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Appraisal of Biffa's Application to Change Waste Types at Stewponey Landfill Site, Stourton

For and on behalf of

FIGHT LANDFILL ACTION GROUP STEWPONEY

September, 1998

Appraisal of Biffa's Application to Change Waste Types at Stewponey LFS

For and on behalf of **FLAGS** September 1998

Contents

Introduction and Summary

This report has been written on behalf of the FLAGS group in response to the planning application by Biffa Waste Management for permission to change the waste types and extend working at the Stewponey Landfill site, Stourton, Staffordshire. I have been employed by the FLAGS group to review the planning application and accompanying environmental statement, to make comments on the evidence provided by Biffa, and to present planning grounds for the refusal of the application. I am an independent 'environmental investigator' based in Banbury, Oxfordshire. I trained in the engineering industry before setting up my current business in early 1992. Since then I have been working across the UK as a consultant to community groups and small businesses in the fields of planning, waste management, sustainable development, pollution and risk assessment.

Section 1 of this report considers the application and the information contained in the environmental statement. Section 2 considers the important legal and procedural issues raised by the application, and section 3 contains a number of proposed reasons for refusal of this application, with supporting arguments. The points made in these sections are supported by more extensive evidence provided in the appendices (section 5). Section 4 provides a final conclusion, with recommendations should this application be refused or granted.

References to other documents are presented at the foot of each page. References to pages/paragraphs in the environmental statement are presented in the text in [square brackets]. The content of the report may seem over-simplistic at times. This is because the report has been written for the members of the local community as well as the officers of the local planning authority. It is therefore necessary to specify or explain terms, acronyms, etc., and provide a greater number of references.

Summary of report

There are clear land-use grounds why this application should not be permitted. The reasons for producing the application – ostensibly to ensure restoration of the site as soon as possible – cannot be considered valid when considered against the detrimental effects of changing the waste types permitted at the site.

Legal and policy overview

The environmental statement is more comprehensive than a number of others that I have reviewed recently – for example the inclusions of the relevant planning permissions and sections of development plans. However, in my view the information that is presented is only a partial investigations of the problems that the site would present to the local residents, and the environment, should permission be granted.

In our view there are clear reasons why this proposal for a change of waste types for restoration is inappropriate. But the important division that Staffordshire County Council must address itself to is the juxtaposition of the planning and pollution control systems. More importantly, what pollution issues are required by law to be considered by the planning

authority. Many applicants argue that issues relating to waste disposal, safety, health, etc., are all a matter for the pollution control authority – in this case the Environment Agency. We do not agree that this is factually or legally the case. In terms of a planning authority determining an application, the emphasis is often on the separation of planning and pollution control to the point where they are mutually exclusive. This is often justified by reference to the 'Gateshead' case. This is a misrepresentation of the issues that were the subject of that appeal. It was not the division of planning and pollution control which were at the core of that appeal, it was the Secretary of State's powers to intervene and reach a different conclusion.

A further issue arises with the consideration of waste issues. It is the one area of environmental law and planning where there is a legal requirement for the local planning authority to consider pollution issues as part of the '*relevant objectives*' of the Framework Directive on Waste. The Part 1, Schedule 4 of The Waste Management Licensing Regulations 1994 makes planning authorities the '*competent body*' for the taking of '*any specified action*'. The objectives are therefore considered to be 'obligations' albeit less specific than the 'obligations' imposed by the Articles of the directive. Paragraph 1.47 of Circular 11/94, Annex 1, paragraph 1.47 states:

> *"The general duty in paragraph 2(1) [of Schedule 4 to the 1994 Regulations] means that in exercising the specified functions authorities must always consider the objectives of the Directive and aim to determine decisions ... in line with them"* [emphasis added]

Insofar as the planning authority are a competent authority, they must be able to demonstrate the application of the relevant objectives. In terms of role, planning authorities assess 'damage' to interests of acknowledged importance. This of course gives them a more holistic view than the Environment Agency who can only consider what is before them in a waste license application. But beyond that, a planning authority has a much greater freedom to identify and definite 'harm' to interests of acknowledged importance than is indicated in paragraph 1.35 of PPG23.

In the case of the Stewpony site, we are not dealing with a fresh application – we are essentially changing the operation of an existing landfill. In this sense the site does have an established use to which members of the public would have relied on in making decisions regarding development or property purchases in the area. In terms of the legal obligations on the planning authority me must balance the effects that the new restoration scheme would have compared to the effects of the existing one.

In the mind of the applicant if the site is not completed using the existing waste types, within the existing time limit, then there appears to be committed some heinous offence. I do not think this is a credible argument. If this situation were to arise, then the planning authority could take enforcement action, but this is not a certainty. In terms of the Government's general guidance in the recent 'good practice guide' on enforcing planning control one of the automatic steps in any case would be to ask for a planning application. I do not believe that a longer timescale for restoration could be resisted since this has happened elsewhere. If we are to judge harm, then a delay in restoration will have very little consequence compared to a change in waste types.

Review of information supplied with the application

Despite the voluminous nature of the environmental statement there are a number of issues that I feel are not properly explained or commented upon. These are:

- The relationship of this application to national planning policy;
- The issue of need, and the practical effects of changing waste types;
- Geotechnical issues – in particular the current doubts about the safety of landfills;
- Traffic impact;
- The long-term future for the site, and the stabilisation of the materials in the site, and health issues.

These issues must be addressed, and adequate safeguards sought to remedy the problems identified in this report, before permission is (if ever) granted.

Evidence is being presented that the site is limited to 200 vehicle movements per day. This is not my understanding of the planning permissions (unless of course there are other legal agreements on this not presented with the environmental statement). The recycling centre is limited to 200 vehicles per day. However there is no numeric limitation on the deposit of waste in the landfill, or on the export of materials from the sand quarry.

There has been little consideration of the disamenity caused by litter blowing from the site. The issue of pests has also not been adequately dealt with. One particular concern are carrion feeding birds such as gulls, crows or starlings. These birds carry a number of harmful pathogens on their bodies and in their droppings, and there is anecdotal evidence from elsewhere in the UK that this has a harmful effect on farm livestock and the public.

The effects on amenity of landfill sites are known and foreseeable. Therefore the relevant sections of Planning Policy Guidance (PPG) No.23 should have been examined, and a case made to demonstrate that the requirements were complied with. No such case has been made. I am also not satisfied with the noise data produced in the environmental statement. The analysis in the environmental statement relies on the guidance of Minerals Planning Guidance (MPG) No.11. However the guidance in PPG24 is also relevant in the procedures or assessing noise impact.

