D'ALBORA SPIT MARINA

NOISE AND AIR QUALITY ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 07068
VERSION C

WILKINSON MURRAY

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MAY 2008

PREPARED FOR

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SUITE 405/ LEVEL 4
203-233 NEW SOUTH HEAD ROAD
EDGECLIFF NSW 2027

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APPENDIX A – Glossary of Terms

APPENDIX B – Noise Measurement Results

EXECUTIVE SUMMARY

Air

The air quality from operations of the Spit Marina is acceptable with respect to the surrounding residential areas which are remote from the site.

Noise

The expected noise generated as a result of the alterations and additions during both construction and operational stages will comply with established site specific noise criteria. It is recommended that management of construction noise emissions be included in the project Environmental Management Plan.

Vibration

A review of the surrounds of the site indicates that there is no vibration sources associated with the extended use of the site.

1 INTRODUCTION

Wilkinson Murray Pty Limited (WM) has been engaged by Ardent Leisure Pty Ltd to conduct an acoustic and air quality assessment forming part of an application for an Environmental Assessment, pursuant to Part 3A of the Environmental Planning and Assessment Act to be submitted to the NSW Department of Planning.

It is proposed to upgrade and expand the berthing capacity of the existing d'Albora marina at The Spit, Sydney. These works include alterations and additions to the existing building on the site and provision for berthing of 35 additional boats (currently 165 boats) to 200 boats. This assessment addresses the air quality and acoustic impacts associated with construction and operation of the proposal on the amenity of surrounding land uses including residences to the North, North-West and South of the site.

The noise and air quality assessment considers the following:

- Existing background noise levels of the area;
- Air quality and noise criteria for the residential areas;
- Assessment of construction noise on the surrounding residential areas;
- Assessment of operational noise on the surrounding residential areas;
- Assessment of air quality on the surrounding residential areas;

The development has been assessed primarily in accordance with the following policy guidelines published by the NSW Department of Environment Climate Change and Water (DECCW):

- *NSW Industrial Noise Policy (INP)*, January 2000
- *Noise Guide for Local Government (NGLG),* June 2004

In the case of vibration the site is remote from surrounding receivers thereby rendering the issue of vibration insignificant. Accordingly vibration has not been assessed beyond this point.

Figure 1-1 illustrates the locality of the Marina and the surrounding suburbs of Balgowlah, Clontarf, Seaforth and Beauty Point.

Figure 1-1 Locality Map

2 DESCRIPTION OF PROPOSAL SITE & SURROUNDS

2.1 The Proposed Development

The proposal has been divided into the following components as detailed.

Extension to Berthing Facilities

In order to accommodate the additional 35 vessels proposed, there are a number of alterations and extensions to the existing arms of the marina facility, as detailed below. The revisions to the berthing structures will allow for the accommodation of vessels ranging in size, between twelve and thirty metres in length, of which there is a significant demand in this locality, with a shortage of such facilities.

A-Arm

A minor extension to A-Arm is proposed to accommodate an additional 4 vessels, including one vessel up to 18 metres in length on the T-head. It will also be necessary to replace the fingers along this arm to meet modern day standards.

The maximum boat length permitted on this Arm is 10 metres.

B-Arm

It is proposed to reconfigure B-Arm to accommodate an additional 12 vessels and to include a vessel up to 27.5 metres in length on the T-head. Replacement of the fingers will also be required.

The maximum boat length permitted on this Arm is 12 metres.

C-Arm

It is proposed to reorientate berths on the western side of C-Arm, from a parallel layout to a perpendicular one, along with reconfiguration of the fingers on the eastern side of the Arm. This will result in the accommodation of 52 vessels, reflecting an increase of 14 vessels over the current situation.

The maximum boat length permitted on this Arm is 25 metres.

In addition, it is proposed that a vessel will be moored on the T-head of this Arm, accommodating a boat up to 35 metres in length.

D-Arm

The proposed works will involve the re-orientation and extension of D-Arm, to accommodate a total of eight vessels, as opposed to the existing capacity of only four. Use of these new berths is intended for the on-site boat dealers as a holding area for boats before and after maintenance works, as well as a holding area for the delivery of new boats.

It must be noted that these berths will not be used as permanent customer berths.

In addition, two fuel/sewage pump-out berths will also be located on this Arm, providing significant benefit to the local and public boating community, providing free sewage pump out facilities.

N-Arm

It is proposed to demolish the existing fixed jetty at N-Arm, which has a current capacity of 5 vessels. This will be reconfigured to accommodate fourteen vessels, including one on the thead.

The structure will be replaced with a more modern floating system, consistent with the existing modern floating structure of the marina, as opposed to the current fixed pier arrangement. This will minimise the level of penetration of the sea bed and accord with more modern day marina infrastructure that is available to the market.

Slipway & Hardstand Replacement

The proposed works include the replacement of the existing slipway, located on the northern side of the building, with a new hardstand area.

A new travel lift will be located on the northern side of the new hardstand, allowing boats to be positioned parallel to the tidal flow, rather than against the tidal flow, which reflects the existing situation. The new travel lift will be able to raise vessels up to 45 tonnes in weight.

This new hardstand area will also accommodate nine car parking spaces and a garbage storage area, servicing the proposed marine workshop tenancies located on the ground floor of the proposed new building.

Access & Parking

Car parking will be provided on the hardstand area. There are no proposed changes to the Council car parking area located on the eastern boundary of the site, accessed from Spit Road.

It is proposed to undertake works to the vehicle layoff area on the eastern boundary of the site to improve egress.

New Fuel & Sewage Pump Out System

The proposal includes the relocation of the fuel berth and sewerage pump out from N-Arm to D Arm. Installation of the new system is to coincide with the decommissioning of the existing fuel system. This new fuel system will be located underground, below the existing on-grade car parking area on the north-eastern side of the site. New fill points and lines will be installed to facilitate this.

Replacement of the Existing Building

The proposal includes demolition of the existing building on the site and the construction of a new building to enable the use of two full floors. To accommodate the new structure, it is proposed to replace piling beneath the building to ensure longevity. The details of the proposed new structure are provided below.

Ground Floor

The proposed ground floor is oriented to face The Spit Reserve, across a pedestrian entry bridge. From this bridge, the ground floor includes a public boardwalk, running east to west, connecting public spaces on the site with ground floor tenancies. In addition, the entry bridge leads into a covered foyer area, separating the eastern and western tenancies on this floor.

The northern portion of the proposed building will include four workshops and an amenities room, oriented to look over the hardstand area to the north of the building. These workshops have a total area of 246m^2. It is intended that these will house marine related uses such as boat repair and maintenance businesses.

The eastern portion of the ground floor is a large single tenancy 294m^2 in area, which is intended to house a boat dealer's showroom. This tenancy is oriented towards the eastern adjoining outdoor display space. Adjoining this showroom, inside the foyer area, includes a stairway leading to the first floor.

The western portion of the ground floor will include three marine-related office tenancies with a total area of 348m^2, each with dual access points from the internal foyer area and the western adjoining public deck. The office tenancy in the south-western corner includes an internal stairway to its first floor component.

Located outside the building, leading to the berthing facilities is a public deck, with a small kiosk and public seating facilities. Positioned at the northern side of this public deck are external stairs, which lead to the restaurant and offices on the first floor level.

First Floor

The proposed first floor may be accessed via the stairway or the lift located in the foyer area. Each of the two access points lead to a bridge area, overlooking a void to the ground floor. This will promote a sense of openness and natural light between the ground and first floor levels.

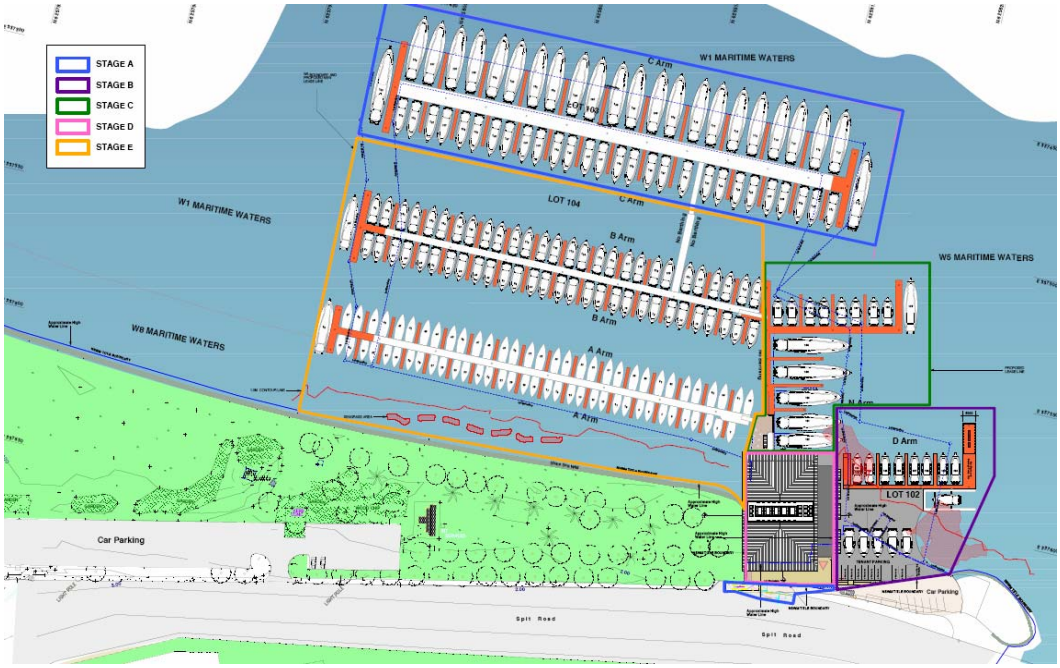
Located on the eastern side of the proposed first floor is a single, large office tenancy of 462m^2, including male and female amenities. This proposed office tenancy has windows to the north, east and south of the building, providing generous outlook to both the southern adjoining reserve and the waterways to the north.

The western side of the proposed first floor includes an extension of the office tenancy positioned below, at the ground floor level. This component of the office tenancy includes a large deck on its western side, overlooking the marina facilities and the waterway.

Adjoining this office tenancy to the north is a restaurant with associated kitchen facilities. This restaurant includes dual decks, one facing west, and the other facing north. It is proposed to relocate the existing restaurant on the site to the first floor level to enable an appreciation of views over the waterway.

The following Figure 2-1 illustrates the final configuration of the Marina.

Figure 2-1 Proposed Alterations & Additions



d'Albora does not propose to alter any operational hours of any part of its operations (24 hour access is available to boat owners) or upgrade any car parking facilities, which are not owned by d'Albora Marinas. The current marina caters for 165 boats and has an existing sewage pump out and fuel facility, along with various tenancies.

Current tenancies and their operating hours are detailed in Table 2-1.

Table 2-2 Proposed Alterations & Additions

Tenancy	Hours of Operation
Showroom / Boat Sales	9 am – 5 pm
Seven Seas Workshop and Offices	9 am – 5 pm
Marine Workshops	9 am – 5 pm
d'Albora Offices and Workshop	9 am – 5 pm
Restaurant	11 am - Midnight
Kiosk	7 am – 6 pm

2.2 Surrounding Area

The site has been used for marine activities since the early 1900's and was purchased by d'Albora (in 2000). The site fronts the western side of Middle Harbour whereby waterway bounds the site on the western and northern side. To the east of the site is Military Road whilst the southern side is bounded by a council park.

The nearest residential receivers are located as follows:

- To the North at Seaforth at a distance in the order of 300 m;

- To the North East at Clontarf at a distance in the order of 600 m; and
- To the South at Beauty Point at a distance in the order of 650 m.

3 AMBIENT NOISE LEVELS

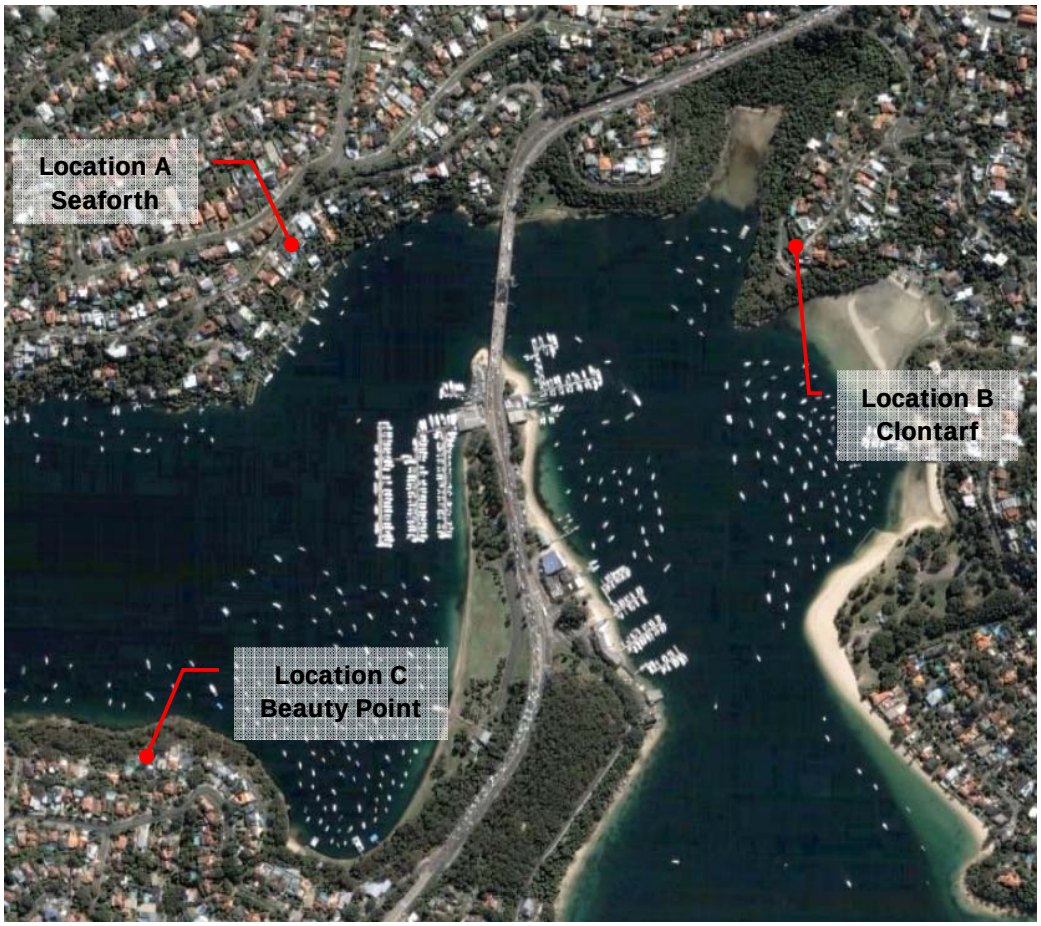
Ambient noise levels were monitored using unattended noise loggers at selected residences around the site to cover the range of environments in potentially affected residential areas. The locations are presented in Table 3-1 and illustrated in Figure 3-1.

