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LANDFILL AND THE WATER ENVIRONMENT

NRA POSITION STATEMENT



NRA

National Rivers Authority

INTRODUCTION

In common with a number of north european countries the United Kingdom has adopted a hierarchical approach to waste management which places an emphasis on the reduction in waste volumes that ultimately have to be landfilled. The hierarchy requires in order of priority:-

- Waste minimisation (reduce waste production)
- Waste recycling (reuse of various waste streams, composting)
- Waste conversion to energy (incineration for heat generation)
- Waste pretreatment (incineration, shredding)
- Waste to landfill (final storage)

The NRA strongly supports the philosophy behind the approach of waste minimisation, recycling and conversion to energy as this must lead to a reduced threat to water quality in the longer term. Although the government intends to introduce a tax on waste deposited in landfill, there are currently no significant legislative or financial incentives in place to drive a strategy based on the hierarchy. It is therefore inevitable that landfill will remain the primary means of solid waste disposal in the UK for the foreseeable future. This paper presents an overview of some of the issues that relate to landfill and the protection of the water environment and describes the way in which the NRA wishes to approach the activity in its role as statutory consultee under the Environmental Protection Act 1990. A number of internal guidance notes on specific issues relating to landfill and waste management in general are in preparation by the NRA.

The wastes that pose most threat to the water environment are those that degrade or leach to produce water soluble products. Examples are domestic waste, commercial wastes and various industrial wastes. All controlled waters can be placed at risk from landfills but groundwater tends to be the most vulnerable, due largely to the practice of infilling mineral excavations below ground level. It is this potential risk of water pollution that gives the NRA a strong and clearly defined role in waste regulation which has been recognised by central government.

LEGISLATION AND POLICY

CONTROL OF POLLUTION ACT AND ENVIRONMENTAL PROTECTION ACT

Since May 1st 1994 the disposal of waste onto land has been regulated under Part II of the Environmental Protection Act 1990 (EPA). Before this date, and since 1976, regulation of waste operations was under Part I of the Control of Pollution Act 1974 (COPA). The NRA is a statutory consultee of Waste Regulatory Authorities (WRAs) with respect to the issue, modification, subsistence and surrender of licences that are a prerequisite to the operation of waste management facilities handling controlled wastes. It has a virtual right of veto over the issue and surrender of waste management site licences. In the event of a disagreement between the WRA and NRA the matter must be referred to the Secretary of State for determination. Perhaps the most significant change in legislation relates to the need to demonstrate waste stability after site completion such that the site no longer poses an environmental threat (Certificates of Completion). Another influential change relates to the Duty of Care provisions which have imposed on waste producers and carriers the requirement to ensure that wastes are handled with due regard to the environment and are deposited at sites licensed to receive them. Responsibility for waste management is therefore divided more equitably in the chain of custody.

TOWN AND COUNTRY PLANNING LEGISLATION

Planning permission, or its equivalent, is necessary before a licence can be issued. The NRA is also consulted on planning applications but, in contrast to waste management licence consultations, its views can be disregarded by the Planning Authority.

Applications for larger landfills are required to be accompanied by an Environmental Statement which is a formal statement arising from the Environmental Assessment process. Comprehensive statements include details of the proposed site engineering and operation as well as any predicted impact on the environment. Conditions on planning permissions and Agreements made under Section 106 of the Town and Country Planning Act 1990 (Obligations under Planning and Compensation Act 1991) have previously been considered necessary to ensure a degree of regulation of the completed operation. This is because under COPA the site licence only related to the operational phase of a waste disposal site. Under EPA, licences remain in place until the site is no longer considered to pose an environmental risk and hence controls under the planning legislation may not be so important in future. However, planning controls may continue to play a vital role in controls over closed sites in appropriate cases.

GROUNDWATER PROTECTION POLICY

The NRA has published a Policy and Practice for the Protection of Groundwater. The policy sets out the way in which the NRA intends to carry out its responsibilities in respect of the EC Groundwater Directive. This Directive effectively prohibits the direct or indirect discharge of listed substances to groundwater. The policy propounds the concept of groundwater vulnerability and encourages the establishment of new landfills preferentially in areas where groundwaters are least vulnerable (ie on Non-aquifer outcrops). It reinforces the need to contain wastes and manage them positively. Groundwater vulnerability maps associated with the policy are being prepared according to a phased programme between 1994 and 1999 and are a valuable tool in explaining the policy at a local level. The NRA will liaise with Planning Authorities and WRAs in the preparation of Waste Local Plans and Waste Disposal Plans respectively. It is hoped that relevant parts of

the policy will be incorporated into these documents. Advice in planning policy guidance issued by Government encourages the consideration of groundwater protection in drawing up Plans. (PPG 12 and PPG 23).

