ENVIRONMENTAL NOISE GUIDELINES PROPOSED FOR THE NEW HEALTH AND SAFETY EXECUTIVE GUIDE FOR POP CONCERTS

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1. INTRODUCTION

The health, safety and welfare of audiences attending pop concerts and the potential impact on local residential areas near the events is of concern to licensing authorities, licensees, promoters and enforcement officers. The Health and Safety Executive (HSE) are in the final stages of producing a guidance document covering all aspects related to the holding of 'live' events in a safe manner.

In October 1991, a draft of the above document[1] was issued by the HSE for public consultation. The consultation period has now ceased and all the responses have been considered for the final document.

With regard to noise and sound issues, the document will cover two main aspects; worker/audience exposure and environmental noise. The hearing damage noise guidance will feature in the main body of the HSE document and a discussion paper[2] outlining this area is presented in these proceedings.

HSE's draft guide included advice on environmental noise, but this aspect is being reviewed and will take into account a draft code of practice on environmental noise from pop concerts being prepared by the Noise Council with input from the Department of the Environment. The Council plans to submit its code to the Secretary of State for Environment for approval as a Code of Practice under the Control of Pollution Act [3]. HSE's guide is likely to include the Council's draft code as an advisory annex to serve until a decision has been made on its approval.

Travers Morgan have been advising the HSE on various noise issues and are also represented on the Noise Council's working party. This paper culminates our advice to the various parties and discusses our findings from various concert events, in order to justify the guidance likely to form part of the Noise Council's code and HSE guidance document.

ENVIRONMENTAL NOISE GUIDELINES PROPOSED FOR THE NEW HEALTH AND SAFETY EXECUTIVE GUIDE FOR POP CONCERTS

2. ENVIRONMENTAL NOISE GUIDELINES

Community Response to Music
Community reaction to concert noise is dependent upon both physical and non-physical variables. Physical parameters include the sound level, the frequency characteristics of the sound, the number of concerts and the time of day the concert is held. An individual's views on the artiste, the venue etc, may also effect their response to the concert irrespective of the sound level. Taking account of these factors and our objective data related to complaints, the following guideline figures are being considered by the Noise Council for inclusion in the draft code.

Proposed Daytime Guidelines
The music noise levels (MNL) when assessed at the prediction stage or measured during sound tests, rehearsals or the concert should not exceed the following criteria (Table 1) assessed at 1 metre from the facade of any noise sensitive dwelling for concerts held between the hours of 09.00 - 23.00.

Table 1 - Proposed Daytime Guidelines

Concert days per year, per venue	Venue Category	Criteria
1 to 3	Urban venue	The MNL should not exceed 75dB(A) over a 15 minute period
1 to 3	Rural venue	The MNL should not exceed 65dB(A) over a 15 minute period
4 to 12	All venues	The MNL should not exceed the background noise level by more than 15dB(A) over a 15 minute period
More than 12	All venues	The MNL should not exceed the background noise level by more than 5dB(A) over a 15 minute period

The music noise level (MNL) is the L_{Aeq} noise level generated by the noise from the music during the concert or rehearsals.

If the L_{Aeq} is likely to be affected by other local sources, then the MNL should be assessed by measuring the typical 'A' weighted sound pressure with time weighting 'slow', when the music is audible in the absence of other noise sources. This should be assessed over a fifteen minute period of the concert or rehearsal.

The background noise level is the arithmetic average of the hourly L_{A90} levels measured over a comparable period when no concert or rehearsal is taking place.

The two venue categories relate to concerts either held in an urban or rural area. Typically an urban site refers to venues which usually hold sporting events sited in towns or cities. The rural venue describes a concert held in a green field site located some distance from a built-up area.

Proposed Night Guideline
For events continuing after 23.00 hours, the sound from the music should be inaudible inside any noise sensitive building, with the windows opened in a typical manner for ventilation, from 23.00 hours onwards to 09.00 hours.

Low frequency Sound Guidance
The 'A' frequency weighting can under-estimate the disturbance caused by pop concerts when high levels of low frequency sound are generated. Sound pressure levels should be below 80dB in the 31.5Hz or 63Hz octave frequency bands, measured outside any noise sensitive building, to reduce the risk of complaints of low frequency sound.

