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'Inaudibility' A Concept in the Assessment of Noise Nuisance

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CONTENTS

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INAUDIBILITY - SO WHAT IS NEW?

K Dibble

Consultant, The Sound Practice, Rugby

INTRODUCTION

It was 1986 before we as a practice first encountered inaudibility as a statuary criteria for noise nuisance, when we were involved with two projects in Edinburgh city centre and consequently found ourselves dealing with noise control officers of the City of Edinburgh Einvironmental Health Department. One project was Cinderella/Rockerfella's discotheque in St Stephen Street, the other the Empire Theatre in Nicholson Street. At the time it was felt by all concerned that the 1984 amendment to the Licensing Act (Scotland) 1976, in which inaudibility is the criteria by which the existence of a nuisance is determined, was a little unreasonable. After reflection however it was concluded that although inaudibility had not previously been stated as a criterion, it had in effect been the criterion in a number of previous instances of noise nuisance due to the playing of amplified music, due principally to the absence of an effective descriptor by which this type of nuisance can be established.

The problems however must surely start when what is in anybody's terms a subjective quantity, finds its way onto the statute book. In order to be enforceable a quantity must surely be quantifiable and herein it is feared, lies the danger.

SCOPE

This paper is concerned only with noise arising from entertainment involving amplified music, whether from live performance or from replay of pre-recorded material. It is not relevant elsewhere.

The paper will consider the reasons why conventional A-weighted measurements are not an acceptable descriptor for entertainment noise, will briefly look at two recent case histories in which inaudibility was, either in fact or in effect, the criterion applied, and will conclude with a proposal for a quantifiable measured descriptor for the subjective term "inaudibility".

THE PRESENT STRUCTURE

Most entertainment noise nuisance enforcement is enacted either by service of the ubiquitous Section 58 Notice under the provisions of Part 3 of the 1974 Control of Pollution Act, or by registering an objection to a liquor or entertainment license renewal. Since responsibility for the licensing of premises has been increasingly devolved to local authority licensing committees it is becoming more and more widespread to find noise level restrictions imposed as a condition of license with renewal being made dependant upon compliance. Since such venues are unable to operate without a license this has become the more effective and immediate device to bring offenders to heel - this especially if trouble arises when a renewal is imminent. It is for this reason that Edinburgh prefers the licensing angle, recoursing to the Act only as a last resort or for non-licensed premises.

In such cases it is invariably the opinion of the local EHO which will have most influence upon the decision to grant or refuse a license application. And increasingly, it is the opinion that matters - not what the meter might read. Magistrates Courts or Licensing Committees are increasingly concerned as to whether occupants are actually being disturbed by noise which is directly attributable to the operation of licensed premises - not with some mysterious decibel level which they do not understand and usually, do not want to know.

This approach is supported by an increasing reluctance on the part of EHOs to provide a clear guideline as to what level of entertainment noise is acceptable in a given situation and what is not, the reluctance being usually based on previous experiments with BS4142 or the application of an NR curve, usually with the result that the complaints continue to flood in even though the offender has complied with an earlier stipulated limit. Even when "SPL not to exceed ambient" is stipulated, sure enough, the A-weighted SPL meter reading may not exceed ambient but that ubiquitous bass thump is still there. So in the absence of a convenient and generally understood measurement unit, inaudibility has in effect become the point at which the EHO will say that he is satisfied that the "best practicable means" have been deployed, or that a nuisance no longer exists. In other words, as things stand, it is invariably subjective opinion which will sway the licensing authorities - ie inaudibility.

