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Development Department

Planning Advice Note

PAN 50

CONTROLLING THE ENVIRONMENTAL EFFECTS OF 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

1. The policy context for mineral working is set out in NPPG 4 : Land for Mineral Working. Minerals are an important national resource. They make an essential contribution to the nation's prosperity by meeting industry's need for raw materials, creating employment opportunities and assisting the balance of payments through exports and import substitution. However the extraction process can often be disruptive and have significant environmental impact. Whilst acknowledging that minerals can only be worked where they are found, the Government recognises that the need to work mineral resources must be reconciled with care for the environment particularly in relation to the natural and built heritage, and communities.

2. "Sustainable Development : The UK Strategy (1994) indicated that part of the sustainable framework for mineral extraction was :

- To encourage sensitive working practices during minerals extraction and to preserve or enhance the overall quality of the environment once extraction has ceased.

NPPG 4 also indicated that further advice on controlling the environmental effects of surface mineral workings would be covered more fully in future Planning Advice Notes.

Purpose

3. The aim of this Planning Advice Note is to provide advice on the more significant environmental effects arising from mineral working operations. This advice will be relevant :

- a) in the framing of policies in development plans,
- b) in considering planning applications,
- c) in considering existing planning consents in the context of reviews under the provisions of the Environment Act 1995.

4. When considering planning applications, attention should be given to defining the scope of Environmental Assessments, and the acceptability and purpose of any conditions that may require to be attached to any consents. Thereafter, monitoring compliance with any imposed conditions should be a priority so as to determine whether enforcement action is necessary.

5. The advice in this PAN is based on the Government sponsored research report by Roy Waller Associates Ltd. "Environmental Effects of Surface Mineral Workings" and published in 1992 by HMSO. £16 (ISBN 0-11-752637-1)

Scope

6. This PAN deals generally with the environmental effects of surface mineral working and provides the framework for detailed advice in a series of annexes on particular aspects. The first of the planned series of annexes "The Control of Noise at Surface Mineral Workings" is published with this PAN as Annex A. Further Annexes will be published on "Dust", "Blasting", "Traffic" and "Ground & Surface Water", as the current research is completed and evaluated, (see page 29 for relevant references). The PAN and annexes indicate what should be considered 'good practice'. They do **not** however cover all environmental effects, where conflict may arise, for example, in relation to designations intended to protect the natural or built heritage. It is the responsibility of the planning authority, to consider in detail any proposal for mineral working in their area, in relation to the particular

site and its environs. In so doing they should have regard to other published planning guidance and, where appropriate consult relevant bodies, such as Scottish Natural Heritage (SNH) and Historic Scotland (HS) where proposals may effect designations intended to protect natural or built heritage. (see NPPGs 4 and 5, and PAN 42)

environmental issues

7. The Environmental Assessment (Scotland) Regulations 1988 require an environmental assessment to be undertaken for proposed mineral working which in the opinion of the planning authority is likely to have significant effects on the environment. Under proposals to amend the Directive, all mineral extraction proposals where the surface of the site exceeds 25 hectares, or peat extraction, where the surface of the site exceeds 150 hectares, may in future be subject to environmental assessment. The new arrangements are scheduled for introduction from December 1997.

8. The environmental assessment process enables greater understanding to be reached between the intended operator, their neighbours and the regulatory authorities. In the event of planning approval there is also the opportunity to use the results of assessments as a basis for determining conditions to be imposed, for monitoring the actual environmental effects and for evaluating the decisions. Some 67 Environmental Statements have been submitted in association with planning applications for mineral extraction in Scotland since 1985.

9. To be effective, environmental assessment requires to be focused (scoping) i.e. the early identification of the issues that are most likely to be significant and therefore have most relevance in determining whether or not the proposal can be allowed to proceed with appropriate mitigation measures. Care should be taken to ensure that steps to deal with one particular aspect of concern do not create others.

10. Generally speaking the main issues that give rise to concerns in connection with surface mineral working are, in broadly descending order of frequency :

- the various effects of road traffic, particularly where this is the primary means of transport,
- the effects of blasting, noise and dust : these issues will vary according to type of mineral and amount of overburden,
- visual / landscape effects,
- contamination of surface water discharges by solids may occur; contamination by oil and its derivatives is less frequent; dewatering also creates difficulties with reduction of flow of wells and streams, over-drainage and occasionally settlement.

11. This PAN gives advice on how to consider the main impacts that may arise from proposals for surface mineral extraction and ways in which these impacts can be controlled or minimised, in order to ensure that sites are designed and operated to environmentally acceptable standards. Each case must be considered on its merits, and planning authorities and the industry will therefore need to consider the applicability and practicability of the advice in the circumstances of particular proposals. Advice on Restoration, Aftercare and After-use will be covered by a separate PAN.

proximity of mineral workings to communities

12. Residents living in close proximity to proposed workings may be exposed to some or all of the effects referred to above, to a greater or lesser extent. NPPG 4 fully acknowledges the sensitivities that can arise in such circumstances. Accordingly, it is for planning authorities to take particular care in respect of the conditions they attach to any consent they may be minded to give for working in close proximity to settlements. Where they judge that mitigation measures are not sufficient to safeguard the quality of the local environment, outright refusal or restriction of the proposal may be appropriate.

13. While in the past consents have been given for mineral extraction in close proximity to residential property, experience indicates that in some circumstances it may be difficult to provide adequate protection for nearby residents despite requirements for landscaping works such as bunds, screening and planting, especially where the workings will have an extended life. The negotiation of adequate separation distances should therefore be sought in respect of new proposals where appropriate. Current practice on appropriate distances appears to vary considerably.

