



THE SCOTTISH OFFICE

Development Department

Planning Advice Note

PAN 50 ANNEX A

CONTROLLING THE ENVIRONMENTAL EFFECTS OF SURFACE MINERAL WORKINGS

Annex A: The Control of Noise at Surface Mineral Workings

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planning series:

- **National Planning Policy Guidelines (NPPGs)** provide statements of Government policy on nationally important land use and other planning matters, supported where appropriate by a locational framework.
- **Circulars**, which also provide statements of Government policy, contain guidance on policy implementation through legislative or procedural change.
- **Planning Advice Notes (PANs)** provide advice on good practice and other relevant information.

Statements of Government policy contained in NPPGs and Circulars may, so far as relevant, be material considerations to be taken into account in development plan preparation and development control.

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introduction

Background

1. The aim of this Annex to PAN 50 *Controlling the Environmental Effects of Surface Mineral Workings* is to provide advice on how the planning system can be used to keep noise emissions from surface mineral workings within environmentally acceptable limits without imposing unreasonable burdens on minerals operators. See also the results of Government commissioned research by W S Atkins Engineering Science Ltd *The Control of Noise at Surface Mineral Workings* published by HMSO 1990 Price £11.95 [ISBN 0-11-752338-0]
2. Existing advice on noise generally is given currently in SDD Circular 23/1973. It is intended that this will be replaced in due course with updated planning guidance. Additional advice on how to deal with Interim Development Order (IDO) sites is given in SOEnD Circular 2/1992 which covers the commencement of the relevant provisions in the Planning and Compensation Act 1991.
3. The Government recognises that noise from mineral working can have a significant impact on the environment and the quality of life of communities and is concerned to ensure that noise levels are kept to the minimum practicable level consistent with good environmental practice and the efficient and economic working of sites.
4. It is open to local authorities (and individuals through the Court of Session) to use the provisions of Control of Pollution Act 1974 to control noise when it amounts to a nuisance¹. However it is clearly preferable to plan mineral operations which are environmentally acceptable from the outset rather than to rely on retrospective action in the courts. Discussions between planning authorities, Environmental Health Authorities (EHAs) and local communities likely to be affected (see PAN 47 Community Councils and Planning), will be important when planning authorities are assessing planning applications. Such liaison is encouraged.
5. The reasonable use of planning controls by planning authorities, in particular the use of conditions attached to planning permissions, is an important tool for the control of noise at mineral sites. However, the Government also looks to the minerals industry to be a "good neighbour", and to keep noise emissions down to levels which are acceptable to the local community through good environmental practice.
6. The Government wishes to encourage co-operation between operators and planning authorities so that sensible regimes can be agreed for individual sites based on an established methodology. The controls outlined in this Annex should be used where they are necessary and relevant to the individual circumstances under consideration. Controls should be fair and reasonable, and should avoid measures which may impose costs or constraints on the operator where there is no real public benefit.

¹ The Control of Pollution Act 1974 obliges local authorities to inspect their areas from time to time to detect any statutory nuisances which ought to be dealt with and to take reasonable steps to investigate complaints of statutory nuisance which are made to them. Local authorities (and private individuals) can take action, through the courts if necessary, to secure the abatement of a statutory noise nuisance. In the case of local authority action this is done by a nuisance abatement notice which can be served either after a nuisance has occurred or in anticipation of a nuisance occurring or of it recurring. Non-compliance with such a notice can attract a maximum fine of £20,000 if the nuisance arises on industrial premises. However, in such a case, the defendant has a valid defence if he can prove that the best practicable means were used to prevent, or to counteract the effects of, the nuisance (see paragraphs 75-76 below).

Aims of the Annex

7. This Annex:
 - i. recommends the use of a model for the prediction of the likely level of noise emissions from a proposed mineral development;
 - ii. recommends a method for setting noise limits for mineral sites which can be incorporated into planning conditions. The method should take account of the environmental and operational features peculiar to each mineral site and should also be straightforward to monitor;
 - iii. provides advice on how the noise levels from surface mineral sites can be most effectively monitored and on remedial steps which should be taken, to ensure that local communities are not subjected to noise emissions above acceptable levels;
 - iv. discusses a number of noise control practices which can be made the subject of planning conditions and/or incorporated into good practice by the mineral operator.

8. This Annex does not seek to provide detailed advice on the control of noise from blasting. The Government commissioned research "*The Environmental Effects of Production Blasting from Surface Mineral Workings*" by Vibrock Ltd. will be published shortly. This will assist in the formulation of appropriate guidance in a future Annex. In the meantime planning authorities and the industry should have regard to the advice in paragraphs 33 to 38 of PAN 50.

determination of existing and predicted noise

9. In preparing applications for the winning and working of minerals, developers should bring forward proposals for the control of noise. To do this they will need to carry out two steps in order to establish the existing noise climate of the locality and the likely future noise climate associated with the proposed development. These are:
 - i. a survey of background noise to determine the existing noise level ($L_{A,90T}$)² in the area, including that at nearby properties affected by the noise;
 - ii. an estimation of the predicted likely future noise which would arise from the development and its effects at nearby properties.

Survey of Background Noise

10. A survey of the background noise level in the area of the potential development is necessary to determine the nature of the existing noise climate of the locality. Such a survey should record the presence of neighbouring "noise-sensitive properties", and the background noise at these properties. Noise-sensitive properties would normally be dwellings, but schools, hospitals, offices, some factories, livestock farms and places of recreation, among others, may also be justifiably regarded as noise sensitive. However, it would be inappropriate to treat all these as equally noise-sensitive. Planning authorities should take this into account when setting noise limits.