Table 3-1 Noise Monitoring Locations

Site	Location
A	5 Seaforth Avenue Seaforth
B	Adjacent to 4 Linkmead Avenue Clontarf
C	8 Delecta Ave Beauty Point

The selected monitoring locations are considered to be representative of the noise currently experienced by surrounding residential receivers.

Figure 3-2 Noise Monitoring Locations



The noise monitoring was conducted from Thursday, 29 November to Monday, 10 December 2007. The noise measurement results are presented in detailed graphical format in Appendix B.

The noise monitoring equipment used for these noise measurements consisted of ARL Type EL215 Noise Loggers set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

The logger determines a variety of noise descriptors, including L_{A90} and L_{Aeq} levels (see Appendix A for definitions) of the existing noise environment. From the background noise levels (L_{A90}) the Rating Background Levels (RBL's) were determined using methodology as recommended by the *INP*. The DEC considers the RBLs to represent the background noise level.

Table 3-2 summarises the results, for daytime, evening and night time periods as defined in the NSW Department of Environment & Climate Change and Waters' (DECCW) *NSW Industrial Noise Policy (INP)*. The summary values are:

- $L_{Aeq,Period}$ – the overall L_{Aeq} noise level measured over the assessment period; and
- RBL – Rating Background Level is a measure of typical background noise levels which are used in determining noise criteria.

Table 3-2 Measured Ambient Noise Levels

Logger Location	Time Period*	Noise Levels (dBA)	
		$L_{Aeq,(period)}$	RBL (Background)
Location A - 5 Seaforth Avenue Seaforth	Daytime	58	50
	Evening	55	50
	Night Time	51	41
Location B - 8 Delecta Ave Beauty Point	Daytime	59	49
	Evening	58	49
	Night Time	48	43
Location C - Adjacent to 4 Linkmead Avenue	Daytime	56	49
	Evening	53	49
	Night Time	50	43

* Day is defined as 7.00am-6.00pm, Evening 6.00-10.00pm and Night 10.00pm-7.00am

A review of noise levels indicates that the ambient noise levels at residences surrounding the marina are controlled by traffic on Military Road and the Spit Bridge.

3.1 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in Appendix A.

4 NOISE CRITERIA

The following section details the applicable noise criteria based on various guidelines of the DECCW.

4.1 Construction Noise Criteria

The NSW Department of Environment, Climate Change and Water (DECCW) have recently issued an *Interim Construction Noise Guideline* which sets criteria for various types of construction activities regulated by DECCW. The appropriate noise management levels for construction outside normal hours are shown in Table 4-1 below.

Table 4-1 Construction Noise Guidelines

Time of Day	Management Level $L_{Aeq\ (15\ min)}$ *	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. 1. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. 2. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. 1. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise affected RBL + 5 dB(A)	A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see Section 7.2.2.

The guideline glossary defines RBL:

"Rating Background Level *– the overall single-figure background noise level for each assessment period. Determination of the rating background level is by the method described in the NSW Industrial Noise Policy (INP). This approach aims to result in the noise management level being met for at least 90% of the time periods (15 minutes each) over which reactions of annoyance can occur."*

Where the construction period is likely to be over 26 weeks, a construction noise goal based on an intrusive noise criterion of background + 5dBA is usually adopted. Table 4-2 presents applicable noise criteria for this project.

Table 4-2 Construction Noise Criteria - dBA

Receiver Area	Management Noise Goals -dBA	
	Recommended	Maximum
Seaforth	60	75
Clontarf	59	75
Beauty Point	59	75

4.2 Industrial Noise Criteria

The *NSW Industrial Noise Policy (INP)* recommends two criteria, "Intrusiveness" and "Amenity", both of which are relevant for the assessment of noise. In most situations, one of these is more stringent than the other and becomes the dominate noise criteria. The criteria are based on the L_{Aeq} descriptor, which is explained in Appendix B.

For sources such as the fixed plant associated with the facilities, appropriate noise criteria are specified in the *INP*. The criterion depends on whether existing noise levels in an area are close to recommended amenity levels for different types of residential receiver areas (i.e. urban, rural, near existing roads).

Where noise levels are currently low, noise levels from the proposed operation are limited by the intrusiveness criterion. In general, the L_{Aeq} noise level from such sources should not exceed the Rating Background Level (RBL) by more than 5dBA. This is assessed over a typical worst case 15 minute period.

The amenity goal sets an upper limit to the total noise level (L_{Aeq}) in an area from all industrial noise (existing and future). The criterion depends on the time of day, area classifications and the relationship of the total measured L_{Aeq} (and contribution from existing industrial noise) to determine the Acceptable Noise Level (ANL) for the development.

The potentially affected residential areas are classified as suburban by the INP. Given this, the acceptable amenity levels (L_{Aeq}) which apply over the whole day, evening or night period are as follows and are applicable as there are no other industrial noise sources:

- Daytime 55dBA
- Evening 45dBA
- Night time 40dBA

Maximum recommended levels are all 5dBA higher.

Where noise levels from industrial sources are close to or above the acceptable levels then the amenity criterion, which incorporates a sliding scale to set limits, would apply. The sliding scale prevents the overall noise level exceeding the acceptable level due to the addition of a new noise source. Amenity criterion also needs to consider the possibility of other developments which may affect noise levels.

Table 4-3 presents the relevant industrial noise criteria for this project based on a suburban

area classification.

Table 4-3 Industrial Intrusiveness & Amenity Criteria -dBA

Receiver Area	Time Period	RBL	Intrusiveness Criterion $L_{Aeq,15min}$	Amenity Criterion $L_{Aeq,period}$
Seaforth	Daytime (7.00am–6.00pm)	50	55	55
	Evening (6.00–10.00pm)	50	55	45
	Night time (10.00pm–7.00am)	41	46	40
Clontarf	Daytime (7.00am–6.00pm)	49	54	55
	Evening (6.00–10.00pm)	49	54	45
	Night time (10.00pm–7.00am)	43	48	40
Receiver Area	Time Period	RBL	Intrusiveness Criterion $L_{Aeq,15min}$	Amenity Criterion $L_{Aeq,period}$
Beauty Point	Daytime (7.00am–6.00pm)	49	54	55
	Evening (6.00–10.00pm)	49	54	45
	Night time (10.00pm–7.00am)	43	48	40

4.2.1 Sleep Disturbance Noise Criteria

Intermittent noises due to activities such as people noise during the night-time period are not directly addressed by the *INP*.

In order to minimise the risk of sleep disturbance from the operations during night-time operation, the DECCW recommends that sleep disturbance is assessed as the emergence of the $L_{A1,1min}$ level above the $L_{A90,15min}$ level at the time. Appropriate screening criteria for sleep disturbance are determined to be an $L_{A1,1min}$ level 15dBA above the Rating Background Level (RBL) for the night time period.

Based on noise logging, a sleep disturbance criterion of 61 dBA has been established for residences at Seaforth. A criterion of 63 dBA has been established for Clontarf and Beauty Point residences.

With reference to the *NGLG,* the primary assessment for whether or not ones' sleep will be disturbed by activities related to the operation of the Marina is based on whether the $L_{A1,1min}$ noise level (often approximated as the L_{Amax} noise level) from any instantaneous night time noise event will exceed the background noise level by more than 15dBA when measured external to a bedroom window.

This is a simple approach and the *NGLG* acknowledges that further research is needed to define a better relationship between noise levels and sleep disturbance and refers to the *ECRTN*.

4.2.2 Project Specific Noise Criteria

Typically, noise relating to the operation of Marinas primarily emanates from activities such as movements of watercraft at the Marina, low level maintenance works such as cleaning, small repairs and the use of the sewage pump out system. These activities are considered to be transient in nature and will have little impact on the existing amenity noise levels measured, nor

influence the background noise levels. Therefore, it is appropriate to base our assessment of this development on intrusive noise criteria. During the night time period, sleep disturbance is also assessed. Table 4-4 summarises the intrusiveness and sleep disturbance noise criteria for this development.

Table 4-4 Summary of Project Specific Noise Criteria - dBA

Receiver Location	Time Period	Intrusive Criteria $L_{Aeq,15min}$	Sleep Criteria L_{A1}
Seaforth	Daytime	55	-
	Evening	55	-
	Night Time	46	61
Clontarf	Daytime	54	-
	Evening	54	-
	Night Time	48	63
Beauty Point	Daytime	54	-
	Evening	54	-
	Night Time	48	63

5 NOISE SOURCE LEVELS

Noise sources and associated noise levels that are likely to be associated with the development are identified in the following sections.

5.1 Construction Noise Sources

Typical Sound Power Levels (SWL) of the plant likely to be used during floating marina installation, site works, landscaping and equipment installation when the site is being established are identified in Table 5-1. These sound power levels have been determined from measurements at other similar construction sites.

Table 5-1 Typical Construction Plant Sound Power Levels - dBA

Item	Sound Power Level
Excavator	107
Dozer	112
Dump Trucks	112
Tower Crane or Mobile Crane	105
Generators	95
Impact Piling Rig	120
Concrete Trucks	109

5.2 Operational Noise Sources

Noise sources associated with the operation of the marina have also been identified and quantified. Activities that generate noise have been identified as those associated with intermittent activities. These are detailed in Table 5-2 as follows.

Table 5-2 Summary of Marina Noise Levels – dBA

Item	Sound Power Level
Pump out unit	70
Air-conditioning unit (single unit)	85
Watercraft docking / leaving Marina	99
Angle Grinder	103
Pressure Cleaner	98

In addition, potential noise associated with restaurant patrons has been identified as requiring review. The following patron noise levels will be unitised in assessing evening noise emissions from the restaurant.

Table 5-3 Summary of Patron Noise Levels – dBA

Item	Sound Power Level
Normal Voice	78
Raised Voice	83
Shout	88
30 Patrons on Restaurant Deck	95

6 CONSTRUCTION NOISE ASSESSMENT

There are two construction areas that have the potential to generate construction noise. These can be classified as “on water” and “land based” construction activities. Construction activities are to consist of:

6.1 On Water Construction

The floating marina construction method will be decided as part of the detailed design stage with the assistance of the successful contractor. For the purpose of this assessment, impact piling has been selected for evaluation as this piling method will emit the highest noise levels.

The marina construction works will include:

1. Extraction and removal of existing timber piles;
2. Preliminary prep-work to prepare and position each pile for installation;
3. Installation of new concrete piles and floating marina; and
4. Demobilising the piling rig.

These activities will occur over a 3-4 month period.

6.2 Land Based Construction.

Land based construction is associated with path construction, demolition, piling and construction activities. The project “Construction Management Plan” prepared by SX Projects indicates that the following works are proposed.

- Partial demolition of existing buildings;
- Excavation of site;
- Foundation installation;
- Construction of Building and pathway;
- Hardstand Installation; and
- Building Fit out works.

The equipment to be used is likely to consist of a cranes, dump trucks, concrete trucks, excavators, dozers, Generators etc. These construction activities will occur over a 12 month period.

6.3 Predicted Construction Noise Levels

The noisiest land based construction period is expected to be during the earthmoving phase and, with perhaps six machines including excavators, trucks, a dozer and a grader working around the site simultaneously, a total site sound power of 116 dBA may be expected.

Earthmoving activity is likely to occur in various sections of the development and given the size of the site it would only be that equipment that is in the vicinity of residences would be

acoustically significant.

Table 6-1 presents modelled calculations at surrounding receivers based on distance attenuation and shielding from topography, allowing for piling activities to be occurring simultaneously with land based works. In addition, noise levels at surrounding residences when adverse weather conditions occur, being a 3 m/s westerly wind, have been predicted and are shown in brackets.

Table 6-1 Predicted L_{A10} Construction Noise Levels at Residential Receivers - dBA

Receiver Location	Construction Noise Level	Noise Criteria	Compliance
Seaforth	56 (53)	60	Yes
Clontarf	48 (53)	59	Yes
Beauty Point	50 (46)	59	Yes

These predictions indicate that in the case of surrounding residential receivers noise levels from construction are expected to comply with established construction noise criteria.

These conclusions are based on good management practices being adopted. The following general recommendations are made to ensure a good acoustic outcome.

- Machines used on site should be maintained in good condition, particularly considering the exhaust system on diesel powered machines, to minimise noise emissions. Excessively loud machines should be repaired, modified or removed from the site. Sound pressure level measurements should be conducted on all plant prior to works commencing on-site.
- A project manager is available to respond to questions and complaints from the community in a professional, considerate and timely manner.
- Signage on site detailing relevant contact personnel and phone numbers
- Reversing alarms should be controlled to the minimum sound level consistent with safety by replacing, shielding or relocating the alarm unit on noisy machines. Preferably, the use of non-tonal low level “quacker” type alarms should be installed on mobile plant.

7 OPERATIONAL NOISE ASSESSMENT

The Marina has 24-hour access available to boat owners. Therefore it is appropriate to develop scenarios for daytime, evening and night time periods and predict resultant noise levels which can be compared against the project specific noise criteria.

This section of the report assesses the potential noise impact to the surrounding residential receivers.

7.1 Operational Activities

In the case of marine based activities, marinas are generally busier during the summer months, particularly on weekends or Public Holidays. The activities are not consistent each day throughout the year. Also, the movements are generally during the daytime, with little or no movements during the evening and night time periods.

Based on discussions with d'Albora, noise producing activities that are associated with the operation of the Marina facilities have been identified as:

- Watercraft leaving and docking at the Marina;
- Daily low level maintenance on watercrafts (e.g. cleaning, washing, minor repairs);
- Use of the sewage pump out or fuelling systems;
- Mechanical plant noise (i.e. air conditioning and services noise) and;
- Patron noise from the restaurant, particularly outdoor terrace areas.

Typical "worst case" noise emissions scenarios and equivalent L_{Aeq} noise levels for day, evening and night periods are presented in Table 7-2. The noise from these sources, which reference to levels presented in Section 5, have been corrected for duration and then added to establish total source levels for use in predictions.

