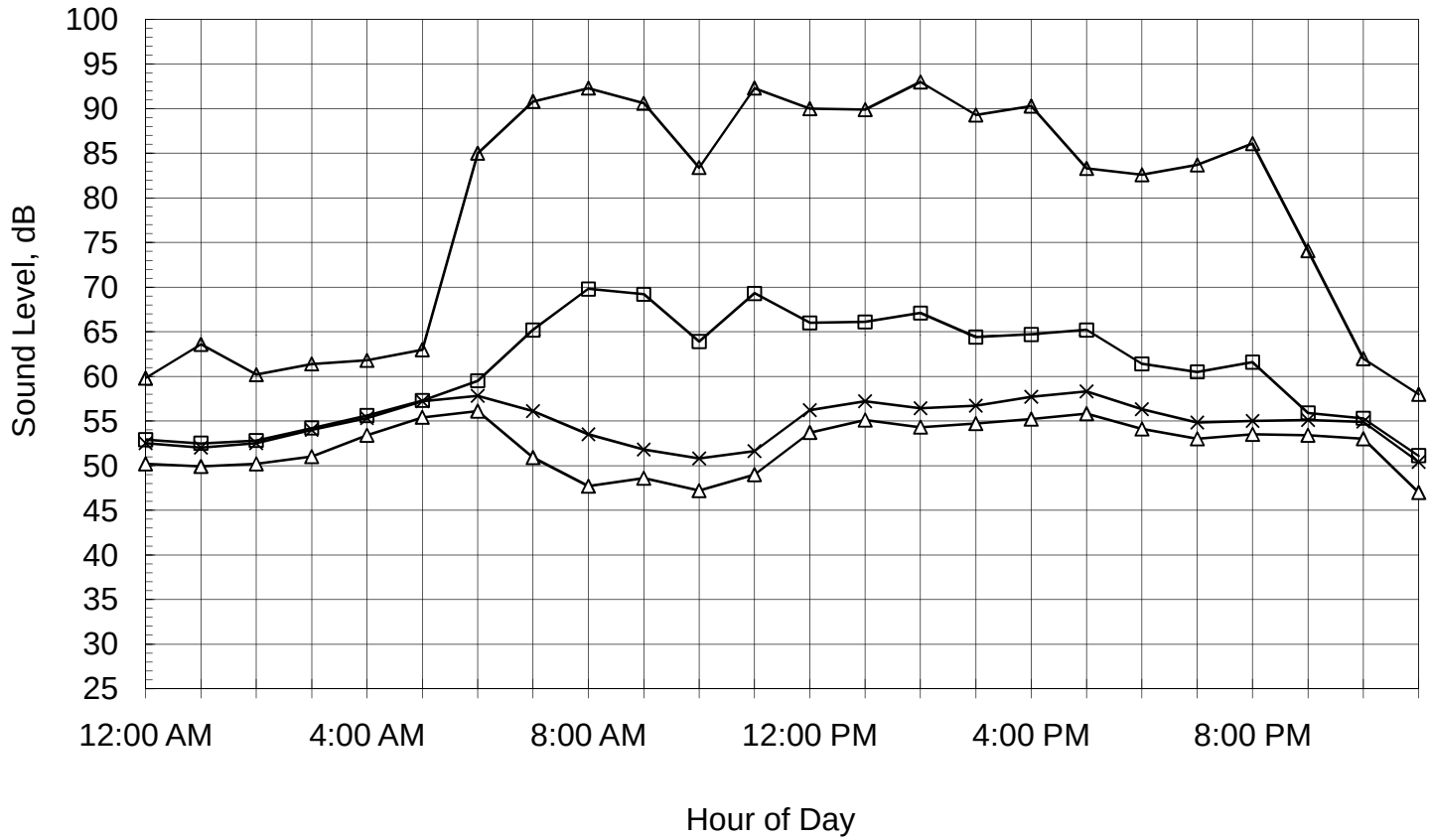


CNEL = 65.0 dB

Figure B-42: Measured Hourly Noise Levels

LVK Site 5

April 18, 2008

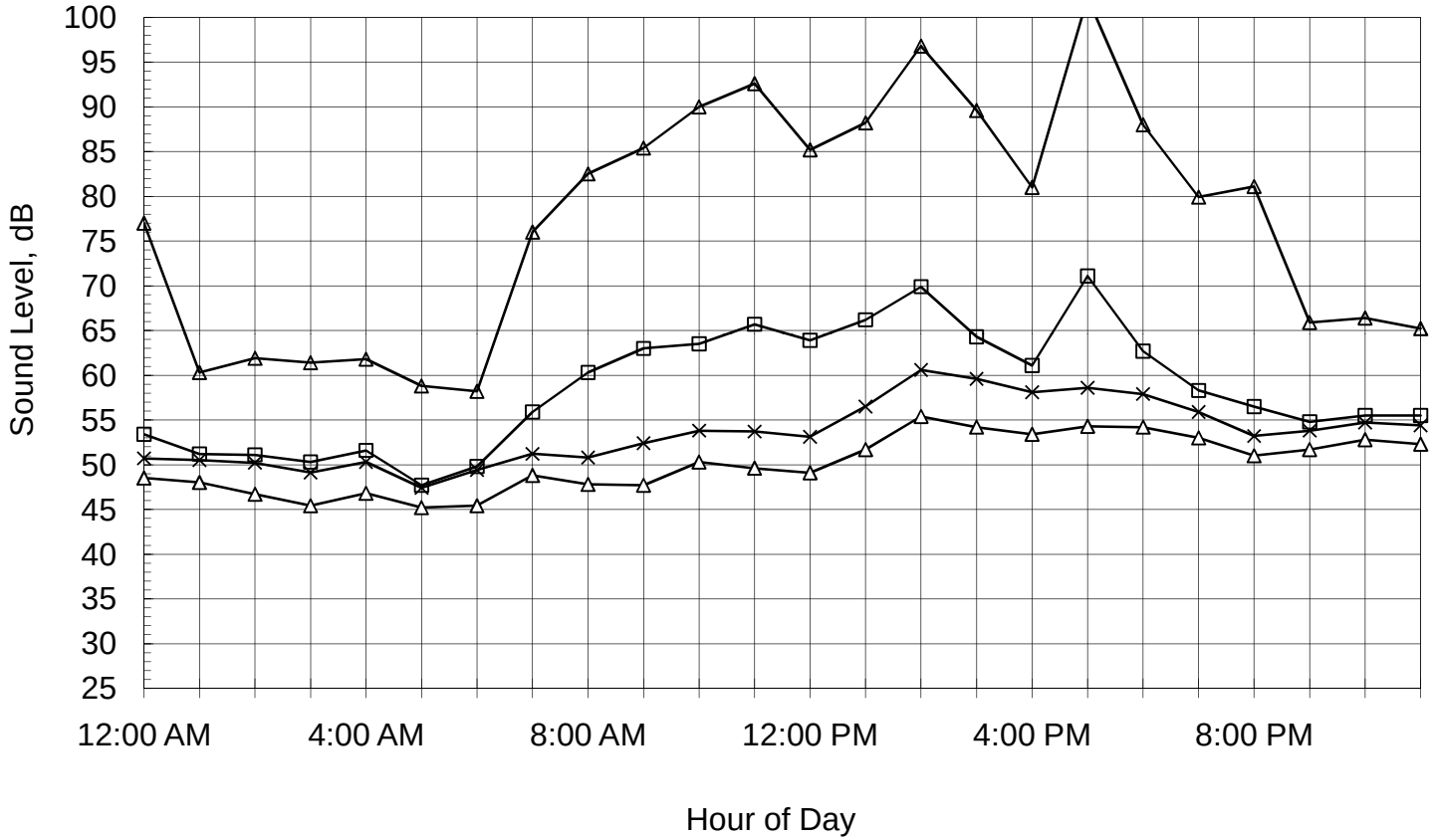


CNEL = 66.0 dB

Figure B-43: Measured Hourly Noise Levels

LVK Site 5

April 19, 2008

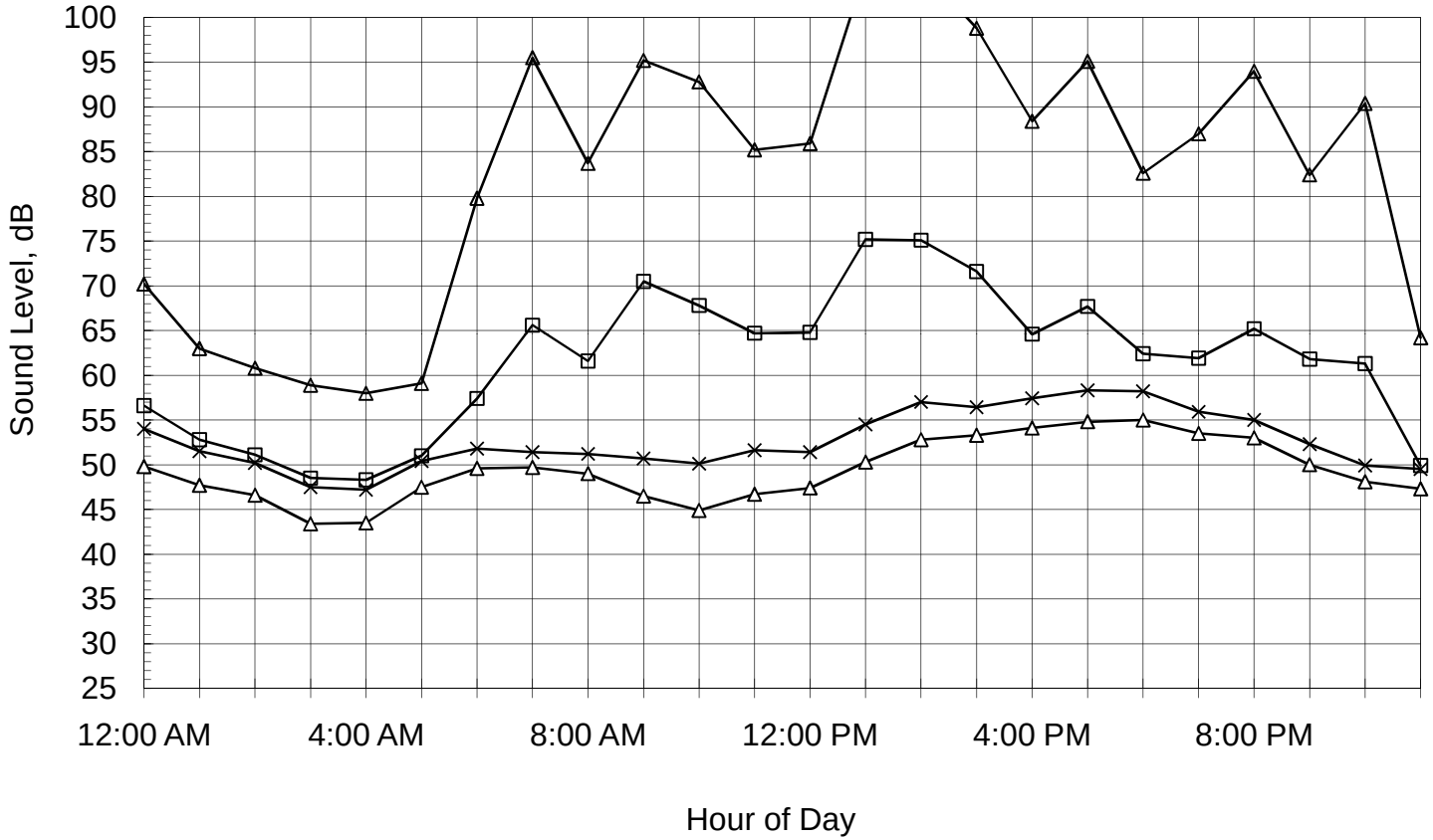


CNEL = 64.3 dB

Figure B-44: Measured Hourly Noise Levels

LVK Site 5

April 20, 2008

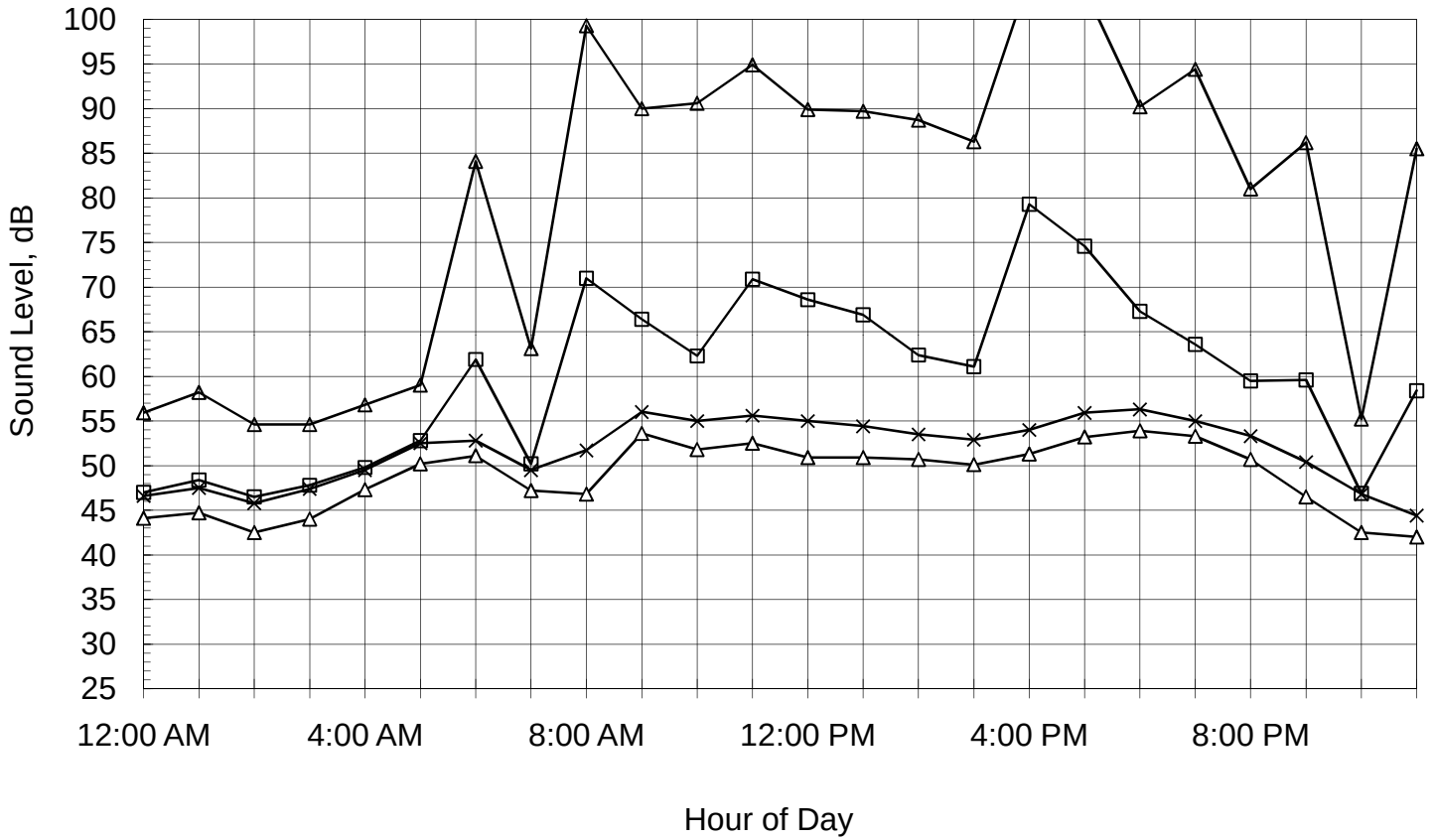


CNEL = 68.5 dB

Figure B-45: Measured Hourly Noise Levels

LVK Site 5

April 21, 2008

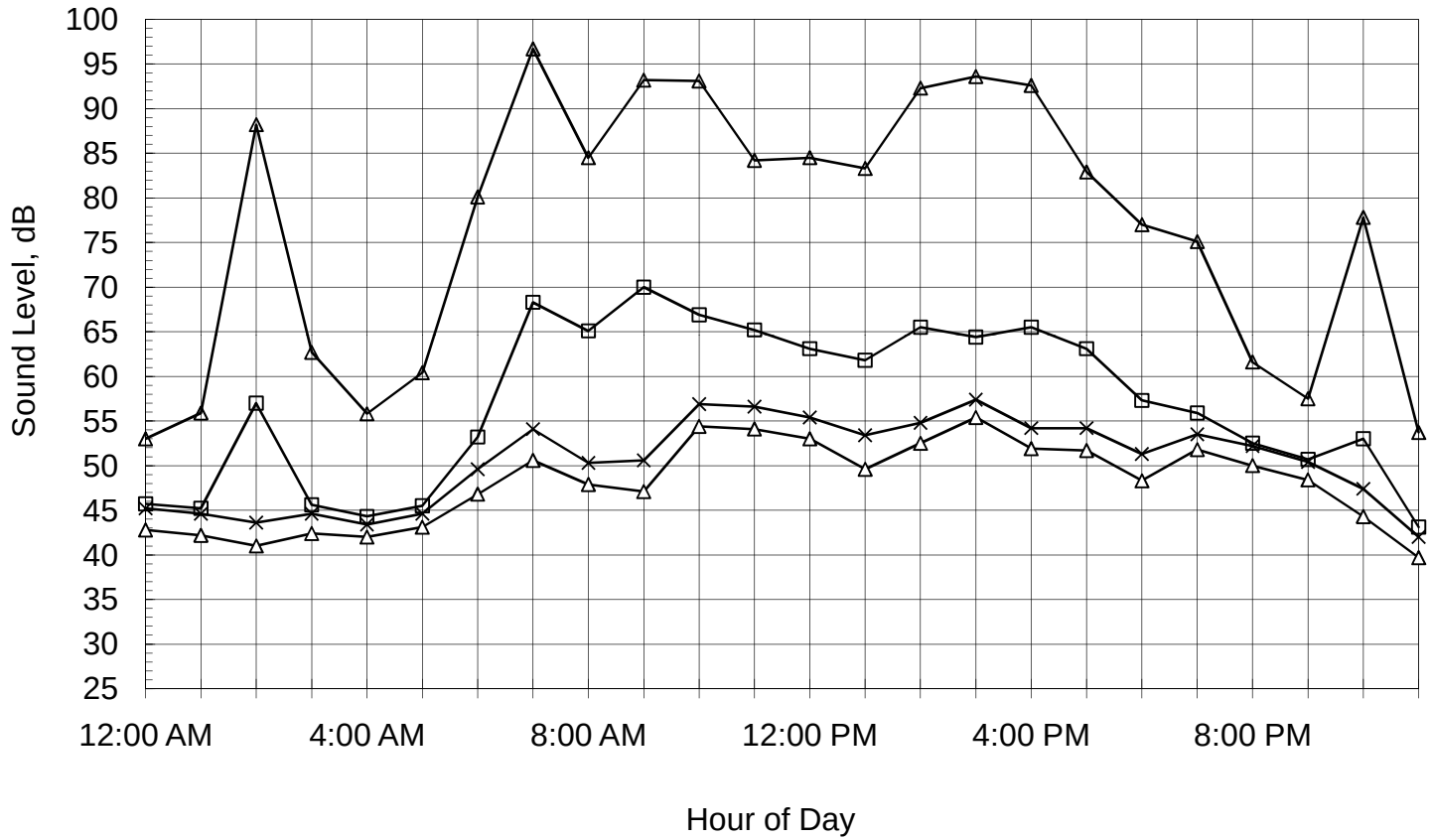


CNEL = 69.3 dB

Figure B-46: Measured Hourly Noise Levels

LVK Site 5

April 22, 2008

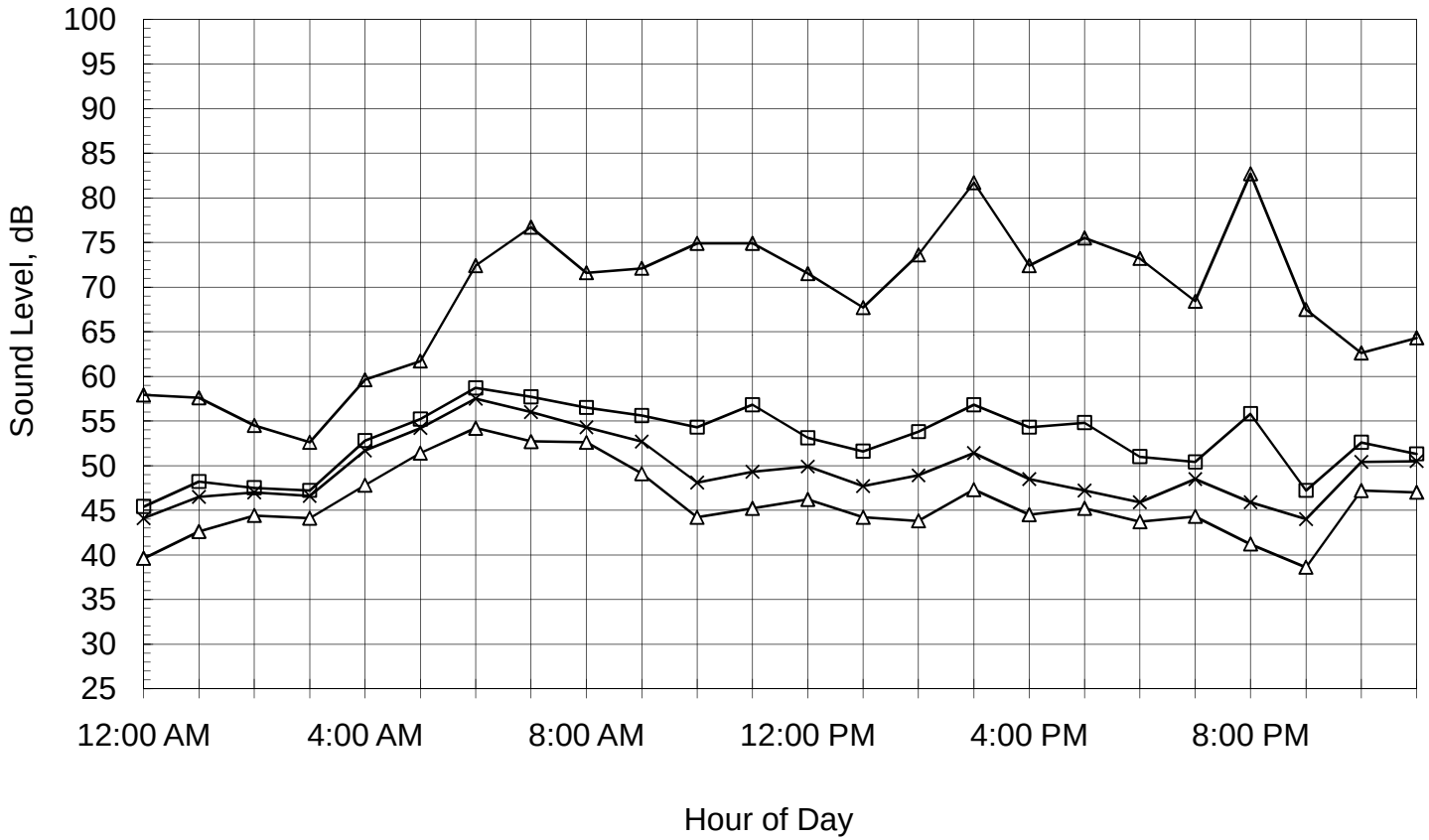


CNEL = 63.8 dB

Figure B-47: Measured Hourly Noise Levels

LVK Site 9

April 16, 2008

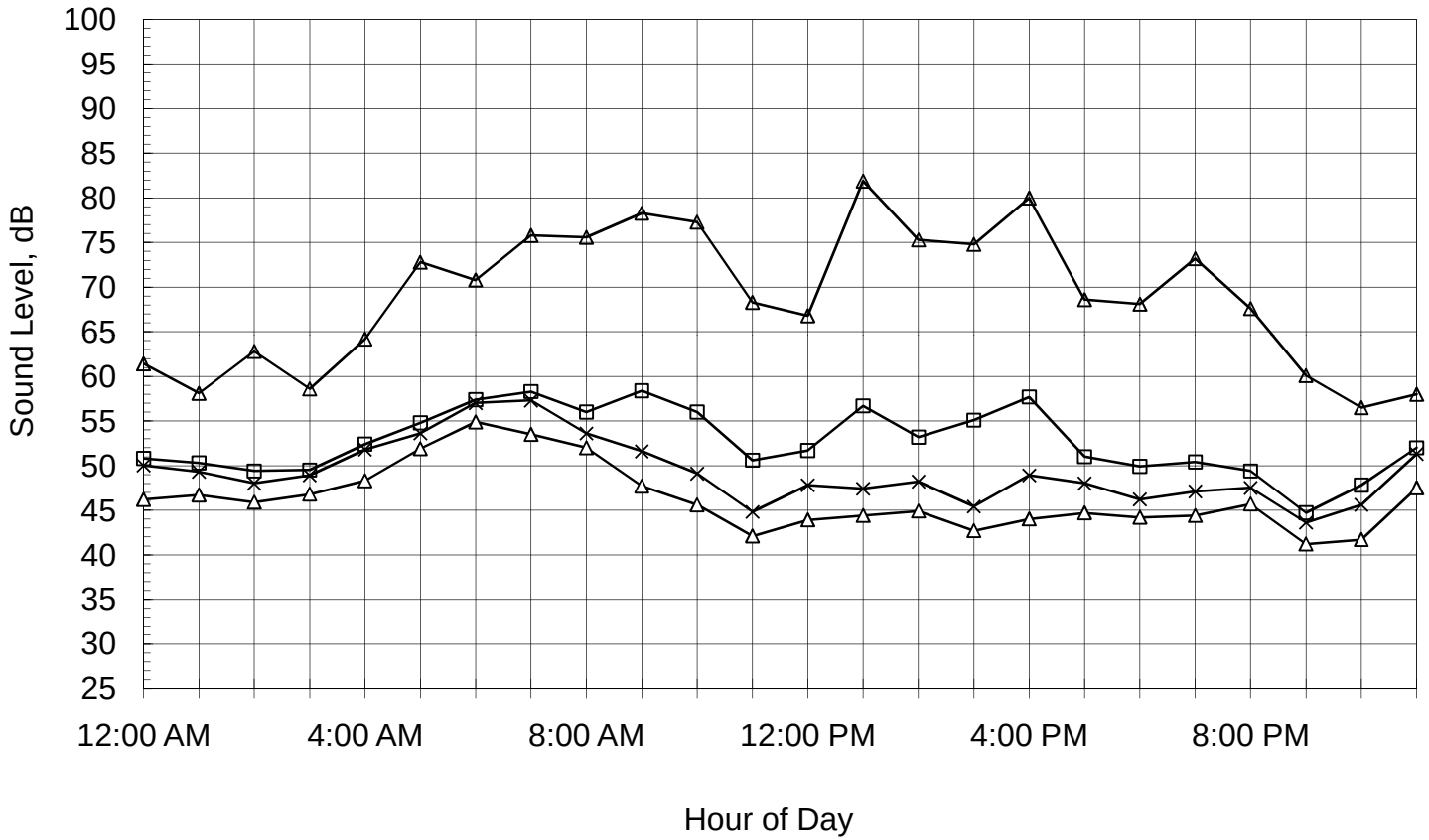


CNEL = 59.9 dB

Figure B-48: Measured Hourly Noise Levels

LVK Site 9

April 17, 2008

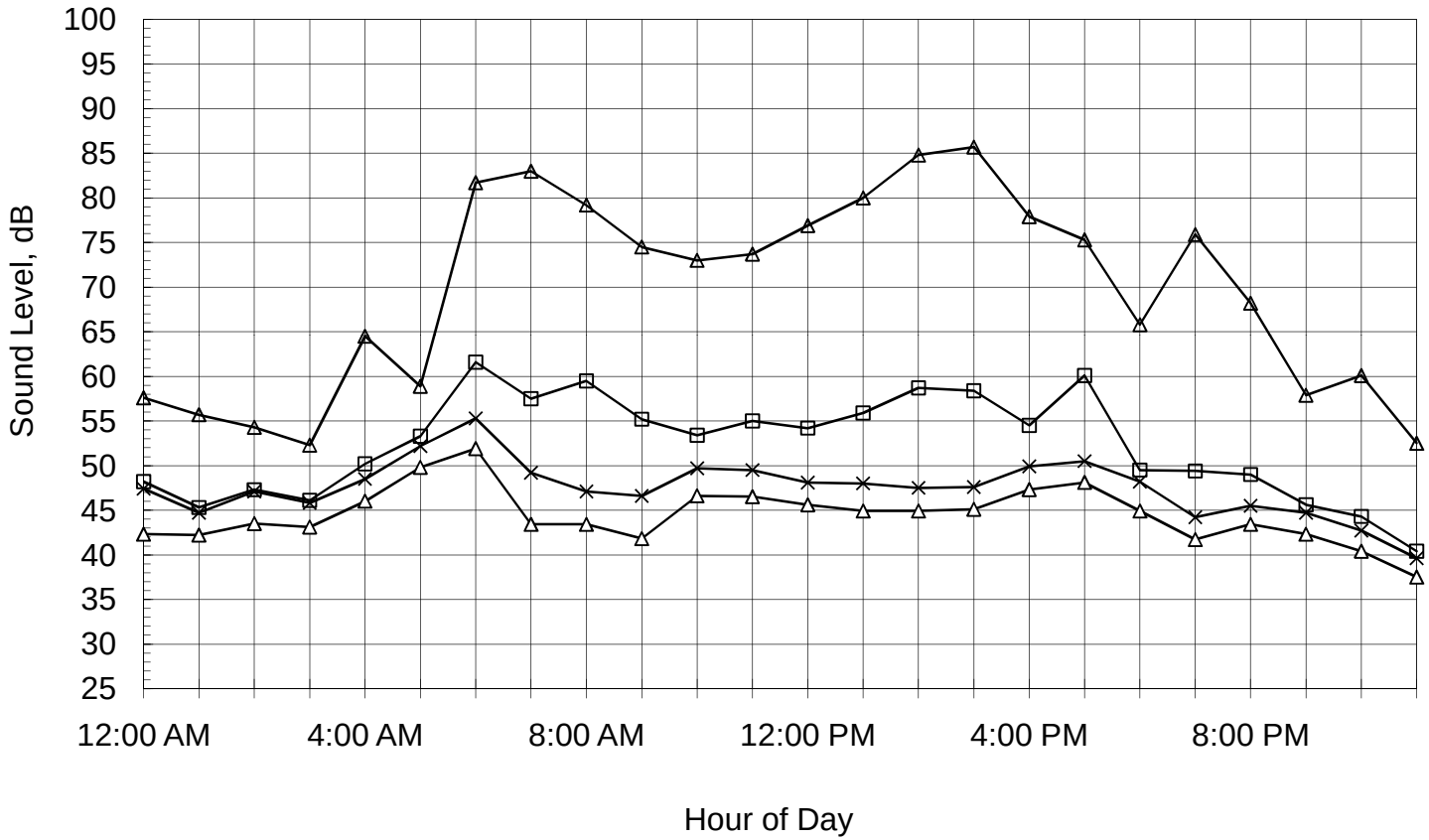


CNEL = 59.5 dB

Figure B-49: Measured Hourly Noise Levels

LVK Site 9

April 18, 2008

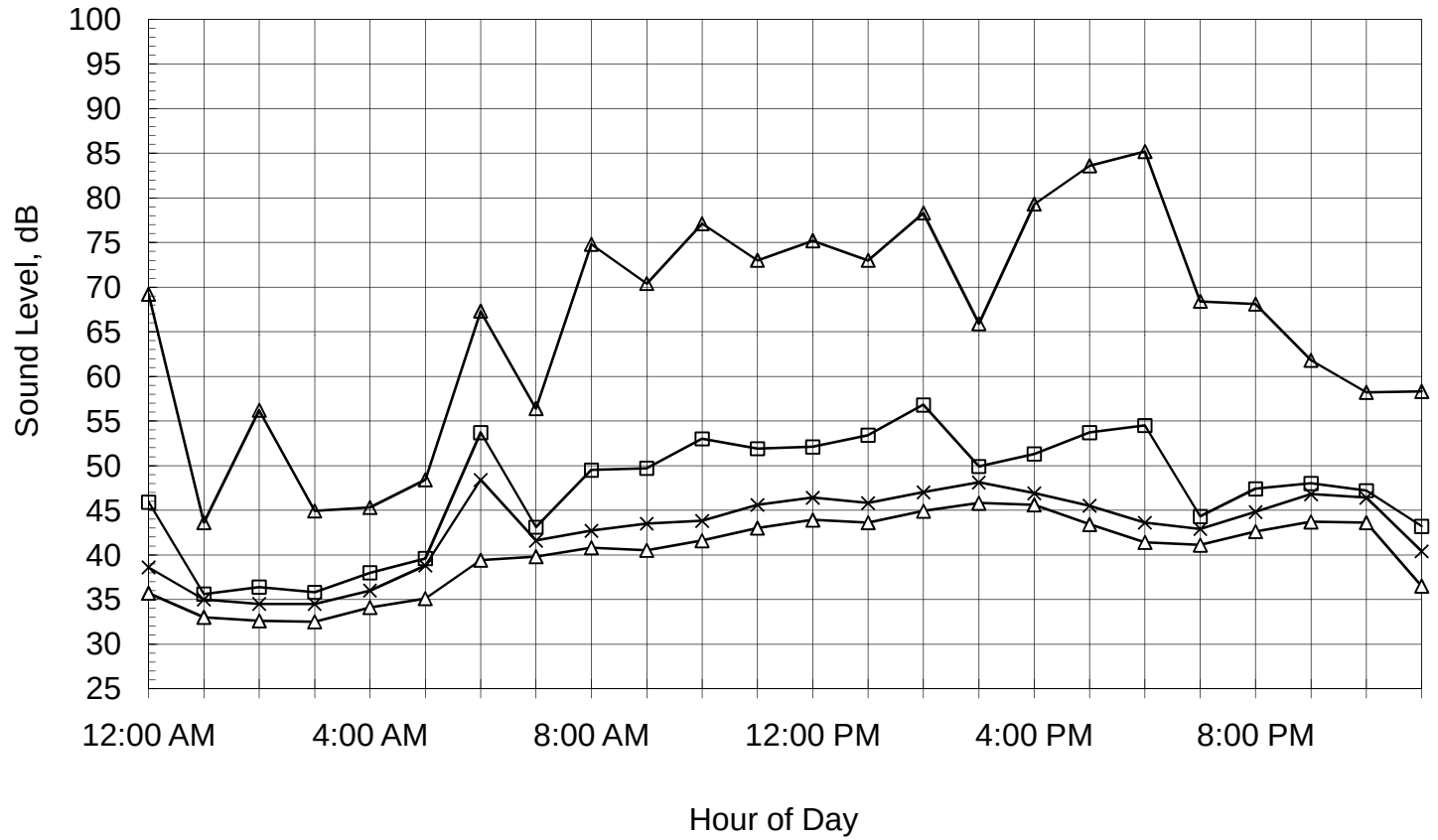


CNEL = 60.4 dB

Figure B-50: Measured Hourly Noise Levels

LVK Site 9

April 19, 2008

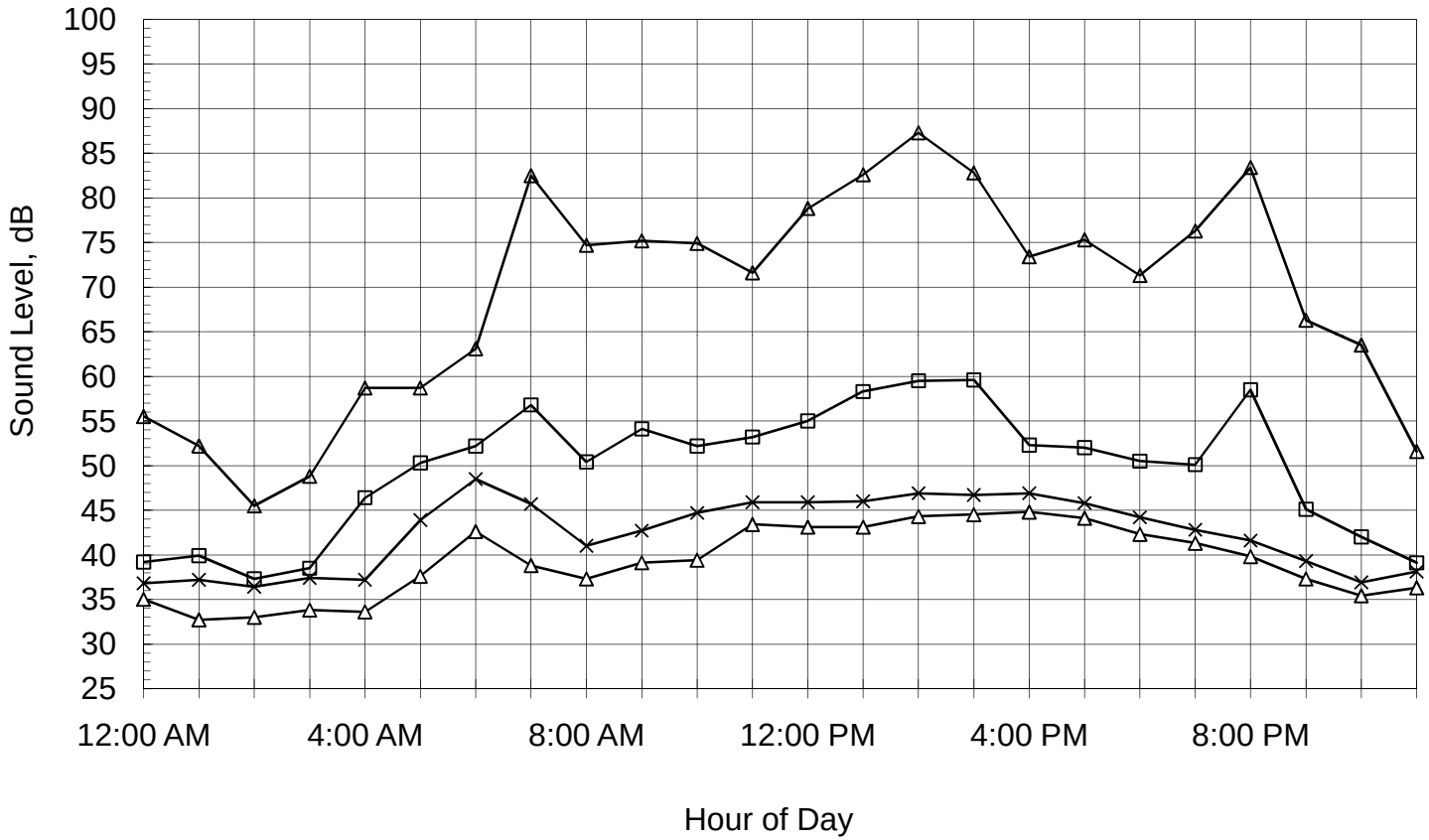


CNEL = 54.2 dB

Figure B-51: Measured Hourly Noise Levels

LVK Site 9

April 20, 2008

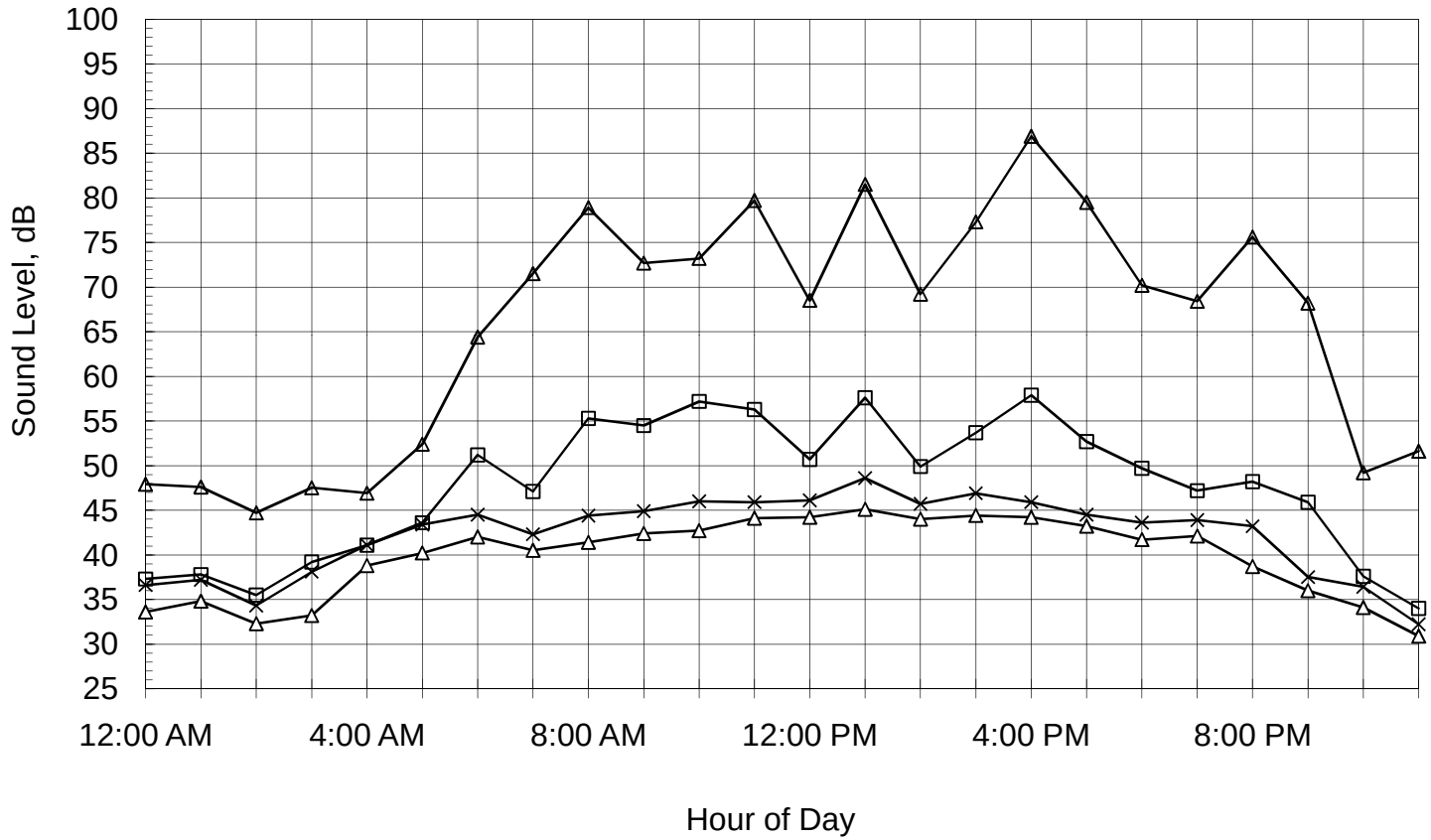


CNEL = 56.5 dB

Figure B-52: Measured Hourly Noise Levels

LVK Site 9

April 21, 2008

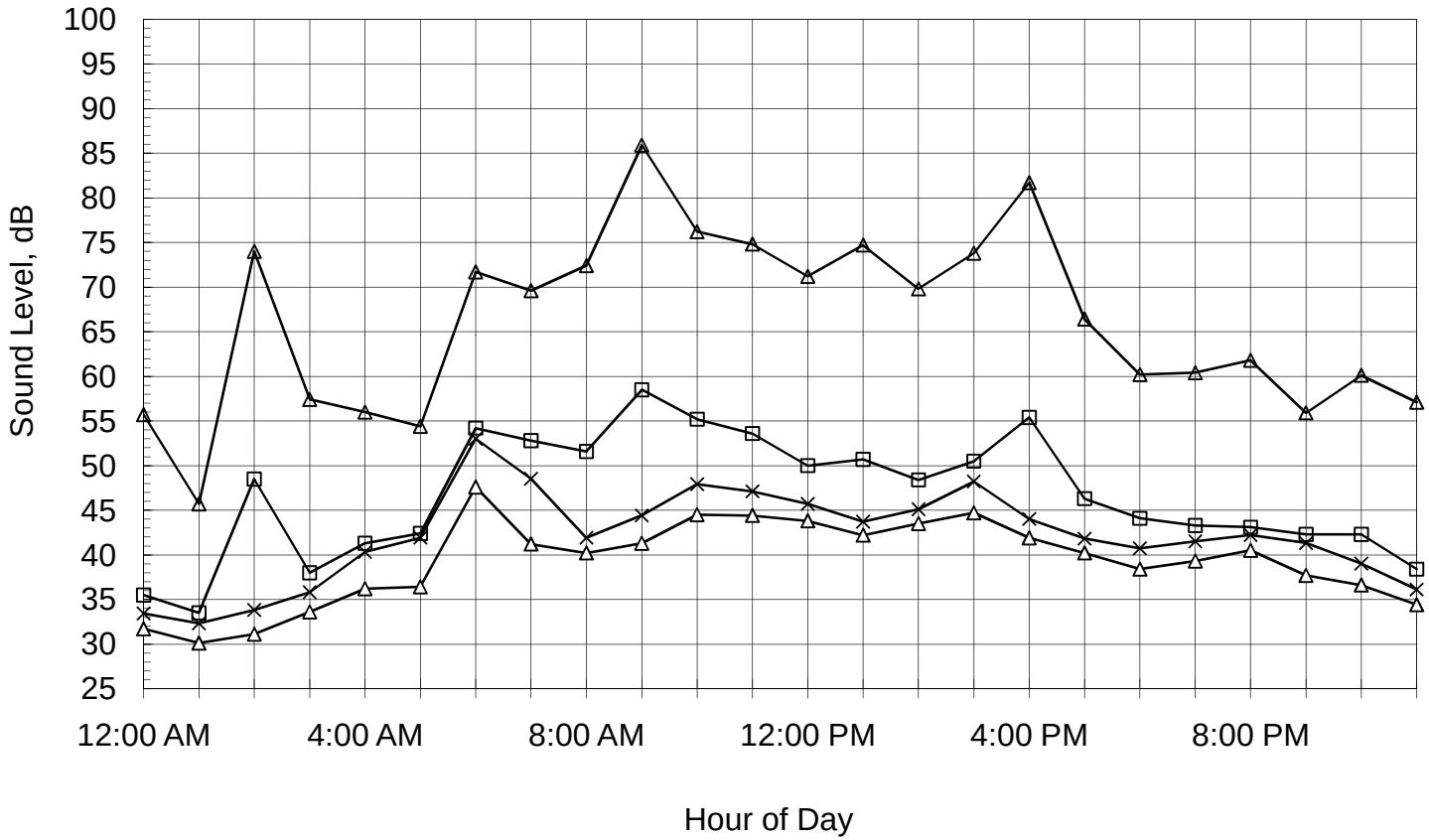


CNEL = 54.0 dB

Figure B-53: Measured Hourly Noise Levels

LVK Site 9