PROPOSED EUROPEAN LANDFILL DIRECTIVE

An EC Directive on landfill is in preparation. It will, when ratified, make containment of certain wastes a legal requirement and may eventually ban the intimate mixing of specific substances contained in industrial waste, and domestic wastes in the same landfill (co-disposal). This is a practice widely, and successfully, adopted in the UK. The leachate quality resulting from co-disposed wastes, and hence their potential impact on the water environment, has been shown to be no greater than for purely domestic waste which has been landfilled. With the introduction of improved waste management operational practices, leachate strength and pollution potential can be significantly reduced within decades. In contrast the deposition of industrial wastes in mono-disposal sites can lead to little change in their pollution potential over time and therefore should this practice become more common there will be a need for very long-term management of the residual risk. The NRA supports the practice of co-disposal in appropriate locations where this is carried out in a controlled manner and with adequate safeguards to prevent the escape of leachate.

IMPLICATIONS OF NEW LEGISLATION AND POLICY

The introduction of the provisions of the Environmental Protection Act, the Groundwater Protection Policy and the likelihood of an EC Directive on landfill will all influence the way in which landfill is carried out. The influences can be considered to require or encourage inter alia: groundwater protection, landfill aftercare provisions and engineered containment. These can then be translated into implications for practice with respect to landfill location, construction and operation. Each of these is considered in turn from an NRA viewpoint.

LANDFILL CONSTRUCTION

There has been a significant move since the late 1980s towards containing landfilled wastes in properly engineered sites. Although the impetus stemmed partly from the very real risks of landfill gas migration, an engineering approach to earthworks on landfill sites has been applied to the need to minimise leachate migration. Effective Quality Assurance (QA) and Quality Control (QC) procedures to ensure that construction standards are met is now a fundamental requirement, particularly where the risks are identifiably high.

However, it is recognised that the leakage of leachate can never be completely eliminated and that even with the most highly engineered sites some migration to groundwater may occur. Quantification of the risk this presents to water resources depends on many factors such as: the leachate quality; the degree and standard of engineering undertaken; the nature of the operational infrastructure and controls; the effective precipitation; the nature of the surrounding geological strata etc. A prescriptive approach to design, construction and operation is therefore not appropriate since the engineering requirements will vary according to the hydrogeological setting. The role of the NRA is to set out its requirements (eg water quality objectives) and for developers to

achieve these by whatever means. The use of impact and risk assessment techniques are a valuable aid in this respect. NRA and DoE are developing a standard methodology for use by regulators and operators alike.

One consequence of the Groundwater Protection Policy is to encourage the siting of new landfills away from vulnerable Major Aquifers. In areas that are less sensitive to groundwater pollution there may be little quarrying activity and attention will need to focus on alternatives to mineral excavations for potential sites.

Landraising is one option which has many attractions from the point of view of water pollution control:-

- a) wastes are placed further from groundwater (ie benefit of greater depth of unsaturated zone).
- b) engineering infrastructure is easier to construct and maintain (eg no quarry walls to line).
- c) any leakage of potentially polluting materials is more visible (eg escape of leachate at ground/waste interface not leakage from base at depth). Remedial action can therefore be taken more quickly, effectively and cheaply.
- d) leachate (and gas) migration through base and sides is less of a problem.
- e) site and cell layout can be designed to suit operations rather than the constraints of the pre-existing void

Many planning authorities regard landraising developments as visually intrusive and seek to direct waste disposal to the "restoration" of mineral voids regardless of the environmental disbenefits. The objectives of LPAs and the NRA may therefore often be at odds. However recent DoE planning policy guidance describes landraising as "an appropriate method of disposal". (PPG 23)

LANDFILL OPERATION

Current and developing landfill practice is to encapsulate wastes and seal them as far as possible from the surrounding environment. Although degradation of biodegradable wastes will undoubtedly occur, it will be very slow in such situations and time scales for stabilisation to occur will be very long (centuries). Even then the products of decomposition, such as ammonia, will remain to be flushed out. Perpetuating the polluting potential of our landfilled wastes is increasingly being considered an untenable practice and a consideration that each generation should be capable of dealing with its own waste production has widespread support in Europe. Interest in contaminated land problems over the past few years has raised the question of residual liabilities. Finance and insurance is more difficult to secure for activities where the risk is high or it cannot be realistically determined.