Table 7-2 Typical Daytime Scenario

Noise Source	Sound Power Level dBA	Duration minutes	Time Correction dBA	Corrected $L_{Aeq,15min}$ noise level dBA
Air-conditioning plant	85	15	0	85
Noise from patrons (on deck)	95	15	0	95
Gurney used for washing boats	98	7.5	-3	95
Watercraft docking / leaving Marina (2 movements)	99	5	-5	94
Sewage pump out / fuelling	70	10	-3	67
Total Daytime Scenario				**100**

In the evening and night reduced operational scenarios have been assumed as detailed in Table 7-3 and 7-4.

Table 7-3 Typical Evening Scenario

Noise Source	Sound Power Level - dBA	Duration minutes	Time Correction dBA	Corrected $L_{Aeq,15min}$ noise level - dBA
Air-conditioning plant	85	15	0	85
Noise from patrons (on deck)	95	15	0	95
Watercraft docking / leaving Marina (1 movement)	99	2.5	-8	91
Sewage pump out / fuelling	70	10	-3	67
Total Daytime Scenario				**96**

Table 7-4 Typical Night Scenario

Noise Source	Sound Power Level - dBA	Duration minutes	Time Correction dBA	Corrected $L_{Aeq,15min}$ noise level - dBA
Air-conditioning plant	85	15	0	85
Noise from patrons (on deck)	95	15	0	95
Total Daytime Scenario				**95**

Site related noise emissions were acoustically modeled using CONCAWE implemented in the "Cadna A" acoustic noise prediction software. Factors that are addressed in the modeling are:

- Equipment sound level emissions and location;
- Receiver locations;
- Ground topography;
- Noise attenuation due to geometric spreading;
- Ground Absorption; and;
- Atmospheric absorption.

Predicted noise levels are presented in Table 7-5.

Table 7-5 Predicted Operational Noise Levels Noise - dBA

Receiver Location	Scenario	Calculated $L_{Aeq,15min}$ Noise Level	Criterion $L_{Aeq,15min}$	Compliance
Seaforth	Day	39	55	Yes
	Evening	35	55	Yes
	Night	34	46	Yes
Clontarf	Day	34	54	Yes
	Evening	30	54	Yes
	Night	29	48	Yes
Beauty Point	Day	32	54	Yes
	Evening	24	54	Yes
	Night	25	48	Yes

A review of predicted noise levels at surrounding residences indicates compliance with established noise criteria.

In addition, we have reviewed these scenarios whereby adverse wind conditions occur at each of the residential areas, that is ; a 3 m/s South East wind at Seaforth residences, a South West wind to Clontarf residences and a North East to Beauty Point residences. In this scenario, an increase in the order of 3 dBA can be expected at Seaforth and Clontarf receivers under adverse conditions.

It is noted that even under adverse conditions compliance with established noise criteria is achieved. Therefore, no noise mitigation measures are required to preserve the acoustic amenity of surrounding residences.

7.2 Sleep Disturbance

Persons on the restaurant balcony potentially shouting have been assessed whereby this noise source may disturb sleep after 10 pm. The noise when halliards strike a mast has not been assessed as most of the marina boats are power boats. This is, in part, due to the Spit Bridge limiting access for sailing craft.

Noise levels due to patrons possibly shouting on the outside northern terrace of the restaurant has been determined to be:

- Seaforth 27 dBA
- Clontarf 19 dBA
- Beauty Point 17 dBA

Accordingly, noise from patrons will be well below established sleep disturbance criteria and likely to be inaudible at residences.

8 TRAFFIC NOISE

Traffic counts for the year 2005 from the permanent Spit Bridge counting station and the volumes in each direction have been provided by Traffix traffic consultants. These counts indicate a two way Annual Average Daily Traffic (AADT) flow of 65,233 vehicles of which about 6-8% would be heavy vehicles.

Allowing for a growth since 2005 of about 1-2% per annum an estimated current 2010 AADT of 70,270 vehicles per day has been determined. Given these volumes, the traffic generated by the Spit Marina will be insignificant in both volumes and the associated noise contribution at surrounding residences.

Accordingly traffic noise generated by the development will be acoustically acceptable.

9 AIR QUALITY

9.1 Construction Air Quality

Air quality in the vicinity of the site, during construction, may be affected by the following demolition and construction activities:

- Removal of buildings;
- Breaking up of concrete;
- Vehicles travelling on site;
- Wind erosion of bare earth surfaces; and
- Excavation of the site.

The site is at sea level and, consequently, there will be little excavation and associated dust generation with this stage of the project. To mitigate the generation of excessive quantities of dust the following measures will be implemented during demolition and construction activities:

- The use of water sprays across the site to suppress dust as required;
- Cleared areas and internal access routes would be kept to a minimum;
- All dry spoil entering and leaving the site would be securely covered with a tarpaulin or contained within bins; and
- Designated vehicle wash down areas would be used to remove soiled material from vehicles prior to them leaving the site.

The closest residential receivers from the site are approximately 300m, and at this distance, it is unlikely that there would be any air quality impacts from construction and demolition on the site.

9.2 Operational Air Quality

Motor vehicles are the principal source of airborne pollutants in the area around the site. The distribution of these pollutants is determined mainly by the changing traffic volumes over the day, the topography of the area, and the local weather conditions.

The pollutants applicable to a residential area are the components of vehicle exhaust, namely:

- carbon monoxide;
- oxides of nitrogen;
- particulate matter;
- hydrocarbons (Benzene); and
- lead.

The assessment of air quality impacts from marina operations at the site is principally that associated with diesel inboard and petrol out board motors operating. Information supplied by the harbourmaster indicates that a weekend average of 20 boats use the facility daily. This results in water traffic movement on the site being in the order of 40 movements a day

A review of traffic data published by the Roads and Traffic Authority indicates that Annual

average weekend daily traffic flow is in the order of 60,380 vehicles per day of which 6-8 % can be classified as Heavy Vehicles.

A comparison between the traffic volumes on Spit Road and marina operations indicates that any contribution from the marina would be insignificant when compared to the emissions from road traffic. Therefore given the low level emissions associated with Marina operations, current traffic volumes and distances to residences we consider that the operations of the marina will not impact on air quality in the surrounding area.

In addition work on the Hardstand consisting of pressure cleaning and sanding will generate localised dust concentrations. However, the dispersion of this concentration over the distances to residences will result in no adverse impact.

10 CONCLUSION

Having assessed the air quality and noise impacts associated with the proposed works at the Spit Marina it is considered that the proposed works are acceptable from a noise and air quality perspective. With regard to the impact of air quality and noise, the following is concluded:

- Air quality in the area from construction and marine operations will not impact on air quality in the surrounding area due to the low level of emissions associated with Marina operations;
- Construction noise levels in the general area will comply with established noise criteria. A small 1 dBA exceedance is indicated at Seaforth is acoustically insignificant.
- "Worst case" operation noise scenarios have been assessed and resultant noise levels have been determined to well below site specific noise criteria.

Accordingly from an air quality and acoustic perspective the project will be acceptable.

Version	Status	Date	Prepared by	Checked by
C	Final	21 May 2010	Brian Clarke	John Wasserman

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

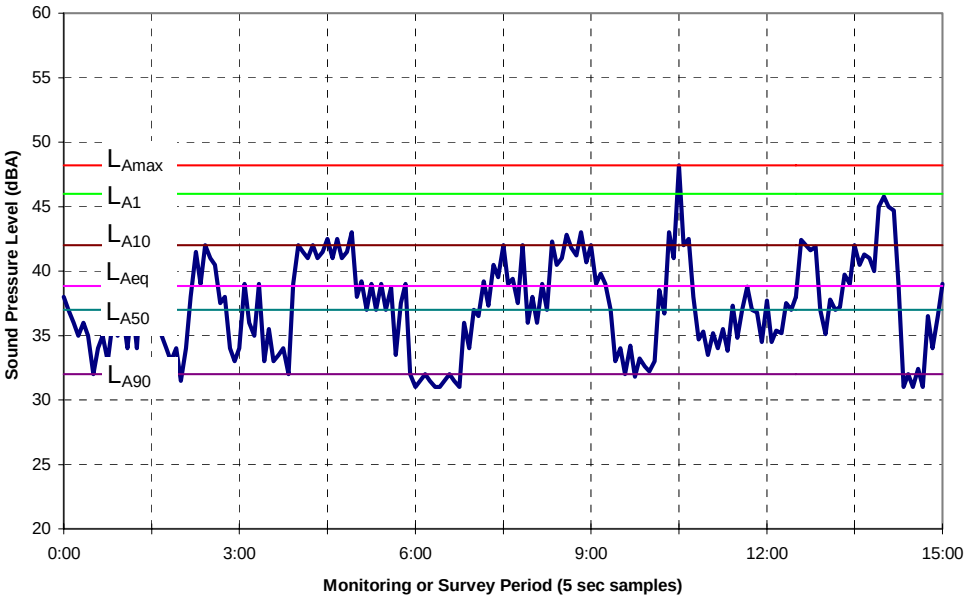
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period **–** daytime, evening and night time.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)

APPENDIX B

NOISE MEASUREMENT RESULTS

Location: 5 Seaforth Crescent

Data shaded: Showers

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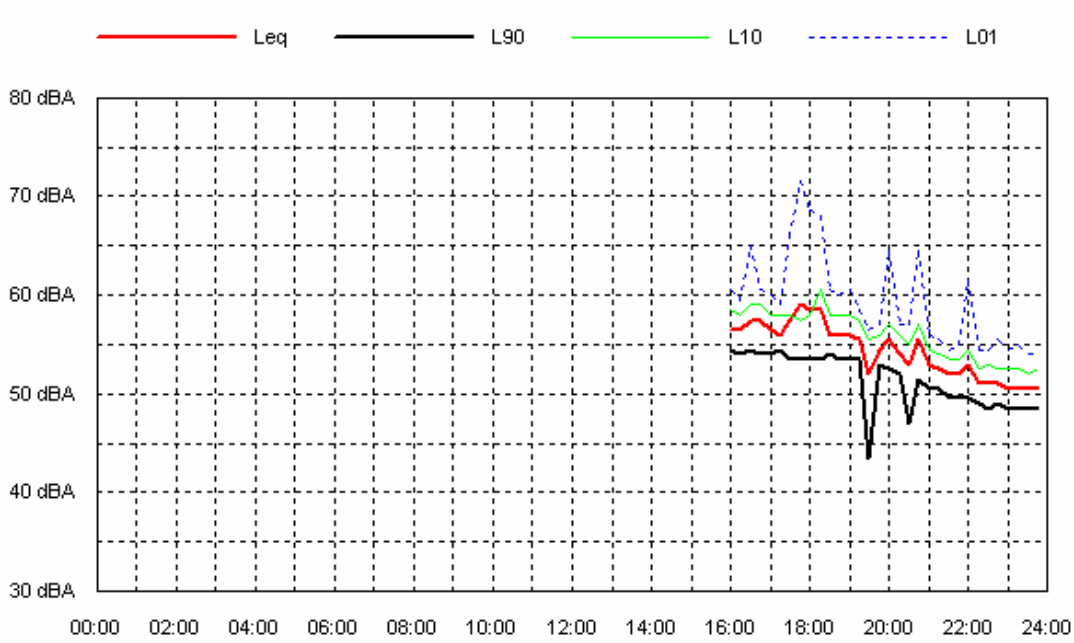

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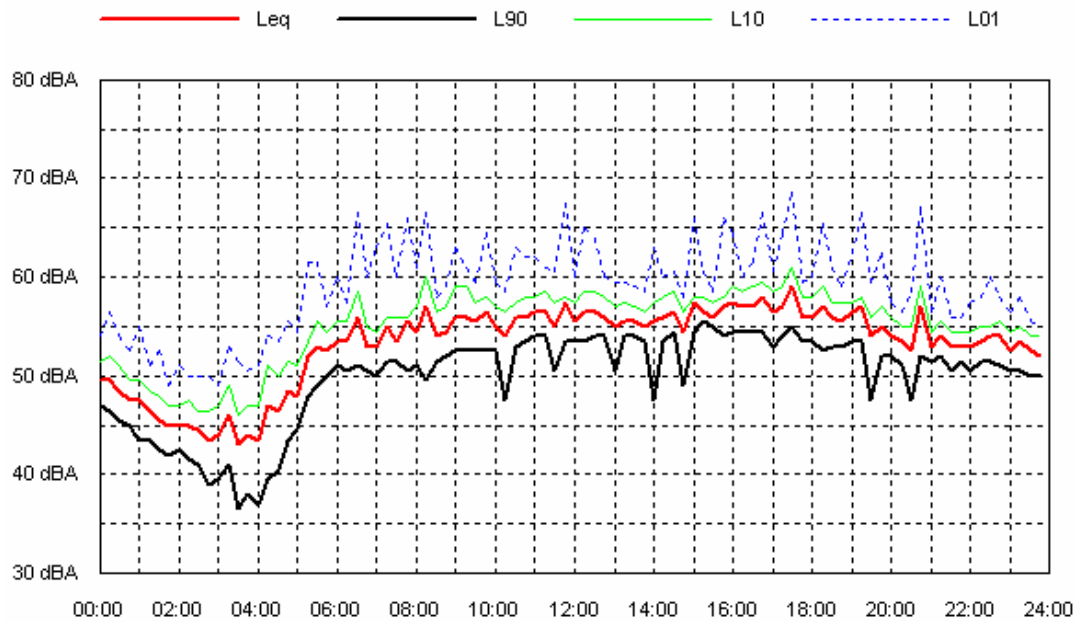