There has been no evidence provided to demonstrate that the development of this site is necessary. Such an assessment has three themes to it: the actual need for disposal capacity; proximity; and a demonstration that this site is the '*best practicable environmental option*' (BPEO). Such assessments are now required as part of the 'sustainable' planning of waste disposal facilities. The recent change in emphasis within the field of planning and waste management is highlighted in paragraphs 13.13 to 13.16 of Regional Planning Guidance (RPG) No.11. Paragraph 13.17 of the RPG also stresses the need to reduce the environmental impact of waste developments, and to have regard to sustainable development objectives.

We must also consider the effect that a change in waste types will create. Biodegradable material will undoubtedly bring greater impacts from odour, landfill gas, leachate contamination and health impacts. I am not convinced that the site is suitable on the basis of its proximity to dwellings. In any case the expectation of the public would be that such a site,

highly polluting materials such as biodegradable materials. I am also concerned that the applicant has not specified the types of 'special waste' to be accepted at the site. This is an

the safety of the environment and public health.

The important balance we are seeking in the application is the ' ' the change in waste types will cause versus the ' ' for that change. There is no objective evidence provided with the application that the site is needed in terms of the assessment of capacity, proximity BPEO – hence no justification for the change in waste types.

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speed migration scenario. Pollutants would move slowly through the sandstone unless assisted by fissure flow through faults or
migration I envisage is flow along the erosion surface at the contact between the drift geology and the solid geology. This is where there will be the greatest change in leachate.

The theory of containment landfill is relatively new. Although it only became common in the

years). However recent experience in the USA and the UK has demonstrated that containment landfill is unreliable, and unsafe in use. Much emphasis is laid on the results of

seepage from the site. The parameters chosen for the '*Landsim*
In any case, the modelling of the site seepage has only taken place over a sixty year period.

I am very concerned that no detailed information has been given regarding landfill gas and leachate management. These can have serious land-use impacts such as noise, odour, as

controlled. In term of the 'point source' of polutants as flare or generating plant presents it

I do not consider that the information on traffic is satisfactory. There should be a full traffic impact assessment (TIAs set by the Institute for Housing and Transport.

common at a number of sites recently because of the shortage of quality inert materials for restoration, that contaminated soils will be used. There must be demonstrable safeguards on

of the condition that the site will be returned it.

I consider that the 60 year period for stabilisation, used in the environmental statement, is completely unrealistic. Given the thickness of the waste deposit, and using standard assessment methods, it is possible to demonstrate that the site will take at least 1,500 to 3,000 to reach full stability. This is a long-term risk to the residents of the area, and cannot be considered to be a 'sustainable' landfill. In any case, all landfill liners leak. This is accepted, albeit in private, by most people in the waste management industry. In fact there is a standard methodology to assess site leakage in Government guidelines on landfill construction. This demonstrates that leakage would be in the region of 28,000 litres of leachate per year while the site in operating normally, and at least 120,000 litres per year once the site is 'completed'.

In practice, the leakage through the base of the site in the early life of the landfill is not the only issue. After one to two hundred years the cap liner will begin to break down. At this state the site will receive a high infiltration from rainfall, infiltration will exceed seepage, and the site will fill up with water. If the basal layer does not rupture from a fluid pressure of 35 tonnes per square metre, then the fluid will begin to flow out from the side of the now cracking cap. This will inevitably cause environmental pollution.

An issue not discussed at all in the environmental statement is the effect of the landfill on the health of local people. There is mounting evidence that landfills have a definite and damaging effect on the health of those who live near them. This should have been considered by the applicant and evidence presented to demonstrate the scale of the risk.

When we consider the long term polluting potential of the site we have to remember that in depositing waste in holes we set in train a process lasting many thousands of years. As was stated in the Government's recent consultation paper on the revised UK Sustainable Development Strategy:

> "*We should never forget that decisions on matters like planning, or transport, or housing, are ultimately about the quality of life of communities and individuals. Past mistakes happened when decision-makers lost sight of that. We have to take decisions at the right level, and find ways to enable people to play a part in finding ways forward in their own communities.*"

Conclusions

It is my view that the permitting of this development, on the base of the evidence currently available in the environmental statement, would not be lawful. It would leave the planning authority open to challenge by the objectors to this development. Even if refusal were to cause a section 78 appeal, I believe that on the basis of the information presented in the environmental statement the reasons for refusal specified in section 3 of this report would be defendable.

This report, and its appendices, demonstrate many grounds as to why this development is unacceptable in the location chosen. Having considered the contents of the application and environmental statement **I recommend that this application is refused on the following grounds:**

1. **Development of this site would not be in accordance with the approved**
2. **Approval of this development, with the evidence currently available, would be**
3. **There has been no assessment to demonstrate that the management system at the site would be the '*best practicable environmental option*';**
4. **There has been no capacity assessment to demonstrate that there is a local or regional need for the site;**
5. **Approval of the development would present unknown risks to public health, the environment, local amenity and groundwater. The uncertainties regarding current national waste policies, and the safety of landfills, require that the precautionary principle is applied in this case.**

I do not believe that suggesting conditions is appropriate in this case. I do not believe that, in terms of the guidance in PPG1, the site is allowable even if conditions were applied. However, should the planning authority be minded to approve this development I would recommend to the local community that a judicial review is sought of that decision at the earliest possible date.

1. Appraisal of Application and Environmental Statement

This section presents a general review of the content of the application and environmental section.

1.1. General commentary

The environmental statement is more comprehensive than a number of others that I have sections of development plans. However, in my view the information that is presented is only the environment should permission be granted.

some subsequent appeal inquiries (both section 78 of the Town and County Planning Act statement only develops those issues that are favourable to the case of the applicant. Those geotechnical issues – are only given superficial treatment by the statement.

relating to the environment are not planning matters. This has not been the case in this material to the planning application. In my view, with some relatively minor exceptions, the planning authority. This matter is fully explained in section 2.1 below (‘
Obligations

Despite the voluminous nature of the environmental statement there are a number of which I feel are not properly explained or commented upon. These are:

- The issue of need, and the practical effects of changing waste types;
- Traffic impact;

  health issues.

identified in this report, before permission is (if ever) granted.