THE PROBLEM

The principle difficulty lies in the fact that the relatively high volume levels normally associated with discotheque and rock music performance falls in that part of the frequency spectrum where the A-weighted filter is decreasing meter sensitivity to compensate for the Equal Loudness Contours (1) Fig 1 shows the 1/3rd octave analysis of actual discotheque programme inside and outside a premises (2). Based on many such measurements and more than ten years experience working with entertainment noise the author would strongly defend the general form of Fig 1 as being typical of this type of discotheque and live performance sound. It is contended that alternative spectra as shown by others (3), (4), which may well have been accurate in the particular instances cited, are not representative and fail to show the inherent "adrenalin pump" characteristic in the 50Hz, 63Hz, and 80Hz 1/3rd octave bands.

Because of the relative weakness of most buildings over these low frequency bands the bass peak is often more predominant in the outside environment than it is inside the building and the bass hump is seen poking through the ambient noise envelope even in this noisy area. Fig 2 shows how another discotheque music spectrum with peak levels in the 50Hz 1/3rd octave band in excess of 125dB is accommodated underneath the 96dB(A) filter slope. It is this unrecorded energy peak which is the cause of most of the trauma associated with discotheque and rock music noise.

Reverting to an unweighted SPLM does not provide an answer as the ambient broadband linear measurement may be principally influenced by very low and mid frequency levels thus providing only limited masking of equivalent levels of music bass because of the "window effect" as shown in Fig 3. Under these conditions the pulsating thump of the bass beat would be clearly audible. Thus, despite work carried out by Scannel (5) the only practicable and adequate way of quantifying the problem at this present time is by real-time, 1/3rd

octave analysis. The examples shown here were recorded using the Ivie IE-30A precision SPLM/RTA, using the instantaneous spectrum freeze facility to hold a representative peak sample. The contents of the internal memories are then transferred to its associated IE-17A processor to run the memory plot programme, in this instance using an HP XY plotter.

The situation as described has existed for several years and instances involving the local authorities in Dundee, Barnsley, Wakefield, Norwich, Worcester, Brentwood, Guildford, Southampton, and the London boroughs of Tottenham, Westminster, Havering and Camden, can be cited from our own records where the matter was not resolved until virtual inaudibility had been achieved. Experience shows that if any of that bass hump penetrates the ambient noise envelope it will be audible as music and will cause annoyance, and as a matter of course, our own design targets in specifying new build or remedial works is to reduce the energy in each 1/3rd octave band so that there is no increase in the corresponding 1/3rd octave band in the ambient noise analysis - then, and only then can inaudibility be achieved.

SOME CASE HISTORIES

Bugatti's Nightclub, Brentwood

An unfortunate sequence of events in 1986 led to a refusal by Brentwood Magistrates Court to renew the liquor and entertainment licenses at this venue, principally because of noise nuisance complaints by one woman supported by the local authority. We were asked to advise as a matter of urgency and in the three month time interval between the Magistrates Court decision and the date set for an appeal to the Crown Court, extensive alternations to the fabric of the building and to the sound system had been carried out and a sound level limiter installed. Eventually it was agreed by the EHO responsible that noise amounting to a nuisance no longer existed and during a monitoring exercise a few days before the appeal hearing, neither the EHO, the author, his clients or their solicitor, or a retired policeman now working as a private investigator, were able to hear any noise emanating from the premises. The EHO stood up in court and stated that there was no longer a nuisance and that he was satisfied that proper measures had been taken to control the situation. The private investigator stood in the witness box and read from his surveillance notes that he had heard no noise over the period since the works had been carried out. Three policemen who had visited the complainant in response to a complaint that neither she or her children could get to sleep because of the noise, testified that they could hear nothing when they attended her house. The author testified that nothing could be heard and produced SPL readings and 1/3rd octave spectra to support the opinions being expressed. Yet the complainant persisted with her claim and the Judge disallowed the appeal. As a result a select and well run £3/4m development in a rural part of Essex - where this one complainant, whose house was some 120m distant, was the only resident within a 500m radius, was forced to close down just twelve months after it had opened (6). In this instance it should be acknowledged that there were other aspects of management conduct which influenced the decision but the original and principle factor was noise.