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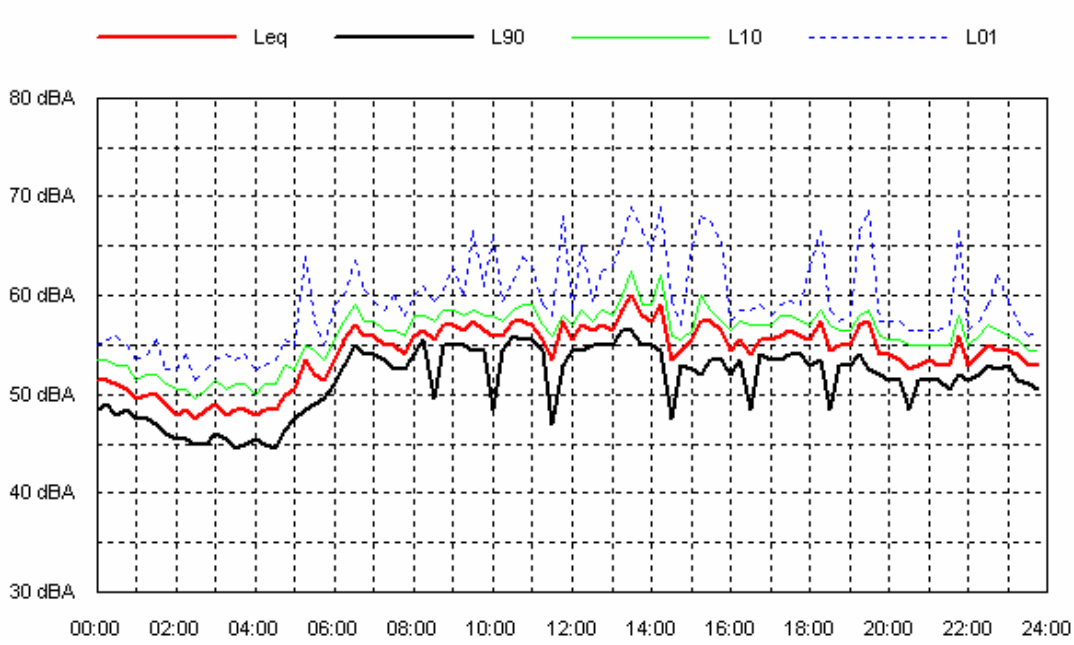

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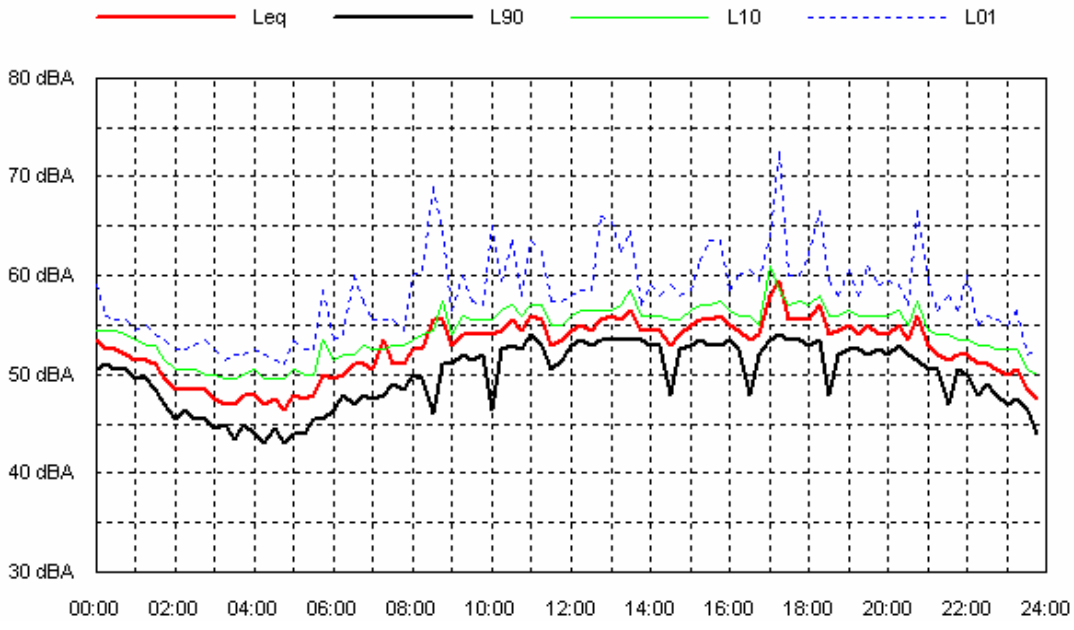

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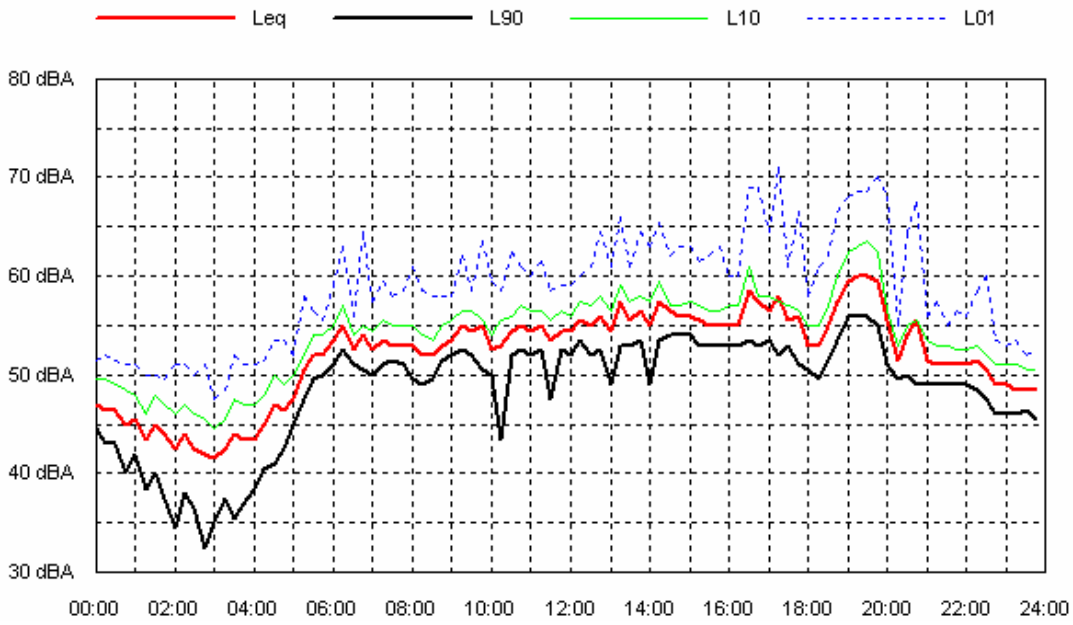

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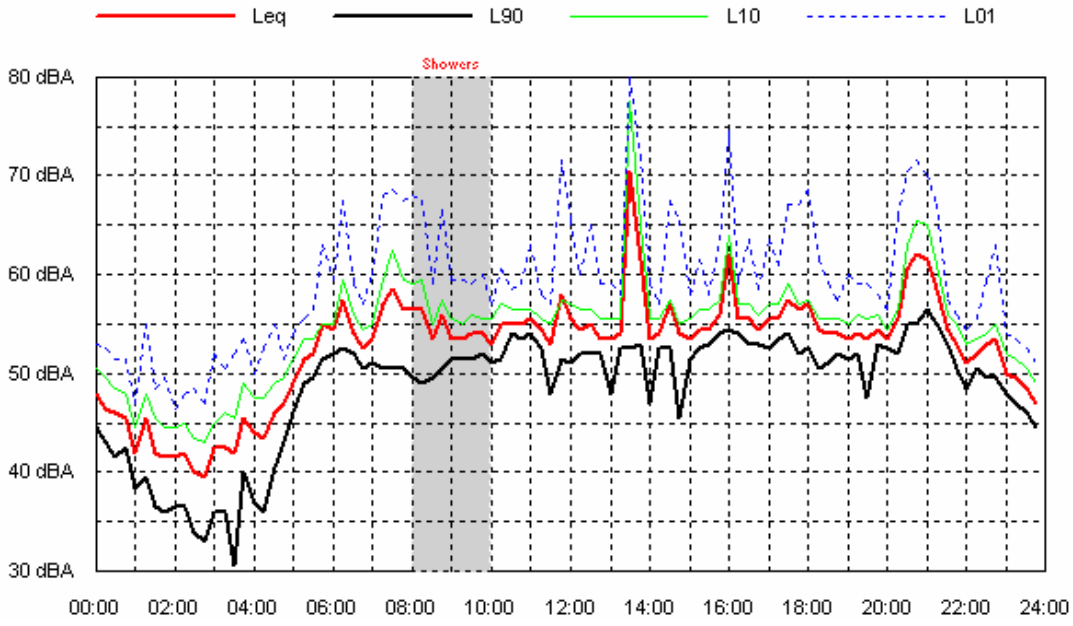

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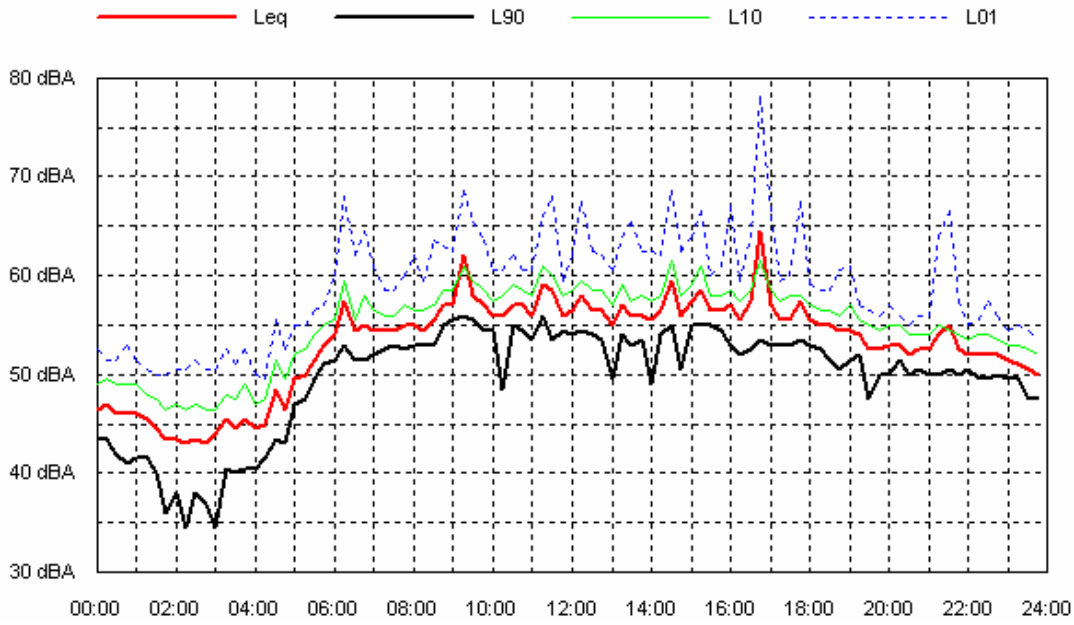

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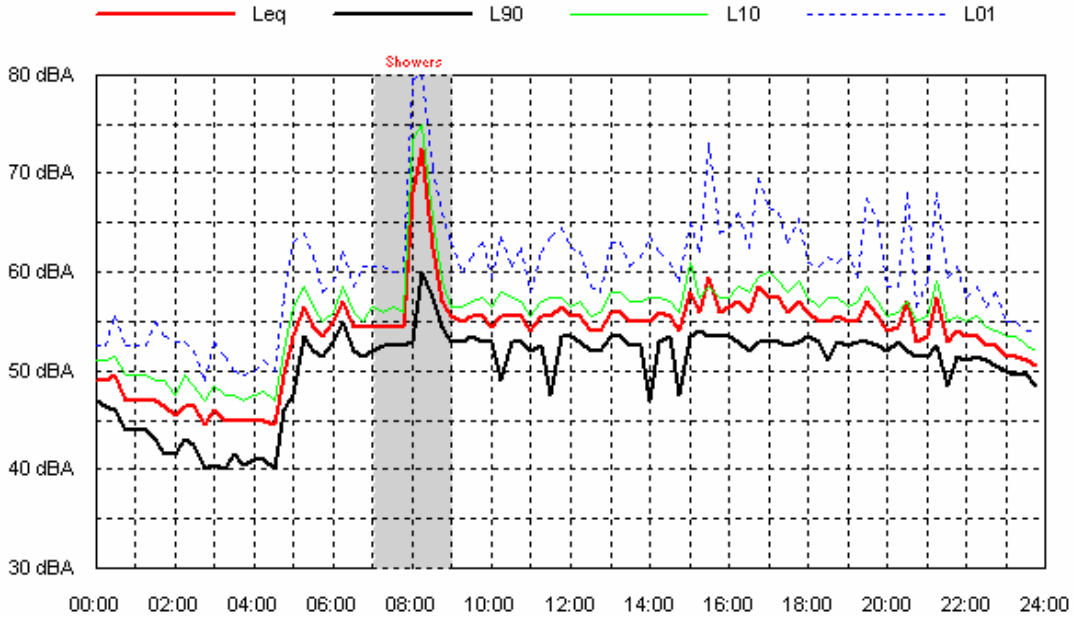

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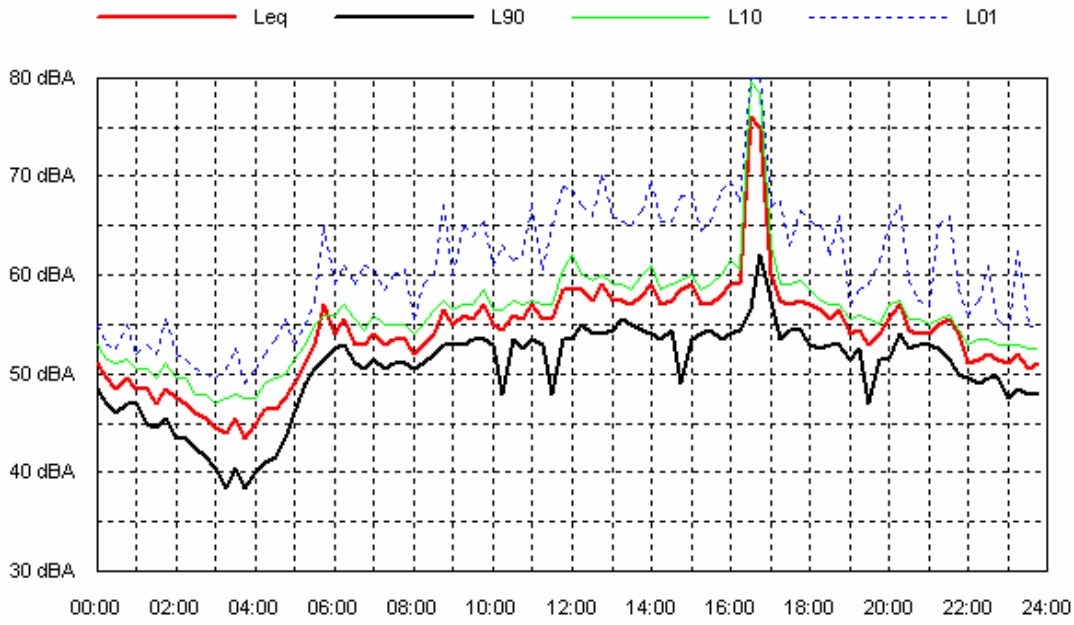