Estimating Likely Future Noise

11. The likely future noise emissions arising from the new development should be predicted and the total amount of noise which would be emitted from the site

² Technical terms are defined in the Glossary of Technical Terms

determined. The amount of noise from the site that would be received at the noise-sensitive locations identified in the survey should then be predicted.

12. Where the application is for an extension to an existing quarry, actual recorded results, where available, may be used; however, for some extensions operators will need to make predictions.

13. While many disagreements between mineral operators, planning authorities and community groups can be overcome if there is a standard approach to predicting the likely level of noise from a proposed development, the circumstances of individual cases must be taken into account. The complexity of any noise prediction model will therefore vary considerably, depending on a range of physical factors such as the size of the site and topography of the locality. This Annex recommends that British Standard 5228, Part 1 (1984) "Noise Control on Construction and Open sites" should form the basis for the noise prediction model, modified to take account of particular circumstances of mineral sites.

Use of British Standard 5228

14. BS 5228 provides basic information and a code of practice for procedures for the control of noise on construction and open sites. It has been applied to the prediction of noise emissions from mineral sites, and gives advice on how monitoring should be carried out. While BS 5228 continues to form the basis for the noise prediction model recommended to operators in this Annex, refinements to take account of the particular circumstances of mineral sites may be necessary. Noise attenuates as it travels over soft ground, and screening also plays a vital role in reducing noise at mineral sites. These factors, and others, described at paragraphs 16-23, should be taken into account in the prediction of noise.

15. Annex A of Part 1 of BS 5228 provides a number of mathematical charts and formulae to allow the user to calculate the noise level arising at any distance from the site. It is necessary to know what plant will be employed, the noise which it will generate, the amount of time it will be in use, the distance of the reception point from the plant, and whether there will be any screening. Mineral operators should provide this information when discussing planning proposals with planning authorities so that the noise implications of the proposed activity can be understood. Operators should also provide data on the actual emissions from the plant which they propose to use if these are available. If data are not available, data on noise emissions from various plant and operations can be obtained from Annex C of Part 1 of BS 5228. The overall predicted level of noise from the site can then be estimated by combining the noise from each item of plant to arrive at the equivalent continuous noise level, the $L_{Aeq,T}$. The methodology used should be set out so that the basis for the prediction is clear.

Barrier and Soft Ground Attenuation

16. BS 5228 recognises that noise can be reduced by barriers. It proposes a simple but straightforward and effective approach to calculating the effect of barriers on noise emissions: if a noise source is partly visible from the measurement point, it is assumed that the noise level at this point should be reduced by 5 dB; if the noise source is completely screened, the noise level should be reduced by 10 dB. However operators and planning authorities may choose more detailed methods for the calculation of the estimated noise attenuation of barriers. If a detailed method is used, its basis should be clearly set out.

17. In addition, it should be recognised that for deep workings, quarry faces may provide a barrier (see paragraph 57). In such cases, it may be appropriate to assume a further reduction due to the face, *as well as* reduction for any barrier present above the face. There are models available to determine the appropriate reduction.

18. BS 5228 makes no allowance for noise being reduced as it passes over soft ground both within and outside the site. Soft ground attenuation can sometimes have a greater impact in reducing noise than barrier attenuation, especially if the ground supports vegetation. This may be an important factor, as mineral workings tend to be in rural or semi-rural areas and the extra attenuation over soft ground can have a significant effect on the resulting noise level. Changes in vegetation, both due to the operation itself, and those of a seasonal nature, may also need to be taken into account.

19. A correction for the effects of soft ground attenuation such as that developed for the CONCAWE Report 4/81 "The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities" may be used for the calculation of soft ground attenuation for surface mineral workings. Other methods of assessing ground attenuation may also be considered. For example, for short distances, it may be appropriate to use a correction for ground absorption such as that given in "Calculation of Road Traffic Noise", Department of Transport, 1988. Whatever method is used, it should be clearly set out.

20. The effects of barrier attenuation and soft ground attenuation should not be added together for predictive modelling purposes. It is generally accepted that barriers intercept much of the noise which would otherwise be reduced by soft ground, so that combining the corrections for barrier and soft ground attenuation would introduce an element of double counting. In practice it is sufficient to use the higher of the two corrections for modelling purposes.

Noise Reflection

21. An allowance may need to be made to the noise prediction calculation for sound reflection due to significant topographical variations and reflections from working faces, as well as the reflection effects of large bodies of water. Currently, however, there is no established method for dealing with such reflections, and planning authorities and operators will need to exercise caution in taking these into account. While it is not possible to offer guidance on a specific technique for dealing with such reflections, there should be evidence that some consideration has been given to their possible occurrence. Specialist advice may be needed in cases where these effects are considered to be important.

Mobile Plant

22. BS 5228 offers the scope to treat mobile plant either as operating over a limited area or as plant which covers large distances such as in haul road type of situation. Either method may be appropriate depending on the particular circumstances. If the haul road method is used, it should incorporate a correction to take account of the angle of view where this is less than 180 degrees. The angle of view correction (A) should take the form:

$$A = 10 \times \log (\text{angle of view}/180)$$

(Note: this correction will nearly always be negative since most facades cannot be exposed to an angle greater than 180 degrees, and should be added to the calculated noise from the haul road to yield a lower overall figure.)