The Giffard Hotel, Worcester

In a recent case of environmental noise nuisance due to noise from an hotel function suite the local authority issued a Section 58 Notice requiring

our client to:-

"...suitably control the amplification of sound at the premises so that it is inaudible in adjacent residential property."

Although there undoubtedly was justification for the issue of the Notice and appropriate remedial works have now been implemented, we advised the solicitors that an appeal should be entered under the provisions of Section 4(2)(c) of the 1975 Control of Noise (Appeals) Regulations on the grounds that inaudibility is a subjective term which cannot be substantiated or quantified, and would leave our client open to enforcement action arising from malice. The resulting few weeks grace were gainfully employed to sort out the problems and get the remedial works under way without our client being subject to fines under the terms of the Act every Saturday night. When the appeal case came to court the Section 58 Notice was withdrawn by the City Solicitor. (7)

AN ALMOST QUANTIFIABLE DEFINITION

In the first cited instance the worst fears of inaudibility as a statutory instrument are realised in that although no one but the complainant herself could hear this noise, and according to conventional measurement there was no increase in the pre-existing background level, a Crown Court Judge chose to disregard both the informed and the expert testimony provided and found in favour of the complainant.

Conversely, in the second instance, where inaudibility was actually cited on a Section 58 Notice, the appeal against the terms of the Notice resulted in an uncontested withdrawal by the authorities.

Given the foregoing discussion on music spectra, coupled with the general agreement that the L90 percentile provides a realistic measure of the subjective assessment of a background level whilst the L10 percentile provides a similarly representative measure of an intruding noise, it has been found that music will only become subjectively inaudible when the unweighted L10 values in the sixteen 1/3rd octave bands between 40Hz and 1.6KHz of the disturbing noise do not exceed their L90 counterpart values in the background or ambient noise spectrum. Fig 4 reminds us of the L90 and L10 relationships.

This relationship can serve as a useful design base in the specification of noise control measures and in nuisance prediction. Clearly however, the L10 percentile of the intruding noise can only be measured objectively when the ambient L90 is exceeded and therefore, whilst capable of quantifying non-compliance with an inaudibility order, cannot be used to prove compliance, except by default.

INAUDIBILITY - SO WHAT IS NEW?

SUMMARY

It has been shown that inaudibility has long been, in effect, the criterion used in the determination of nuisance. It has also been shown that reliance on a wholly subjective assessment of nuisance can, and has, led to judgement that was at best, unsatisfactory.

Therefore, whereas the underlying contention of the inaudibility protagonists is not itself in dispute, the concern is expressed that reliance on subjective assessment alone is not a realistic or workable basis for enforcement and that it is wide open to abuse, prejudice and malice.

Some means of objective measurement is therefore seen as an essential prerequisit before enforcement on this basis is considered and one such method, which has been proved on a number of occasions, has been described here.

References:

1) BS3383:1988 "British Standard Specification for Normal Equal Loudness Level Contours for Pure Tones under Free Field Listening Conditions".

2) The Sound Practice, Rugby: project file CF2701 (not published)

3) Scannel K & Finch R "The Assessment of Discotheque Noise for a Planning Application" Proc IoA, Vol 10, Pt 2, pp439, 1988

4) "The Silent Disco" SRL newsletter No1, Vol 17, 1986

5) Scannel K "An Objective Method of Assessing Noise Annoyance from Discotheques". Proc IoA Vol 8 Pt 4 1986

6) South Essex Entertainments Ltd licensing appeal to Chelmsford Crown Court (Judge B Watlin) May 30 - June 03 1986

7) THF Hotels Ltd vs Worcester City Council, appeal against terms of Section 58 Notice, Worcester Magistrates Court, March 17 1988