April 22, 2008

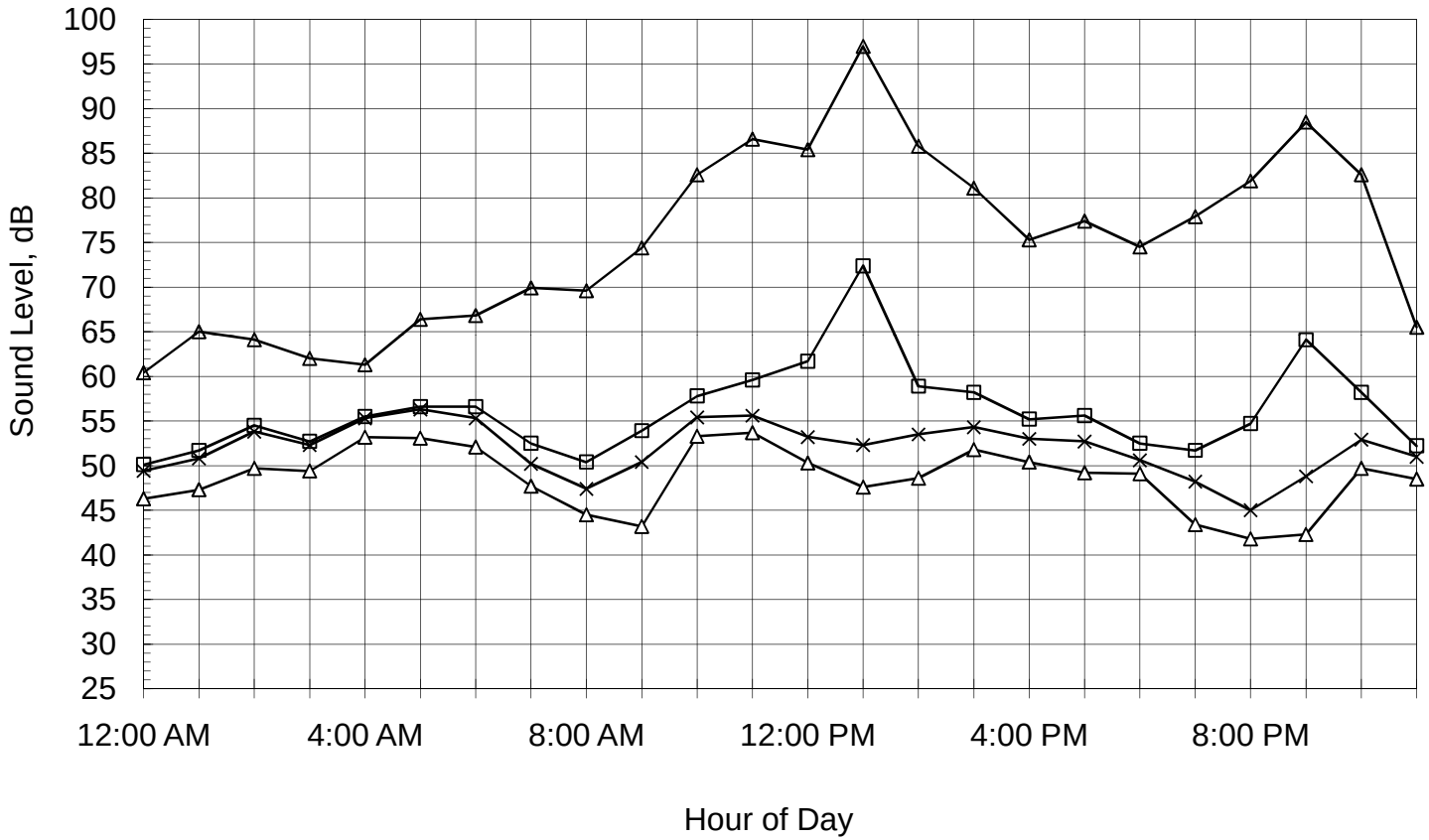


CNEL = 54.4 dB

Figure B-54: Measured Hourly Noise Levels

LVK Site 10

April 16, 2008

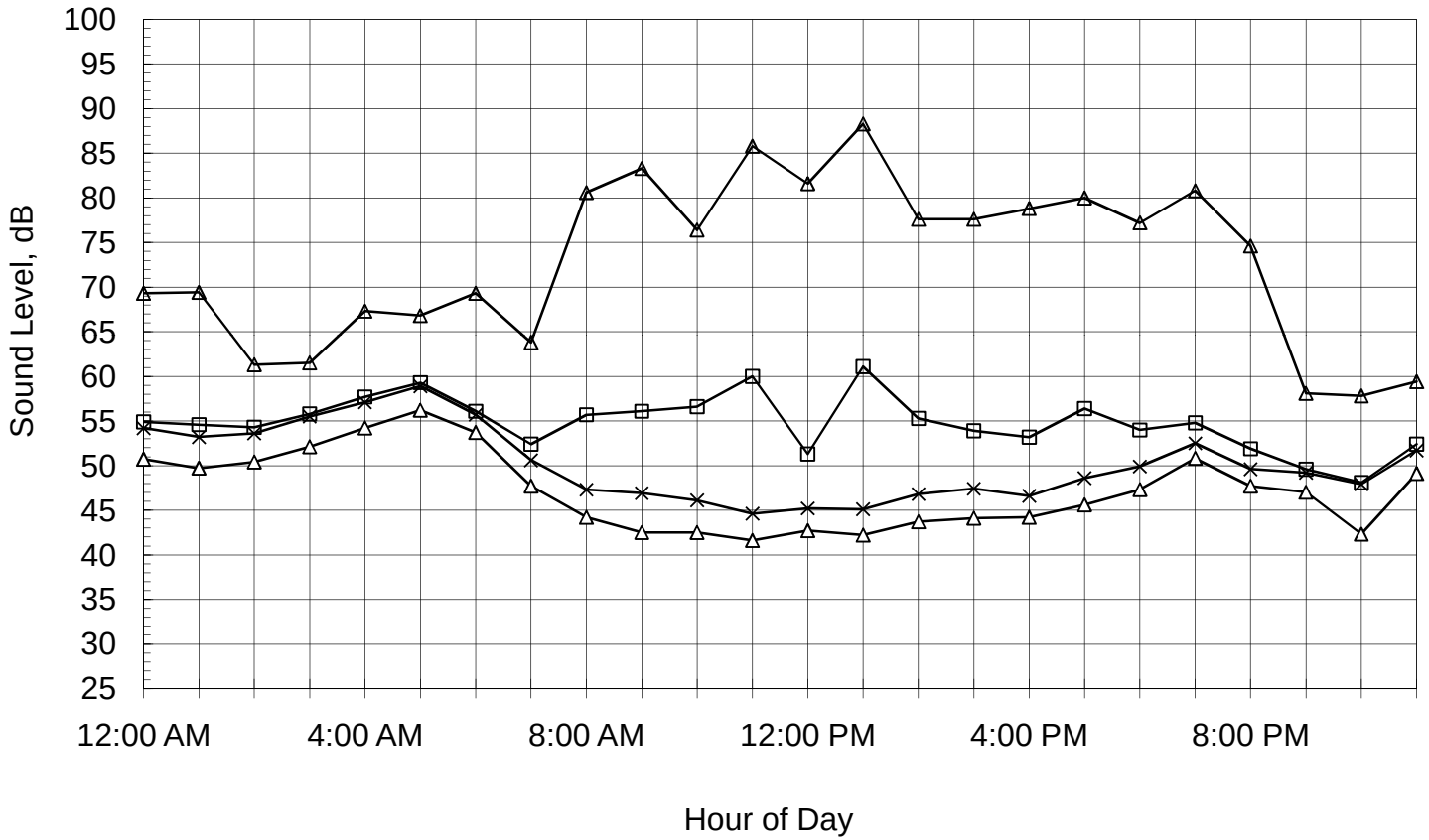


CNEL = 64.0 dB

Figure B-55: Measured Hourly Noise Levels

LVK Site 10

April 17, 2008

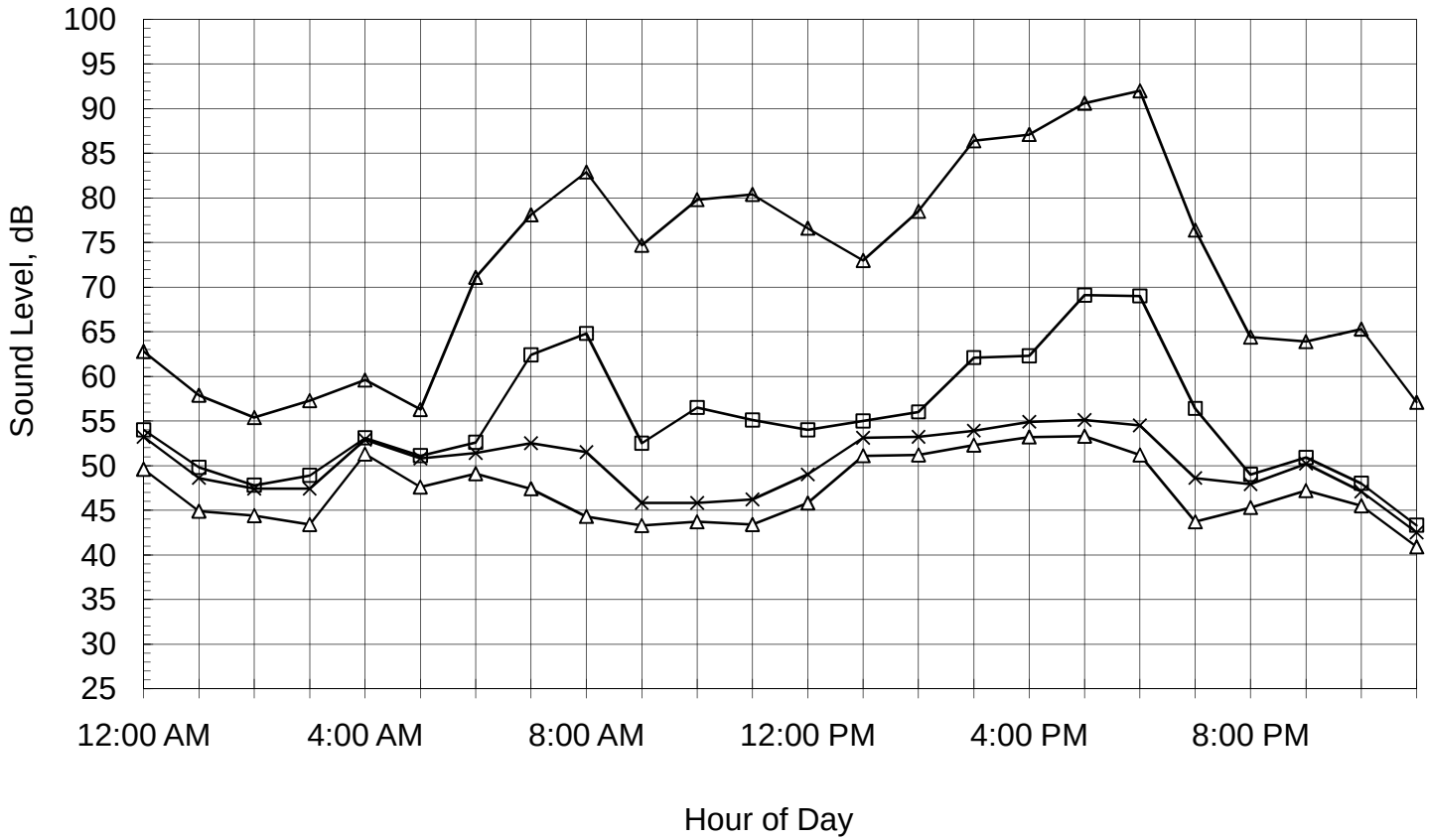


CNEL = 62.2 dB

Figure B-56: Measured Hourly Noise Levels

LVK Site 10

April 18, 2008

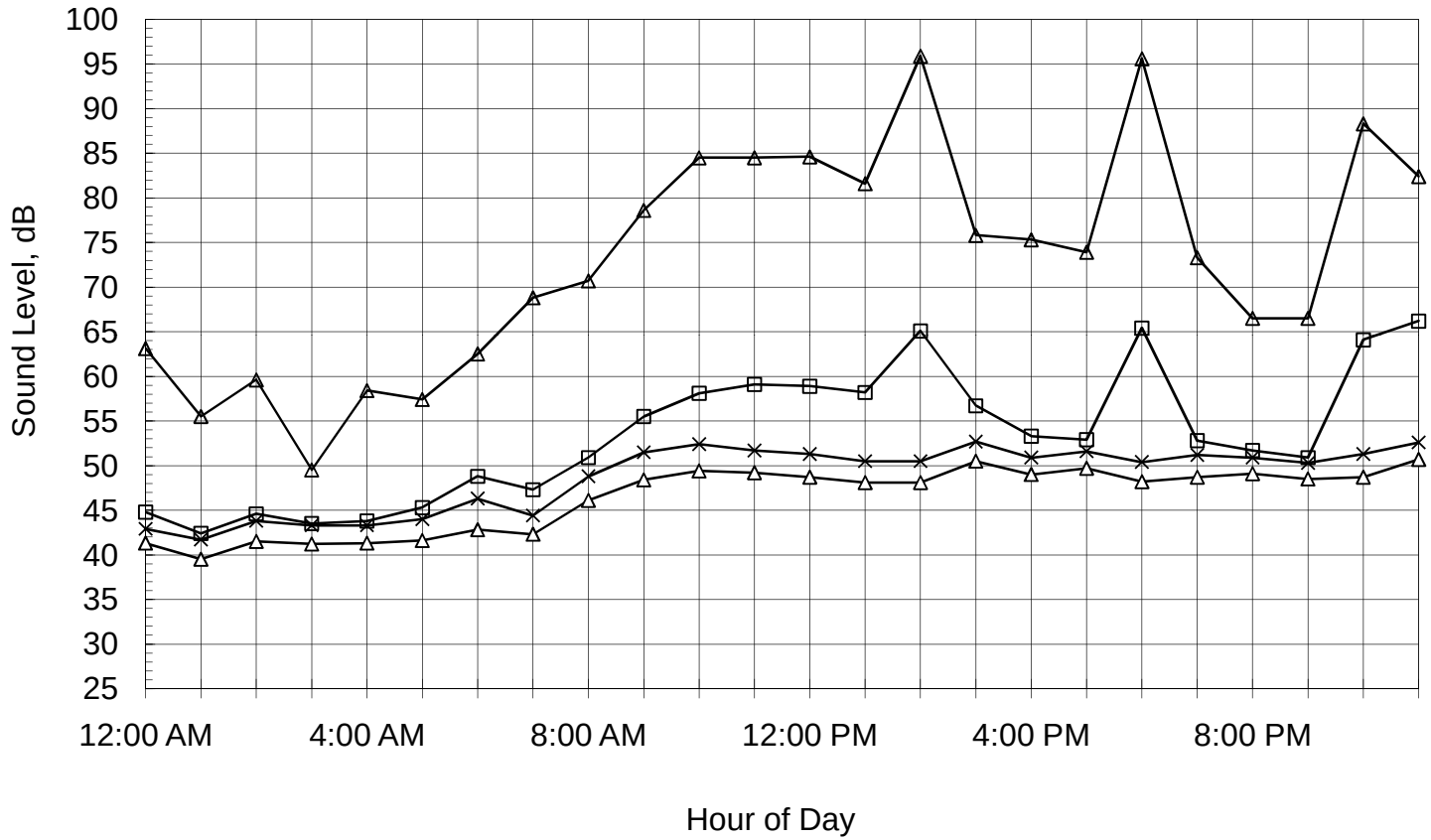


CNEL = 62.1 dB

Figure B-57: Measured Hourly Noise Levels

LVK Site 10

April 19, 2008

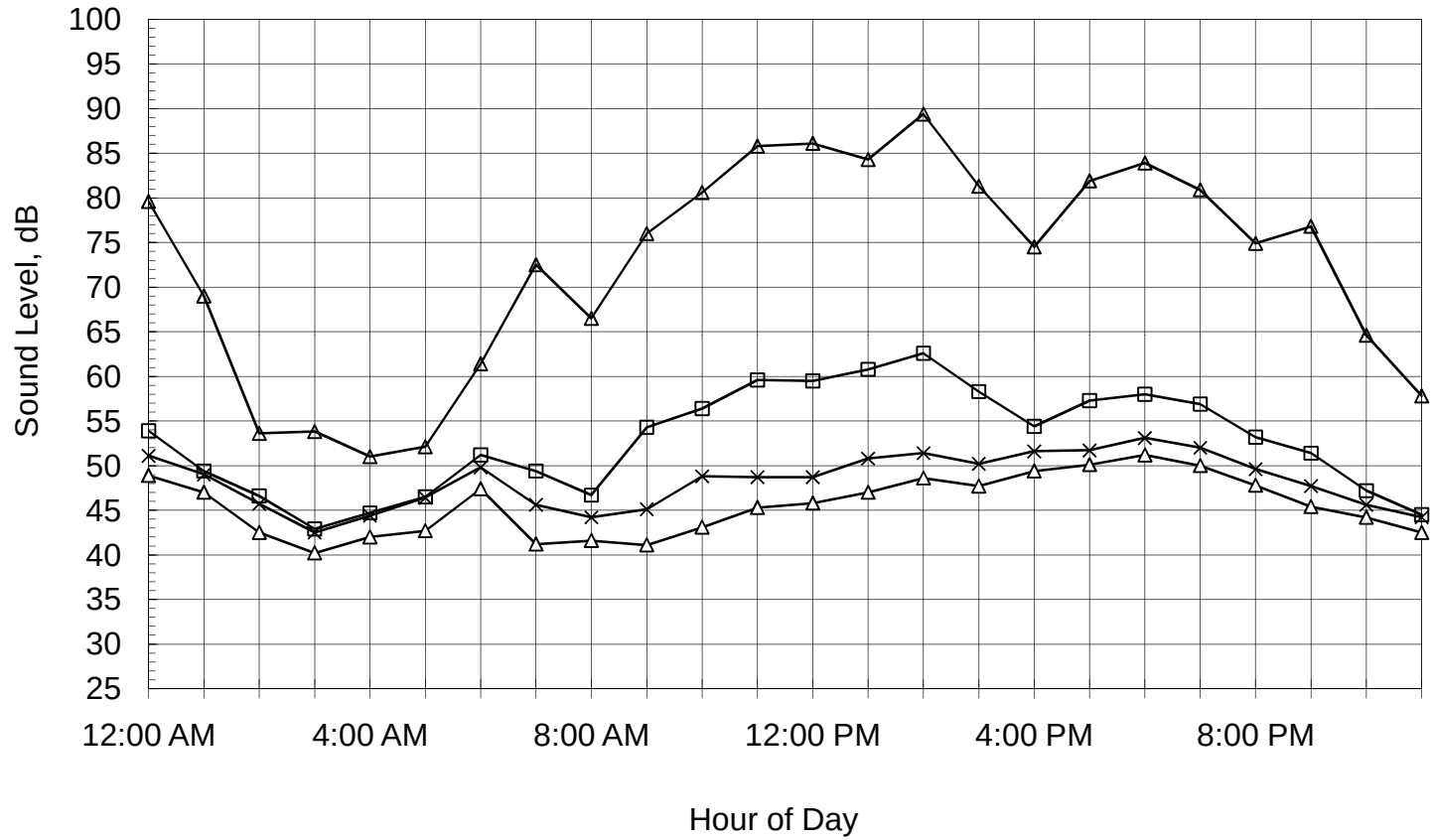


CNEL = 65.3 dB

Figure B-58: Measured Hourly Noise Levels

LVK Site 10

April 20, 2008

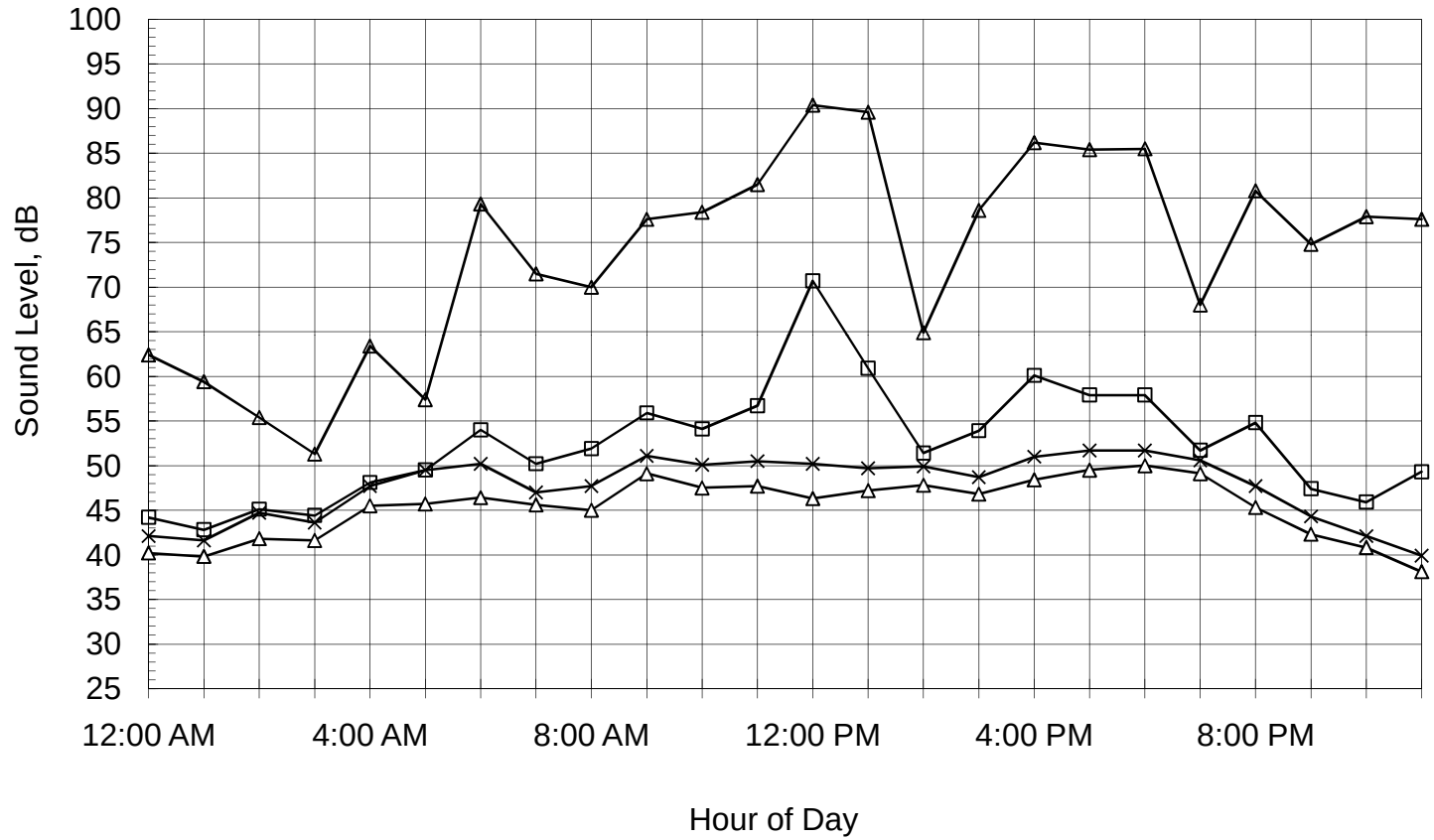


CNEL = 58.5 dB

Figure B-59: Measured Hourly Noise Levels

LVK Site 10

April 21, 2008

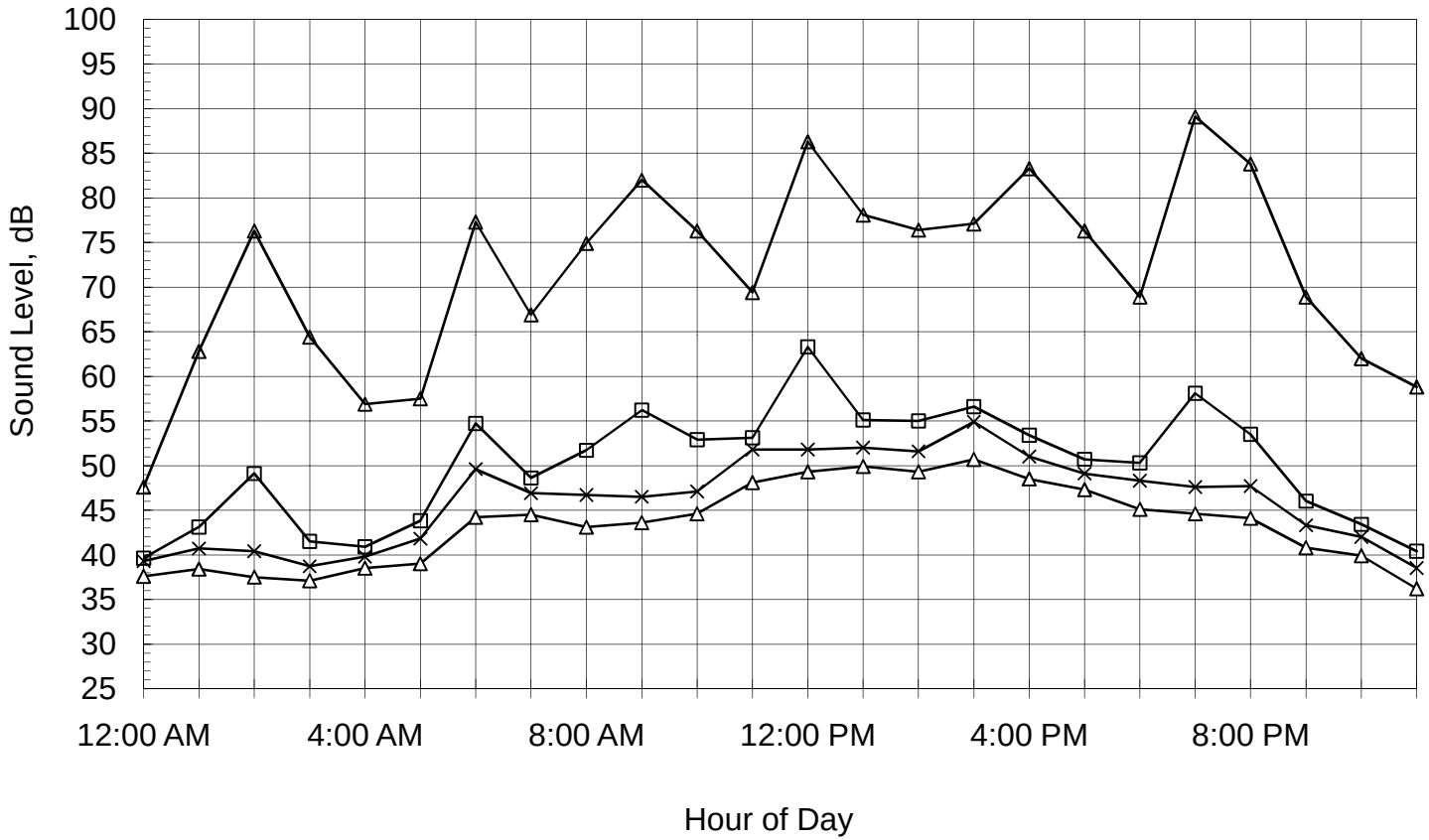


CNEL = 60.2 dB

Figure B-60: Measured Hourly Noise Levels

LVK Site 10

April 22, 2008

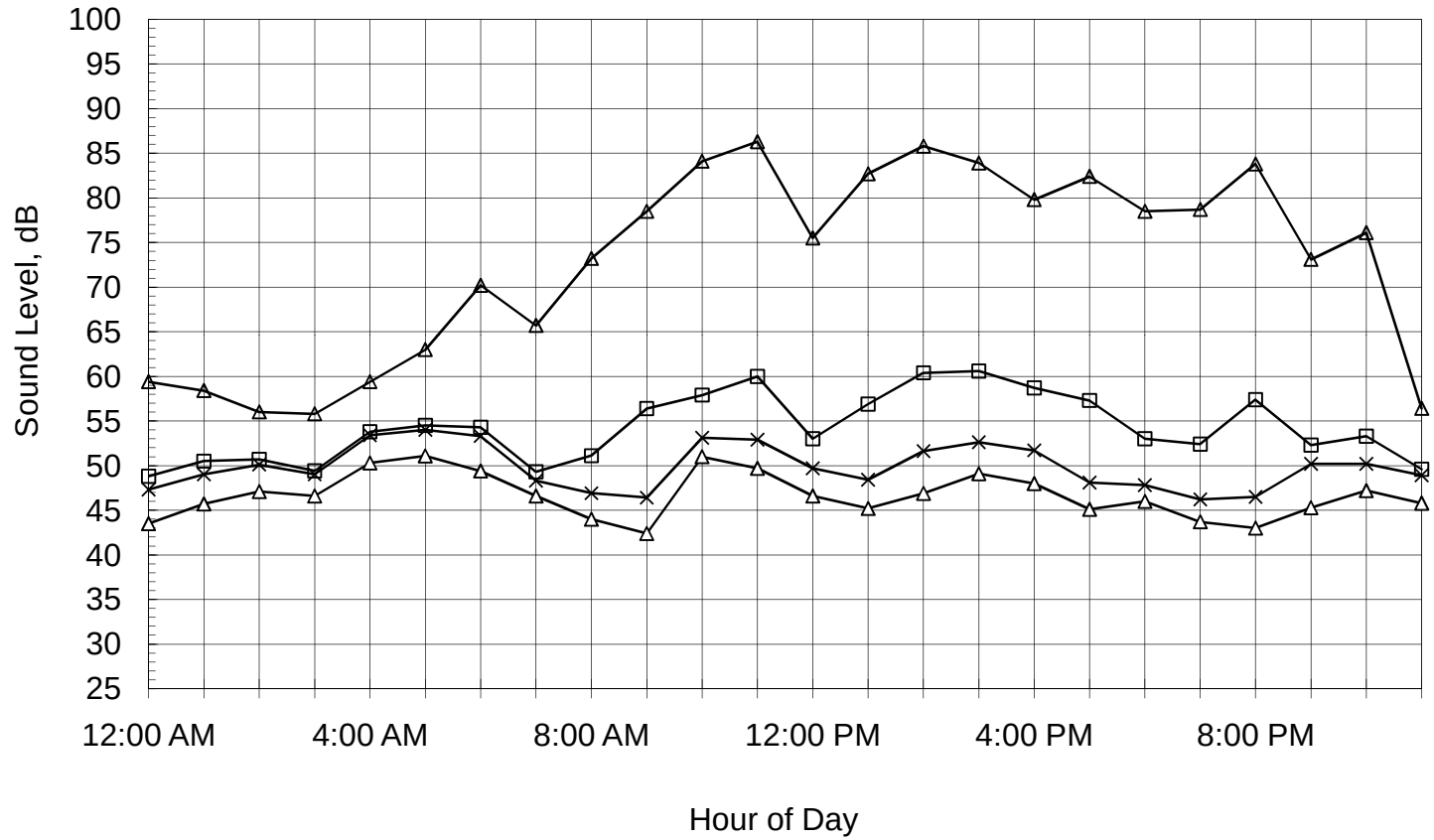


CNEL = 57.1 dB

Figure B-61: Measured Hourly Noise Levels

LVK Site 11

April 16, 2008

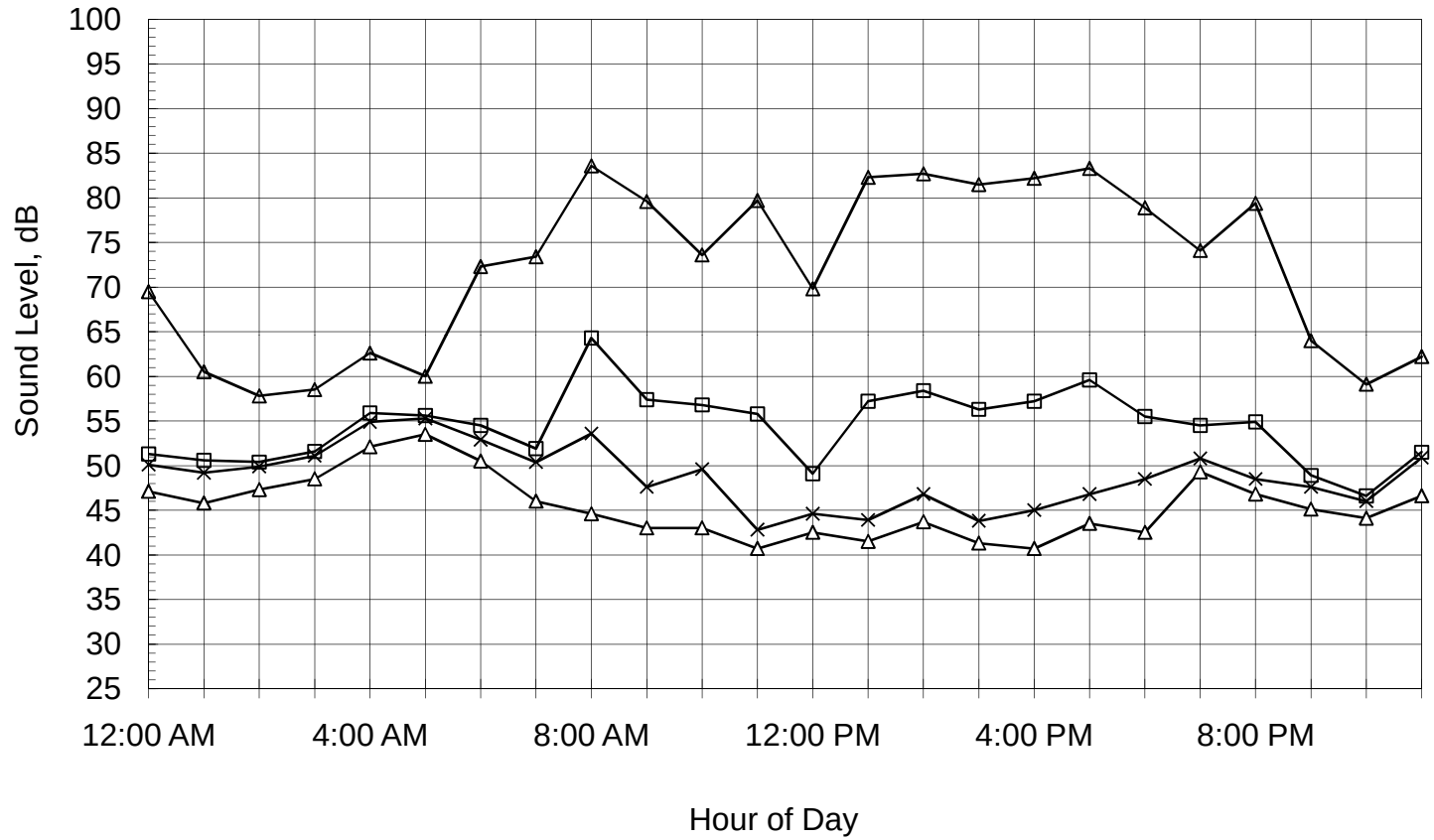


CNEL = 60.0 dB

Figure B-62: Measured Hourly Noise Levels

LVK Site 11

April 17, 2008

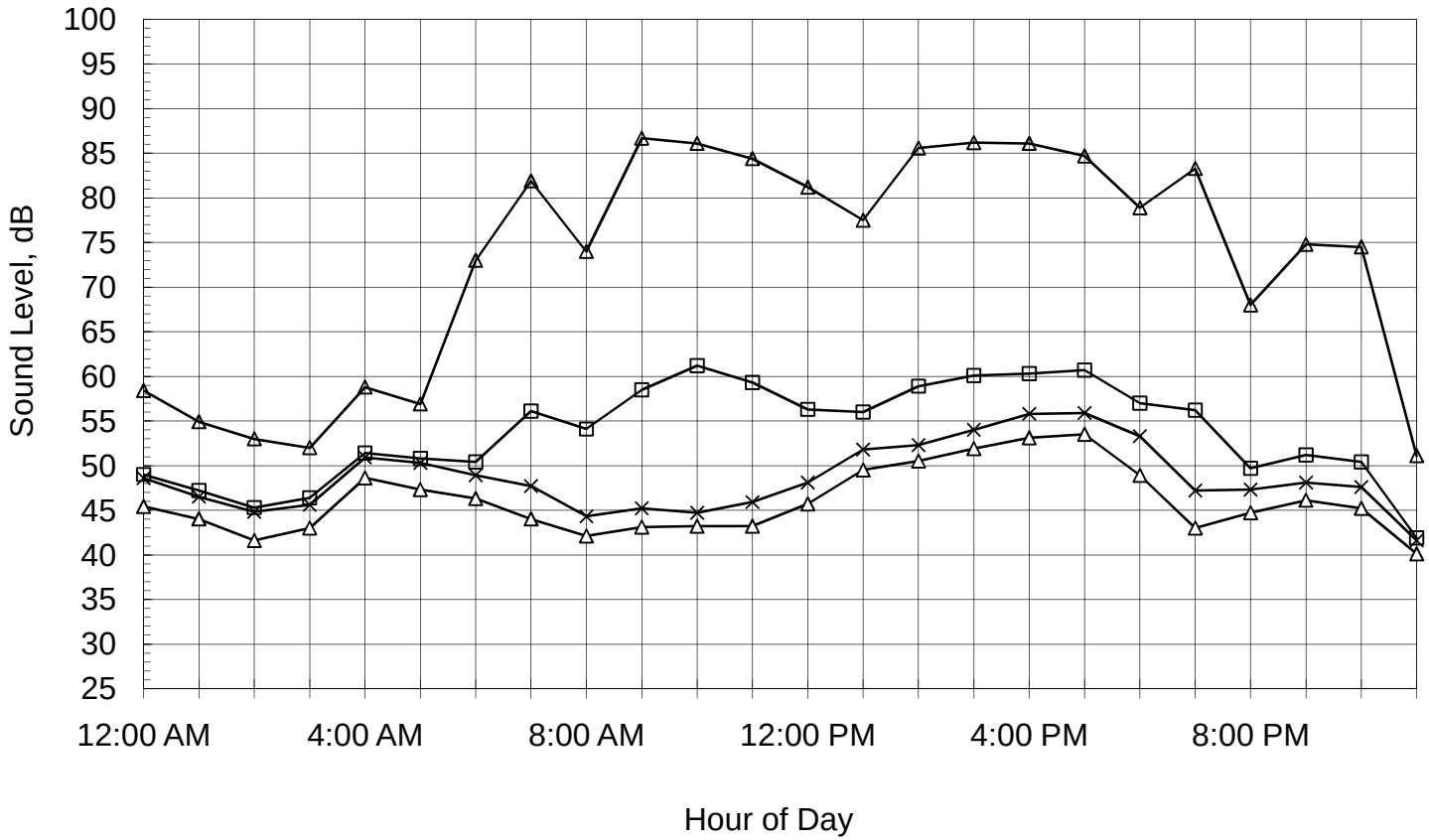


CNEL = 60.5 dB

Figure B-63: Measured Hourly Noise Levels

LVK Site 11

April 18, 2008

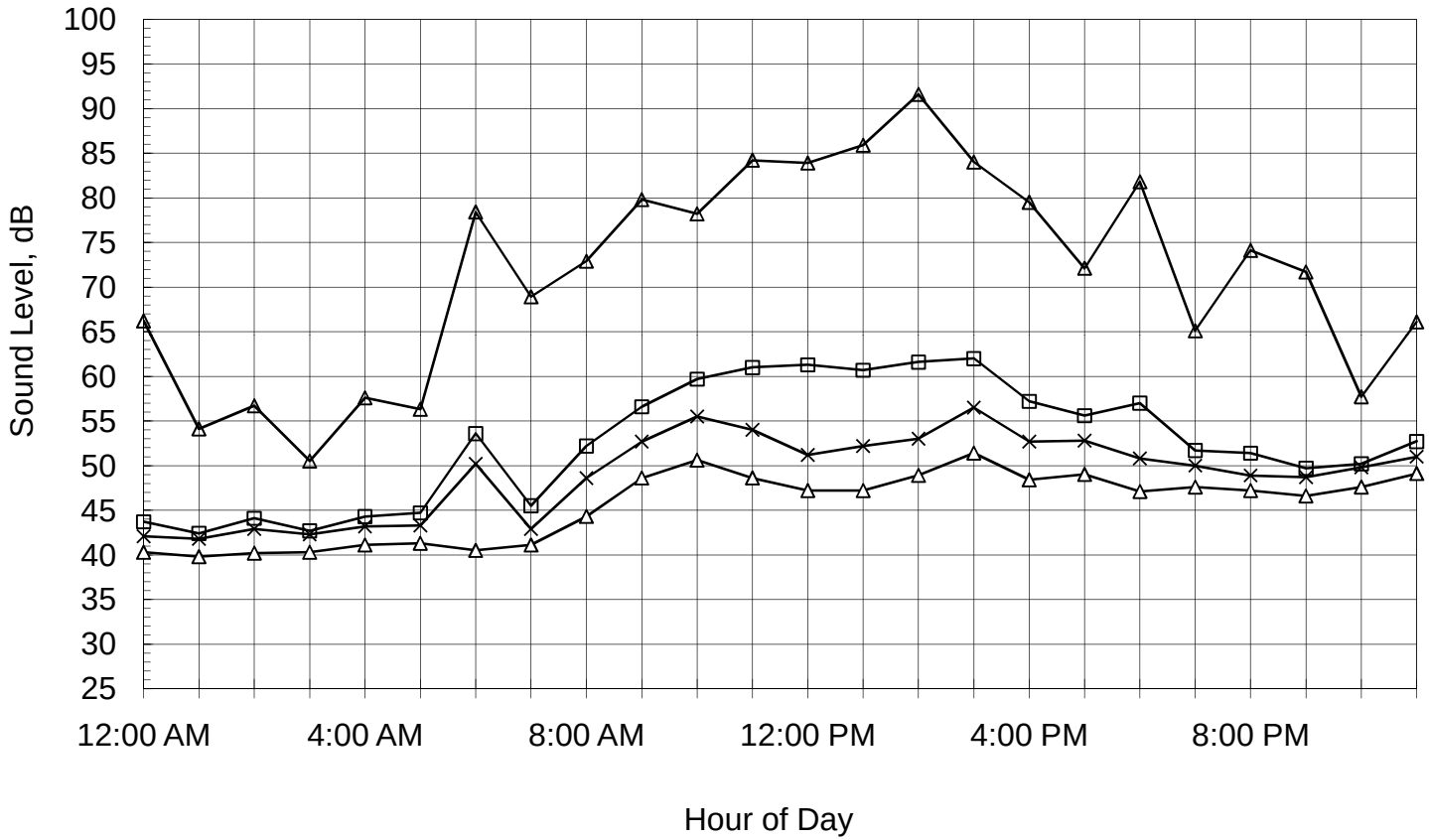


CNEL = 58.7 dB

Figure B-64: Measured Hourly Noise Levels

LVK Site 11

April 19, 2008

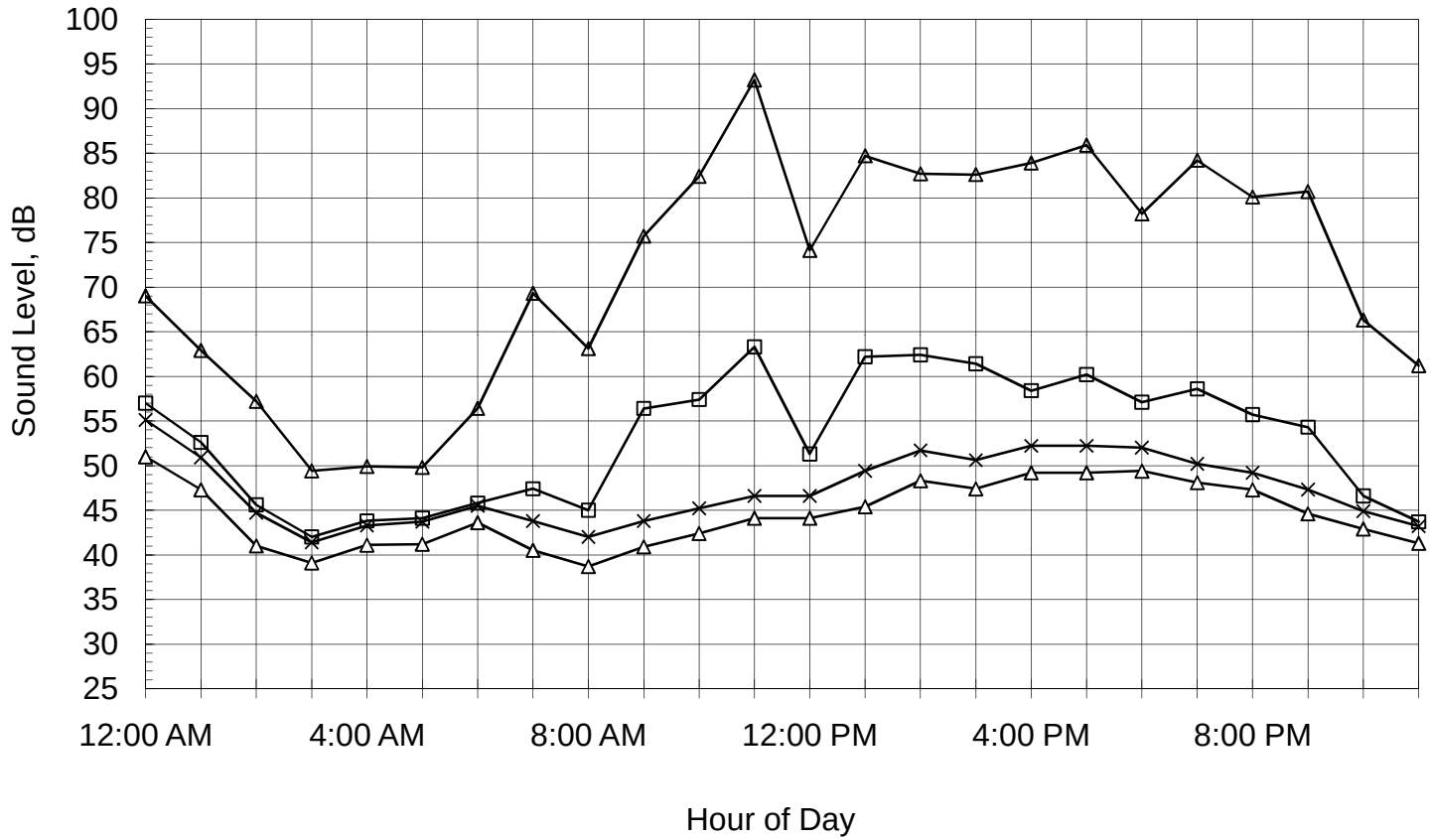


CNEL = 58.6 dB

Figure B-65: Measured Hourly Noise Levels

