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PRACTICAL ASPECTS OF THE ASSESSMENT AND AVOIDANCE OF NUISANCE CAUSED BY NOISE IN THE NEIGHBOURHOOD OF INDUSTRIAL PREMISES

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1. INTRODUCTION

Experience within Lucas Industries has shown that noise nuisance can be minimised. This requires careful action to prevent noise levels increasing, in particular a noise specification should be used when buying new external plant, and complaints should be investigated promptly.

A study of fifty investigations of noise outside industrial premises has been carried out by Lucas Industries Noise Centre (LINC). This has provided practical guidance on acceptable sound levels and highlighted the most significant factors likely to cause nuisance which is manifested as complaints.

It is important to take actions to avoid noise nuisance and investigate complaints promptly. Actions to reduce the incidence of nuisance are presented and some effective noise control measures are described. A noise specification is essential for the purchase of new external plant and equipment. A method of calculating this specification is outlined.

2. STUDY OF SOUND LEVELS LIKELY TO CAUSE COMPLAINTS

In 1984 LINC undertook an analysis of sound levels measured in the vicinity of Lucas premises in an attempt to determine the levels which give rise to complaints. The company's criteria for noise outside factory premises are specified in a Lucas Standard. This study was intended to check the criteria used in this standard. It involved the results of fifty investigations undertaken over a 12 year period [1]. The conclusions of that analysis were;-

- There is little benefit from employing Noise Rating instead of 'A'-weighted sound level as a measurement quantity for the comparison of industrial noise with relevant annoyance criteria.
- Of the forty four complaints of excessive noise from Lucas premises exactly half concerned noise with a strong tonal or impulsive component.
- If 5 dB is added to 'A'-weighted measurements where strong tones and impulses are audible then the separation of sound levels which were alleged to cause nuisance, from those which were not alleged to cause nuisance, becomes more distinct.

- The threshold sound levels which separate complaints from non-complaints are lower than the 'A'-weighted sound levels given in the *(then)* existing Lucas Standard [2], by approximately 5 dB in the evening and at night and by approximately 10 dB for levels during working hours. *(This Lucas Standard has since been revised [3]).*

- Nuisance is alleged at sound levels lower than those calculated in accordance with BS 4142 (Ref 4) based on the 'notational background' of 50 dB(A).

- Nuisance is also alleged when sound levels exceed the lowest of the recommendations reported to the Wilson Committee prior to 1963 [5].

- The sound levels above which nuisance was alleged fall within the band of values which can be calculated from the data in ISO R1996, (this band is 10 dB during the working hours and in the evening, and 15 dB at night [6]) but they do not fall consistently near the top or bottom of these bands.

Criteria and measurements are based upon sound levels at "noise sensitive premises". This term is used to mean those buildings, such as residences, schools, hospitals, or land, occupied or used by persons to whom noise might cause a nuisance.

General experience in assessing, predicting and reducing the likelihood of complaints from neighbours has been gained by LINC over several years. This experience, together with the analysis reported above, shows that the most significant factors to be considered when noise is being assessed are;-

the level of sound from the factory measured in the vicinity of the noise sensitive premises,

the characteristics of this noise (specifically tonality, impulsiveness and intermittency),

recent significant increases in noise level,

the time of day,

and the nature and level of any background noise.

3. GUIDANCE ON ACCEPTABLE SOUND LEVELS

There are no universally recognised noise limits to prevent the occurrence of nuisance. However, the results of the analyses described above were used, together with British Standard 4142, ISO 1996 and other published data to generate criteria. These criteria (or target levels) consisted of sound levels which should not be exceeded at noise sensitive premises in the vicinity of factories (see Table 1).

ASSESSMENT AND AVOIDANCE OF NUISANCE

If sound is intermittent or pure tones or impulses are clearly audible, the sound levels must be reduced by 5 dB. Where there is a history of complaints then local residents become sensitised to noise and lower sound levels are necessary.

Classification of Area in which the Industrial Premises are Situated	Time of Day Night 23.00 to 7.00h	Evening 18.00 to 23.00h	Day 7.00 to 18.00h
	dB(A)	dB(A)	dB(A)
a) Where all surrounding premises are industrial	50	55	60
b) On the fringe of an industrial area or where traffic noise on nearby roads occurs at all times	45	50	55
c) Urban and suburban residential areas	40	45	50
d) Quiet suburban or rural residential areas with little or no road traffic noise	35	40	45

Table 1. Maximum Acceptable Broad band Sound Levels at Noise Sensitive Premises.

These criteria can be applied in the following circumstances;-

to assess whether complaints are justified,

to compare with results of a routine external noise survey and assess the likelihood of causing a nuisance,

and as a basis for the calculation of the noise specification of new external plant and equipment when no measurements have been undertaken to establish the acceptable sound level at noise sensitive premises.

4. ACTIONS TO REDUCE THE INCIDENCE OF NUISANCE

The incidence of nuisance can be minimised by adopting the following three guidelines.