These considerations have been highlighted by the provisions of the EPA that require a waste management licence to continue in force for an indefinite period until the site is considered by the relevant WRA and NRA to no longer pose an environmental threat. At that time a Certificate of Completion can be issued. Sites that have taken significant quantities of degradable wastes are unlikely to be given such Certificates in any reasonable timescale. Therefore means of accelerating the stabilisation process will need to be found and implemented to avoid the problems of long-term liability.

Sites will have to be actively managed for upwards of 30 years *after closure*, a period that fits in with the "one generation" approach and also appears in the draft EC Directive with respect to post-closure controls. Leachate re-circulation will be required to provide optimal conditions in which methanogenic bacteria can thrive. Liquid addition may be required, particularly in some of the lower rainfall areas of eastern England. Because of this it is inevitable that greater quantities of leachate will be produced with the need to dispose of the excess. Therefore greater management controls over leachate will be necessary and a secure disposal route a prerequisite of new developments.

The options for disposal fall into three broad categories:-

- a) tankering away from site to a suitable treatment facility.
- b) disposal to the sewerage system, with or without pretreatment. (Trade effluent consent required from Water Company)
- c) on-site treatment and disposal to controlled waters. (Water Resources Act consent required from NRA)

For larger waste disposal sites the long-term tankering of leachate off-site is usually uneconomic and disposal to the sewerage system is the more usual option adopted. However, consent is required from the Water Companies who impose both volumetric and quality controls and are increasingly reluctant to accept difficult or unpredictable discharges.

Discharge to rivers, canals, lakes, etc. is rarely practised from active landfills due to the strict controls necessary to adequately protect the water environment and the still emerging technology associated with landfill leachate treatment. The tighter consents which the NRA would impose on such discharges are unlikely to be met with currently available treatment methods and management practice, at least for landfills where active decomposition of waste is proceeding (in the methanogenic stage). Where breakdown is substantially complete then leachate concentrations will be much weaker and so the application of systems such as reed bed treatment to older, completed landfills may become more acceptable as experience increases.

The establishment of purely industrial waste landfills or mono-disposal sites may give rise to leachates less amenable to biodegradation and therefore leachate treatment may be more difficult. As the degradation of such wastes may be uncertain the NRA will seek secure long-term encapsulation that may require even higher standards of engineering in order that they are isolated from the water environment.

The issue of Certificates of Completion will need to be considered on a site specific basis within broad guidelines. Locally based targets for leachate quality will relate to the surrounding groundwater or surface water quality and the perceived residual risk. An impact assessment will be necessary using site investigation data that will need to be as, if not more, comprehensive than that required before landfilling took place.

LANDFILL LOCATION

The Groundwater Protection Policy sets out a framework for the NRA, other regulatory bodies and the waste management industry to approach the siting of waste disposal facilities with a view to minimising the risk to groundwater quality. The containment of potentially polluting wastes and the recognised requirement for waste stabilisation will have other implications that may further influence site location.

The effect of active leachate management is to flush pollutants from the solid phase to the liquid, and ultimately the gaseous phase. The liquid phase poses the greatest threat of pollution to the water environment. Therefore a move away from dry entombment to controlled leachate generation and management can only take place with the recognition that such activities can be encouraged only in those areas where there is least risk to the water environment. Landfill sites where positive leachate management and accelerated waste degradation is practised will be more akin to sewage works in their complexity and pollution potential. They will therefore need to be more carefully located, not just in relation to hydrogeological criteria, but also in regard to the disposal of the surplus leachate load. This can either be discharged to the sewerage system or directly to the water environment after suitable treatment. If the latter option is to be considered it must be realised that on-site treatment to high standards, over extended time scales is technically difficult and potentially costly. Formal consent from the NRA will be required. Remote rural areas or locations close to small or sensitive watercourses will therefore be impractical as new site locations.

NRA POSITION AND APPROACH

- The NRA supports strategies that result in waste minimisation and recycling. It also supports the concept of pretreatment that results in less waste being landfilled or decreases its polluting potential.

A reduction in the amount of controlled wastes disposed of to landfill will decrease the pollution threat to water resources. Similarly pretreatment methodologies such as incineration are supported for their role in reducing the pollutant load to landfill.