Meteorological Factors

23. BS 5228 does not take account of meteorological conditions, such as wind direction and temperature inversions. But these factors may have a significant bearing on the impact which a noise source can have on a noise-sensitive property. On the whole, such factors are too unpredictable for general advice to be given on how they should be included in predictive models, but planning authorities and operators will wish to discuss this on an individual site basis. They will need to take into account the

possible implications of prevailing wind direction when considering the likely environmental impact of a mineral working proposal. The effect of prevailing wind might be to make a noise source louder or quieter to people living respectively downwind or upwind of it than BS 5228 would predict. Meteorological records of wind speed and direction can provide a useful reference from which both planning authorities and operators may recommend that a fixed allowance of 2 **dB(A)** should be incorporated in predictive modelling, having first considered site-specific conditions, e.g. elevation, general topography, and natural or artificial wind shielding.

noise limits

Noise Limit Conditions

24. As stated above, it is necessary for operators submitting applications for mineral working to have regard to the likely predicted noise impacts of the proposed development. They should be able to demonstrate what the background noise level is and what the noise emissions from the proposed development would be. Where necessary, the planning authority will have regard to the environmental acceptability of a proposal by the setting of maximum noise limits in a condition attached to the planning permission. However, there has been, to date, no widely agreed approach to where these limits should be set in relation to the development or what they should be. **This Annex recommends a procedure for the setting of limits, but recognises that each case should be treated on its merits, having regard to the particular circumstances of the potential site and its surrounding area.**

25. Planning authorities and operators should bear in mind the cumulative effect of noise sources at a noise-sensitive property. Where more than one quarry is, or would be, in operation, the increase in noise received at the property due to the cumulative effect of one operation over the other is an important consideration. The cumulative effect should also include the impacts of all other noise not related to mineral working.

Locations for Setting Noise Limits

Noise-sensitive Properties

26. The most common approach by planning authorities has been to set noise limits at those places where people live and work. Compared with the other approach of setting limits at the site boundary (paragraph 27), this has the major advantage of taking direct account of the possible disturbance caused to the local community. It also has the advantage of providing for a greater degree of accuracy in the noise prediction model in cases where mobile plant are employed. However, there may be some problems in monitoring and enforcement of limits at properties because of difficulties of access. In such cases, the monitoring equipment could be placed at the nearest accessible spot to the noise-affected property. Noise measurements at or near noise-sensitive properties might be affected by extraneous noise; however, supervised monitoring, as recommended in this Annex (paragraph 48), would usually overcome this.

Site Boundaries

27. The practice of setting noise limits at specified points on site boundaries may have the advantage of being easy for operators to monitor. However, it does not normally take into account the proximity of noise-sensitive properties to the site boundary and so does not directly tackle the problem of ensuring that noise levels are kept to a reasonable level at those places where local people actually live and work.

Recommended Method for Choosing Locations for the Setting of Noise Limits

28. The setting of noise limits at noise-sensitive properties and at site boundaries can both be valid practices. But in order to relate the noise limits most closely to the impact on the local people, the setting of limits at or near noise-sensitive properties is generally preferable. However, the circumstances of each site and its neighbouring locality should be taken into account, and in some circumstances it would be more appropriate to set the limits at the site boundary. Further, there may be situations where it is inappropriate to set the limits at either the nearest noise-sensitive property or the site boundary, and some other point should then be chosen. In other exceptional cases, it may be appropriate to set limits at a mix of locations for different areas of the same site.

Setting Values for Noise Limits

29. Previously, in the absence of any guidance about specific noise limits at mineral sites, two methods of setting limits have been used. In some cases, absolute limits have been placed on the maximum amount of noise from the site that should be measured at particular locations, e.g. site boundary, noise-sensitive property, and these limits incorporated into planning conditions. Alternatively, BS 4142 "Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas" (1967, revised 1990) has been used. BS 4142 rates the likelihood of complaints in terms of how far the intruding noise is above the background noise level. It concludes that complaints will be likely if the new development will lead to noise levels, of 10 decibels $L_{Aeq,T}$ ³ above the background noise level ($L_{A90,T}$), while a difference of 5 dB is of marginal significance (see paragraph 37). Where planning authorities have used the BS 4142 approach, they have generally drawn up planning conditions requiring operators not to exceed the background level at nearby properties by specified amounts. The BS 4142 method has the advantage of relating the noise limit directly to existing background noise levels, but relies on accurate assessments of background noise.

Recommended Method for Setting Noise Limit Values

30. This Annex recommends a set of absolute values for limits on site-attributable noise, linked to daytime and night-time working periods which are considered to be related to the tolerance levels of most people.⁴ It must be stressed that it is not intended that the recommended noise limits should become the norm at which operations work: operators are asked to take any reasonable steps they can to seek to achieve quieter working wherever this is desirable and technically feasible, having regard to the principle of **BATNEEC**. However, there should be sufficient flexibility in the guidance on what these limits should be, so that account can be taken of particular circumstances.⁵

³ L_{Aeq} is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies, and averages fluctuating noise levels in a manner which correlates well with human perceptions of loudness. See Glossary of Technical Terms for a fuller explanation.

⁴ The World Health Organisation's publication "Environmental Health Criteria 12: Noise" states that general daytime outdoor noise levels of less than 55 dB L_{Aeq} are desirable to prevent any significant community annoyance.

⁵ Noise limits are not suitable for considering whether farm livestock will be caused distress or suffering as a result of noise. Different species react to different degrees, and, for example, many large animals will acclimatise quickly to noise, while noise near poultry enterprises, particularly large colony systems, may be so devastating that the enterprise would have to close on welfare grounds. However, variations also exist within species. International standards dealing with the welfare of farm animals recommend that animals shall not be exposed unnecessarily to constant or sudden loud noise and account should be taken of this recommendation. If advice is thought necessary, developers should seek expert veterinary

31. The noise limits should be set in terms of $L_{Aeq,T}$ over a 1-hour measuring period. The averaging period, in this case one hour, must always be stated.