LVK Site 11

April 20, 2008

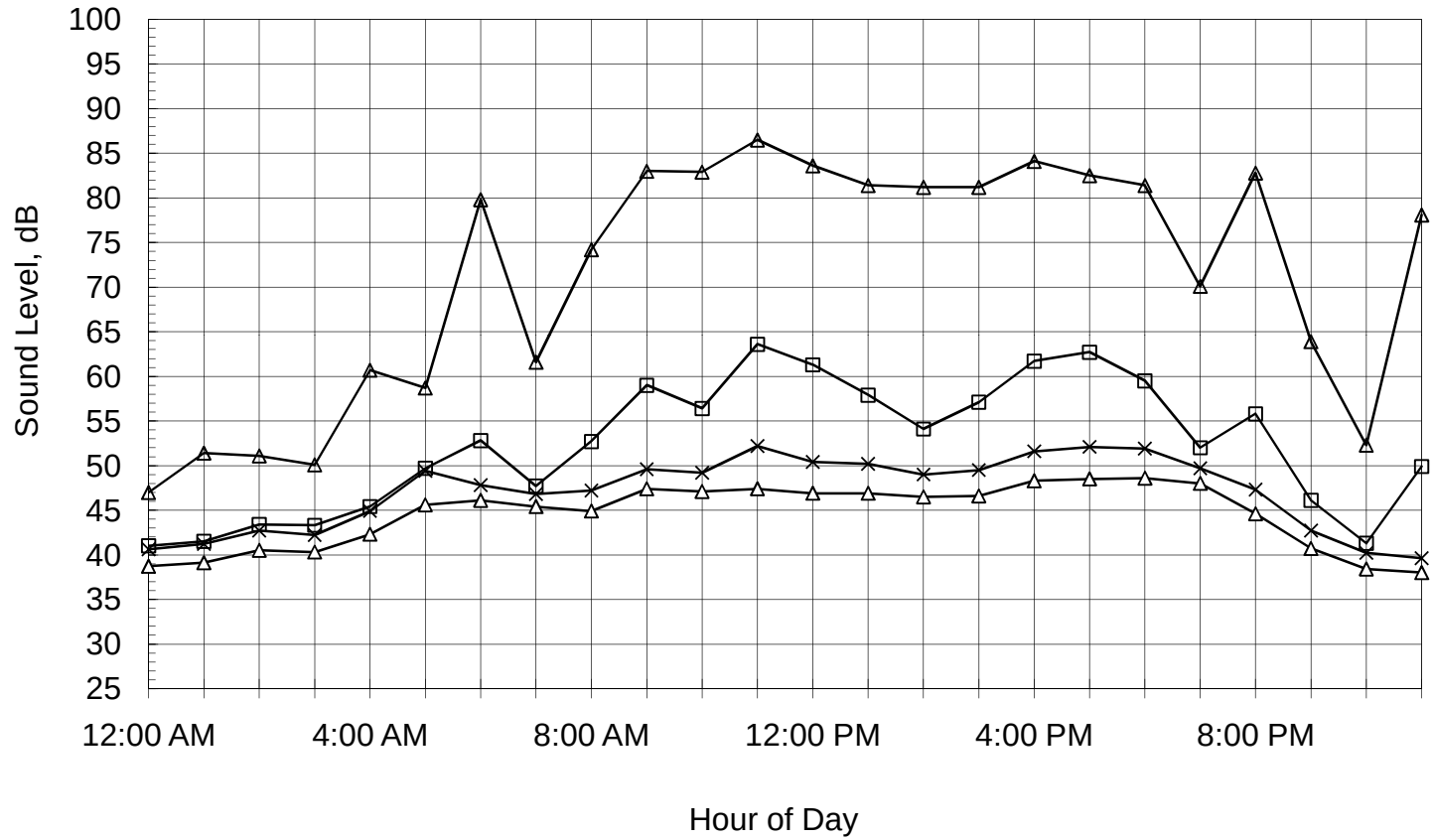


CNEL = 59.9 dB

Figure B-66: Measured Hourly Noise Levels

LVK Site 11

April 21, 2008

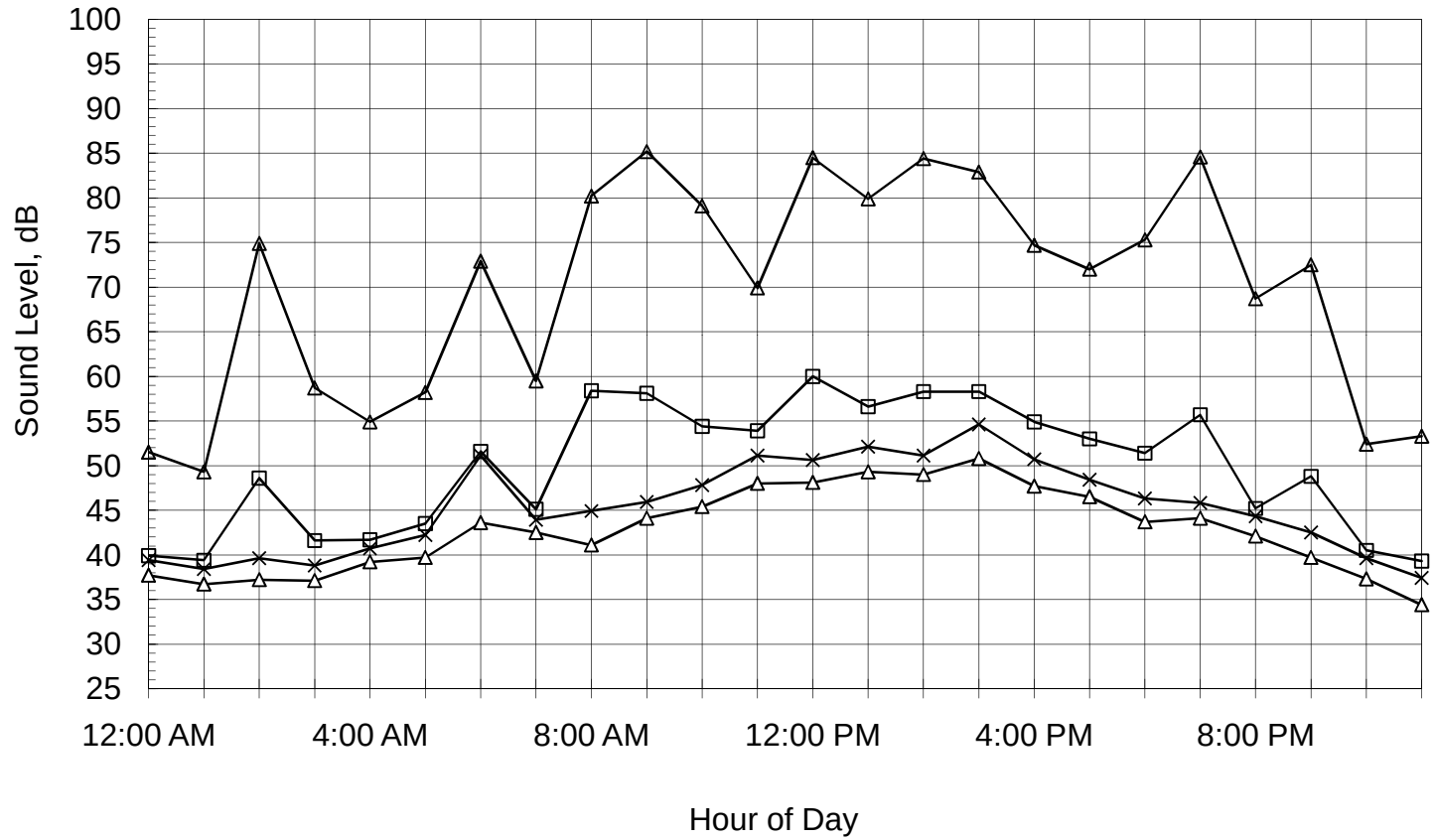


CNEL = 58.6 dB

Figure B-67: Measured Hourly Noise Levels

LVK Site 11

April 22, 2008



CNEL = 56.1 dB

APPENDIX C
MEASURED SINGLE EVENT NOISE LEVELS
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Site	Date	Time	Runway	Operation A/D/OVF	Aircraft Type	Duration Sec.	SEL dB	Lmax dB	Azimuth Degrees
4	10/29/2007	13:08:00	25R	D	SEP	20.7	81.1	72.9	75N
4	10/29/2007	17:02:00	25R	D	JET	17.8	83	75.1	75N
6	10/30/2007	9:04:00	25R	A	SEP	6.9	78.5	70.1	75N
6	10/30/2007	9:31:00	25R	A	SEP	8.15	78	68.9	75N
6	10/30/2007	9:59:00	25R	A	SEP	--	--	<65	75N
6	10/30/2007	11:38:00	25L	A	SEP	--	--	<65	75S
6	10/30/2007	11:43:00	25L	A	SEP	--	--	<65	75S
6	10/30/2007	11:44:00	25L	A	SEP	--	--	<65	75S
6	10/30/2007	11:46:00	25L	A	SEP	--	--	63	75S
6	10/30/2007	11:48:00	25L	A	SEP	--	--	55	75S
6	10/30/2007	11:50:00	25L	A	SEP	--	--	61	75S
6	10/30/2007	11:53:00	25L	A	SEP	--	--	56	75S
6	10/30/2007	11:54:00	25L	A	SEP	--	--	61	75S
6	10/30/2007	11:56:00	25L	A	SEP	--	--	61	75S
6	10/30/2007	11:58:00	25L	A	SEP	--	--	58	75S
6	10/30/2007	11:59:00	25R	A	SEP	--	--	<65	75N
6	10/30/2007	12:00:00	25R	A	SEP	--	--	<65	75N
6	10/30/2007	12:01:00	25R	A	SEP	--	--	63	75N
6	10/30/2007	12:02:00	25R	A	SEP	--	--	62	75N
6	10/30/2007	12:06:00	25R	A	SEP	--	--	64	75N
6	10/30/2007	12:07:00	25R	A	SEP	--	--	59	75N
6	4/23/2008	8:48:30	25R	A	SEP	7	62.3	56.1	30W