1.2. Evaluation of Planning Permissions and Planning Policy

The environmental statement helpfully contains the planning permissions that relate to the site. Extracts of 'relevant' development plan policies are also included. However there has been very little discussion of how this application relates to the wider body of national or regional planning guidance (this issue is developed in sections 2.1/2.2 below).

Evidence is being presented that the site is limited to 200 vehicle movements per day. This is not my understanding of the planning permissions (unless of course there are other legal agreements on this not presented with the environmental statement). The recycling centre is limited to 200 vehicles per day [Appendix 3]. However there is no numeric limitation on the deposit of waste in the landfill, or on the export of materials from the sand quarry.

The planning permissions present no limitation through conditions on the waste types permitted. However we would assume that the types of waste we would permit through the planning system are those which were fit for deposit in the site, having regard for local amenity, and the protection of the environment and human health. But there is no argument presented to support the need for additional biodegradable waste capacity other than the requirement to restore the quarry workings by a certain date, and the perceived 'need' for such capacity. The amenity implications, in terms of the benefits of the development weighed against the possible effects caused, are not presented as a series of land-use related arguments.

The problem about filling the quarry by a certain date is not itself an insuperable issue. There are many former quarry workings across the country where restoration has become compromised by the fall in inert waste arisings. Inert waste has not actually disappeared. The waste is being deposited as small-scale infill or land restoration operations as part of other developments, using waste license exemptions. This does not attract the inert waste landfill tax.

There has been little consideration of the disamenity caused by litter blowing from the site. This is a matter for waste licensing. However there is evidence from many landfills across the UK that current license controls may minimise, but do not prevent the escape of windblown litter across the surrounding area. This can be a hazard to local livestock, and a disamenity to local residents. The issue of pests has also not been dealt with. One particular concern are carrion feeding birds such as gulls, crows or starlings. In large groups these have a disamenity on the area because of their droppings. These birds also carry a number of harmful pathogens on their bodies and in their droppings, and there is anecdotal evidence from elsewhere in the UK that this has a harmful effect on farm livestock and the public.

The effects on amenity of landfill sites are known and foreseeable. Therefore the relevant sections of Planning Policy Guidance (PPG) No.23[1] (in particular, section 3 of that guidance) should have been examined, and a case made to demonstrate that the requirements were complied with. No such case has been satisfactorily made.

I am not satisfied with the noise data produced in the environmental statement. The analysis in the environmental statement relies on the content of Minerals Planning Guidance (MPG)

[1] Planning Policy Guidance No.23, 'Planning and Pollution Control', Department of the Environment July '94.

No.11[2]. However the guidance in PPG24[3] is also relevant. Apart from the fact that PPG24 post-dates MPG11, it also stresses a qualitative difference in noise sampling methods. MPG11 relates to British Standard (BS) BS5228 (essentially, noise assessment of open sites). PPG24 notes the use of BS4142 (noise assessment for mixed residential/industrial sites). There are important differences between the two standards, in particular the propagation of noise across soft ground, and the methods used to measure noise emissions. For example, it is not clear under what conditions the noise measurements were conducted – more especially whether or not the mineral workings were active at the time measurements were taken.

Finally, there is a general requirement that all development should attempt to be 'sustainable'[4]. There has been no sustainability assessment provided with this environmental statement. Although one could trawl through the statement to gain a certain amount of information for such a determination, there are two important pieces of evidence missing. Firstly, what is Biffa's general definition of what a '*sustainable landfill*' (in this respect, we could take draft PPG10[5] as a starting point). But more importantly we need information as to how this landfill will fit into the wider network of waste management systems, and why the addition of this capacity in this location will aid the attainment of sustainable development.

These issues can all be related back to planning policy guidance, and should have been openly discussed in the environmental statement in order to rebut any comments that might subsequently be made by the local planning authority or members of the public.

1.3. Waste Types, Need and Capacity

There has been no evidence provided to demonstrate that the development of this site is necessary. Such an assessment has three themes to it:

- Firstly, actual need for disposal capacity. This should be presented in terms of:
  - an assessment of the current landfill capacity in the area, with a demonstration that the site will meet national objectives on sustainable development (e.g., in terms of proximity) more effectively than other sites;
  - an assessment of the development plan provision for sites or capacity, with evidence that this provision is not adequate or will not be met;
  - an argument to demonstrate a shortfall in capacity given restrictions at other sites; or
  - an argument that there exists a need to contribute to regional self-sufficiency.

  I can see nothing in the environmental statement that properly argues for any of the above conditions.

[2] Minerals Policy Guidance No.11, '*The Control of Noise at Surface Mineral Workings*', Department of the Environment, April '93.

[3] Planning Policy Guidance No.24, 'Planning and Noise', Department of the Environment, Sept. '94.

[4] Paragraph 4, Planning Policy Guidance No.1, '*General Policy and Principles*', Department of the Environment, Feb. '97.

[5] Draft Planning Policy Guidance No.10, '*Waste Disposal and Management – Final Draft*', Department of the Environment, Transport and the Regions, March 1998.

- Secondly, proximity. The main determination of the proximity principle must be area from which waste will be sourced. No evidence is presented in the statement to indicate where the waste to be deposited in this site will come from. It is not clear if this site is intended to primarily serve Staffordshire, Dudley, Birmingham, Worcestershire, Shropshire, all of these five, or other areas still more distant. Proximity is an issue stressed in the Governments' sustainable waste strategy[6], and in draft PPG10.

- Finally, a demonstration that this site is the '*best practicable environmental option*' (BPEO). This is an assessment of the source of the waste streams, and for the major components of the waste streams, a reasoned arguments as to why landfilling is the best option for that waste material. No such assessment has been provided in the environmental statement (note, this issue is also covered in section 2.1 below).

The type or composition of waste is an integral part of the above assessment. For example, BPEO for inert waste may well be for restoring former quarry workings, although some in the industry the most effective use for this material is as daily cover at biodegradable waste sites (currently there is a shortage of cover material). However for domestic/industrial wastes BPEO is likely to be recycling, particularly where there are facilities for this nearby. The Black Country does provide facilities for the reclamation of metals, and there are facilities for recycling other materials such as paper and glass within 100 to 200 miles. The change in emphasis within the field of planning and waste management is highlighted in paragraph s 13.13 to 13.16 of Regional Planning Guidance (RPG) No.11[7]. Paragraph 13.17 of the RPG stresses the need to reduce the environmental impact of waste developments, and to have regard to sustainable development objectives.