32. Definitions of daytime and night-time may depend on local circumstances. Daytime should normally be defined as 0700-1900 hours, and night-time as 1900-0700 hours. In some areas 0800 hours may be more appropriate than 0700 hours. The working week should generally be regarded as Monday to Friday, and Saturday morning, while Saturday afternoons, Sundays and Public/Bank Holidays would normally be regarded as periods of rest. Variations on these may be appropriate in some circumstances if agreements can be reached.

33. During the working week, except in the circumstances outlined below (paragraphs 36-41), the daytime nominal limit at noise-sensitive properties used as dwellings should normally be 55 dB $L_{Aeq,1h}$ (free field) where 1 h means any of the one hour periods during the defined working day. This is roughly equivalent to the noise made by a person talking normally and is generally agreed to be a tolerable noise level; above this level, continuous noise could well cause annoyance. The night-time nominal limit should be 42 dB $L_{Aeq,1h}$ (free field) at noise-sensitive dwellings. "Free field" means at least 3.5m away from a facade.^{6,7}

34. In some local circumstances, it may be appropriate for an evening period, typically 1900-2200 hours, and/or a dawn period, typically 0600-0700 (or 0800) hours, to be defined. If evening and/or dawn periods are to be defined, depending on local circumstances, limits modified from those indicated at paragraph 33 should be set.

35. The limits specified at paragraph 33 for dwellings are considered to be generally appropriate as they are related to typical levels of tolerance to noise. However, there may be a need to modify the nominal limit in the light of local circumstances.

36. A lower nominal daytime limit might be appropriate in quieter rural areas if a limit set at 55 dB $L_{Aeq,1h}$ for noise from the proposed development would exceed the existing background noise levels by more than 10 dB(A). In these circumstances, planning authorities and operators should have regard to how the noise from the development would relate to existing background levels and to the likelihood of complaints arising from the proposed development; and there may then be a need to modify the nominal daytime limit to a lower level in the light of local circumstances.

37. In exceptionally quiet rural areas where the daytime background noise level is below 35 dB(A), a condition limiting mineral operators to a 10 decibel excess over the existing background noise level is likely to be both difficult to achieve and unduly restrictive. It would not normally be appropriate to require a daytime limit below 45 dB $L_{Aeq,1h}$, as such a limit should prove tolerable to most people in rural areas. The exercise of care and some flexibility are important in addressing these issues.

38. In the case of night-time working, planning authorities and operators should have particular regard to the needs of local people, and discussion with local Environmental

advice. In such circumstances, planning authorities may wish to consult the Scottish Office Agriculture Environment and Fisheries Department (SOAEFD).

⁶ Noise from a specific source, such as mineral operation, is reflected by any facade which directly faces the operation. The resulting reflection adds to the direct sound level to yield a level measured at a microphone placed 1-2m in front of the facade which is typically 3 dB(A) higher than the "free field" level. In order to standardise the approach, 3 dB(A) should be added to predicted or measured free field levels to take account of the level actually experienced at any facade directly facing the operation. Such a correction does not apply to any facade which does not face the working.

⁷ Where the noise-sensitive property is a school, planning authorities and operators should have regard to the advice in BS 8233 (1987) "Sound Insulation and Noise Reduction for Buildings".

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Health Officers may well be appropriate as to whether the night-time limit stated at paragraph 33 is reasonable. This may be a particular issue in quieter rural areas.

39. There are some circumstances where the setting of nominal limits higher than those quoted in paragraph 33 may need to be considered. Due to the nature of opencast coal operations which are characterised by the removal of large amounts of overburden and the use of heavy earth moving equipment above ground level, a nominal daytime limit at the nearest noise-sensitive dwelling within the range 55-60 dB $L_{Aeq,1h}$ (free field) for such operations will normally be justified at present. However, opencast coal operators should (by 1998) work by good practice towards the same daytime limit of 55 dB $L_{Aeq,1h}$ (free field) recommended for minerals workings in general. They should also take advantage where possible of improvements in vehicle design.

40. In exceptional circumstances, lower nominal noise limits might be appropriate if it is known that the mineral operations will include equipment which will make high pitched or whining tones. In such circumstances, it may be desirable for Planning authorities to impose separate conditions on tonal noise which contribute significantly to the total site noise, and which are considered to be particularly annoying (paragraph 74). Vehicle reversing alarms apart, these situations are rare at surface mineral workings. But an exception to the recommended noise levels should not normally be used to take account of vehicle reversing alarms, which are required for safety. These alarms are discussed in paragraphs 64-66.

41. It will often be necessary to raise the noise limits to allow temporary but exceptionally noisy phases in the mineral extraction operation which cannot meet the limits set for routine operations. A prime example would be to allow for the construction of baffle mounds. Other activities which would also merit a temporary raised limit include soil-stripping, removal of spoil heaps, and construction of new permanent landforms. These activities are in themselves noisy, but can bring long term benefits. See paragraph 60.