6	4/23/2008	8:49:44	25R	A	SEP	18	81.2	73.5	90
6	4/23/2008	8:52:24	25R	A	SEP	8	68.5	61.9	75N
6	4/23/2008	8:54:07	25R	A	SEP	26	82.0	74.2	90
6	4/23/2008	8:56:53	25R	A	SEP	7	59.2	52.6	75N
6	4/23/2008	8:58:50	25R	A	SEP	17	81.9	74.3	90
6	4/23/2008	9:00:15	25R	A	SEP	11	71.7	64.5	90
6	4/23/2008	9:01:41	25R	A	SEP	8	65.3	57.4	90
6	4/23/2008	9:03:33	25R	A	SEP	15	79.3	71.8	90
6	4/23/2008	9:04:51	25R	A	SEP	16	70.9	62.9	90
6	4/23/2008	9:07:56	25R	A	SEP	14	79.6	71.5	90
6	4/23/2008	9:09:32	25R	A	SEP	15	73.0	65.6	90
6	4/23/2008	9:12:02	25R	A	SEP	22	79.3	69.8	75
6	4/23/2008	9:13:15	25R	A	TETP	22	91.5	85.7	90
6	4/23/2008	9:14:24	25R	A	SEP	14	73.1	65.0	75N
6	4/23/2008	9:15:34	25R	A	TEP	17	85.9	79.8	90
6	4/23/2008	9:16:55	25R	A	SEP	17	84.8	78.0	90
6	4/23/2008	9:19:06	25R	A	SEP	15	68.6	59.7	90
6	4/23/2008	9:20:15	25R	A	TEP	17	85.8	78.7	90
6	4/23/2008	9:21:06	25L	A	SEP	14	73.2	65.8	45S
6	4/23/2008	9:23:51	25R	A	SEP	16	71.9	62.6	90
6	4/23/2008	9:24:52	25R	A	TEP	23	85.9	79.3	90
6	4/23/2008	9:25:15	25L	A	SEP	15	79.9	71.2	60S
6	4/23/2008	9:29:40	25R	A	SEP	18	69.1	59.5	75N
6	4/23/2008	9:30:24	25R	A	TEP	22	83.3	76.7	90
6	4/23/2008	9:33:26	25R	A	SEP	16	69.3	59.8	90
6	4/23/2008	9:34:47	25R	A	TEP	18	81.5	74.6	90

APPENDIX C
MEASURED SINGLE EVENT NOISE LEVELS
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Site	Date	Time	Runway	Operation A/D/OVF	Aircraft Type	Duration Sec.	SEL dB	Lmax dB	Azimuth Degrees
6	4/23/2008	9:37:08	25R	A	SEP	16	78.2	70.9	90
6	4/23/2008	9:38:25	25R	A	SEP	15	72.2	64.5	90
6	4/23/2008	9:39:44	25R	A	TEP	17	84.3	77.4	90
6	4/23/2008	9:43:11	25R	A	SEP	12	70.5	61.8	75N