- avoid allowing noise levels to increase
- avoid irritating characteristics
- avoid obviously unnecessary noise

Both the level and significance of the annoying characteristics of noise can increase noticeably if care is not taken in the specification of new external plant and if existing plant is not adequately maintained. A method of calculating this noise specification is outlined later in this paper.

Noise which is obviously unnecessary, particularly at night, such as the filling or removal of waste skips and the leaving open of vehicle access doors is likely to cause a nuisance and should be avoided.

Investigation of Complaints

A complaint of excessive noise should be investigated promptly. In the first instance it should be discussed with the complainant and its nature and the times and durations of its occurrence should be established.

If it is established that the noise does not emanate from Company premises, then the complainant should be suitably informed and the sound levels giving rise to the complaint should be recorded.

If it has been established that the complaint is caused by the Company's operations then its source should be identified and any simple corrective action should be taken. It may be necessary to undertake a more searching investigation to identify the noise source and determine the best practical means of noise control.

Experience has shown that noise sources can often be identified by simply turning off suspect items of plant and assessing the resultant change in noise level at the noise sensitive premises.

Simple Treatment

In many cases there are simple inexpensive means of reducing noise levels. For example intermittent and sometimes tonal noise is produced by cooling fans or similar equipment, which is controlled using a temperature sensor. During the night when the external temperature and perhaps the level of factory activity are relatively low, then the capacity of the cooling equipment may be far in excess of that required and be capable of producing rapid temperature reductions. This combination may lead to the cooling equipment repeatedly operating at full capacity for relatively short periods. The rapid change in noise level as the equipment starts up is particularly disturbing. This problem is readily solved by operating the cooling equipment at reduced capacity (ie reduced fan speed) at night.

5. PROCEDURE FOR THE SPECIFICATION OF SOUND LEVELS OF NEW EXTERNAL PLANT

The specifying and acceptance procedures described below are intended to avoid nuisance by preventing noticeable increases in either the level or annoying characteristics of noise emanating from industrial premises.

Acceptable Sound Levels

The first step in this specification is the determination of the Acceptable Sound Level outside the neighbouring noise sensitive premises. These should normally be defined for day, evening and night periods.

The Acceptable Sound Level is usually estimated from the results of routine noise surveys or sound levels measured following the resolution of previous complaints. Where the site has no history of complaints or routine measurements, it is based upon the values given in Table 1.

Acceptable addition to the sound level at the noise sensitive premises

The increase in sound level at the noise sensitive premises, over the Acceptable Sound Level, should be limited to 1 dB by ensuring that the contribution of the new external plant is at least 6 dB below the Acceptable Sound Level.

If nuisance has previously been alleged or if the site is in a Noise Abatement Zone, then this increase should be limited to 0.5 dB by ensuring that the contribution of the new external plant is at least 10 dB below the Acceptable Sound Level.

If the plant produces noise which is tonal, impulsive or intermittent then the permissible contribution of the new external plant is reduced by a further 5 dB.

Formulation of the Specification

Lucas specifies sound level limits at positions 10 metres from the principal noise source of the plant. These levels are calculated from the maximum permissible contribution at the noise sensitive premises assuming the radiation to be either hemi-spherical or quarter-spherical (this is determined by the acoustic conditions at the proposed location of the plant).

Acceptance Conditions

The plant is acceptable if, under appropriate test conditions, the highest sound level does not exceed the limit specified for each time of day. If the plant is to operate at night, then the night-time limit must not be exceeded when the plant is operated in the noisiest mode of operation that could be used at night.

If the sound emitted by the plant is directional, then the plant may be acceptable if it can be orientated such that the sound levels at all the noise sensitive premises will be satisfactory.

6. CONCLUSIONS

Noise nuisance is not a necessary consequence of industrial activity. With a little care and attention to detail it can be avoided or at least its incidence can be minimised. Prompt and above all effective action upon the receipt of a complaint will usually lead to its resolution.

The incidence of alleged nuisance due to noise in the vicinity of Lucas premises has been reduced from forty four complaints in the twelve years prior to 1984 (an average of 3.6 per year) to seven complaints in the past five years (an average of 1.4 per year). This improvement is due, in part, to continual care and vigilance in the design and specification of new facilities.

7. ACKNOWLEDGEMENTS

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8. REFERENCES

[1] M F RUSSELL, "Noise Emanating from Company Premises", Internal Report, February 1984.

[2] LUCAS STANDARD 599-50-12, Issue 1, "Noise in the Neighbourhood of Company Premises", September 1979.

[3] LUCAS STANDARD 599-50-12, Issue 2, "Noise in the Neighbourhood of Company Premises", April 1985.

[4] BRITISH STANDARDS INSTITUTION "Method of rating industrial noise affecting mixed residential and industrial areas", BS 4142.

[5] WILSON COMMITTEE "Noise", 1963, Cmmd 2056 HMSO. Final report of the Committee on the problem of noise.

[6] INTERNATIONAL STANDARDS ORGANISATION "Acoustics - Assessment of noise with respect to community response", ISO R1996.