42. In some circumstances gardens may be regarded as noise-sensitive, for example, if they are heavily used during periods of likely operation. Open spaces which the public uses for relaxation may be considered to be noise-sensitive in some circumstances, for example, if extensively used during likely periods of operation, and if there would be an adverse impact from noise. In such cases, the nominal noise limit should normally be calculated from the perimeter of the area. The limits would not be expected to be as low as at dwellings, and it is suggested that 65 dB $L_{Aeq,1h}$ during the normal working day and 55 dB $L_{Aeq,1h}$ at other times would be reasonable. However, planning authorities will need to consider carefully the restrictions which treating open spaces as noise-sensitive would have on the feasibility of the planned operation, and should exercise flexibility. There may be exceptional cases where Sites of Special Scientific Interest, designated to protect the habitats of animal and bird life, might need to be regarded as noise-sensitive. In such circumstances, there should be proof or justification provided by Scottish Natural Heritage that increased noise would be prejudicial to particular species throughout or at any particular time of the year. Footpaths and bridleways should not normally be regarded as noise-sensitive.

noise monitoring

43. When determining monitoring requirements, planning authorities should consider the circumstances of each site and the likelihood of complaints arising from noise emitting from the site. Planning authorities may specify in a condition attached to the planning permission that monitoring will be undertaken according to a scheme to be agreed between the planning authority and the operator. Alternatively, a condition might specify a number of noise control points where noise will actually be measured

for monitoring purposes, and the intervals at which the monitoring should be carried out. The monitoring points would generally be at noise-sensitive properties, but may be on site boundaries or at other specified points.

44. If monitoring has to be other than at the noise-sensitive property, the nominal noise limit (free field) at noise-sensitive properties must be converted into equivalent noise limits at the monitoring points on the site boundaries or other locations. This calculation uses the recommended noise prediction model (BS 5228 incorporating the modifications mentioned above at paragraphs 16-23). These equivalent noise limits at the monitoring points will then become the actual noise limits incorporated into the planning condition. The noise limits at the site boundary will be higher than the nominal limits at noise-sensitive properties which were used in the initial stages of the calculations. This is a reflection of the diminution of noise levels over distance and attenuation caused by soft ground or barriers.

Monitoring Locations

45. The monitoring of noise at noise-sensitive properties will enable noise to be most closely related to those people that it affects. Nevertheless, the Government recognises that local circumstances may require the flexibility for monitoring at the site boundary or at other specified locations. But there should normally be provision for monitoring at the noise-sensitive properties if complaints are received. Whatever approach is adopted, the monitoring points should:

- be related to the general location of noise-sensitive properties, particularly those which were used for calculating the site boundary noise limits;
- not be disproportionately close to any one noise source unless this is taken into account in setting the noise limit;
- pick up all noise from static and mobile sources within the site which could affect the noise-sensitive properties.

46. Where monitoring is to take place at noise-sensitive properties, the monitoring may be near the facade or in the free field. If it is to be near the facade, the microphone used for monitoring should be located approximately 1m from the facade, and a 3 dB facade reflection should be accounted for, as the limits described above are as in the free field (see footnote 6). To minimise the influence of reflections, the microphone should be placed at least 3.5m from any reflecting structure other than the facade in question or the ground.⁸ Where monitoring is to take place on the site boundary, microphones should be sited as near as practicable to the boundary, but away from the shadow of any acoustic barrier (e.g. buildings; baffle mounds), unless an appropriate correction factor is applied.

Equipment

47. Equipment used for monitoring should normally correspond to that specified in Type 1 of BS 6698 "Specification for Integrating Averaging Sound Level Meters" 1986. It should be capable of measurement in $L_{Aeq,T}$. It should be calibrated before and after use and be operated in accordance with the manufacturer's instructions. Equipment should be protected from the rain, and the microphone covered with a windshield.

48. The monitoring equipment should have a "pause" button so that when site-specific noise is being measured, extraneous noise can be cut out. The equipment

⁸ If the facade in question relates to a first floor room or higher, for example, in relation to night-time levels or limits, then it will be necessary to apply a correction for the difference in height compared with the monitoring position.

should be supervised continuously during monitoring so that the pause button can be pressed as required. There should be careful logging of use of the pause button. It may not be possible to exclude every noise event not directly attributable to the operation, and in such cases an allowance may need to be made for noise which is not directly attributable to the site. BS 4142 section 5 provides advice on this.

The Monitoring Period

49. Although it is common practice for existing noise conditions to stipulate a 12 hour monitoring period, monitoring average levels of noise emission over a one hour working period would generally result in little loss of accuracy. A shorter monitoring period also makes it more feasible to manually operate the equipment (e.g. to press the pause button). Periods even shorter than 1 hour, e.g. 15 minutes, may also be permitted for sampling purposes once the noise climate of a site in relation to the surrounding area has been established.

50. Monitoring should be undertaken during typical normal working hours (or such other times as may be stipulated in the planning permission) and should avoid meal breaks and periods of plant breakdown. Measurements should only be taken in calm conditions or at those control points with a component of wind blowing from the site. BS 4142 gives advice on weather conditions which would preclude monitoring. Monitoring should generally be avoided in conditions of: wind speeds greater than 5 m/second average; rain; low temperatures (less than 3°C).

Frequency of, and Responsibility for, Monitoring

51. Planning conditions should normally require periodic monitoring to be carried out by the operator at intervals either specified in the condition or agreed according to a scheme between the operator and the planning authority. The operator should be required to provide periodic, e.g. annual, monitoring reports to the planning authority. Monitoring requirements should be decided on a site specific basis, and unnecessarily onerous requirements should be avoided. Monitoring for periods of up to 1 hour at intervals of 1-2 months might be regarded as reasonable, but in well established operations, it should be possible to relax the duration and frequency. Any condition on the operator to monitor should also require monitoring to be carried out where relevant at the start of each new phase of working or working in a new area. The condition should also require advance notification of any substantial changes in the work programme, thereby facilitating early monitoring of the new circumstances and pre-empting complaints.