14. The aim should be to agree a distance that is reasonable, taking into account the nature of the mineral extraction activity (including its duration), location and topography, the characteristics of the various environmental effects likely to arise and the various amelioration measures that can be achieved. Agreement on an acceptable separation distance at an early stage in the formulation of proposals may help allay many of the concerns of local residents. Working in close proximity to residential property should only be contemplated in exceptional circumstances e.g. where there are clear, specific and achievable objectives e.g. for the removal of instability and preparing land for subsequent development. But such working should be for a limited and specified period without scope for extension. However, the removal of the potential dangers associated with former shallow mining e.g. subsidence, old mine shafts etc., can in itself be an advantage to the local community especially where the restored site has recreational potential.

15. It will also be the case that in many larger sites, working in any one area will be of limited duration as the operation will be phased. Working nearest to occupied dwellings could either be at the beginning of the operation or at the end or at any point in between. This flexibility may be constrained by operational considerations but operators and planning authorities should consider and agree the pattern of extraction which takes account of local residents' views.

16. Some minerals are concentrated in specific areas. For example shallow coal deposits that may be worked by open cast extraction are found within the known coalfield areas mainly in the Central Belt and are generally well documented. Sand and gravel deposits are generally associated with glacial deposits that are widely distributed throughout Scotland but with commercial interest focused within relatively restricted local market areas associated with the main urban areas where most construction activity is concentrated. It is also relevant that the characteristics of the mineral, and hence the suitability for different end uses, will vary from place to place.

17. Situations will therefore arise where commercially attractive deposits will be concentrated in certain areas where the mineral rights may be held by a few or many interests. This can result in instances where there is the prospect of several simultaneous operations over a relatively short period of time or phased operations over a relatively longer period of time. The potential cumulative effects will be

particularly relevant where proposed extraction would be carried out close to existing communities.

18. In these circumstances it will be for the planning authority to determine whether the working of the mineral can be reconciled with the need to protect communities from unacceptable environmental consequences. In coming to such decisions the primary consideration would be that the planning authority should act reasonably. Pointers on current best practice are set out below.

summary of good practice : the relationship of workings to local communities

Planning authorities should :

- consider the possible cumulative effect of proposals,
- avoid inappropriate development and encroachment in the area around the longer-term workings and significant reserves,
- encourage a dialogue between operators and the community,
- encourage elected members to visit sites before making judgements,
- encourage liaison committees and officers and members to participate in them.
- establish effective monitoring i.e. noise, dust and vibration and where necessary enforcement.

Operators should :

- endeavour to be good neighbours, i.e. :
 - ° get to know the neighbours, be concerned about them and try to understand their problems, encouraging them to know site personnel, listen as well as talk,
 - ° set up regular liaison and provide information as freely as possible, hold open days,
 - ° create a good impression by running a tidy and efficient site,
- ensure lines of communication, e.g. :
 - ° appoint a liaison officer; widely publicise name & telephone number,
 - ° support a liaison committee,
 - ° give advance notice and explanation of activities that might cause complaint,
 - ° keep systematic records of complaints and the remedial actions taken,
 - ° follow up complaints by personal visits and action,
- ensure that staff are environmentally aware and are trained to cope with the issues,
- do not rely on the letter of the law where there are obvious problems but culpability cannot easily be proved; be prepared to be flexible,
- offer / provide compensatory measures where the impact is excessive or borderline,
- try to co-operate and avoid being adversarial.
- offer opportunities to see how effective operational (planning) conditions have been in practice elsewhere.

People living in proximity to surface mineral working sites should :

- get to know the operator :
 - ° take advantage of any overtures,
 - ° try not to have preconceptions,
 - ° listen as well as talk,
 - ° encourage site personnel to visit you at home to discuss your queries/concerns,
- try to understand the operator's activities and problems :
 - ° ask for a visit to the site or a similar one,
 - ° speak to people who have lived in the vicinity of similar workings,
 - ° take advantage of open days, liaison committees,
- try to be specific when making complaints, e.g. date, time, clear description,
- try to co-operate and avoid being adversarial.
- seek opportunities to see how effective operational (planning) conditions have been in practice elsewhere.

planning conditions

19. The identification of environmental effects need not necessarily preclude development from proceeding. Planning conditions can enable development to proceed where it might otherwise be necessary to refuse planning permission. The sensitive use of appropriate planning conditions, which address known and anticipated problems and concerns, can provide important environmental safeguards. In turn, they can influence the action that operators might take as good neighbours.

20. To be effective, planning conditions must be enforceable. This means that they must be :

- precise,
- capable of being monitored, i.e. infringements must be detectable,
- defined sufficiently for breaches to be provable.

In addition to being valid, they must be necessary, relevant to planning and to the development, and reasonable. (see SDD Circular 18/1986 'The Use of Conditions in Planning Permissions')

21. 'Conditions' can set requirements in a variety of ways. The principle ones are :

- performance requirements,
- the use of specific amelioration measures,
- the use of "good" practice, e.g. as set out in a code of practice.

Performance Requirements

22. Effective planning requires judgements based upon local circumstances and local objectives. Where feasible, performance requirements are in many ways the ideal basis for planning conditions. They make clear to operators what is expected of them and leave them to decide the most cost-effective way of meeting those criteria. To go beyond this may inadvertently and unnecessarily prejudice the flexibility of operators working methods and profitability. It should never prejudice other statutory controls for health and safety. Performance requirements will usually be designed to achieve a minimum environmental quality or to limit degradation of the environment. An example of such criteria is a maximum acceptable level of noise at sensitive properties and / or other appropriate points.