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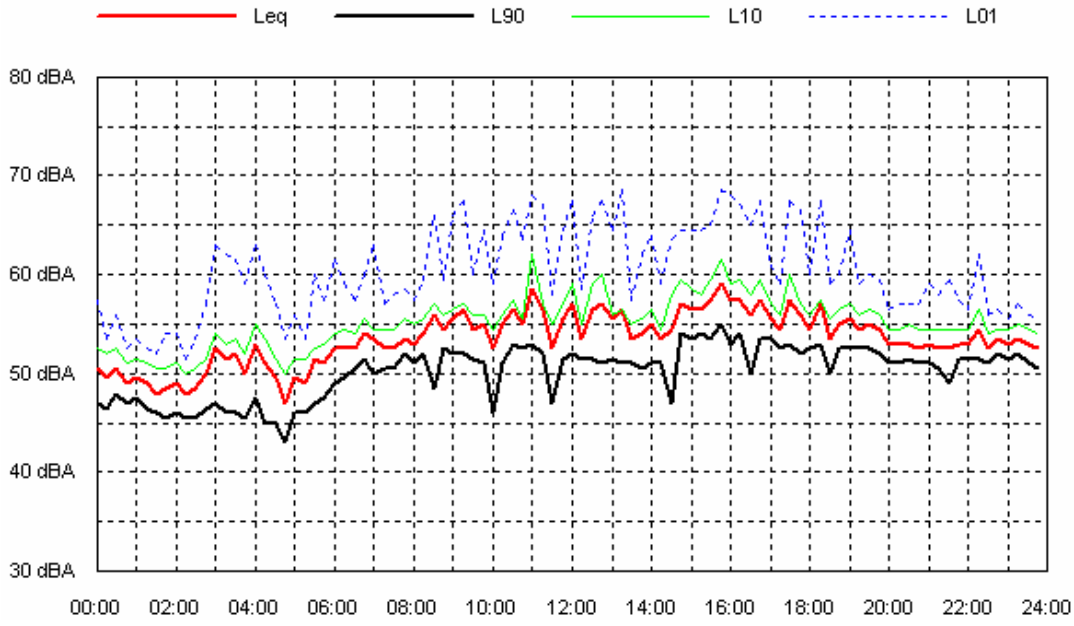

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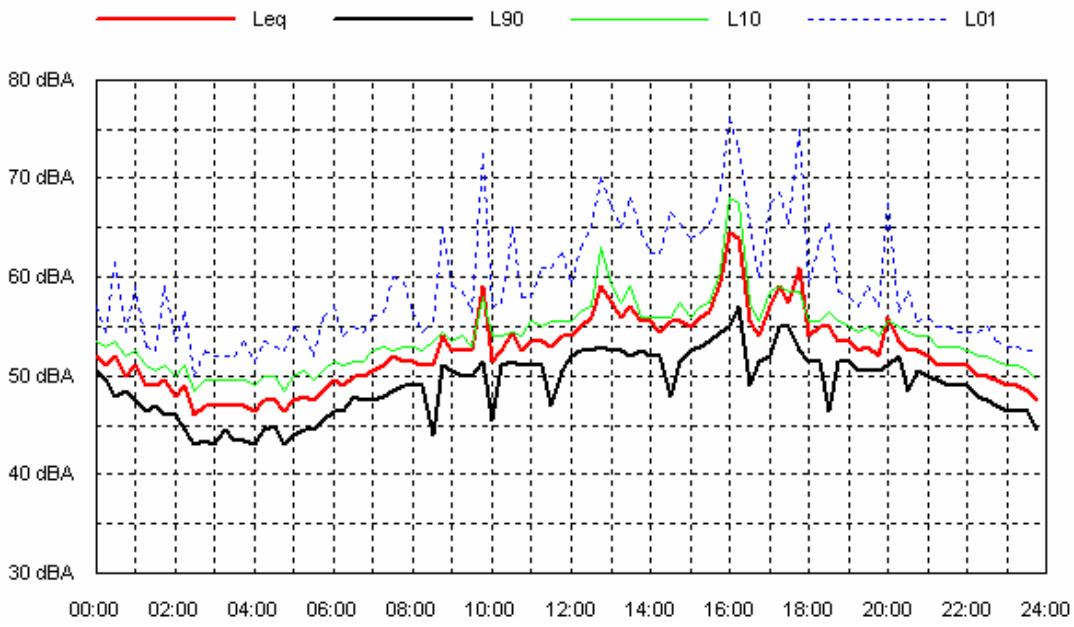

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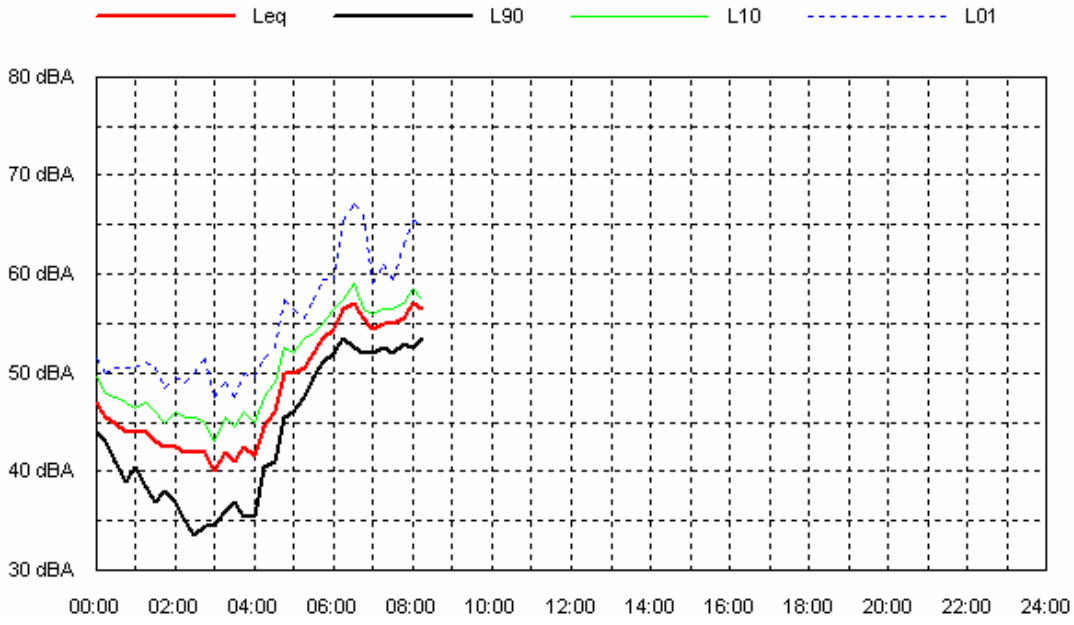

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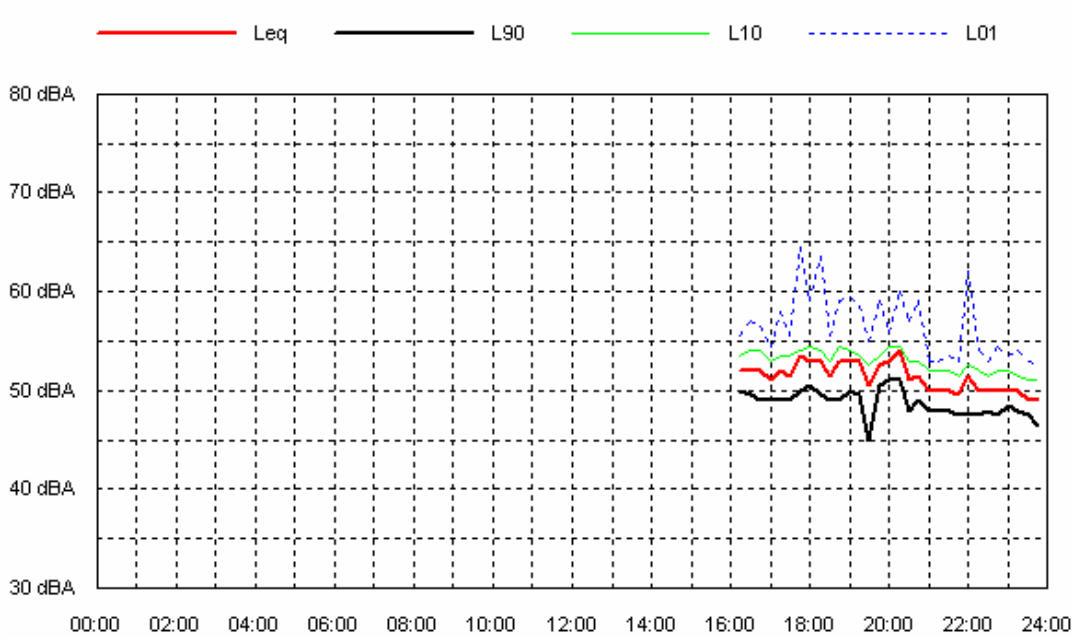

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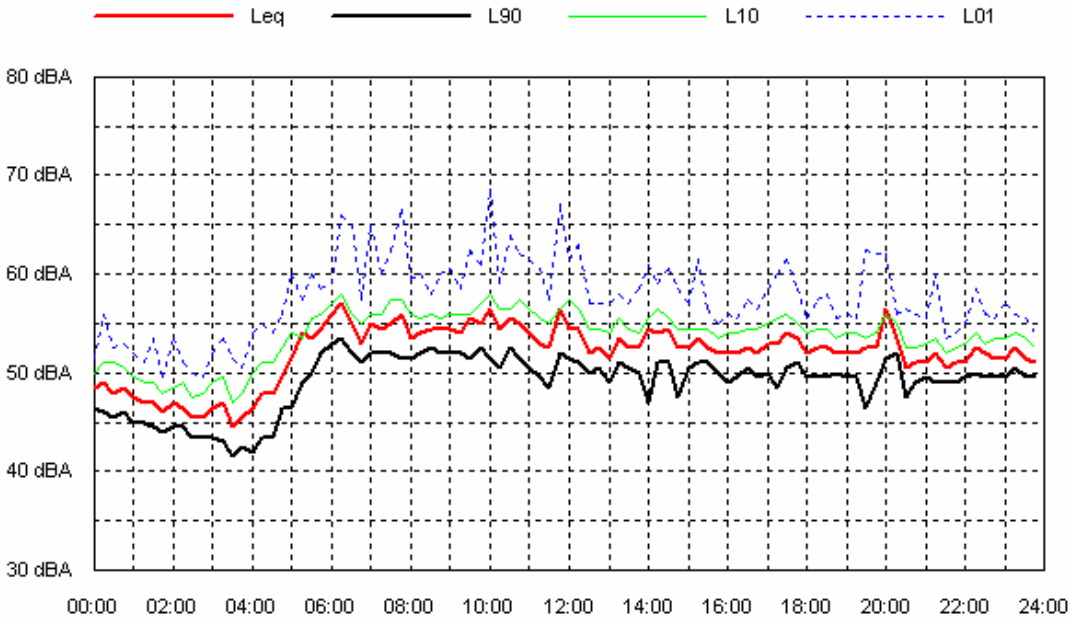

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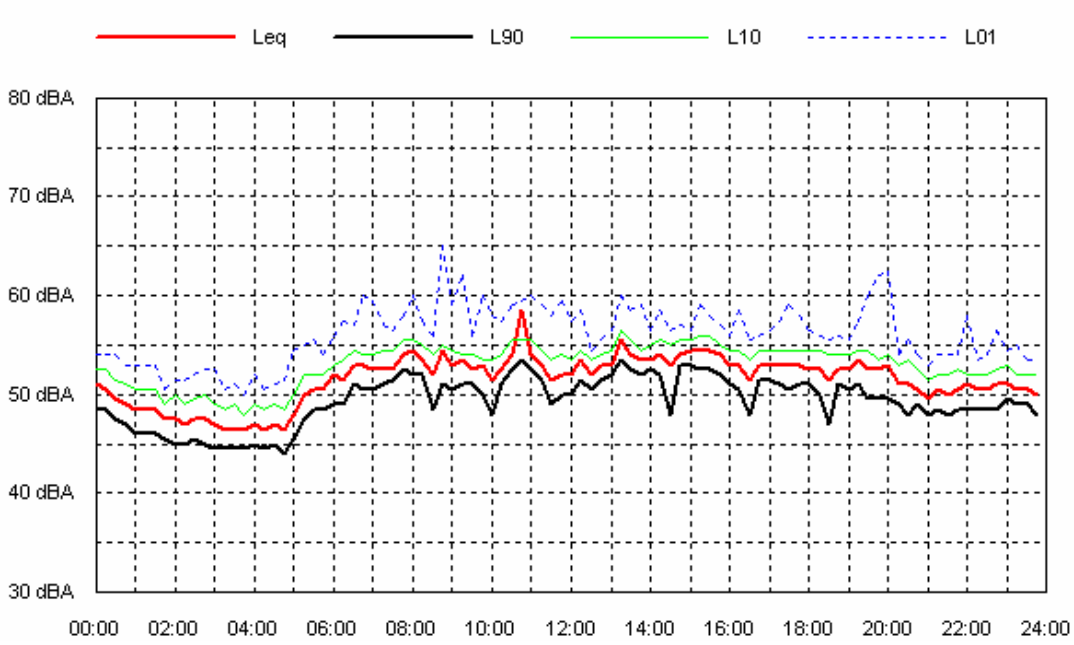