52. There may be exceptional circumstances in which it will not be feasible for the operator to carry out the monitoring. In such circumstances, monitoring should be undertaken by the planning authority. Planning authorities should also carry out periodic checks of their permitted sites and in particular, when complaints are received.

53. If any monitoring or checks by the planning authority indicate compliance with the limits set in the condition, the operator should be notified so that it is known that the operator's actions are acceptable. Where there is a breach of any condition, the planning authority will wish to discuss the matter fully with the developer before taking further action. The developer may wish to make checks and remedy the matter quickly. If this is not done, the planning authority will wish to consider enforcement action.

noise abatement controls

54. There are a number of existing practices which mineral operators can adopt to reduce the impact of noise emission from surface mineral workings. Planning authorities can require many of these to be implemented by means of planning conditions. These conditions can supplement the condition controlling the maximum amount of noise permitted. Where planning conditions to control noise have not been imposed, mineral operators will nevertheless wish to consider adopting this advice in order that they may conduct their operations in an environmentally acceptable manner.

Work Sequencing and Site Layout

55. Planning conditions can be used to specify the programme of work and the layout of a minerals site, and thereby significantly reduce noise levels as well as other environmental impacts. Mineral operators will wish to discuss these factors with the planning authority when proposals are initially being formulated, before the planning application is submitted. But it must be recognised that noise control is not the only environmental factor to be considered in determining site layout and work programme.

56. Wherever possible, the workings should be arranged so that earlier operations provide screening for noise-sensitive properties from the noise generated by subsequent operations.

57. If excavation proceeds towards the noise-sensitive properties, the quarry face can provide considerable protection by acting as a screen to those properties. Wherever possible, plant and machinery should be sited on the quarry floor.

58. Fixed plant and facilities, including maintenance areas and permanent haul roads, should be located so as to minimise their impact on noise-sensitive properties. Where feasible acoustic screens around plant can help to reduce noise emissions. Speed limits within the site can help to reduce the noise from on-site traffic. Speed control beds and "sleeping policemen" can be used to this effect, though it should be noted that, when in the path of empty vehicles, the latter can sometimes cause noise through "body slap". Site roads should be kept as smooth as possible to reduce vehicle noise. Operators should also recognise that the manner in which vehicles are driven is very important.

Baffle Mounds

59. Planning authorities can use planning conditions to require mineral operators to construct baffle mounds around the perimeter of the site or at other appropriate locations within the site. These can make a significant reduction in the exposure of local people to noise emissions from mineral working. These mounds are frequently constructed from the top soil, sub-soil and over-burden which an operator has to remove and store in order to access the mineral.

60. The process of baffle mound construction, though short-lived, is itself one of the noisiest aspects of mineral working. It may therefore be appropriate for planning authorities and mineral operators to reach an agreement that, for a specified short period of time, and within specified working hours, according to local circumstances, noise limits should be raised by a specified amount to allow for the construction of these mounds. This will cause temporary inconvenience to local residents but will lead to longer term benefits. The agreement to modify normal noise limits during mound construction should be incorporated into the terms of the planning condition. It should be made clear to local residents that these higher noise levels are only temporary and are to serve a beneficial purpose. It is suggested that 70 dB $L_{Aeq,1h}$ (free field) for periods of up to 8 weeks in a year should be considered to facilitate this, but planning authorities and operators may also wish to weigh up the effects of shortening this period and allowing higher levels of noise, in order to get such temporary operations

completed as quickly as possible. However, some operations may require longer than 8 weeks for completion, and in such cases, an increased limit up to 70 dB $L_{Aeq,1h}$ (free field) may be allowed during these periods. This advice may also apply to other temporary processes including those set out in paragraph 41.

61. It may be possible to limit the noise impact of baffle mound construction by the use of temporary screening. Straw bales have sometimes been used for this purpose.

62. There is potential for significant dust generation during construction of baffle mounds, and operators should take steps to minimise this. Baffle mounds should, wherever possible, be shaped, and seeded, if appropriate, to provide a visual as well as an acoustic screen for mineral operations.

Acoustic Fencing

63. Operators may erect acoustic fencing as an alternative to baffle mounds to provide protection against noise, either where insufficient land is available for a baffle mound, or where a baffle mound would prevent the extraction of a significant mineral resource, or where there are difficulties in making a stable mound of adequate size. The use of acoustic fencing on top of a mound can provide increased acoustic protection, or reduce the land take required for a given degree of protection. There may, however, be a conflict with landscape interests and care will be needed to protect the skyline from visual intrusion. In such cases, prior discussions with planning authorities may be appropriate.

Vehicle Reversing Alarms

64. Vehicle reversing alarms are one of the sources of noise at mineral working sites which cause the most environmental disturbance.

65. Alarms are fitted for safety reasons, but can cause annoyance through their tone even when the level of background noise is higher than the noise emitted by the alarm. This can be especially disturbing whilst working is taking place during the night. The Quarry Vehicle Regulations 1970, made under the Mines and Quarries Act 1954, require quarry vehicles to have an adequate audible warning system, whilst the Health and Safety at Work etc. Act 1974 places a general duty on operators to operate a safe working system. These requirements are commonly interpreted as requiring the installation of an audible reversing alarm system. However the requirement in the 1970 Regulations is for the installation of a horn to sound warnings, not specifically to be used continually whilst reversing, and it is possible that other reversing warning systems may satisfy the requirements of the 1974 Act. The European Commission Machinery Safety Directive (91/368/EC) came into effect from January 1993. It contains the following relevant clauses:

3.2.1 para 1 "Visibility from the driving position must be such that the driver can operate the mobile machinery and its tools in the intended conditions of use in complete safety for himself and the exposed persons. Where necessary, appropriate devices must be provided to remedy hazards due to inadequate direct vision"; and

3.6.1 para 1 "Machinery with a ride-on driver must have an acoustic warning device to alert exposed persons".