23. Setting performance requirements should not sanction adverse effects for which there are readily available solutions and which do not involve significant costs. In some cases the operator will be able to achieve worthwhile improvements on the performance requirements without incurring significant expense. Clearly it is desirable that this be done but it can be difficult to provide the appropriate incentives.

24. Monitoring is an essential feature of controls over the consequences of surface mineral extraction. In many cases periodic checks should be sufficient to identify undesirable trends and allow action to be taken to avoid breaching the requirements. In sensitive situations the provision by the operator of continuous monitoring systems can be a condition of the planning permission. Access to the monitoring positions will be essential and this will influence their choice. It may be desirable that monitoring be carried out at a sensitive property not owned by the operator; however, whilst criteria applicable to that property can be set in a planning

condition, it cannot be a requirement that it be a monitoring position because the operator has no right of access.

Amelioration Measures

25. The difficulty or impossibility of defining a criterion which can be readily measured and enforced may lead to planning conditions which require the use of specific ameliorative measures e.g. :

- In order to reduce visual intrusion (see para 47 to 51) , the planting of trees may be required before mineral working begins or it may be specified that processing plant be moved into the quarry away from the entrance when there is room to do so.

- It is a statutory offence for vehicles to deposit material on the roads. The objective is simple enough to understand but it is difficult to enforce. In such a case it may be much easier to require specific action, e.g. the cleaning and sheeting of all lorries prior to leaving a site.

Codes of Practice

26. Environmental management is an integral part of environmental codes being adopted by many sectors of industry in recognition of the public concern for better safeguards for the environment as a whole. Such codes within the aggregates industry are now well established for those operators who are members of the BACMI and SAGA trade associations. At the present time, in Scotland, there are early discussions between opencast coal operators (Confederation of United Kingdom Coal Producers - COALPRO) and planning authorities on the development of a 'Coal Code of Practice'.

specific environmental effects

27. The remainder of this PAN is devoted to providing summaries of good practice points in addressing the main effects associated with surface mineral extraction. The topics covered are traffic, blasting, noise, dust, visual intrusion ground and surfacewater, wastes and severance and footpaths. Details of the more technical aspects are to be addressed in the planned series of annexes to accompany the PAN. The first of these on "noise" is published with this PAN.

Traffic

28. The potential off-site effects of traffic are :

- to add to the number and size of vehicles on the road; this may cause congestion, accidents, difficulties for pedestrians;
- damage to roads or their verges;
- spilled or dropped material onto roads and spreading dust;
- creating visual intrusion, air pollution, dust, noise and vibration in areas adjacent to the roads.

On-site the potential effects are largely noise and dust in neighbouring areas.

29. Concern arises about traffic regardless of the type of mineral extracted. Parts of the industry acknowledge that traffic is one of the most intractable

problems. Complaints arise from 'intimidation' by large vehicles, danger, roads unsuitable for the size of vehicle, damage to verges, dust, spillage, mud from wheels and body of vehicles, noise from early starts and early arrival at sites (parking off site), vibration and congestion.

30. Vehicles carrying minerals (particularly on local roads) are among the heaviest and possibly the largest to use the roads in question. They are often out of scale with the rural and urban roads they use, especially in the vicinity of the workings and customer's site. Even low traffic flows in sensitive areas give rise to complaints.

31. Empty lorries are an equal cause for concern. They tend to travel faster and be noisier because they suffer from 'body-slap' when going over bumps or pot holes. If not sheeted, turbulence in empty bodies of vehicles may scour out dust.

32. Operators may be under commercial pressure to work 'unsocial' hours. Building contractors in urban areas require early delivery of aggregate or pre-mixed concrete to avoid delays during the peak traffic hours. Roads Authorities / contractors need material for the start of the working day. Road maintenance work may be done outwith peak hours (especially at weekends) to avoid disruption to peak hour traffic. Pointers on current best practice are set out below.

Summary of Good Practice on traffic

Planning Authorities should :

- encourage alternatives to road traffic especially onsite between an excavation and processing plant;
- consider the need to agree or specify planning conditions relating to the :

- site entrance, e.g. which way vehicles can turn,
- provision of signposting,
- sheeting of lorries before leaving the site,
- provision of sheeting bays,
- provision of information and instructions to drivers,
- provision of adequate wheel / vehicle washing facilities
- cleaning of roads when deemed necessary by the Roads Authority
- hours of operation (vehicles arriving and leaving the site)

- liaise with the Roads Authority to limit the size, weight or axle loads of vehicles using particularly difficult roads,
- consider the construction of dedicated haul roads in relation to large scale proposals

Operators should :

- seek alternatives to road haulage from excavation to processing plant or depot e.g. conveyors.
- seek alternatives to longer distance road haulage e.g. rail
- avoid sensitive areas and the use of large vehicles in narrow winding roads by agreeing routes,
- require their drivers and others to use agreed routes, use washing facilities and sheet their vehicles where appropriate,
- offer a legally binding agreement on matters that cannot be satisfactorily covered by planning conditions.

See page 29 for ongoing research which will facilitate the production of a further Annex to this PAN .

Blasting - Vibration, Overpressure and Flyrock.

33. The Explosives at Quarries Regulations 1988 were introduced in January 1990 accompanied by an Approved Code of Practice (ISBN 0 11 8854623). These Regulations take into account modern blasting practice and set out particular duties for the quarry owner and manager. One of the primary objectives is to reduce the fly rock from blasting activity. These Regulations and

Codes of Practice are not exhaustive and only set out good blasting principles that should be adhered to in quarry blasting.