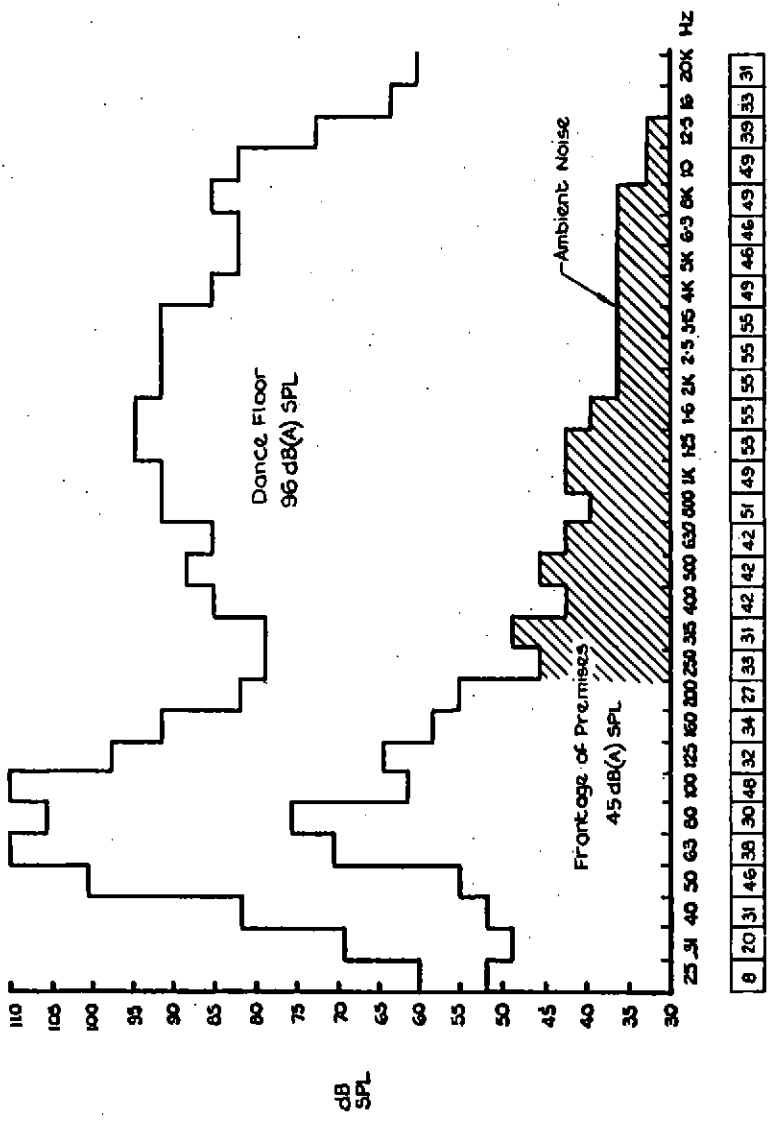

Fig.1 Typical Discotheque Noise Spectra Inside & Outside Premises

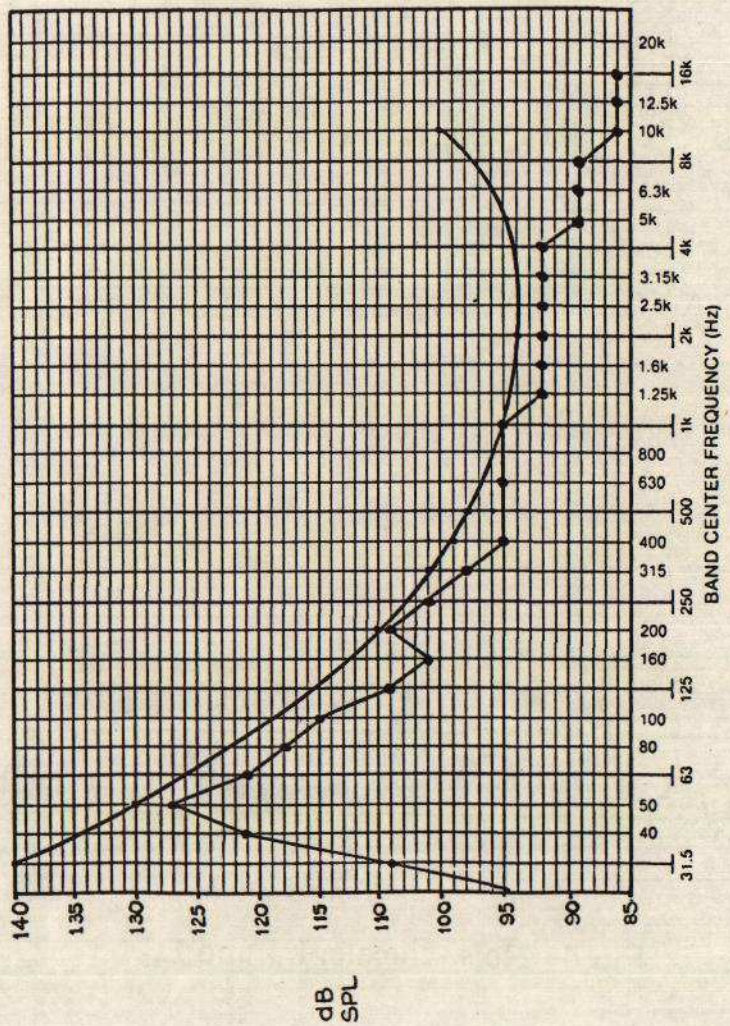

Fig. 2 Typical Discotheque Noise