66. Alternatives to the alarms currently in general use include those which adjust their noise level automatically to 5 dB(A) above the ambient noise level, and directional alarms which reduce the area over which these alarms are likely to cause annoyance. Other alternatives include flashing bright lights during the night (but these may also cause a nuisance if not operated with care), radar-operated safety devices which will automatically apply the brake of the vehicle if something or somebody is in its way, audible "warble" devices, TV camera systems, and reduced level audible warnings for night time use. Where it is not feasible to use these alternative devices, operators should consider whether their working practices can be arranged so that their vehicles reverse predominantly away from noise sensitive properties. Having regard to Health and Safety Executive legislation, and within the flexibility it offers, operators should devise acceptable systems in discussion with planning authorities.

Off-site Road Traffic

67. As well as seeking to control noise emission from the mineral site itself, planning authorities should be mindful of the noise caused by traffic going to and from the site. Noise from off-site traffic related to a minerals operation can sometimes cause as much, if not more, annoyance as the noise from the operation itself.

68. Planning conditions restricting the hours of working can limit on-site traffic to the same hours. Planning conditions for mineral sites cannot control the right of passage over public highways, but such conditions may have limited side-effects of constraining the times when off-site lorry movements actually take place. Conditions may also be used to require mineral operators to erect notices at site exits requesting drivers to follow specific routes to avoid noise-sensitive properties.

69. While it is possible for planning authorities to reach agreements with site operators to restrict lorry movements to particular times or routes, it must be remembered that not all lorries calling at a mineral site may be under the control of the mineral operator. It should also be borne in mind that any restrictions on when lorries can first enter the site may have the side effect of causing noise elsewhere as lorries may park off-site early in the morning awaiting the start of the working day.

70. Mineral operators can do much to counter the noise nuisance that can be caused by off-site traffic. They should ensure that their own lorries use routes and operate at times which cause the least disturbance, and include the same requirement in their contracts with other transport firms whose lorries take material away from the site.

Maintenance of Plant

71. The regular and effective maintenance of plant can play an important role in keeping noise within reasonable standards. Planning authorities should consider asking operators to agree voluntarily a general programme of regular maintenance paying particular attention to the lubrication of bearings, the sharpness of cutting edges and the integrity of silencers.

Equipment Selection

72. Minerals operators are encouraged to obtain information on noise levels of equipment and the minerals industry should have regard to noise issues when making its choice of equipment, in order to show itself a good neighbour to local residents.

73. As stated at paragraph 11 on noise prediction, mineral operators should supply information on predicted noise levels in support of a planning application. Often the operator and the planning authority will wish to discuss the impacts of noise at the pre-application stage. Planning authorities might require the applicant to supply data on the sound level generated by the equipment which it is proposed to use. Such data, if determined by a competent acoustic agency, can be used in place of the information contained in BS 5228 Part 1 Appendix C for prediction purposes.

74. It is open to planning authorities to specify planning conditions setting noise limits to important individual items of plant and equipment at the mineral site, e.g. those with certain tonal noise characteristics. However it should not be necessary to do this if the planning authority is imposing a noise limit which will apply to all noise coming from the site, and might be reserved for plant or equipment which has a particularly irritating tone.

Best Practicable Means and “BATNEEC”

75. The concept of “best practicable means” (BPM) is well-established in pollution control legislation. Part III of the Environmental Protection Act 1990 allows industrial operators to defend themselves against charges that they are causing a nuisance if they can prove that they are using the best practicable means to control emissions. The more recent concept of “Best Available Techniques Not Entailing Excessive Cost” (BATNEEC) is used for the purposes of the new integrated pollution control system set up under Part I of the Environmental Protection Act 1990 and is also used in EC Directives on pollution control issues and local authority air pollution control systems.

76. The term BPM does not readily translate into meaningful planning conditions because it does not in itself specify what practices constitute the best practicable means. However, it is a useful concept to limit environmental impact because of its flexibility; it takes into account the current state of pollution abatement technology, the financial implications of installing new plant, and local operating circumstances.

Acoustic Double Glazing and Secondary Glazing

77. In addition to planning conditions and voluntary agreements to control noise emissions, planning authorities may exceptionally find it appropriate to ask mineral

operators to pay for acoustic double glazing or secondary glazing for people who live in noise-sensitive properties. Any such requests should be consistent with the Government's general policy on the use of planning agreements (see SODD Circular 12/1996), and should only be made where the need for double glazing or secondary glazing is directly related to the nuisance caused by the mineral development. Double glazing and secondary glazing should not be seen as alternatives to other measures to control noise emissions, nor should their installation be seen as a means of legitimising noise limits higher than those recommended in this Annex. Instead they should be seen as additional safeguards on the quality of life for local residents. They may be particularly appropriate where it can be clearly demonstrated that noise arising from off-site traffic has an unacceptable effect on noise-sensitive properties, and where, as explained in paragraphs 68-69, the effectiveness of planning controls may be limited. They might be useful as a last resort where otherwise a single property might stand in the way of a substantial development. However, it is not within the powers of planning authorities or operators to impose such safeguards upon members of the public.