34. Blasting at surface mineral working gives rise to a number of effects :

- vibration; the levels of vibration generated by mineral workings are well below those required to cause structural damage to properties. However, vibration transmitted through the ground and pressure waves through the air ('overpressure') shake buildings and people and may cause nuisance. The effects of the two factors are difficult for even an expert to distinguish without instrumentation. However, the pressure wave may arrive after the ground vibration by up to 2 seconds over a distance of 1 km. The perception of both factors is likely to be stronger inside a building than outside,
- audible noise, because it is part of the pressure wave, occurs at the same time as overpressure. It may be augmented by the rattling of windows etc., caused by the overpressure,
- flyrock, i.e. fragments of rock propelled into the air by the explosion. This is clearly potentially dangerous to people and property both inside and outside the site. Flyrock, in the context of this PAN, always means that crossing the site boundary,
- dust,
- fumes, which may be noticeable in confined spaces.

35. The levels of overpressure and noise can be significantly affected by meteorological conditions. Areas in which levels are enhanced will generally be down-wind. In addition noise can be affected by a range of weather conditions, e.g. temperature inversion or low cloud can concentrate / direct the effects to specific areas around the blast site. Once a blast is set up and the holes charged, firing must proceed under safety regulations, irrespective of the weather conditions. There is also a range of weather conditions which can increase overpressure effects. Because of these factors it will be difficult to define and enforce appropriate planning conditions

36. The need for blasting varies significantly amongst the types of mineral being worked e.g. for sand & gravel, clay and peat working it is unlikely ever to be required. For coal working it may be necessary to loosen or 'heave' the rock overburden or rock strata between seams. Most of the energy stays in the ground because the rock strata is only loosened. In hardrock quarrying it is necessary not only to loosen the rock but to fragment and move it away from the quarry face. Because of this, more energy is lost to the atmosphere than with 'heaving' so the overpressure may be greater. The basis of good blasting design is to achieve the desired degree of fragmentation in the rock safely and economically.

37. As a result of these and other differences in the blasting of coal overburden and rock, less explosive per unit of volume is used for coal than hardrock and levels of ground vibration tend to be higher for coal for a given explosive charge and distance. The converse is true of peak overpressure, i.e. it is greater for hardrock quarries than opencast coal workings for a given charge and distance.

38. Planning conditions should relate, where practicable, to performance i.e. they may set limiting levels for ground vibration. However it is not advisable to do

the same for overpressure as this would imply a degree of control by the operator that is not in fact possible, due to compounding meteorological effects. Use of good blasting practice is the responsibility of the operator and its oversight that of the Health and Safety Executive (HSE). The operator may have more economical ways of achieving the same end or may be asked to do things that create an unsafe situation. The HSE strongly deprecates conditions which set limits on, for example, the charge per hole, because they may lead to unsafe practice and even the specification of a maximum instantaneous charge may cause an operator to work in an unfamiliar way and lead to an error. It should be noted that an operator will always be concerned with maximising the efficiency of a blast, i.e. directing maximum energy into breaking or loosening rock and therefore minimising lost energy, i.e. overpressure. A Glossary of terms associated with blasting and pointers on current best practice are set out below.

Glossary of Terms associated with blasting

Collar	The opening of a borehole
Toe	The bottom of the borehole
Priming & detonation which where	Primer is a package of explosive used to initiate other explosives or blast agents and includes a detonator (or detonating cord to which a detonator is attached). Detonation a charge is passed to the explosive causing it to react.
Decking of Charges	The division of the explosive in a single drill hole into two or more separately detonated charges to reduce the maximum instantaneous charge (MIC).
Secondary Blasting explosive can noisy and uncertain	The initial blasting may leave lumps of rock which are too large to be handled; then be attached to these lumps to make them smaller. This can be a operation. Also called ' plaster blasting '.
Stemming	An inert material used to confine or separate the explosives loaded into a borehole.
Surface Detonating Cord itself loud sharp noise.	Explosives can be detonated electrically; sometimes a cord is used which is in explosive. It burns so quickly that unless covered, makes a very

Summary of Good Practice on blasting

Planning Authorities should consider the need to agree or specify planning conditions relating to :

- the levels of ground vibration and overpressure to meet the 95% confidence level monitored over an appropriate period
- the prohibition of the use of surface detonating cord and plaster blasting,
- the control of flyrock, after advice from the Health & Safety Executive.

Operators should :

- carry out face surveys
- design blast, including the size of MICs and detonating sequence, to minimise environmental effects,
- check the setting out of holes and record any deviations,
- revise the design, if necessary,
- use correct stemming,
- monitor the blast to provide feed-back for future blast designs.

To limit ground vibration :

- minimise MICs e.g. by using decked charges,
- take special care in unusual situations e.g. in corners.

To minimise overpressure :

- avoid use of surface detonating cord and secondary blasting where possible,
- minimise the area of heave and the total charge,
- avoid blasting in adverse weather conditions when feasible, especially when the wind is towards

sensitive premises and there is low cloud.

To avoid flyrock :

- ensure that the design is thorough and follows the Quarries (Explosives) Regulations 1988,
- move fragmented rock horizontally rather than vertically,
- use toe rather than collar priming / detonation,
- use screen nets when in any doubt.

See page 29 for ongoing research which will facilitate the production of a further Annex to this PAN .

Noise.

39. The research report "The Environmental Effects of Noise from Surface Mineral Working" prepared by WS Atkins Engineering Sciences Ltd was published by HMSO in 1990. The detailed technical aspects of 'noise' are discussed in Annex A to this PAN.