Much is made in the application of the presence of the 'materials recovery facility' (MRF) on the site. As far as I can tell from the permission for this facility, and the new application, this will only be used for the reclamation of inert materials. In any case if the facility were used to recover biodegradable materials it would operate on the 'dirty MRF' principle – waste would have to be sorted on site from the bulk loads received. This is highly inefficient, it does not produce good quality materials for reclamation, and hence cannot be considered BPEO when compared to existing practice elsewhere using segregated waste streams.

We must also consider the effect that a change in waste types will create. Biodegradable material will undoubtedly bring greater impacts from odour, landfill gas, leachate contamination and health impacts. I am not convinced that the site is suitable on the basis of its proximity to dwellings. In any case the expectation of the public would be that such a site, on a highly vulnerable groundwater aquifer, would not usually be used for the disposal of highly polluting materials such as biodegradable materials.

I am also concerned that the applicant has not specified the types of 'special waste' to be accepted at the site (although, this has apparently been done as part of the waste license variation received by the Environment Agency). This is an important issue as it will have repercussions for the polluting potential of the site, and hence the safety of the environment and public health. If the special waste is only such items as bonded asbestos then that has relatively few impacts. However if the site is to be used for the disposal of hazardous

[6] '*Making Waste Work: A Strategy for Sustainable Waste Management in England and Wales*', Cm3040, HMSO December 1995

[7] Regional Planning Guidance No.11, '*Regional Planning Guidance for the West Midlands*', Department of the Environment, Transport and the Regions, April '98.

industrial wastes then that will pose a risk to groundwater via leachate, and human health via landfill gas emissions and leachate. In any case the permitting of ordinary industrial waste means that harmful substances can lawfully be incorporated into the waste mass at source that, on their own, would be considered special waste. For example waste can contain up to 20% by weight of chlorocarbon solvents such as chloroform, perchloroethylene or trichloroethylene.

The important balance we are seeking in the application is the '*harm*' the change in waste types will cause versus the '*need*' for that change. There is no objective evidence provided with the application that the site is needed in terms of the assessment of capacity, proximity and BPEO – hence no justification for the change in waste types.

1.4. Geology and Hydrogeology

I am not satisfied with the information on geology [section 6] and hydrogeology [6.3] in the environmental statement. The geology of the area is postulated on the basis of no evidence. For example I would expect an environmental statement to identify the geology using the British Geological Survey sheet for the area as a base, and then verifying the inferences drawn in that general survey by conducting follow-up surveys of the site and the area around it. I would then expect that data to be presented as a series of standard maps and sections. For example we are told that boreholes were drilled, but no graphical/tabulated borehole logs have been produced to verify the occurrence and composition of the strata beneath the site.

The evidence of the hydrogeological systems in the area is flawed because of the failure of the pump tests. If the size of boreholes or the silting of pumps were the cause of this then steps should have been taken to overcome the problem. If silting of the holes/pumps was a problem this immediately informs me that if this site were to fail at a future date then the standard '*pump and treat*' method of remediation would be difficult to maintain.

Finally, I do not agree with the hydrological relationship inferred between the quarry site and the River Stour (the Stourbridge Canal, not mentioned in the environmental statement, is likely to be unaffected by groundwater because it is clay lined, but it could be affected by surface water inputs). The fact that the river is not directly in contact with the groundwater table does not mean that seasonal connectivity does not take place. In any case I would expect a two-speed migration scenario. Pollutants would move slowly through the sandstone unless assisted by fissure flow through faults or diagenetic joints/voids. The more likely route for migration I envisage is flow along the erosion surface at the contact between the drift geology and the solid geology. This is where there will be the greatest change in permeability, and hence the greatest collection of water and leachate.

In any case the migration route for pollutants is not a straightforward thing to assess. The movement of pollutants is not primarily controlled by groundwater flow. The important factor is the density of the pollutants relative to water, and their solubility. In general the following can be said about pollutant movement in saturated rocks:

- Where the pollutants are less dense than water, and are partially/totally insoluble, they will float/pond on the surface of the groundwater table. The main effect of these pollutants will be to arise in high concentrations at springs nearby since they are not readily

dissolved throughout the water column.

- Where the pollutants are more dense than water, and are partially/totally insoluble, they will fall to the bottom of the water column (i.e., the first point where a change in permeability causes them to accumulate) and 'pond'. This 'pond' of material will then fall along the surface of the strata according to gravity, along the dip of the strata, not necessarily groundwater flow.
- Where the pollutants are of neutral density, or are soluble, they will disperse through the water column. Their concentrations/mixing in these circumstances is primarily determined by the mode of groundwater flow (whether this is primarily pore flow or fracture flow), and the thickness of the strata through which they permeate.

This idea of the 'mode' of pollutant migration is not considered in the environmental statement. In the context of this site this is of great importance since the movement of pollutants on the top of the water column could potentially give rise to pollution very close to the site (for example, groundwater fed ponds or springs), and in high concentrations. The ponding and movement of insoluble or very dense substances can also cause high concentrations of pollutants to emanate further afield.

I do not consider that the hydrological/geological character of the area has been properly identified. There remains a great deal of uncertainty about the suitability of this site for the disposal of leachable and leachate producing materials.

1.5. Landfilling Geotechnical Issues

The theory of containment landfill is relatively new. Although it only became common in the UK from the 1980s, in the USA it has been used for a much greater period (around 40 years). However recent experience in the USA and the UK has demonstrated that containment landfill is unreliable, and unsafe in use. For these reasons the UK Government developed the concept of the '*bioreactor*' landfill, and according to current policy guidance of landfill design[8], it is the 'sustainable' type of landfill we should envisage constructing.

The main benefit is that the waste is degraded within one to one and a half generations, after which it will cease to pose a problem as a source of landfill gas or leachate. To do this leachate and water are circulated within the site to aid degradation. This site, as far as I can tell, is not a bioreactor. Hence, in terms of government guidance, it cannot be sustainable. In any case, bioreactors require a great deal more site engineering because of the need to operate with much higher leachate heads in the site.

Much emphasis is laid on the results of the landfill risk assessment [Appendix 5]. In my view, this is not a sound assessment of the likelihood of seepage from the site. The parameters chosen for the '*Landsim*' model are highly optimistic. In any case there are serious flaws with the Landsim model – which was developed by Golders Associates – because it has problems interpreting seepage in certain geological environments such as where the groundwate rlevel is higher than the base of the site, or where randomised/highly permeable

[8] Waste Management Paper 26B - '*Landfill Design, Construction and Operating Practice*', Department of the Environment 1995

geologies are involved. There are some critics of the Landsim model who point out that it very rarely ever gives a negative effect, and in any case the model cannot cope with the uncertainties associated with some of the important variables.