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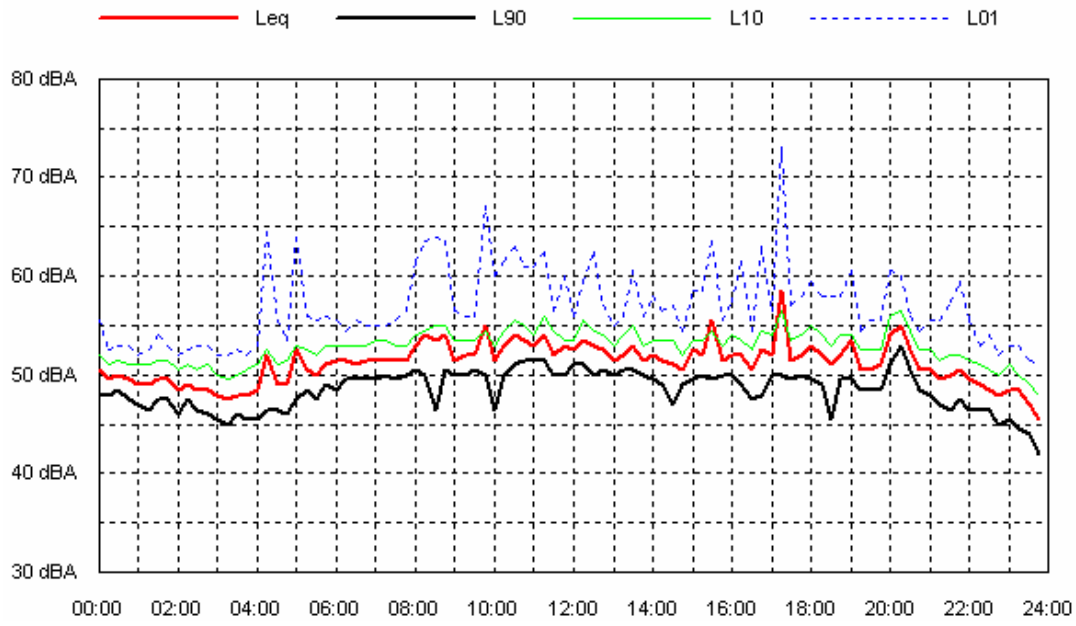

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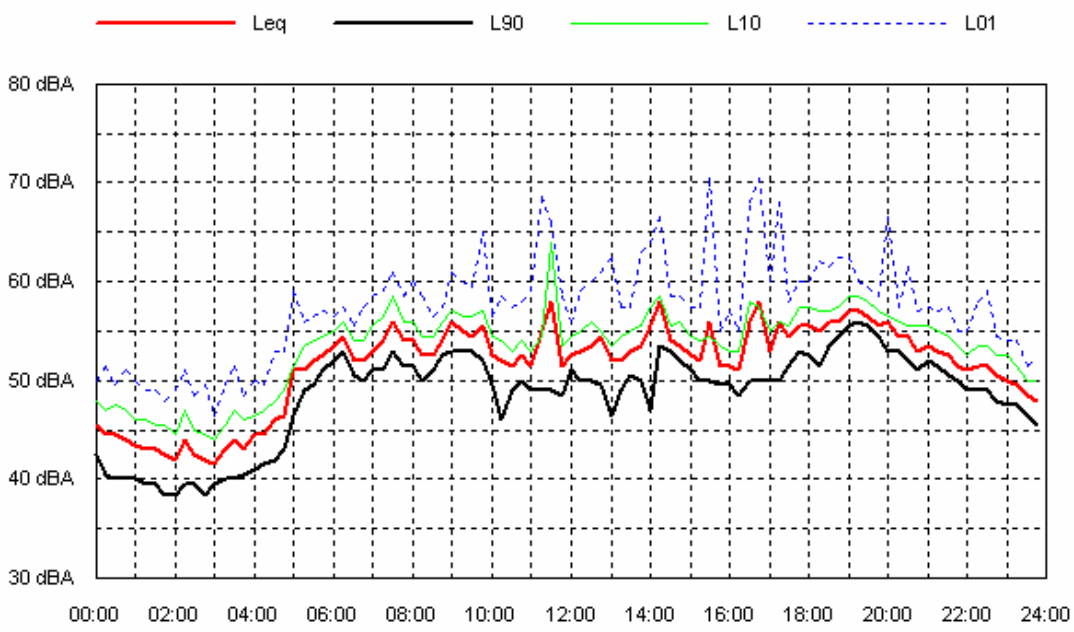

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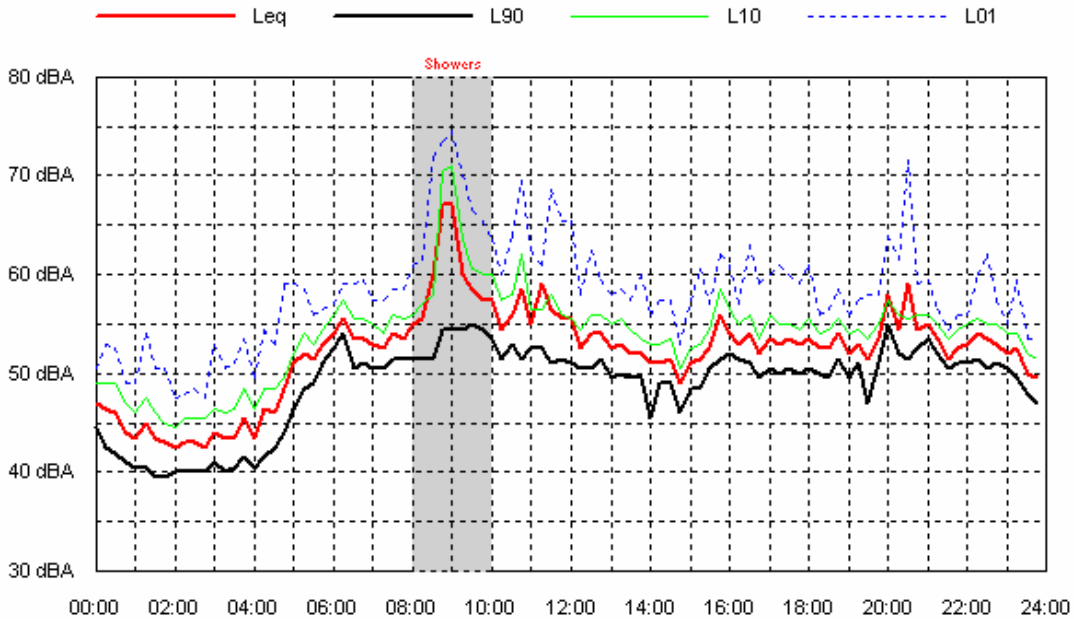

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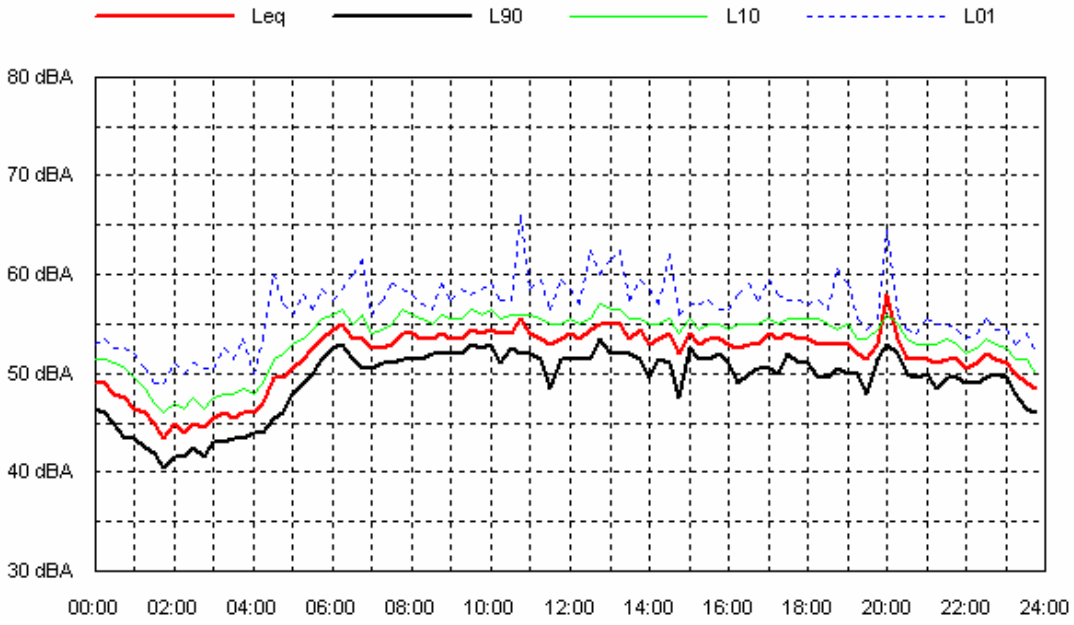

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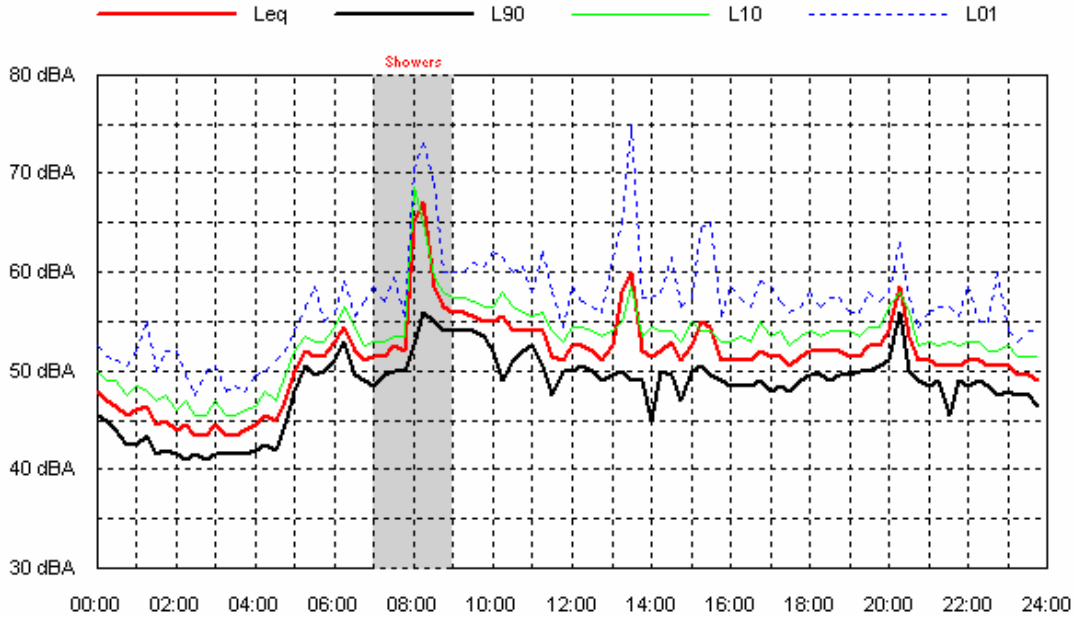

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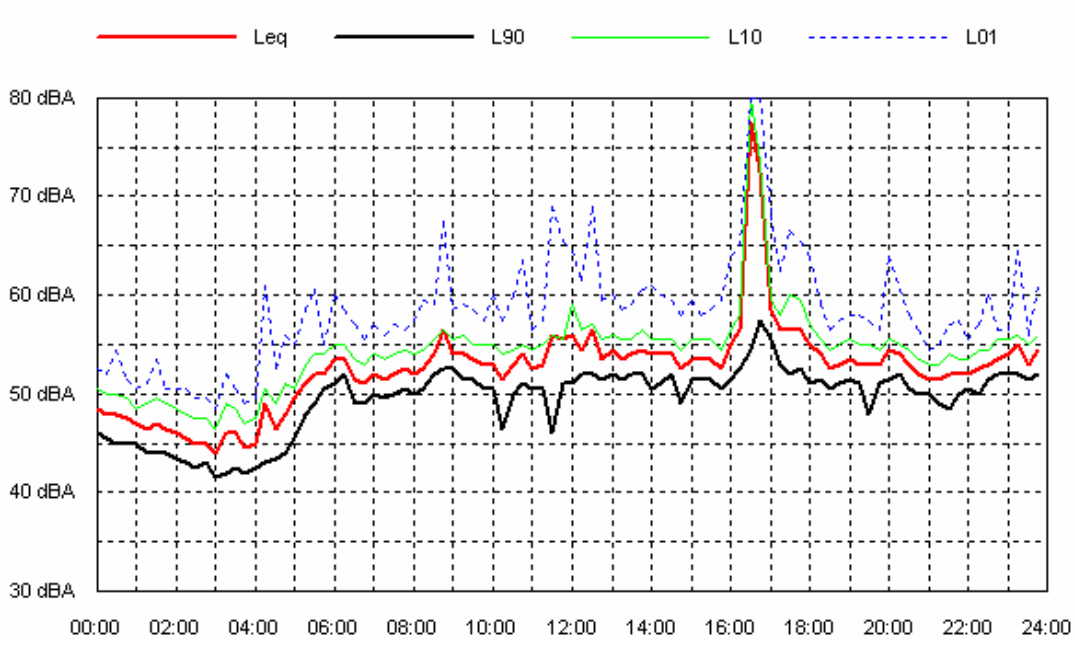

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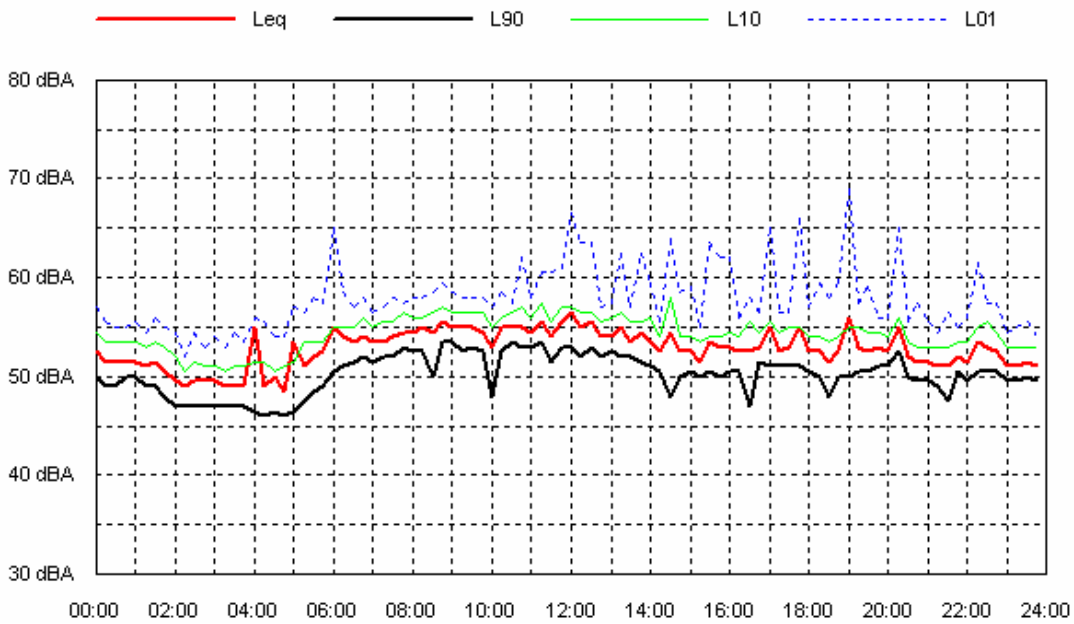