40. The potential effects of noise beyond the site boundary of a surface mineral working are to :

- distract or annoy; a noise does not have to be loud to be intrusive, it may be different in character and identified as coming from an unwelcome source;

- mask desirable 'noises' e.g. conversation, lost opportunity to sit in the garden or the effort of close concentration

- prevent or disturb sleep;

- disturb animals and birds that can also be affected, particularly by sudden noises.

41. The prediction of noise levels using the methods of BS 5228 are reasonably accurate, especially when using the specific measured noise values of the proposed or actual items of plant and equipment. In the case of many larger operations predictions can make use of computer models. Weather conditions affect the propagation of noise. Calm weather often means a low background noise level and a uniform propagation in all directions. A light wind enhances levels downwind, up-wind there can be significant reductions. With high winds noise propagation is variable; the background levels are likely to be higher and may mask other sources of noise.

42. Noise is often identified as one of the main problems associated with surface mineral workings, although research suggests that the actual problem of noise can be less intrusive than residents expected it to be. The construction of baffle mounds and soil stores are among the noisier operations that occur in the initial phase. Because noise screens are usually close to noise-sensitive properties, their construction can create considerable nuisance. This highlights the need for the developer to explain to the public the sequence of events and the timetable for particular site works. Other sources of noise include :

- reversing warning signals (often considered as "the most significant additional noise intrusion over the last few years"),

- the squealing of dry caterpillar tracks and the operation of draglines, dumpers, drills and pumps at night,

- operation of fixed plant.

Pointers on best practice are set out below.

summary of good practice on noise.

Planning authorities should consider :

- the ambient noise, predicted likely future noise levels, planning policies and the duration of the noise; discuss any limits, attenuation methods and monitoring with the local Environmental Health Officer.
 - the need to agree or specify planning conditions relating to :
 - noise limits at "noise sensitive properties", etc., for various periods of the day,
 - the provision of monitoring equipment,
 - limits on hours of operation,
 - noise control measures, e.g. a lower noise limit for the first hour of working,
 - adherence to a code of practice
- or in the last resort, usually for particular activities :
- noise emissions from plant temporarily working close to houses,
 - types of plant and / or numbers of items in use simultaneously.

Operators should :

- discuss noise pre-application with the planning authority and demonstrate in their application that the proposed conditions can be met,
- plan ahead and ensure that :
 - noise has been taken into account in the layout, and the nature and sequence of working,
 - night working near sensitive areas is avoided where possible,
 - screening is part of the design, e.g. by bunds and working face,
 - the quieter of the methods or plant available is chosen,
 - especial care is taken with reversing alarms,
 - haul-roads are screened and without severe gradients,
 - location of on-site loading plant to minimise noise,
 - noise emissions from off-site traffic is minimised.
- ensure that site management and operatives are aware of the need to run the site as quietly as possible,
- check the noise characteristics of plant before use and periodically thereafter, where appropriate retro-fit noisy plant, ensure good operation and maintenance,
- make no unnecessary noise and reduce noise emissions, e.g. :
 - minimise height which material drops from lorries or plant,
 - minimise distance between loading and emptying dragline buckets,
 - reduce clanging of dragline buckets and chains by careful operation,
 - use rubber linings in chutes, dumpers, trucks, transfer points
 - clad plant and ensure that the cladding is kept free of holes,
 - start items of plant one by one, possibly behind mounds,
 - switch-off equipment when not in use, avoid unnecessary revving of engines,

 - keep noise control hoods closed when machines are in use,
 - keep lorry tailgates closed where possible,
- as a last resort, reduce the propagation of noise, by the use of :
 - temporary bunds,
 - portable screens.

Dust.

43. The Government sponsored research report "The Environmental Effects of Dust from Surface Mineral Workings" prepared by Arup Environmental was published by HMSO in February 1996. This work will facilitate the production of an Annex to this PAN in due course.

44. Dust is considered to be any solid matter emanating from surface mineral working, or from vehicles serving it, which is borne by the air and can range in size from 1 - 75 microns (μm). It can be emitted from a stack as a plume or it can be picked up by the wind from the ground, the surface of a road or a stockpile. Depending upon their chemical composition, the particles can be chemically active e.g. limestone, or effectively inert, e.g. sand. Their colour varies from black, e.g. coal, through brown to white e.g. cement or chalk. The finest particles, i.e. less than $10\mu\text{m}$ in diameter, will be respirable.

45. The main potential effects of dust are :

- visual; dust plumes, reduced visibility, coating and soiling of surfaces (including drying clothes) leading to annoyance, loss of amenity, the need to clean surfaces,

- physical and / or chemical contamination and corrosion of artefacts leading to :

electro-
and
medical facilities,

- ° a need for cleaning
- ° mechanical or electrical faults, e.g. with computers, mechanical devices,
- ° abrasion of moving parts,
- ° soiling of finished products, spoiling paint or polish finishes,
- ° contamination of laboratory, quality control, standards room

agricultural
products,

- coating of vegetation and contamination of soils leading to changes in growth rates of vegetation and possibly reduced value of

- contamination of water courses.

46. Based on current evidence, it seems unlikely that dust of respirable sizes could be present off-site in concentrations sufficient to affect health. The Waller report suggests however that, in some cases, larger non-respirable particles could irritate the eyes, nose and throat of those exposed. The possibility of the effects of dust on health should be considered by planning departments in collaboration with pollution control authorities in the circumstances of the particular developments proposed. Pointers on best practice are set out below.

summary of good practice on dust.