3. GUIDELINE DISCUSSION AND CASE STUDIES

The various criteria proposed in section 2 are discussed with case studies to justify the selection of each guideline.

1-3 Daytime Concerts
Our recent studies demonstrate that very few complaints are received from residents living in urban areas near to sporting venues which hold just several concerts per year, even though they are exposed to high sound levels. Table 2, shows the typical L_{Aeq} noise levels and noise complaints recorded at various urban sites. Although it appears that with few events, residents seem to tolerate virtually any level, a limit of 75dB(A) should at least achieve a maximum acceptable internal criteria [4] with windows closed. It would also raise other issues in terms of health and safety if sound levels were allowed to rise to the mid-eighties in community areas.

ENVIRONMENTAL NOISE GUIDELINES PROPOSED FOR THE NEW HEALTH AND SAFETY EXECUTIVE GUIDE FOR POP CONCERTS

Table 2 - Noise Levels and Complaints at venues holding occasional concerts

Location	No. of events	Typical L_{Aeq}	Total No. of Noise Complaints
Maine Road Manchester	4	74-84*	10
Lancashire Cricket Ground	2	75	1
Old Trafford Manchester	1	66	0
Venue in Scotland	3	71-89*	0

* Range given where typical levels varied due to the different concerts held at the venue

The type of venue and locations is also an important aspect in assessing a suitable guideline. Residents living in urban areas close to sporting venues are likely to get accustomed to the noise and activity generated by the regular events held in the venue (football, cricket, rugby etc) and therefore generally accept in-frequent concert noise. Villages near green-field sites however, are less likely to accept the same intrusion as highlighted by data from concerts held in Knebworth Park. The Deep Purple concert held in 1985 provoked widespread complaints of noise with L_{Aeq} levels of the order of 70dB(A) being reported[5] in local villages.

L_{Aeq} results from more recent (1986,1990,1992) Knebworth concerts which have been strictly controlled have varied from 52dB(A) to 63dB(A) with very few complaints of noise. A guideline figure of 65dB(A) would therefore seem a reasonable upper limit for concerts held on green-field sites.

4-12 Daytime Concerts

For some years, the criterion of allowing a 10dB(A) increase of the background L_{Aeq} has been reported[6] and adopted for concerts held on up to 12 occasions per year at a particular venue. This guideline has been reasonably successful at minimising the number of complaints, however, further investigation of the data this year has resulted in the recommendation of a revised guideline.

ENVIRONMENTAL NOISE GUIDELINES PROPOSED FOR THE NEW HEALTH AND SAFETY EXECUTIVE GUIDE FOR POP CONCERTS

Wembley Stadium has been the main outdoor UK venue which has held up to 12 concerts a year. The 10dB(A) criterion has been adopted as a yardstick by the local authority which has limited the numbers of complaints to acceptable levels. However, with a change of stage position for several shows this year, the residents to the North of the Stadium reported the levels were unacceptable although the 10dB(A) increase of L_{Aeq} was being met.

Further investigation of the area shows that there is a marked variation of the background L_{A90} and L_{Aeq} due to the intermittent trains operating from Wembley Park station which significantly affects the L_{Aeq} results. In this case, the L_{Aeq} index is insensitive to change from the introduction of other sources (such as pop concert noise) and will therefore underestimate the impact. This effect was also noticed during controlled sound tests carried out at another central London venue.

Table 3 - Criteria and Response Assessment

Venue	Background		Criteria and Response	
	L_{A90}	L_{Aeq}	Background L_{Aeq} +10	Background L_{A90} +15
Wembley Stadium	39	51	(61)-numerous complaints	(54)-no complaints
Indoor Venue	46	63	(73)-at levels of 66, music clearly audible, complaints likely	(61)-music audible, but far less intrusive, complaints unlikely

All results are in dB(A) ( ) maximum limit according to criteria

Table 3 shows examples of results, criteria and subjective responses when large variations between background L_{Aeq} and L_{A90} levels exist. From these data, the 15dB(A) increase of the L_{A90} is more appropriate at predicting the likelihood of complaints and also equates to the previously adopted guideline when there is less variation between the background L_{Aeq} and L_{A90} results, as is often the case at many sites.