- The NRA encourages the siting of new landfills away from vulnerable Major Aquifer areas.

Landfills located in areas where there are risks to groundwater or surface water resources will be required to be highly engineered and controlled so that pollution risks are minimised in both the short and long-term.

- The NRA will play a key role in the strategic planning process relating to landfill by supporting and contributing to waste local plans, waste disposal plans and waste company plans.

Planning Authorities and others will be encouraged to accept the principle of landraising where this is clearly the best option for the protection of the water environment.

- The NRA encourages early consultation on potential new landfill sites.

Early informal discussion is encouraged in order that inappropriate sites are not selected. The NRA will make any information they hold available to assist in the planning process. There may be a charge made for the provision of certain information.

- The NRA requires operators to present detailed leachate management and operational plans for individual sites and encourage the development of new technologies for leachate treatment.

Where appropriate NRA will seek opportunities to encourage waste stabilisation in a controlled manner.

- The NRA requires assessments to be undertaken, where appropriate, of the impact of proposed landfills on the surrounding water environment.

Standard methodology is under development by DoE/NRA and is expected to be available in 1995 for such assessments.

- The NRA requires existing landfills to be operated in accordance with modern practice and legal requirements and require adequate monitoring to enable the NRA to assess existing pollution and its future potential.

NRA will be reviewing with WRAs licences for all sites where there is a potential for a discharge to groundwater of List I or II substances. Monitoring standards for uncontained sites will need to be improved, where necessary.

- The NRA is undertaking Research and Development to improve its understanding of landfill processes and the behaviour and environmental fate of leachate.

The NRA has an ongoing programme of research, partly in collaboration with DoE, in this area.

- The NRA will only agree to the issue of Certificates of Completion where it can be demonstrated that no unacceptable residual risk of pollution to the water environment remains from the landfilled wastes.

Residual impact assessments will be required in most circumstances. General guidance given in Waste Management Paper 26A will need to be supplemented on a site by site basis depending on the specific risks relating to individual situations.

REFERENCES

PPG 12; Planning Policy Guidance; Development Plans and Regional Planning Guidance; DoE; 1992; HMSO.

PPG 23; Planning Policy Guidance; Planning and Pollution Control; DoE; 1994; HMSO.

Policy and Practice for the Protection of Groundwater; NRA; 1992; HMSO.

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HEAD OFFICE

Rivers House
Waterside Drive
Aztec West
Almondsbury
Bristol
BS12 4UD
Tel: 01454 624 400
Fax: 01454 624 409

LONDON OFFICE

Eastbury House
30-34 Albert Embankment
London SE1 7TL
Tel: 0171 820 0101
Fax: 0171 820 1603

ANGLIAN

Kingfisher House
Goldhay Way
Orton Goldhay
Peterborough PE2 5ZR
Tel: 01733 371 811
Fax: 01733 231 840

NORTHUMBRIA & YORKSHIRE

Rivers House
21 Park Square South
Leeds LS1 2QG
Tel: 0113 244 0191
Fax: 0113 246 1889

NORTH WEST

Richard Fairclough House
Knutsford Road
Warrington WA4 1HG
Tel: 01925 653 999
Fax: 01925 415 961



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Help the
NATIONAL RIVERS AUTHORITY
to protect the
water environment

If there is a pollution threat to watercourses or drains call the 24 hour national NRA Emergency Hotline on **0800 80 70 60**. Calls are free from anywhere in country, the NRA may be able to prevent the incident from becoming serious.

SEVERN-TRENT

Sapphire East
550 Streetsbrook Road
Solihull B91 1QT
Tel: 0121 711 2324
Fax: 0121 711 5824

SOUTHERN

Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD
Tel: 01903 820 692
Fax: 01903 821 832

SOUTH WESTERN

Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: 01392 444 000
Fax: 01392 444 238

THAMES

Kings Meadow House
Kings Meadow Road
Reading RG1 8DQ
Tel: 01734 535000
Fax: 01734 500388

WELSH

Rivers House/Plas-yr-Afon
St Mellons Business Park
St Mellons
Cardiff CF3 0LT
Tel: 01222 770088
Fax: 01222 798555



ENVIRONMENT AGENCY



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The NRA is committed to the principles of stewardship and sustainability. In addition to pursuing its statutory responsibilities as Guardians of the Water Environment, the NRA will aim to establish and demonstrate wise environmental practice throughout all its functions.

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