I do not have faith that the risk assessment proves that the site is safe. The applicants should have provided detailed copies of the variables fed into the model, and their chosen range of probabilities, in order to demonstrate that a fair assessment had been made.

I am very concerned that no detailed information has been given regarding landfill gas and leachate management. These can have serious land-use impacts such as noise, odour, as well as health effects. The location of landfill gas flaring or usage must be carefully controlled. The 'point source' of pollutants a flare or generating plant represents can be a serious health risk. Likewise leachate treatment, if any, cannot be taken for grated because leaks or spillages can easily contaminate ground or surface water. We cannot assume that leachate will simply be taken to the adjacent sewage works for treatment because it may require pre-treatment before discharge to the sewage works.

In any case, the modelling of the site seepage has only taken place over a sixty year period. This is totally unrealistic given the period of time it will take for this site to stabilise (see 1.7 below).

There is a more detailed discussion of landfill geotechnical issues in Appendix 1 of this report.

1.6. Traffic and Highways Impact

I do not consider that the information on traffic is satisfactory. There should be a full traffic impact assessment (TIA) carried out, in accordance with the guidelines for TIAs set by the Institute for Housing and Transport.

No evidence is presented in the environmental statement on the effect site traffic would have. It is assumed that the recycling plant is permitted 200 vehicles per day, hence the effect will be no greater. The argument put forward is that there are already waste vehicles entering the site, and therefore the impact already exists. However, as noted earlier, there is no restriction on the site in general. Also, current usage is much less than 200 per day because of the depressed state of the inert waste market.

We must have a full TIA for the site that examines the contribution of:

- vehicles exporting primary aggregates from the site;
- vehicles exporting secondary aggregates and other materials from the MRF;
- vehicles delivering to the MRF;
- vehicles delivering direct to the tipping face;
- vehicles delivering materials for the engineering of the site;

…to the <u>total</u> movement of traffic in and out of the site.

1.7. Restoration and Stabilisation

I am not happy with the proposals for capping of the site. It would appear, as has been common at a number of sites recently because of the shortage of quality inert materials for restoration, that contaminated soils will be used. There must be demonstrable safeguards on the quality of those soils, and we must have a specified set of threshold levels to be certain of the condition that the site will be returned it. It is not acceptable to have, for example, soils contaminated beyond the level suitable for use in the open spaces. If the site could, at some point in the future, be used for agriculture then there must be a requirement never to exceed the contamination thresholds for dwellings/gardens.

I consider that the 60 year period for stabilisation, used in the environmental statement, is completely unrealistic. The period over which a biodegradable landfill stabilises is dependent upon the rate at which water passes through the waste mass. The waste will essentially have stabilised when at least five to ten bed volumes (i.e., water has passed from the top to the bottom of the waste mass) have passed through the site. Given the thickness of the waste deposit, the capacity of waste to absorb moisture (the 'field capacity'), and the infiltration of water through the cap, we can calculate how long the site will take to stabilise:

- D = Height of tipped waste – depth of deepest part of site = 100m AOD – 55m AOD = 45 metres;
- Fc = Field capacity = 0.33 (33% v/v)
- Ir = Infiltration rate = 0.05 (50mm) (an average assuming rainfall and 5-10% infiltration)

  Rate for one bed volume = D x Fc / Ir = 45 x 0.33 / 0.05 = <u>297 years</u>

Therefore, the time taken to flush five to ten bed volumes of water through the site in order to ensure degradation will be 1,485 to 2,970 years.

This is the reason why the siting of a landfill is so important. The lining system will have to stay in place for at least 1,500 years. It is very unlikely that this will be the case because highly engineered systems such as landfill liners have never been engineered to last that length of time. In fact liner manufacturers will not guarantee liners for more than 20 to 30 years for landfill operations.

In any case, all landfill liners leak. This is accepted, albeit in private, by most people in the waste management industry. In fact there is a methodology to assess site leakage in Appendix H of Waste Management Paper 26B. Applying it to this site:

- c = Contact constant = 0.5 (lower average of range)
- a = Area of holes in plastic liner (m^2/ha) = 0.88 (average of range)
- h = Leachate head (m) = 1
- K_s = Substrate conductivity (m/s): $1x10^{-9}$ (bentonite sand)
- Convert m^3/sec to l/ha/day: 86,400,000
- Area of site containing standing leachate: 4.5 (estimated)

Flow rate (litres/hectare /day)= $(c \times a)^{0.1} \times h^{0.9} \times K_s^{0.74} * 86{,}400{,}000$

Flow rate per day per hectare: <u>17.0 litres</u>

Flow rate for whole site: <u>76.6 litres</u>

Flow rate for whole site: <u>27,950 litres</u>

This of course assumes that there is only one metre of standing leachate. If there were five, as anticipated in the environmental statement, the flow would be 72.4 l/ha/day (119,000 l/year for the whole site). This is a significant release of contaminated leachate to the environment.

In practice, the leakage through the base of the site in the early life of the landfill is not the only issue. After one to two hundred years the cap liner will begin to break down (there is evidence that this begins shortly after restoration because of the settlement of the site). At this stage the site will receive a high infiltration from rainfall, infiltration will then exceed seepage, and the site will fill up with water. If the basal layer does not rupture from a fluid pressure of 35 tonnes per square metre, assuming the distance from the deepest point to the lowest part of the rim of the cell is 35 metres, then the fluid will begin to flow out from the side of the now cracking cap. This will inevitably cause environmental pollution.

An issue not discussed at all in the environmental statement is the effect of the landfill on the health of local people. There is mounting evidence that landfills have a definite and damaging effect on the health of those who live near them. This should have been considered by the applicant. There is a detailed discussion of landfill and health issues in Appendix 2 of this report.