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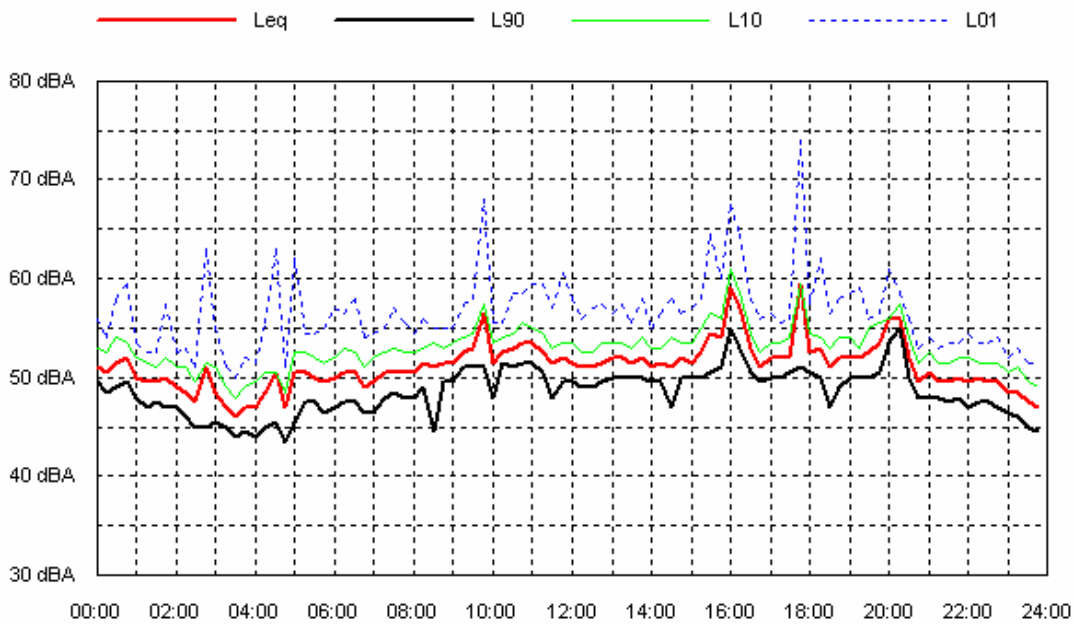

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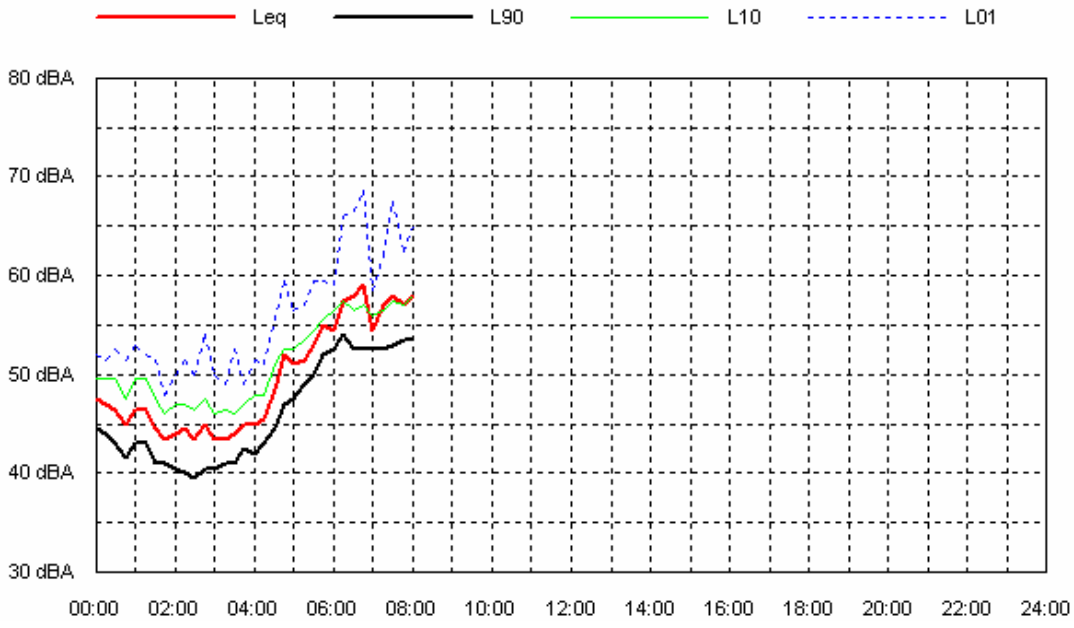

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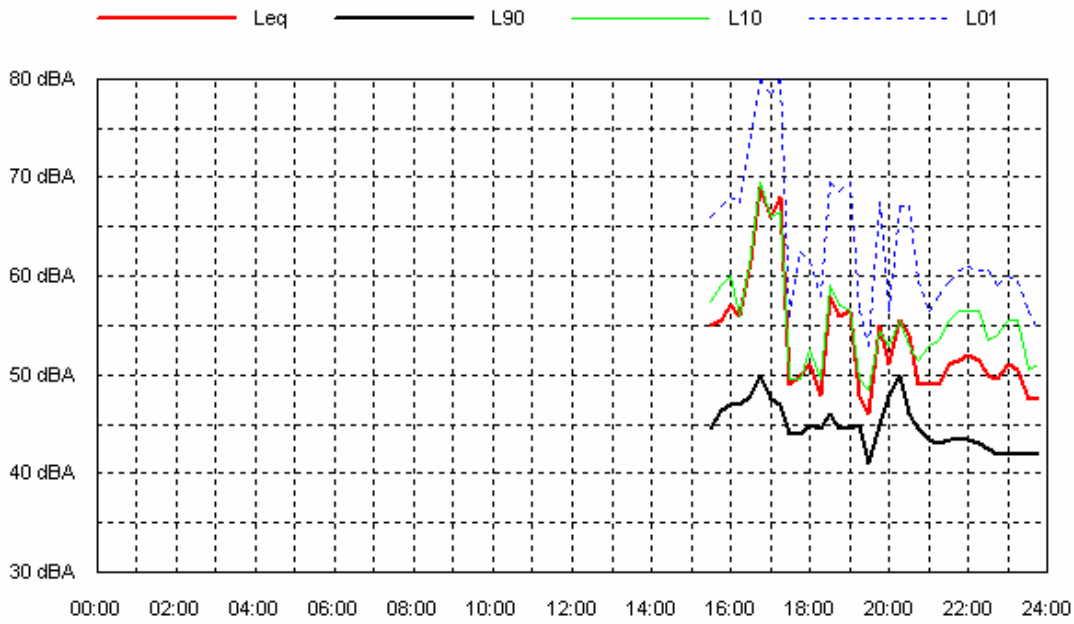

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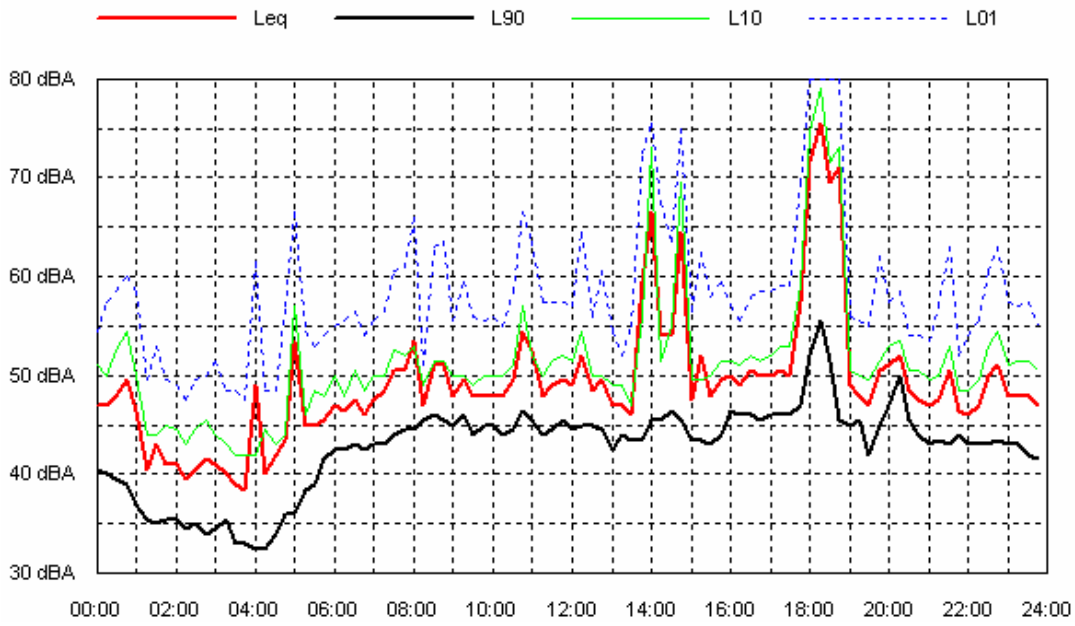

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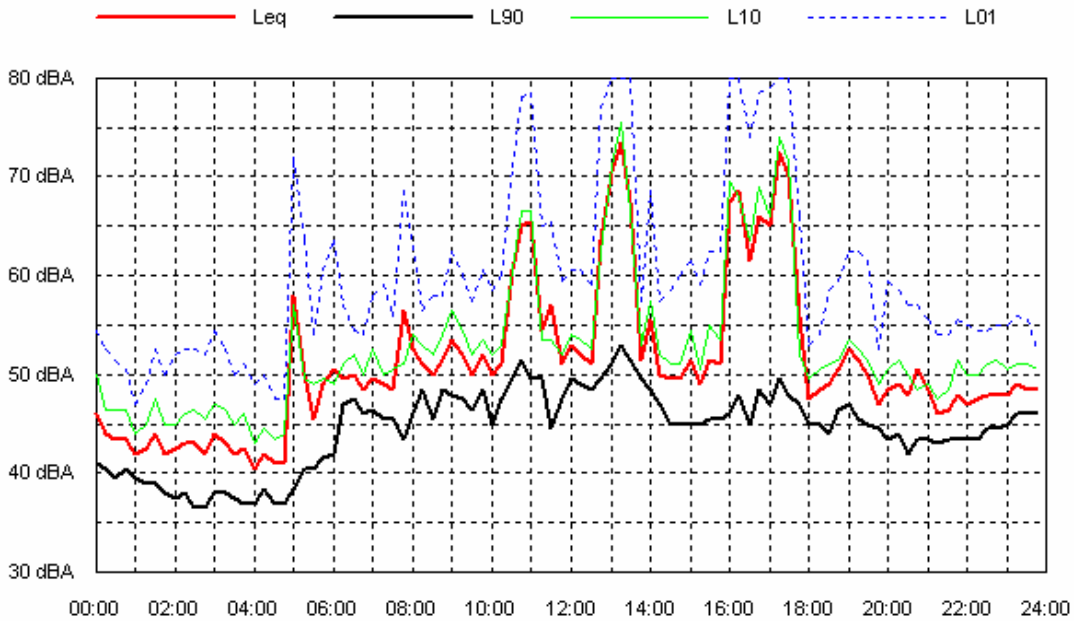

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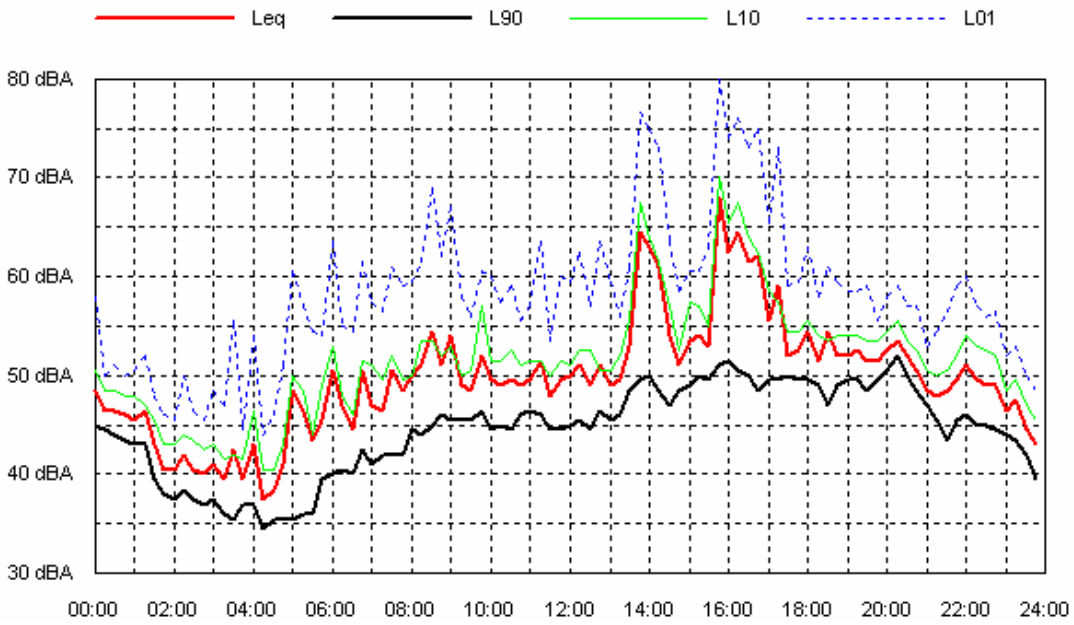