statutory considerations

Planning Conditions

78. Planning conditions for the control of noise may be attached to planning permissions for mineral workings under the powers given to planning authorities under Section 27 of the Town and Country Planning (Scotland) Act 1972. A power to impose conditions can enable many development proposals to proceed where it would otherwise be necessary to refuse permission, on the grounds that, without these additional controls over specific environmental impacts, the development would have an unacceptable impact on the local community. Under the Control of Pollution Act 1974, local authorities have powers to control noise by serving notice and imposing orders, if noise is considered to be a statutory nuisance or a potential statutory nuisance. Planning authorities are encouraged to liaise with environmental health authorities so that the imposition of noise abatement orders for potential statutory nuisance can be avoided where planning conditions by the planning authority are considered to control noise adequately. General advice on the imposition of planning conditions is set out in SDD Circular 18/86.

Environmental Assessment

79. EC Directive 85/337/EEC and The Environmental Assessment (Scotland) Regulations 1988 are discussed in paragraphs 7 - 11 in PAN 50. As noise is often an important factor in assessing the environmental acceptability of a minerals proposal, it should be one of the factors included in an Environmental Statement. The advice contained in this Annex on how noise emissions should be predicted, limited and monitored will be relevant to the consideration of noise issues in preparing Environmental Statements.

Development Plans

80. One of the functions of development plans is to provide guidance to mineral developers on the appropriate development control criteria that will be used in determining planning applications for mineral development. Structure plans set out this guidance in general terms, and local plans set out this guidance in greater detail. NPPG4: Land for Mineral Working gives further advice on the minerals content of development plans.

81. In drawing up their development plans, planning authorities will wish to consider the advice in this Annex on the steps that might reasonably be taken to control noise emissions and also the approach to setting noise limits that will be incorporated in planning conditions.

implementation and review

82. This Annex will provide the basic framework for the consideration of noise aspects of surface mineral development proposals and for the monitoring and control of operations.

83. The Annex has been based on the best information currently available. It may need updating in the future to reflect changes in technology and environmental standards, and in the light of any future relevant research findings.

note

84. Enquiries about this Annex to PAN 50 should be addressed to Brian Spiers (0131 244 7546). Further copies, together with other PANs, NPPGs and a list of current advice and guidelines, are available from SODD Planning Services, Rm 2-H, Victoria Quay, Edinburgh EH6 6QQ (0131 244 7538).

glossary of technical terms*

A-Weighting: Normal hearing covers the frequency (pitch) range from about 20 Hz to 20,000 Hz but sensitivity is the greatest between about 500 Hz and 5,000 Hz. The "A-Weighting" is an electrical circuit built into noise meters to mimic this characteristic of human hearing.

Background: See $L_{A90,T}$.

BATNEEC: Best available techniques not entailing excessive cost.

decibel (dB): The logarithmic measures of sound level. 0 dB is the threshold of normal hearing, 140 dB is the threshold of pain. A change of 1 dB is detectable only under laboratory conditions.

dB(A): decibels measured on a sound level meter incorporating a frequency weighting (A-Weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessments of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to doubling or halving the loudness of a sound.

$L_{A10,T}$: The "A-Weighted" noise level exceeded for 10 per cent of the specified measurement period (T). It gives an indication of the upper limit of fluctuating noise.

$L_{A90,T}$: The "A-Weighted" noise level exceeded for 90 per cent of the specified measurement period (T). In BS 4142, used to define the *background* noise level.

$L_{Aeq,T}$: The equivalent continuous sound level - the sound level of a steady sound having the same energy as a fluctuating sound over a specified measuring period (T). Used to describe many types of noise, and can be measured directly with an integrating sound level meter.

Tonality: The degree to which a noise contains audible pure tones. Broad-band noise is generally less annoying than noise with identifiable tones.

* Source: Adapted from Department of Environment's *Report of the Noise Working Party, 1990*, HMSO

bibliography

SO Circulars

SDD 23/1973 "Planning and Noise"

SDD 18/1986 "Use of Conditions in Planning Permissions"

SDD 13/1988 "Environmental Assessment: Implementation of EC Directive"

SDD Memorandum 1975: "Noise Insulation (Scotland) Regulations 1975"

SOEnD 2/1992 "Planning and Compensation Act 1991 : Commencement of Minerals Provisions.

SODD 12/1996 "Planning Agreements"

National Planning Policy Guidelines

NPPG4: Land for Mineral Working 1994

Legislation

The Town and Country Planning (Scotland) Act 1972

The Control of Pollution Act 1974

The Town and Country Planning (Minerals) Act 1981

The Town Planning and Compensation Act 1991

The Environment Act 1995

British Standards

BS 4142 (1990) "Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas"

BS 5228 Part 1 (1984) "Noise Control on Construction and Open Sites"

BS 6698 (1986) "Specification for Integrating-Averaging Sound Level Meters"

BS 8233 (1987) "Sound Insulation and Noise Reduction for Buildings"

Other References

World Health Organisation (1980) "Environmental Health Criteria 12; Noise"

CONCAWE (The Oil Companies International Study Group for the Conservation of Clean Air and Water - Europe). Report 4/81 "The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities".

Department of Transport (1988) "Calculation of Road Traffic Noise".

DOE Noise Review Working Party (1990) "Report of the Noise Review Working Party 1990". HMSO.

W S Atkins Engineering Science Ltd "The Control of Noise at Surface Mineral Workings", HMSO 1990.