When we consider the long term polluting potential of the site we have to remember that in depositing waste in holes we set in train a process lasting many thousands of years. As was stated in the Government's recent consultation paper on the revised UK Sustainable Development Strategy:

> "*We should never forget that decisions on matters like planning, or transport, or housing, are ultimately about the quality of life of communities and individuals. Past mistakes happened when decision-makers lost sight of that. We have to take decisions at the right level, and find ways to enable people to play a part in finding ways forward in their own communities.*"

2. Obligations on Staffordshire County Council

In our view there are clear reasons why this proposal for a change of waste types for restoration is inappropriate. But the important division that Staffordshire County Council must address itself to is the juxtaposition of the planning and pollution control systems. More importantly, what pollution issues are required by law to be considered by the planning authority. We can generalise this as:

- the division between the powers of a planning authority to determine issues relating to landfill design, operation and safety – and hence the planning officer's ability to form views on pollution matters;
- the sources and effects that the polluting impacts created by waste filling have on the environment and human health; and
- the ability of the Environment Agency to carry out their function as the competent body responsible for waste licensing.

2.1. Overriding Legal Obligations

Many applicants argue that issues relating to waste disposal, safety, health, etc., are all a matter for the pollution control authority – in this case the Environment Agency. We do not agree that this is factually or legally the case.

There is no one cut off point between the two camps of planning and pollution control. There is in fact significant overlap…

> "*The point where pollution concerns can be left to the pollution control regime is a matter of planning judgement for the decision maker. His decision to leave a pollution control matter to be dealt with by the pollution control legislation is not susceptible to challenge unless it is unreasonable in the Wednesbury sense*".[9]

In terms of a planning authority determining an application, the emphasis is often on the separation of planning and pollution control to the point where they are mutually exclusive. This is often justified by reference to the Gateshead case (PPG23, paragraph 1.3). This is a misrepresentation of the issues that were the subject of that appeal. It was not the division of planning and pollution control which were at the core of that appeal, it was the Secretary of State's powers to intervene and reach a different conclusion.

Another issue with regard to planning and pollution control is the extent to which planning authorities might pre-judge the role of the pollution control authority. In general the assumption that planning should always assume pollution control authorities will studiously discharge their responsibilities (PPG23, para. 1.34). In practice, the experience of those involved with the system is somewhat different. In relation to the certainty with which issues will be given consideration by regulators, Robert Carwarth QC[10] stated:

[9] '*A Burning Issue? Planning Controls, Pollution Controls and Waste Incineration*', Tony Kitson and Russell Harris [1994] JPL 3-7

[10] '*The Planning Lawyer and the Environment*', Robert Carnwarth QC, Journal of Environmental Law Vol.3 No.1 1991

> "*Legally an authority may conscientiously have 'regard to' something, and conscientiously put it into the waste paper basket.*"

We must therefore question the extent to which the planning system has the responsibility to ensure 'full coverage' of pollution issues. This of course means that decision makers in the planning field would have to act against current guidance by seeking to address those areas not adequately investigated by pollution control, where they can be shown to be material to the case. This will of course lead to situations where Inspectors and planning authorities may have to consider taking it upon themselves to refuse permission for development after appraising the position of the pollution control authority. This is again not excluded from the Gateshead decision, and was actually foreseen (paraphrasing Glidewell LJ.) in the decision of that case:

> "*If it had become clear at the inquiry that some of the discharges were bound to be unacceptable… the only proper course… should have* [been to] *refuse planning permission*".

A further issue arises with the consideration of waste issues. It is the one area of environmental law and planning where there is a legal requirement for the local planning authority to consider pollution issues. The Part 1, Schedule 4 of The Waste Management Licensing Regulations makes planning authorities the '*competent body*' for the taking of '*any specified action*' in relation to the '*relevant objectives*' of the Directive. 'Any Specified action' also extends to the determination of applications and section 78 appeals.

There is the note in paragraph 2(2) of Schedule 4 *that 'nothing… above requires a planning authority to deal with any matter which the relevant pollution control authority has the power to deal with*'. This seemingly absolute position is not reiterated in the DoE Circular[11] that accompanies the regulations, and which clarifies the duties of planning and pollution control authorities in paragraphs 1.46 to 1.56.

Some planning authorities and the legal representatives of the waste industry may try to downplay the importance of the relevant objectives and place some weight upon the Lombardia Case[12]. In fact Lombardia adds little to the interpretation of the relevant objectives as it is not necessary to draw upon European case law for a proper interpretation of regulations that are properly framed and fully transposed in our own national legislation. This is the case with Schedule 4 to the 1994 Regulations. The relevant objectives are considered to be 'obligations' albeit less specific than the 'obligations' imposed by the Articles of the Directive. Nowhere in the Lombardia Judgement, is there any comment that supports the argument that the relevant objectives can be treated simply as 'material considerations'. Furthermore *The Journal of Environmental Law* 'Case Law Analysis' comments:

> "*Kramer describes the prohibition in Article 4 that wastes must be disposed of without risk to human health or the environment as unambiguous. And, since Article 4 does not allow Member States a discretionary margin, for example to permit a method of waste disposal which poses a risk of human health, he considers it to be sufficiently precise, and hence capable of producing direct effects.*"

[11] DoE Circular 11/94, '*The Framework Directive on Waste', April 1994*.

[12] Comitato di Coordinamento per la Difesa della Cava v Regione Lombardia and Others (Case C-236/92)

With or without 'direct effect' there is no authority for simply assuming that it is possible to interpret the relevant objectives in the terms of it being acceptable to allow some risk, or harm, to air, soil, plants or animals. Clearly it is a tough test. Professor Richard Macrory summed up the situation of the Waste Framework Directive in the ENDS Law report:

> "*As has so often happened with EC Directives, Member States no doubt agreed to the general principles concerning the disposal of waste without risk to human health and the environment without appreciating the full consequences of what they were doing*."[13]

We believe that there is a positive requirement for competent authorities to evaluate every proposal in terms of the relevant objectives. This is reinforced in paragraph 1.47 of Circular 11/94 Annex 1 paragraph 1.47 states:

> *"The general duty in paragraph 2(1)* [of Schedule 4 to the 1994 Regulations*] means that in exercising the specified functions authorities must always consider the objectives of the Directive and aim to determine decisions ... in line with them"* [emphasis added]

This is the language of materiality (to consider) but the duty imposed by the relevant objectives is far more onerous than this implies. Paragraph 2(1) of Schedule 4 to the 1994 Regulations actually requires that:

> "*2(1) …the competent authority shall discharge their specified functions, insofar as they relate to the recovery or disposal of waste, with the relevant objectives*" [my emphasis]

Insofar as the planning authority are a competent authority, they must be able to demonstrate the application of the relevant objectives. In terms of role, planning authorities assess 'damage' to interests of acknowledged importance. This of course gives them a more holistic view than the Environment Agency who can only consider what is before them in a waste license application. But beyond that, a planning authority has a much greater freedom to identify and definite 'harm' to interests of acknowledged importance (PPG23, paragraph 1.35.