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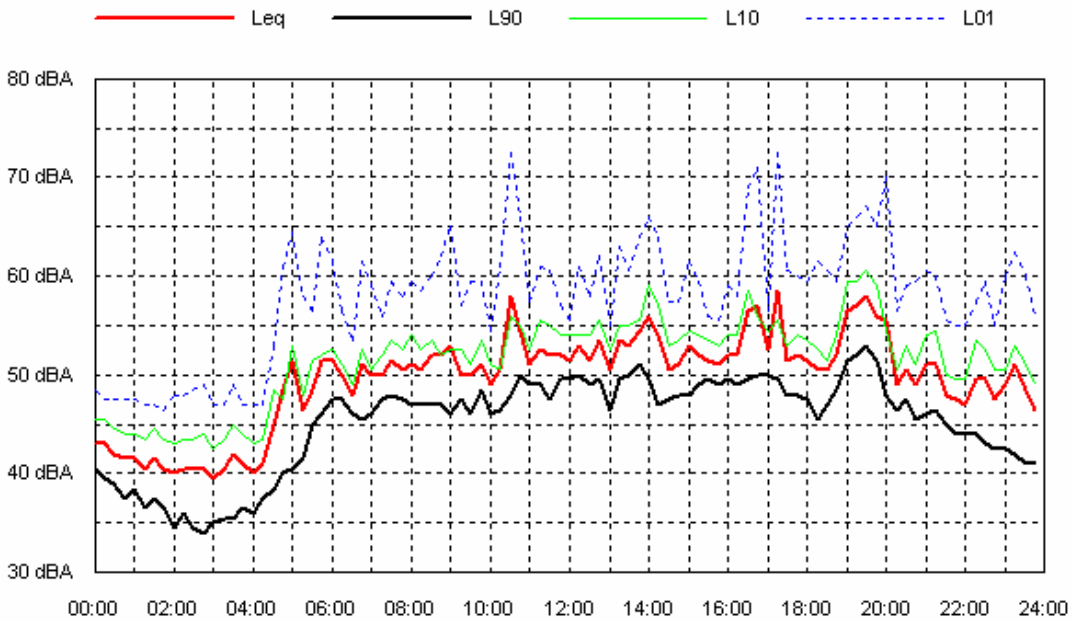

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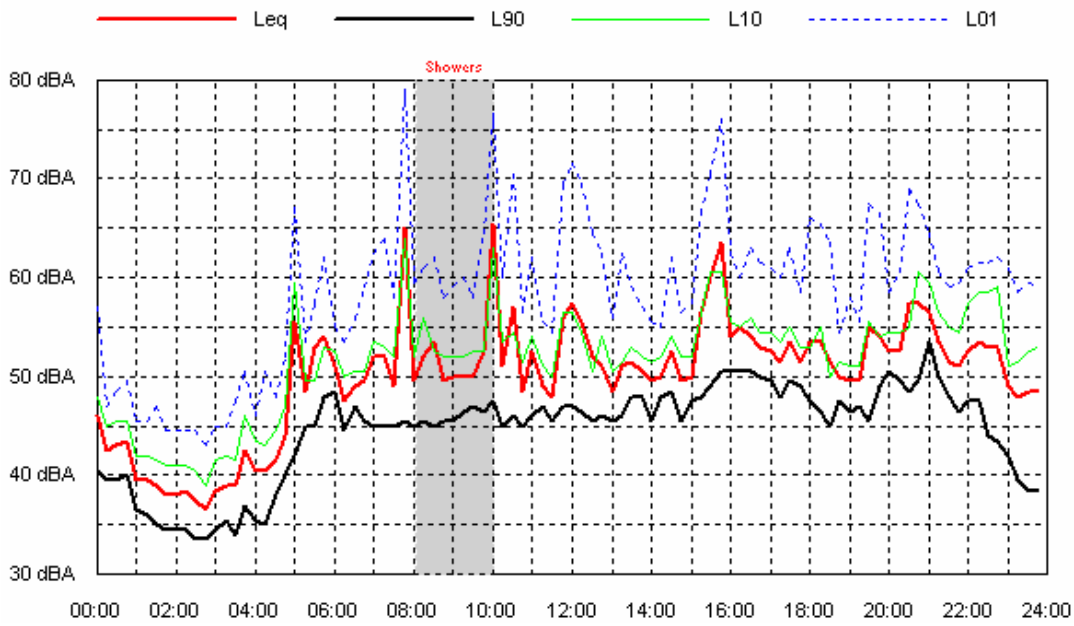

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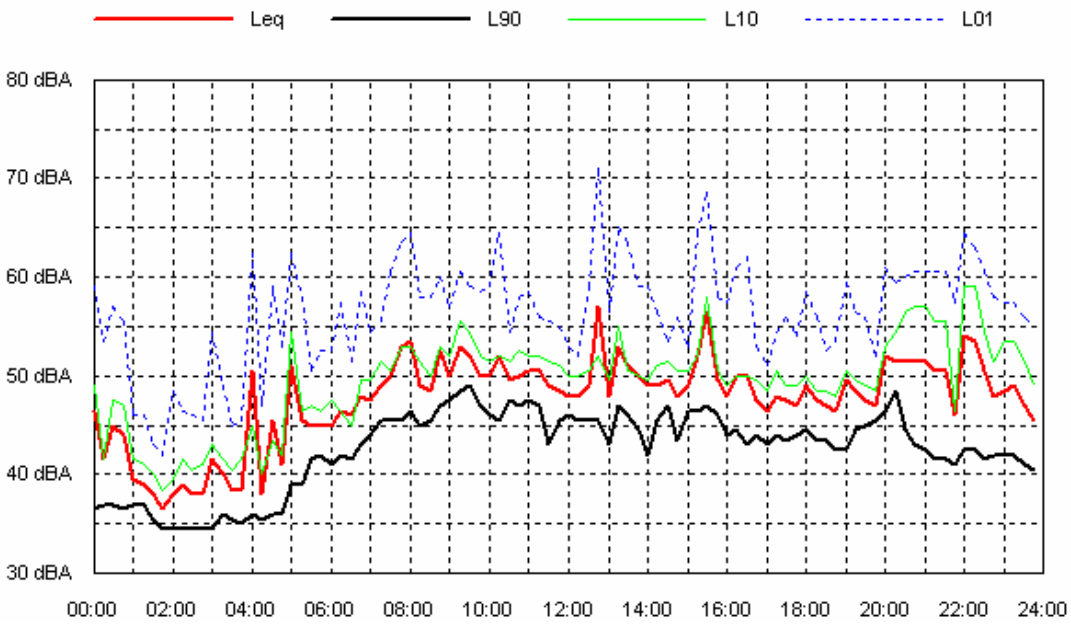

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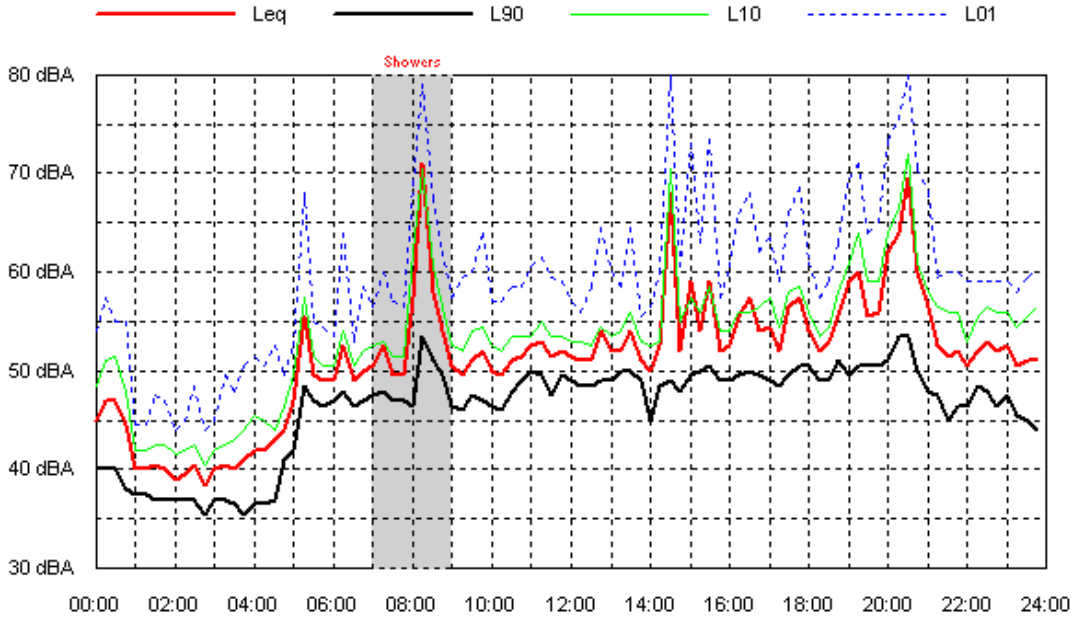

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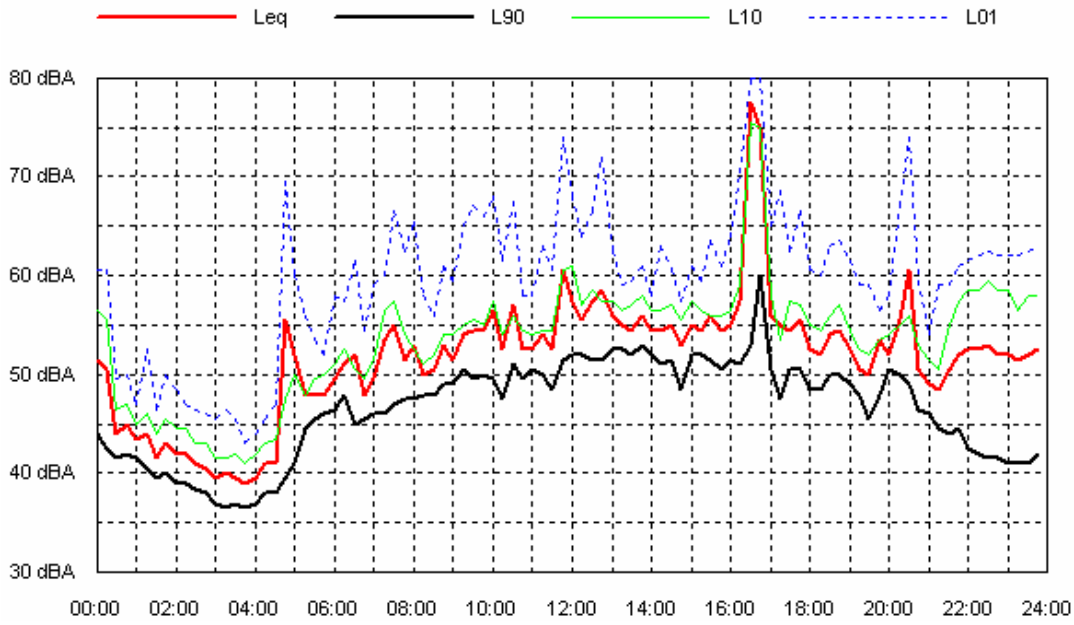

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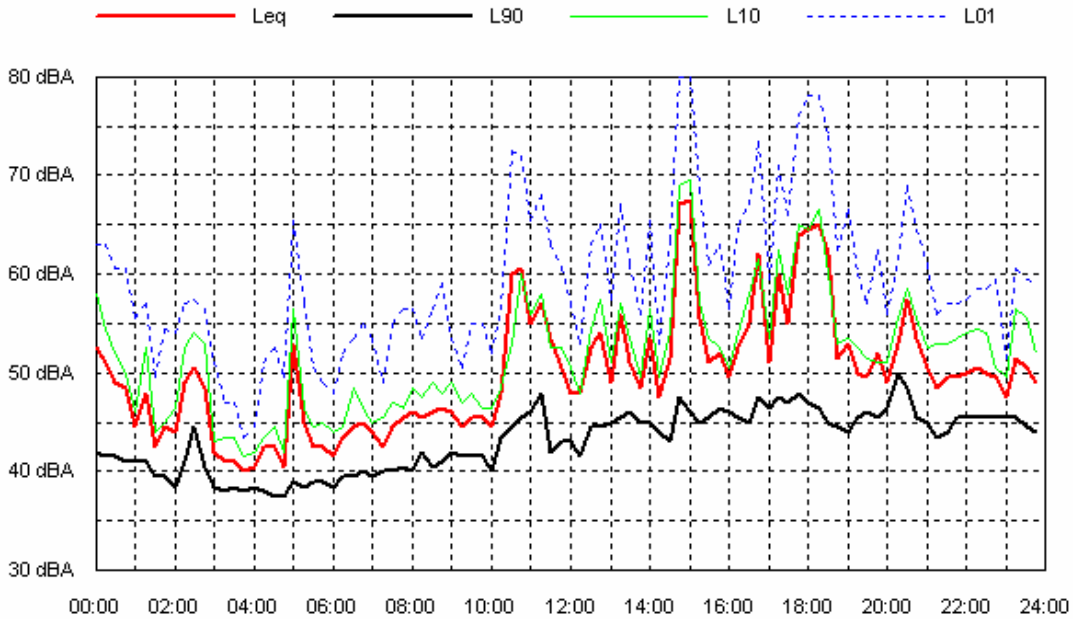

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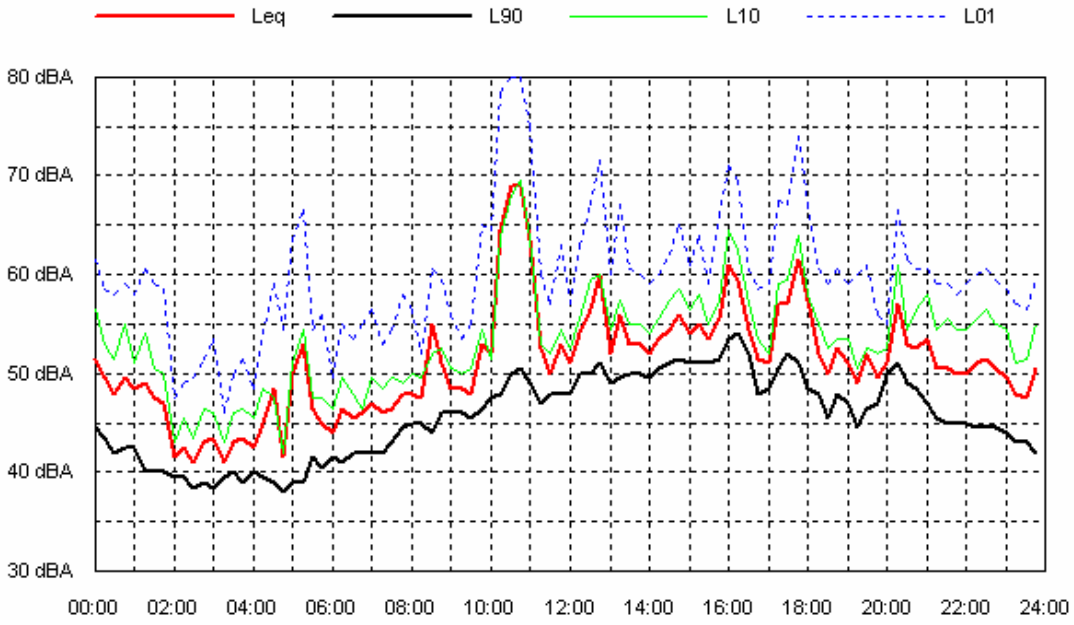

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