6	4/23/2008	9:44:37	25R	A	TEP	15	85.6	78.6	90
6	4/23/2008	9:47:59	25R	A	SEP	13	71.0	61.9	75N
6	4/23/2008	9:49:00	25L	A	SEP	11	69.2	60.0	60S
6	4/23/2008	9:49:24	25R	A	TEP	11	83.5	76.1	90
6	4/23/2008	9:53:42	25R	A	TEP	19	84.2	77.5	90
6	4/23/2008	9:56:34	25L	A	SEP	13	65.5	56.0	45S
6	4/23/2008	9:59:50	25R	A	SEP	20	74.4	66.7	90
6	4/23/2008	10:02:21	25R	A	SEP	10	74.1	68.0	45N
6	4/23/2008	10:08:26	25R	A	SEP	7	64.3	59.2	45N
6	4/23/2008	10:21:31	25L	A	SEP	5	59.8	55.3	45S
6	4/23/2008	10:22:02	25R	A	SEP	19	80.0	71.3	90
6	4/23/2008	10:30:17	25R	A	SEP	15	86.2	80.8	90
6	4/23/2008	10:34:30	25R	A	SEP	18	81.6	73.3	75N
6	4/23/2008	10:39:32	25R	A	SEP	17	84.9	79.2	90
6	4/23/2008	10:43:39	25R	A	SEP	13	68.3	59.3	90
6	4/23/2008	10:44:30	25R	A	SEP	17	86.3	80.3	90
6	4/23/2008	10:46:55	25L	A	SEP	11	63.1	54.1	45S
6	4/23/2008	10:48:55	25R	A	SEP	13	69.2	60.9	90
6	4/23/2008	10:49:51	25R	A	SEP	23	82.9	75.3	90
6	4/23/2008	10:54:21	25R	A	SEP	16	87.7	82.7	90
6	4/23/2008	10:56:22	25L	A	SEP	11	64.2	56.1	45S
6	4/23/2008	10:58:20	25L	A	SEP	14	63.3	54.1	45S
6	4/23/2008	10:59:37	25L	A	SEP	17	75.8	67.1	45S
6	4/23/2008	11:00:32	25R	A	SEP	17	73.4	65.2	90
6	4/23/2008	11:03:31	25L	A	SEP	12	68.6	60.5	45S
6	4/23/2008	11:04:24	25L	A	SEP	16	81.0	73.2	45S
6	4/23/2008	11:07:03	25R	A	SEP	17	82.3	75.0	90
6	4/23/2008	11:09:14	25L	A	SEP	17	80.6	72.5	45S
6	4/23/2008	11:10:18	25R	A	SEP	21	70.0	59.6	90
6	4/23/2008	11:11:23	25R	A	SEP	16	70.1	60.6	90
6	4/23/2008	11:12:46	25R	A	SEP	17	82.4	75.3	90
6	4/23/2008	11:13:28	25R	A	SEP	15	82.8	76.8	90