2.2. National Planning Policy

The determination of any planning application will involve environmental considerations. But there is often difficulty in assessing the scope of considerations where there is a close interlock with environmental legislation - the main examples being applications involving sites which require further authorisation under Part I (air pollution) and Part II (waste) of the Environmental Protection Act 1990.

Section 70(2) of the Town and Country Planning Act 1990 states, "*In dealing with such an application the authority shall have regard to the development plan, so far as material to the application, and to any other material considerations*". This gives two considerations in relation to mineral and waste issues...

[13] '*Key decision on BPEO and use of solvents in lime and cement kilns*', ENDS 280, May 1998

- Those issues reference in development plan policies must be directly considered, where relevant, in the determination of the application;
- Those issues which are not referenced in the development plan, or new issues which have arisen since the adoption of the plan, may be considered where they have significance.

The consideration of issues outside of the topics addressed in the development plan is often a hot issue of contention between the different groups involved with the determination of planning applications and planning appeals. The main source of guidance to planners on this issue is paragraph 50 of PPG1 which gives two broad considerations of the scope of material considerations...

- In principle and consideration which relates to the use of land is capable of being a planning consideration, but this will depend upon the circumstances;
- The considerations must fairly relate to the purpose of planning legislation, which is to regulate the use of land in the public interest.

Paragraph 51 notes that the Courts are the arbiters of what constitutes a material consideration. The issues has been clarified in the case *Bolton Metropolitan Borough Council v. Secretary of State for the Environment*. Lord Justice Glidewell concluded that some matters have to be taken into account because statutes direct (for example the development plan) but these are not necessarily the only matters. He states,

> '*the decision maker ought to take into account a matter which might cause him to reach a different conclusion to that which he would reach if he had not taken them into account*'.

Paragraph 3.2 of PPG23 gives a long list of material considerations to be considered in the determination of applications. But in addition to these 'standard' criteria for considerations there are two other significant directions in this section:

- In para. 3.1 it notes that determinations must be made in accordance with relevant EC directives;
- In para. 3.3 it notes that there are other issues that pollution control authorities take responsibility for, and advice should be taken on these issues.

There will of course be some overlap between these two considerations. Waste licensing is the responsibility of the Environment Agency, and any waste applications will require consultation with that Agency. But at the same time the Waste Management Licensing Regulations 1994 also have direct effect on the determination of the planning authority.

The limitation oft quoted in response to the consideration of environmental issues in the determination of applications is the *Gateshead*[14] case. However the main debate in this case was the assumption by the planning authority that the grant of planning permission would mean the pollution control authority was bound to issue a permit, and that insufficient consideration would be given to pollution issues. The Court of Appeal held that it is right and proper for planning authorities to consider pollution issues, and that there is overlap, but the determination as to whether or not a pollution control authorisation should be given is a matter which is the sole responsibility of the pollution control authority.

[14] *Gateshead Metropolitan Borough Council v. Secretary of State for the Environment and Northumbrian Water* [1993, 67 & CR179; affd 1994, 71 P & CR350]

It is clear on an examination of the available guidance that the consideration of a wide range of issues, and sometimes issues which are not the direct responsibility of the local planning authority, are an implicit requirement within case law and sections 54A/70(2) of the Town and Country Planning Act 1990. The '*material considerations*' in any determination will, in the first instance, be the policies specified in the development plan (meaning the whole set of plans, not just the minerals and waste local plan). But other matters must also be considered, including environmental pollution and health, and standing given to each accordingly, at the time of the determination.

2.3. Established Land Use

In the case of the Stewpony site, we are not dealing with a fresh application – we are essentially changing the operation of an existing landfill. In this sense the site does have an established use to which members of the public would have relied on in making decisions regarding development or property purchases in the area. In fact the planning permission for the site is backed up by a waste license which seeks strict limits on the types of waste which may be deposited on the site.

We cannot simply regard this as a fresh application. In terms of the legal obligations on the planning authority me must balance the effects that the new restoration scheme would have compared to the effects of the existing one.

In the mind of the applicant if the site is not completed using the existing waste types, within the existing time limit set in the planning permissions that apply to the site, then there appears to be committed some heinous offence. I do not think this is a credible argument. If this situation were to arise, then the planning authority could take enforcement action, but this is not a certainty. In terms of the Government's general guidance in the recent 'good practice guide' on enforcing planning control one of the automatic steps in any case would be to ask for a planning application. I do not believe that a longer timescale for restoration could be resisted since this has happened elsewhere. If we are to judge harm, then a delay in restoration has very little consequence compared to a change in waste types.

In my view there is no arguable case to change waste types on the basis of the failure to restore within the required time. There is also a long standing land use on this site which local people would have been mindful of when buying properties in the area. A change to this existing use is unwarranted, and would cause unnecessary blight on surrounding properties.

2.4. Public Perceptions and Objections

Since the Gateshead case there have been some important changes. PPG 23 has not only been introduced but events have overtaken it and rendered the advice given of little value (two drafts of full and partial (PPG10) replacement have been floated). More importantly than this guidance has been the introduction of the Waste Management Licensing Regulations and the introduction of the relevant objectives with which the planning functions must be fulfilled. The case law has also developed with the recent Bolton Incinerator cases bringing

the assessment of the '*Best Practicable Environmental Option*' (BPEO) for waste streams into the frame of materiality. The court of appeal decision on the Bolton case also suggests that the division between planing and pollution controls is no longer as clear in respect of waste management facilities.

There have also been important developments in relation to the materiality of public perceptions of risk. Mr Justice Glidewell said in the Gateshead Court of Appeal judgement:

> "*Public concern is, of course, and must be recognised by the Secretary of State to be a material consideration for him to take into account. But if in the end that public concern is not justified, it cannot be conclusive*".