As when measuring background L_{Aeq} results which are dominated by a number of single event noise sources, L_{Aeq} measurements made during the concert to determine the MNL must also be made with caution. In a manner similar to BS4142[7], the measurements should reflect the noise from the source of interest ie. the music. In many cases, the L_{Aeq} can be readily

ENVIRONMENTAL NOISE GUIDELINES PROPOSED FOR THE NEW HEALTH AND SAFETY EXECUTIVE GUIDE FOR POP CONCERTS

measured, but where affected by other sources, the procedure given in section 2, in terms of measuring the typical sound pressure level, should be adopted. Table 4 gives examples of controlled sound tests carried out at various venues which demonstrates the potential problems.

Table 4 - Examples of measuring Music Noise Levels (MNL) and L_{Aeq} Levels

Site Location	Measurements during controlled tests*		Background L_{A90}	Observations
	15 minute L_{Aeq}	Typical SPL/dB(A)		
Earls Court	58.2	58	50	Rear garden, L_{Aeq} unaffected = MNL
Olympia	66.0	60	46	L_{Aeq} affected by several vehicles
Rex Centre	55.9	52	43	L_{Aeq} affected by several vehicles

* A shaped spectrum representing frequency characteristics of music was played through a sound system

More than 12 Daytime events per year

The regular event scenario, in most cases, applies to indoor events, although local conditions may apply where an outdoor event could exceed twelve events. Clearly for regular concerts held in a venue throughout the year, the guidelines need to be far more stringent than those for occasional events. Measurements made near several London indoor venues have indicated that few complaints are likely to arise if the MNL is kept within 5dB(A) of the background L_{A90}. Increases of up to 9dB(A) above the background noise level have led to a rise in complaints at one venue holding regular concerts. The former guideline is therefore recommended.

Low Frequency Noise

During some of our studies this year, an increase in the number of complaints has arisen directly due to residents being disturbed by low frequency sound. The Michael Jackson shows which generated high levels of low frequency energy during some songs caused a number of complaints due to these frequencies.

Octave band frequency measurements were made outside the venue during the Michael Jackson concerts. The results showed that on a number of occasions, levels of the order of 80dB were recorded in either the 31.5 or 63Hz octave bands. These results are similar to those presented [6] in 1985 when it was shown that complaints of low frequency sound were reported at levels in excess of 80dB at low frequencies. Until further data are available, guidance based on achieving sound pressure level below 80dB in the 31.5Hz and 63Hz octave frequency bands has been suggested in order to minimise complaints of low frequency sound. However, where the music contribution at a site clearly dominates the noise climate with high increases of the 'A' weighting sound level over the background level (such as the 1-3 concert category), this low frequency guideline is likely to be less important.

Night Criteria

With the demand for regular all night pay parties, "Raves", throughout the country, there is a need for noise guidelines to preserve sleep disturbance in areas subjected to 'live' entertainment operating after 23.00 hours. Until objective guidance is presented and justified, the subjective criterion of inaudibility inside any noise sensitive dwelling would provide adequate protection for residents, albeit a stringent target to achieve. It may be appropriate however, to use a suitable objective guideline if local data are available for a particular situation to support it. In some cases, for example, consideration has been given to the adoption of a less stringent guideline for just several properties, which by their proximity to the venue, would have prevented the holding of a successful event for many thousand patrons.

From experience, it has been noted that if the sound from the event is only just audible outside the noise sensitive building, then it is likely that the inaudibility guideline is being met inside. Events such a Raves need to be assessed for other sources in addition to the main sound system as the event often attracts fairground rides generating additional noise outside the venue.

4. CONCLUSIONS

This paper forms the basis for the environmental noise guidelines to be considered for the Noise Council's draft Code of Practice which is to be published as an annex in the HSE Guide to Health, Safety and Welfare at Pop Concerts. In additional to these guidelines, the Noise Council's draft Code will include procedures for controlling the sound during the event.

ENVIRONMENTAL NOISE GUIDELINES PROPOSED FOR THE NEW HEALTH AND SAFETY EXECUTIVE GUIDE FOR POP CONCERTS

5. REFERENCES

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