Planning Authorities should :

- liaise with the pollution control authority under the Environmental Protection Act,
- consider the need to agree or specify planning conditions relating to the :
 - layout of the site, design of stockpiles,
 - containment of conveyors and processing plant and dust collection equipment,
 - use of bowsers, sprays and vapour masts on haul-roads, stockpiles, transfer points,
 - design of material-handling systems, drop heights, wind guards, loading points,
 - use of binders on haul-roads and stockpiles (after consulting SEPA)
 - limiting levels of dust measured in a specific way; provision of monitoring facilities.

Operators should :

- minimise the creation of dust by planning and design, e.g.
 - use of conveyors rather than haul-roads,
 - locate haul-roads, tips and stockpiles away and down-wind from neighbours,
 - create 'sensitive zones' within which activities are limited,
 - layout and construct stockpiles, tips and mounds to minimise dust creation; use gentle slopes and avoid sharp changes of shape,
 - use crushing and screening plant within its design capacity,
 - minimise the height of fall of material,
 - use appropriate chippings for stemming,
- control the escape of dust, e.g. :
 - enclose conveyors, chutes, process plant, stockpiles,
 - provision of dust removal system for the plant,
 - use sprays, mists, microfoam or foam,
 - fit outlets with cyclones, wet-scrubbers, filters
 - insist on good maintenance,
- minimise dust pick-up by wind, e.g.
 - compact, grade, surface and maintain haul-roads,
 - fit dust extractors, filters and collectors on drilling rigs,
 - use mats when blasting,
 - restrict dust-making activities to sheltered areas,
 - use wind-breaks / netting screens / semi-permeable fences,
 - limit drop of falling material,
 - fit wind-boards / hoods to conveyors / transfer points,
 - reduce speeds and limit movement of vehicles, use upswept exhausts,
 - use water bowsers, sprays or vapour masts,
 - spray exposed surfaces e.g. unsurfaced haul-roads, stockpiles, with binders (consult SEPA),
 - vegetate exposed surfaces e.g. overburden mounds, with quick growing plants,
 - limit spillage; facilitate the removal by the use of hard surfaces,
 - sweep haul-roads and other dusty surfaces,
 - shake-off dirt from vehicles, provide vehicle washing facilities,
 - provide a surfaced road between washing facilities and site exit,
 - use closed or sheeted vehicles carrying dry material,
- remove dust from the atmosphere, e.g.
 - use fine water sprays / mists, with or without additives,
 - use trees or shrubs around the site,
- temporarily suspend the activity or operation, if the creation of dust cannot be avoided.

Visual Intrusion

47. Mineral working need not necessarily result in the long term change in landscape. Where sufficient quantities of fill are available, it is usually possible to return to the original landscape. However, the effects of surface mineral working on the landscape are arguably one of the most controversial aspects associated with such developments. Because of the diversity of local landscapes, the impacts vary in their nature. Equally, the methods of working and subsequent restoration can in time ameliorate the impact. At worst, however, the damage to the landscape can be permanent. Thus mineral working can :

- remove some features of the existing landscape, e.g. a hill.
- introduce a feature into the, e.g. a quarry face,

48. Landscape change and visual intrusion are accordingly major issues particularly at the planning application stage and authorities and operators need to address the potential impact both on the local environmental setting and in the wider landscape to see whether the topography and vegetative cover of the area can reasonably absorb the proposed development without significant diminution of its perceived qualities. Clearly the identification of measures to ameliorate the effects is a key part of the planning consideration. Over the years the approach has become more sophisticated. However, there remain important judgements to be made about impacts throughout the various stages of the proposed working, the way the extraction is to be progressed and the specific measures proposed to ameliorate the effects. Thus the main perceived 'damage' is often inherent in the planning permission which may only be partially ameliorated by subsequent treatment.

49. On a smaller scale, but no less significant, height limits sometimes result in overburden mounds having flat tops that are unsightly and result in poor run-off. Although screening mounds may generally be better than a view of the mineral working, they may be seen as alien features in the landscape, especially if obviously man-made. Screening mounds and noise bunds are sometimes regarded as unsightly in themselves. They may have a useful function in relation to short term operations such as opencast coal working, but alternative measures may be preferable where the period of working is likely to be over a longer timescale e.g. hard rock quarries. The visual impact of mounds can be reduced by vegetation. This should be a normal requirement for any mound that is likely to remain for more than a couple of years. Vegetation has the added benefit of preventing erosion and loss of material.

50. A freshly exposed rock face is noticeable by contrast with its surroundings and a break in the skyline is particularly obvious. Where possible the working should not break the skyline, either as a result of removal of the top of a hill, or from the placement of mounds or machinery. The size of the excavation need not of itself be a problem but it could be if it is out of scale with its surroundings. Measures to alleviate the visual impact in these circumstances are much more difficult to identify and thus the topography of the area may become a determining factor in deciding on the acceptability of a proposal. Vehicles on access roads and especially processing plant can be visually intrusive. Lights in workings frequently give rise to complaints due to their adverse effects on amenity, the glare they cause and the distraction and danger to traffic. These are additional factors to be taken into account in the overall landscape appraisal.

51. Landscape considerations are a key aspect in deciding the acceptability of surface mineral workings and if approved require detailed monitoring and management arrangements to ensure agreed measures to mitigate impact are

implemented in the most effective way. Pointers on best practice are set out below.

Summary of good practice on visual intrusion

Planning authorities should consider the need to agree or specify planning conditions relating to :

- the sequence of working,
- progressive restoration procedures,
- preplanting and planting requirements,
- the siting of plant and its visibility,
- geometrical screening and the nature of landscaping,
- the location and shape of soil and overburden mounds and waste heaps,
- the use of conveyors,
- the treatment of haul-roads,
- soil handling, stripping, storage and re-instatement of soils and associated remedial treatments.