6	4/23/2008	11:14:54	25R	A	SEP	15	71.1	62.3	90
6	4/23/2008	11:17:03	25R	A	SEP	19	81.2	73.1	90
6	4/23/2008	11:24:14	25R	A	SEP	16	72.9	64.6	90
6	4/23/2008	11:25:35	25R	A	SEP	16	82.1	74.3	90
6	4/23/2008	11:30:00	25R	A	SEP	11	73.3	66.1	90
6	4/23/2008	11:31:22	25R	A	SEP	16	80.4	72.4	90
6	4/23/2008	11:41:45	25R	A	SEP	13	75.3	68.2	90
6	4/23/2008	11:42:51	25R	A	SEP	15	83.1	76.5	90
6	4/23/2008	11:48:43	25R	A	SEP	17	72.6	63.7	90
7	10/30/2007	13:37:00	25R	D	SEP	13.75	71.7	62.7	75S
7	10/30/2007	13:40:00	25R	D	SEP	9.5	72.9	66.5	45S
7	10/30/2007	13:58:00	25R	D	JET	26.96	92.9	85.1	90

APPENDIX C
MEASURED SINGLE EVENT NOISE LEVELS
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Site	Date	Time	Runway	Operation A/D/OVF	Aircraft Type	Duration Sec.	SEL dB	Lmax dB	Azimuth Degrees
7	10/30/2007	14:29:00	25R	D	SEP	26	79.3	70	90
7	10/30/2007	14:50:00	25R	D	SEP	16.75	75.2	67.4	45S
7	10/30/2007	14:52:00	25R	D	SEP	21.87	77.5	68.4	75S
7	10/30/2007	14:57:00	25R	D	SEP	17.53	77.4	68.3	75S
7	10/30/2007	15:12:00	25R	D	TEP	26.2	90	82.6	75S
7	10/30/2007	15:56:00	--	OVF	SEP	9.21	69.9	61.2	90
7	10/30/2007	16:09:00	--	OVF	SEP	12.25	71.5	62.3	90
7	10/30/2007	16:18:00	--	OVF	HELO	19.46	76.8	67	75N
7	10/30/2007	16:47:00	25R	D	TEP	18.8	78.7	70.4	90
7	10/30/2007	17:11:00	25R	D	JET	22.9	76.2	64.8	UNK
7	10/31/2007	8:31:00	25R	D	TEP	8.05	71.3	64.1	75S
7	10/31/2007	8:59:00	25R	D	SEP	27.71	83.8	77.6	75N
7	10/31/2007	12:43:00	25R	D	JET	22.5	84.9	77.1	UNK
7	4/22/2008	13:53:19	25R	D	TETP	23	79.1	71.4	75S
7	4/22/2008	13:55:01	25R	D	SEP	18	72.8	65.8	30E
7	4/22/2008	14:14:45	25L	D	SEP	18	63.1	54.1	15E