Spectra vs "A" Weighting Curve

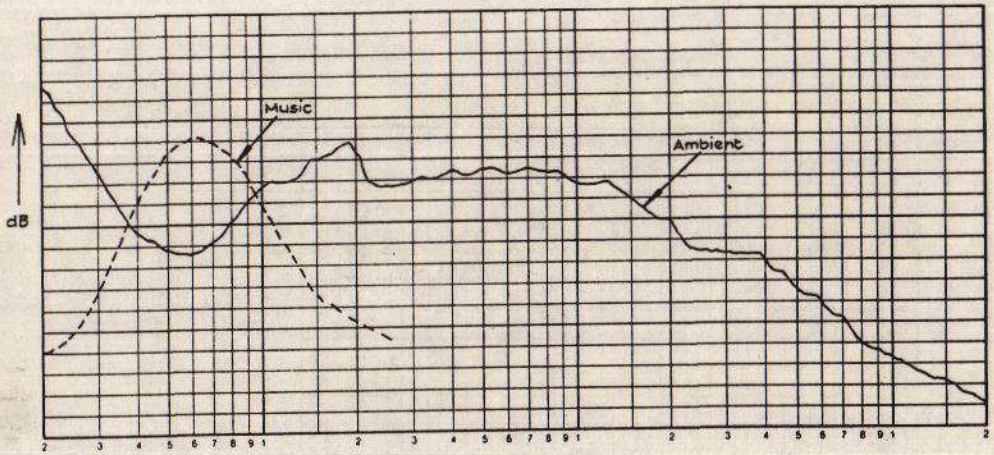

Fig. 3 Masking Window Effect

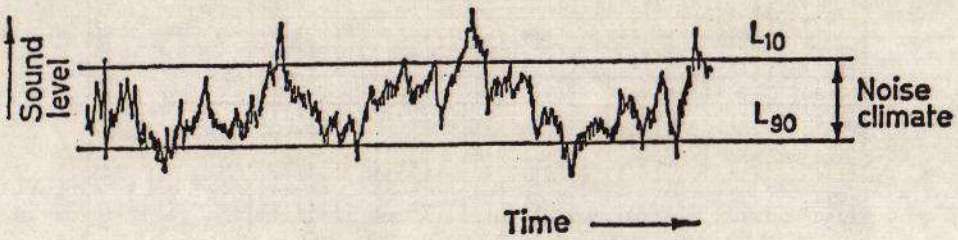

Fig. 4 Noise climate, L_{10} and L_{90}