Operators should :

- have a positive approach to the landscape,
- plan ahead for :
 - ° planting and management
 - ° direction of working
 - ° progressive restoration
 - ° siting of processing plant,
- plant in the first available season following planning permission
- seek to agree landscaping requirements with the planning authority and only depart from them by agreement
- ensure that the site managers have, and are seen to have, the will to produce a visually acceptable operation,
- have a 'good-housekeeping' policy, keep the site tidy and well maintained, including paintwork.

Groundwater

52. The principal changes in the groundwater regime which may arise are :
- possibly
- the removal of topsoil, overburden and mineral, and replacement, in combination with imported materials, which may change :
 - ° the quality of the infiltrating water recharging the aquifer,
 - ° the timing and relative rates of aquifer recharge and surface water flows,
 - dewatering of workings or diversion of surface water courses that may, in taking water from one place and discharging it in another :
 - ° change the supply of water to abstractions and spring-fed surface water courses and wetlands,
 - ° lead to settlement of the ground surface, buildings etc.,
 - ° change the quality of the water before discharging it,
 - discharges may cause physical and chemical contamination.

Many of the above changes are inherent in a planning permission allowing mineral to be extracted, but in many cases the changes can be ameliorated by appropriate operational practices. Pointers on best practice are set out below.

summary of good practice on groundwater

Planning authorities should :

- Have regard to SEPA policies on groundwater protection at the inception and formulation or modification of relevant development plans,
- after close consultation with SEPA, consider the need to agree or specify planning conditions, to support the protection of aquifers, relating to :
 - ° delaying operations until monitoring data are available to demonstrate the absence of problems or allowing precautionary measures to be agreed,
 - ° nature, area and depth of working,
 - ° arrangements for recharge,
 - ° means to minimise problems from storage of oils / chemicals,
 - ° monitoring of quantity and quality of pumped flows from the site,
- consider the need to seek legally binding agreements regarding :
 - ° monitoring off-site, e.g. of groundwater levels and abstractions,
 - ° compensatory measures, e.g. for abstraction likely to be adversely affected,
 - ° long term drainage and / or water quality problems.

Operators should :

- consult SEPA at an early stage,
- monitor base-line before design and planning application,
- define and assess the hydrogeological regime pertaining to the site and its environs,
- monitor during operations :
 - ° ground water levels,
 - ° neighbouring abstractions,
 - ° quantity and quality of recharge flows,
 - ° neighbouring land, crops, ecology for incipient problems,
- plan to minimise potential problems as well as to meet SEPA or planning authority conditions,
- consider not dewatering or, if unavoidable, dewatering progressively in cells and reduce the inflow of water by sealing,
- leave effective filter layers between aquifers,
- use codes of practice for temporary spoil mounds and slope stability,
- provide for recharge of aquifers,
- bund waterlogged archaeological sites and provide water supply,
- provide impervious bases and bunding for oil / chemical stores and wet-process plant,
- avoid seepage of contaminated run-off through floor of quarry,
- encase polluting backfill in impermeable material or dilute it with inert fill.

See page 29 for on going research which will facilitate the production of a further Annex to this PAN.

Surface Water

53. The main potential effects of on the surface water regime are to :
- alter the surface over which water flows,
 - change the pattern of surface water flows i.e.
 - reduction because of lack of recharge from groundwater or seepage from the stream bed or decreased catchment ; or
 - increase because of discharge or increased catchment which may increase scour and be too great for points of limited capacity downstream,
 - change the quantity and physical and chemical quality of those flows.

54. The number and seriousness of problems vary significantly with the depth of working compared to the water table, the extent of dewatering, the nature of the mineral and overburden and the method of working. The main problems are changes in surface water flows and their contamination by particulate matter. Pointers on current best practice are set out below.

summary of good practice on surface water

Planning authorities should :

Consider the need, after consultation with SEPA as statutorily required, to agree or specify planning conditions relating to the :

- siting and landscaping of flow balancing reservoirs,
- siting of settlement lagoons and disposal of silt,
- siting of overburden mounds and waste heaps,
- provision of hard standing and bunding of storage / process areas,
- diversion of water courses,
- provision of monitoring,
- restoration contours and proposed after use.

Operators should :

- effects
the
site
and
:
water,
return
waste.
- consult SEPA and SNH (with respect to SSSIs) about ways of avoiding or minimising the effects of changing the water table, polluting the water course or otherwise changing the hydrology of the area if this would otherwise impinge on any neighbouring SSSI and especially if the proposed site has hydrological links with a wetland area,
 - consult SEPA about any alterations to existing surface water courses, nearby river corridors and any fixed discharges,
 - undertake a baseline survey and establish a monitoring system,
 - provide an appropriate drainage system to keep surface water out of workings,
 - design water management system, including dewatering flows, in an integrated way covering:
 - flow balancing by sumps and pumping,
 - control of particulates by settlement in sumps and lagoons,
 - control of water chemistry
 - oil and scum removal,
 - use of water in processing plant and treatment of effluent including vehicle washing
 - containment of spillage from storage and processing areas,
 - use of water in dust control
 - use of appropriate water to counteract groundwater lowering, e.g. in nearby pools,
 - regular cleaning and maintenance of water system,
 - limit erosion by :
 - rapid vegetating exposed areas,
 - vegetating, physically protecting the surfaces of overburden, soil or waste mounds,
 - progressively restoring working areas,
 - lining water courses,
 - design sumps and lagoons to cope with all conditions, including agreed or specified storm periods, by ensuring that :
 - they are big enough,
 - scouring is avoided,
 - the retention time is adequate, if necessary, enhancing settlement by use of agreed (with SEPA) flocculants or mechanical means,
 - leave adequate margins around water courses, river corridors and other sensitive areas,
 - minimise obstruction of flood flows by inappropriate placing of mounds of overburden or waste.

