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COMMUNITY REACTION TO INDUSTRIAL NOISE

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SUMMARY

It is generally accepted that industrial plant should not be allowed to cause an unacceptable noise level in the neighbourhood, but it appears to be impossible to obtain general agreement on what is "acceptable". The community is made up of people, and people are unstandardised, highly variable and largely unpredictable in their reactions.

The standards organisations have recognised the need to provide some guidance as to the probable response of communities to noise. There are now two important documents available, the British Standard (BS 4142) and the Draft ISO Recommendation (No. 1996) but the predictions made by these two documents for any particular situation tend to differ widely. Experience in the oil industry, both in Britain and on the Continent, suggests that the British Standard gives the more reliable guide, and that it provides a useful method of predicting community response to noise. There is, however, a need for a great deal more evidence relating to community response to different neighbourhood noise regimes.

1. AERODYNAMIC NOISE

The topic of this conference is aerodynamic noise. Such noise affecting the neighbourhood is generated in equipment such as furnaces, fans, compressors, turbines, motors, control valves and vents. Generally speaking this is fairly steady noise and free from impact characteristics. This paper deals with response to noise of this type. Other considerations may apply in the case of impulsive or transient noises caused by mechanical handling equipment, metal fabrication, demolition, road traffic and aircraft.

2. THE LEGAL POSITION

The legal position in Britain with regard to noise has been dealt with fully by Cronin (1) and more briefly by the author (2). The European situation has been covered in detail by CONCAWE (3) and more briefly by the author (4). It is worth mentioning the main points here, to assist in defining the problems we have in dealing with community noise.

Planning provision for new works occasionally includes a provision regarding noise, but it is still rare for a numerical limit to be specified and such provisions are open to appeal in any case.

In Britain there is no specific statutory limit to noise. The Noise Abatement Act (1960) in essence requires that "best practicable means" be used to limit noise nuisance. Under Common Law, however, the citizen has a right to protection against nuisance; the fact that it is impracticable (for economic or technical reasons) to reduce the noise is no defence in a common law action and it lies solely with the Civil Court to decide whether the noise constitutes a nuisance. Thus it is important that a works should avoid causing sufficient resentment to stimulate a neighbour to take civil action. In addition any responsible organisation strives to avoid subjecting the public to undue annoyance or discomfort for public relations and ethical reasons.

This means that in most cases, the works must decide for itself what noise level will be accepted and, since the individual members of a community will vary in their response, what degree of acceptance should be achieved (6). Noise control can be costly and difficult, (2) (5) and generally it is more costly and difficult to reduce noise after plant is built than to incorporate noise control in the design. Thus a reliable basis for setting noise limits is required.

3. METHODS OF ASSESSMENT OF COMMUNITY NOISE

3.1 Standard methods available. The two most authoritative methods of predicting probable community reaction to noise are the British Standard 4142 (7) and the Draft ISO Recommendation No. 1996 (8). Both use dBA noise levels for assessment and the method is essentially the same in the two documents.

- (1) The noise level is measured with the works operating and corrections are made for noise character. This gives the corrected noise level.
- (2) The noise level is measured with the works not operating. This is the background noise level.
- (3) A comparison noise level is derived by using a basic criterion figure and making corrections for type of district, time of day etc. This is the corrected criterion level.

The corrected noise level is then compared with the corrected criterion level and with the background noise level (if this can be measured) and the community response is predicted from the difference in levels.

3.2 Measured noise level is not constant. One very important characteristic of neighbourhood noise which is often overlooked, and which is not catered for adequately in the standard methods of assessment, is the fact that it is variable. Background noise (i.e. neighbourhood noise in the absence of industrial noise) varies from hour to hour and from day to day at any particular location. The noise level resulting from industrial plant will also vary, even if the noise generated on the plant is constant (2). The reason for this is that the attenuation of noise in open air varies with meteorological conditions, and over distances greater than a few hundred feet these variations can be quite large. An inter-quartile range of ± 5 dB(A) about the median is common with both background noise and with works noise at distances of more than about two thousand feet. The extreme readings may well be about 10 dB(A) above the median.

3.3 What noise level should be taken? The standard procedures do not state precisely how the day to day variation in noise level should be dealt with, though they recommend that a "typical" value should be used. Where many readings are available, it would seem appropriate to use the median value.

Another question is whether it is more realistic to use actual background noise on the corrected criterion as a comparison. For intermittent noise, actual background seems appropriate, because it is available to the ear for comparison. This may be true also for continuous noise which affects only a very small area. For noise which is continuous, and affects a large area however, the background noise level seems less relevant. Indeed, with process plant operating round the clock and throughout the year, background noise ceases to exist in the immediate neighbourhood. For this type of situation, it is both necessary and logical to use a corrected criterion as the sole basis for comparison.

A common criticism of BS 4142 is that the corrected criterion is too high. It is true that the median background noise level in a locality is likely to be lower than the corrected criterion but the BS sets the complaint threshold at 10 dB(A) below the corrected criterion.

4. COMPARISON OF PREDICTIONS OF COMMUNITY RESPONSE

4.1 Comparison of BS and ISO Predictions. Direct comparison of the BS and ISO is difficult, because the terminology differs. The broad comparison is as follows:-

- The BS predicts no complaints if the corrected noise level is 10 dBA below the corrected criterion, and likely complaints if it is 10 dBA above (a range of 20 dBA).
- The ISO draft predicts no complaints if the corrected noise level is below the corrected criterion, and vigorous community action if it is 20 dBA above.
- The BS gives a precise corrected criterion, but the ISO draft gives a range of up to 15 dBA.

The following tables compare the two standards when applied to a continuous process works, established for a few years but not typical of the neighbourhood, producing a noise level of 50 dBA free from any noticeable characteristic, at night. (With continuous operation, night-time is the critical period).

Comparison of Criteria and Predicted Complaint Thresholds

Type of Neighbourhood	BS 4142		ISO 1996
	Corrected Criterion dB(A)	Complaint Threshold dB(A)	Corrected Criterion equals Complaint Threshold dB(A)
Rural	45	35	35-20
Suburban	50	40	40-25
Urban - residential	55	45	45-30
Urban - mixed	60	50	50-35

Comparison of Predicted Response to 50 dB(A) Noise Level

Type of Neighbourhood	Predicted Response	
	BS 4142(a)	ISO 1996(b)
Rural	Complaints likely	Threats of action - vigorous action.
Suburban	Intermediate	Widespread complaints - vigorous action.
Urban - residential	Complaints unlikely	Sporadic complaints - vigorous action.
Urban - mixed	No complaints	No complaints - threats of action.

- (a) This wording not used in the BS but can be inferred.
- (b) Wording used in the ISO document; the two predictions relate to the two extremes in corrected criteria.

4.2 Oil Industry experience. Information so far collected in the oil industry indicates that BS 4142 gives a generally reliable prediction of community response to noise from refineries and other installations, (9)(10) and it should be equally applicable to other large continuous process plant. If the median corrected noise level does not exceed the corrected criterion, serious complaints are unlikely; if it is 10 dB(A) below, complaints are very unlikely.

Interpretation of available data is difficult because of day to day (or night to night) variations in noise level and the problem of deciding how much industry or housing is required to change a 'rural residential area' into a 'suburban' or 'industrial' area and what constitutes 'widespread complaint'. In addition, refineries and other petroleum installations have seldom given rise to more than isolated complaints, so response data is sparse.

If ISO Draft Recommendation 1996 is used, then the highest corrected criterion should be taken; if the lowest is taken this method grossly overestimates response.

References

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