7	4/22/2008	14:31:09	25L	D	TETP	20	73.6	65.9	30E
7	4/22/2008	14:38:19	UNK	D	SEP	25	74.1	65.1	30E
7	4/22/2008	15:07:40	25R	D	SEP	17	66.0	57.8	30E
7	4/22/2008	15:14:43	25R	D	SEP	18	78.9	71.9	30E
7	4/22/2008	15:25:07	25L	D	SEP	34	70.9	60.1	60S
7	4/22/2008	16:11:00	25R	D	TEP	34	71.3	61.4	90
7	4/22/2008	16:13:00	25R	D	JET	39	92.1	83.8	90
7	4/22/2008	16:28:13	UNK	D	SEP	25	67.3	57.2	30E
7	4/22/2008	16:37:01	25R	D	SEP	27	68.0	58.3	30E
7	4/22/2008	16:40:33	25R	D	JET	26	65.4	55.1	90
7	4/22/2008	16:41:22	25R	D	SEP	23	68.3	60.3	30E
7	4/22/2008	16:45:36	25R	D	SEP	17	63.4	55.2	30E
7	4/22/2008	16:49:35	25R	D	SEP	29	70.3	60.9	45E
7	4/22/2008	16:53:29	25R	D	SEP	24	70.3	62.7	30E
8	10/31/2007	13:15:00	25R	A	JET	18.09	80.2	72.1	75N
8	10/31/2007	13:26:00	25R	A	SEP	--	--	<60	90
8	10/31/2007	13:29:00	25R	A	SEP	9.62	78.6	73.8	75S
8	10/31/2007	13:51:00	25R	A	SEP	--	--	<60	60N
8	10/31/2007	13:59:00	25R	A	SEP	6.84	68.9	61.8	75N
8	10/31/2007	14:21:00	25R	A	SEP	--	--	<60	75N
8	10/31/2007	14:26:00	25R	A	SEP	--	--	56	75N
8	10/31/2007	14:27:00	25R	A	SEP	--	--	56	75N
8	10/31/2007	14:28:00	25R	A	SEP	--	--	55	75N
8	10/31/2007	14:30:00	25R	A	SEP	--	--	<60	75N
8	10/31/2007	15:04:00	25R	A	SEP	10.18	73.9	66.5	90
8	10/31/2007	15:12:00	25R	A	SEP	13.71	75.4	67.3	90
8	4/23/2008	12:21:54	25R	A	SEP	12	62.4	53.4	30NW
8	4/23/2008	12:27:49	25L	A	SEP	16	67.3	57.6	90
8	4/23/2008	13:31:35	25R	A	SEP	16	69.7	60.3	60N
8	4/23/2008	13:38:47	25R	A	SEP	12	64.0	55.6	75N
8	4/23/2008	13:40:39	25R	A	SEP	23	70.6	60.4	45N
8	4/23/2008	13:43:03	25R	A	SEP	9	58.0	50.0	45NW

APPENDIX C