See page 29 for ongoing research which will facilitate the production of a further Annex to this PAN.

Mineral Wastes

55. Mineral wastes are considered as any excavated material not removed from the site for a useful purpose; it can be considered as either 'temporary' or 'permanent'. 'Permanent' waste will be regarded as that dumped outside the excavation and which will remain there. 'Temporary' waste is immediately or ultimately backfilled or otherwise utilised within the excavation.

56. The main effects of waste are to :

- occupy space within or outside the working area,
- be visible,
- be a source of dust,
- be a source of sediment and other contamination in run-off,
- affect the surface water regime, e.g. by changing surface water flow in a flood plain.

57. Sand & gravel workings do not produce much, if any permanent waste; some produce volumes of clay and silt. Silt from the settling ponds may be used during restoration. Granite and other hard rock may produce permanent waste especially in winter when clay sticks to stone and makes it unsaleable. Mineral wastes may have a role as soil forming materials where conventional sources may be unobtainable. Large volumes of temporary waste from overburden are produced by opencast coal extraction. Whilst top- and sub-soil mounds can have some of the effects of wastes, they are irreplaceable materials for restoration and should be carefully conserved and not regarded as waste. Pointers on current best practice are set out below.

summary of good practice on mineral working waste

Planning authorities should consider the need to agree or specify planning conditions relating to :

- the location of waste heaps both temporary and permanent,
- means of controlling of leachate and run-off,
- the height and shape of waste heaps,
- surface treatment, e.g. vegetation,
- progressive restoration, preferably within the workings,
- the period within which temporary heaps must be removed.

Operators should :

- minimise the production of waste,
- try to find a use for waste e.g. landscaping,
- site waste heaps within workings wherever possible,
- use waste as part of a programme of progressive restoration,
- landscape and vegetate waste heaps as soon as possible,
- site waste heaps having regard to potential effects upon :
 - ° the landscape,
 - ° groundwater,
 - ° surface water courses,
 - ° the flood regime,
- ensure that waste with a physical or chemical contaminant is encased, e.g. by clay, to prevent escape to the atmosphere or be leached to aquifers or surface water courses, store top- and sub- soil and overburden, in a manner that is compatible with ultimate restoration.

See page 29 for on going research which will facilitate the production of a further Annex to this PAN.

Severance and Footpaths

58. Severance can be direct as a result of cutting roads and paths and by diversions making journeys longer and less useful. Severance can also be the result of more subtle effects. Existing paths may be made less attractive than they were due to dust, noise or by enclosure between fences. As a result they may become less frequented.

59. The results of severance are to :

- remove access to leisure / informal facilities, e.g. paths for walking the dog, meadows for enjoyment of flora and fauna,
- make access more difficult, e.g. by having to make detours to visit neighbours,
- cut-off animals from feeding areas.

Pointers on best practice are set out below.

summary of good practice on severance

Planning authorities should consider the need to encourage or agree or specify planning conditions relating to :

- those routes which are to be retained,
- those routes to be diverted, pointing out the necessary statutory procedures,
- the treatment of these routes :
 - ° physical, e.g. surface, stiles,
 - ° landscaping,
 - ° signposting,
 - ° maintenance,
- the provision of compensatory measures where no alternative route is available.

Operators should :

- understand the prior use of their site by people and wildlife,
- retain existing facilities as far as possible,
- otherwise make alternative provision where necessary and practicable,
- maintain the availability and quality of these alternatives, in terms of :
 - ° landscaping
 - ° surface
 - ° stiles
 - ° signposting
 - ° fencing
 - ° safety,
- provide compensatory facilities where necessary.

conclusions

60. Generally, surface mineral workings is contentious because of potentially significant impacts on a wide range of environmental issues. Great care and detailed analysis backed up by close monitoring of approved developments is essential. The industry has demonstrated a desire to carry out its operations responsibly but still important judgements are required of planning authorities. Controlling the environmental effects of surface mineral working is a continuous three stage process:

pre- and application stage

- identifying the likely environmental effects, consideration of amelioration measures and acceptability on planning grounds.

post approval (operational stage)

- monitoring the operation for compliance with approved development and conditions. Periodic review of conditions and updating to current environmental standards. Progressive restoration where specified.

post operational stage

- completion of restoration, aftercare and progress to approved afteruse.

61. Best practice clearly points to the need and benefit of a continuing dialogue between the planning authority and the developer, and where appropriate, the local community so that there is a good understanding of what is being proposed, how it is to be managed over the life of the project and what the long term prospects are when the operational stages are complete. Good practice is continuing to develop and the aim is to ensure it is applied where ever appropriate.

note

62. Enquiries about this PAN 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).

selected references

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Government Research in Preparation

Environmental Impact of Traffic Associated with Mineral Workings : Entec UK Ltd [to be published shortly]

The Environmental Effects of Production Blasting from Surface Mineral Workings : Vibrock Ltd [to be published early 1997]

Environmental Effects of Surface Mineral Workings on Ground and Surface Water : Symonds Travers Morgan : [just started, due for completion 1998]

The Use of Soil Forming Materials in Mineral Working Restoration and Other Land Reclamation : Wye College / Forestry Commission : [for completion early 1998].