MEASURED SINGLE EVENT NOISE LEVELS
Livermore Municipal Airport Aircraft Noise Survey
October-November 2007 and April 2008

Site	Date	Time	Runway	Operation A/D/OVF	Aircraft Type	Duration Sec.	SEL dB	Lmax dB	Azimuth Degrees
8	4/23/2008	13:48:12	25R	A	SEP	17	62.8	52.3	60N
8	4/23/2008	13:53:33	25R	A	SEP	20	64.9	52.7	75N
8	4/23/2008	13:58:08	25R	A	TETP	22	85.4	78.0	60N
8	4/23/2008	13:59:53	25R	A	TEP	24	80.6	71.8	60N
8	4/23/2008	14:09:54	25R	A	SEP	8	65.4	57.6	45NW
8	4/23/2008	14:17:28	25R	A	JET	18	85.3	78.7	60N
8	4/23/2008	14:19:43	25R	A	SEP	14	67.3	57.2	75N
8	4/23/2008	14:25:46	25R	A	SEP	14	68.3	59.4	60N
8	4/23/2008	14:32:46	25R	A	SEP	16	71.8	61.7	45N
8	4/23/2008	14:39:14	25R	A	SETP	25	88.5	80.5	60N
8	4/23/2008	14:46:13	25R	A	TETP	18	80.1	71.9	30N
8	4/23/2008	15:16:31	25R	A	TEP	20	71.3	62.6	30NW
8	4/23/2008	15:20:12	25R	A	SEP	14	72.9	65.2	45N
8	4/23/2008	15:26:06	25R	A	SEP	10	67.6	59.8	45N
8	4/23/2008	15:29:49	25R	A	SETP	20	86.6	79.0	60N
8	4/23/2008	15:51:19	25R	A	SEP	14	70.4	61.5	60N
8	4/23/2008	15:52:57	25R	A	SEP	22	73.8	64.8	45NW
8	4/23/2008	16:08:05	25R	A	SEP	17	68.3	58.3	60N
12	4/22/2008	13:53:22	25R	D	TEP	18.06	77.4	70.1	75N
12	4/22/2008	13:55:12	25R	D	SEP	9.78	71.0	65.1	75S
12	4/22/2008	14:31:13	25R	D	TETP	12.46	74.1	63.2	75S
12	4/22/2008	14:38:31	25R	D	SEP	16.40	75.0	65.9	60S
12	4/22/2008	16:13:10	25R	D	JET	32.96	89.8	81.5	75N

Azimuth is the angle of the aircraft relative to the ground; e.g., 90 means the aircraft was directly overhead, 75N means the aircraft was an angle of about 75 degrees, north of the observer.