In the case of the Stewpony site there is public concern and I believe that this report has demonstrated that concern to be justified. However the Browning Ferris case[15] takes the Glidewell judgement further. The Court of Appeal allowed the application by Newport Borough Council and quashed the decision by the Secretary of State. This is described in the Sept. '98 Journal of Planning Law as:

> "*…a very significant decision, for it establishes that - (i) public concern, even if objectively unfounded, is a material consideration to be taken into account on the question of costs. Arguably this conclusion has wider application. There appears to be no reason why public concern per se requires objective expert justification. (ii) In some circumstances an objectively unfounded, albeit genuine, fear (i.e. public concern) can of itself constitute a valid reason for refusing planning permission.*"

We consider this to be a very important development and, together with the West Midlands and Broadlands cases[16], gives powerful evidence that the local concerns can be weighed heavily. Reference should also be made to a paper in the October '98 issue of the Journal of Planning Law, '*Public Concern: The decision–makers' dilemma*'. The paper concludes:

> "*Recent cases, confirming that public concern is a material consideration, pave the way for potentially the most significant development in planning law since the introduction of section 54(A) of the Town and Country Planning Act 1990 … recognition that "NIMBY" objections to posses real teeth!*"

The FLAGS objections are deeper than NIMBY – we believe that rejection of this proposal will result in the development of more sustainable waste and resource management options.

[15] *Newport Borough Council v SoS Wales and Browning Ferris Environmental Services Ltd [1998] JPL 377*

[16] West Midlands Probation Committee v. Secretary of State for the Environment and Walsall Metropolitan Borough Council [1998] JPL. 388.

R. v. Broadland District Council and others ex parte Dave, Harpley and Wright, January 1998.

3. Reasons for Refusal

This section considers reasons why the planning application for the Stewpony site should be rejected. In my view there are four clear reasons for objection.

3.1. Failure to Comply with 'Relevant Objectives'

The 'relevant objectives' are set in Schedule 4 of the Waste Management Licensing Regulations 1994. As section 3.1 above clearly notes, these objectives are binding on the local planning authority.

In my view the following objectives are breached by this application (all quoted in relation to paragraph 4 of the Schedule 4):

- **Subparagraph 1(a):** On the basis of the information in the environmental statement it is my view that this application, if permitted, would enable the disposal of waste in a manner which would '*endanger human health*'. No evidence has been presented in the environmental statement to the contrary.
- **Subparagraph 1(a)(i):** The effects of this development, over the long term, will be to create a '*risk to water, air, soil and plants*'. This is a highly sensitive location, and landfilling of any waste should be carried out on this site with extreme caution. I do not believe that the long-term containment of contaminants in the site has been demonstrated.
- **Subparagraph 2(a) and 2(b)(ii):** This development cannot be considered to be part of the need to establish '*an integrated and adequate network of waste disposal installations, taking account of the best available technology not entailing excessive cost*'. Proximity has not been demonstrated. BPEO has not been demonstrated. The need for additional capacity has not been demonstrated. Without these three assessments we cannot be certain that this site is required. Also, in terms of the '*best available technology*' and '*protection of the environment*', for such sensitive sites like this, there are much better designs of landfill liner which give much greater protection to the environment – for example double composite liners.
- **Subparagraph 3(a), 3(a)(i) and (iii), and 3(b)(i):** This site facilitates the final disposal of waste. In the absence of a BPEO assessment there is no way to prove that the requirement to encourage waste reclamation is being undertaken. This site, in my view, will continue to facilitate final disposal for the majority of the waste stream because the MRF on site will not provide a significant amount of reclamation.

There are clear and demonstrable grounds for the breach of the objectives. I do not believe that if this case went to appeal, on the basis of the evidence produced in the environmental statement, there can be few, if any, alternate deductions. The planning authority are bound by the obligations imposed by Schedule 4 of the Waste Management Licensing Regulations. If these are not properly discharge it could mean that the planning authority could face judicial review from the opponents of this scheme.

3.2. Protection of Groundwater

This site will pollute the ground – even the environmental statement accepts that. However the applicants justify this in terms of applying '*de minimis*' criteria[17]. I do not believe that this case can be substantiated, particularly if modelling over longer timescales were carried out.

This is not only a breach of the relevant objectives, it is also a breach of the Groundwater Directive. In terms of the *Gateshead* judgement, the planning authority should not give permission to a development which cannot be demonstrated to be safe. There are demonstrable doubts as to the effectiveness of lining of the landfill in such a vulnerable geology, so close to surface waters, and on a major aquifer. I do not believe that the planning authority can abdicate responsibility for this matter to the Environment Agency given the clear-cut nature of the case.

In using this reason for refusal, the planning authority must invoke the precautionary principle. Clearly the repercussions if this site were to fail, on the basis of the currently available evidence about landfill performance (Appendix 1 of this report), would be catastrophic for the local environment. In the sense of the precautionary principle, as defined in UK guidance, European law and international conventions, refusal to permit this development is the 'wise' thing to do. Not to would cost immeasurably more in the long term.

3.3. Failure to Identify BPEO and Need

The applicant has not, as can be considered to be required by the *Bolton* judgement, provided sufficient evidence to prove BPEO. There is also no demonstrable case of need or proximity made in the environmental statement. In using this reason the planning authority must cite the Bolton judgement, and the guidance from PPG23, draft PPG10, and the 'sustainable waste management strategy', '*Making Waste Work*'.

Additionally, in terms of need, the site is not identified in any development plan as being a strategic site for the disposal of biodegradable waste, nor is it identified for the meeting of any regional need. There has been no proven calculation of landfill capacity and site inputs to justify the release of this site over any particular timescale. In my view the site could be as liable to take waste from long distances as it would local sources – contrary to the proximity principle. No evidence has been produced by the applicant to prove any other case.

3.4. Protection of Health and Amenity

Given the evidence produced on behalf of the public in this report, there is sufficient cause to prove that opposition to the scheme on the grounds of efficacy and safety meets the criteria set by the recent *Browning-Ferris* judgement. The planning authority should give due regard to the view of the public in forming its determination. It is important to use the precedent set in the Browning-Ferris case in considering the evidence in this report, and other objections.

[17] From Latin – literally the impact is too little to worry about and it may be disregarded.

4. Conclusions and Recommendations

It is my view that the permitting of this development, on the base of the evidence currently available in the environmental statement, would not be lawful. It would leave the planning authority open to challenge by the objectors to this development. Even if refusal were to cause a section 78 appeal, I believe that on the basis of the information presented in the environmental statement the reasons for refusal specified in Chapter 3 would be defendable.

This report, and its appendices, demonstrate many grounds as to why this development is unacceptable in the location chosen. Having considered the contents of the application and environmental statement **I recommend that this application be refused on the following grounds:**

1. **Development of this site would not be in accordance with the approved development plans;**
2. **Approval of this development, with the evidence currently available, would be contrary to the relevant objectives of the Framework Directive on Waste;**
3. **There has been no assessment to demonstrate that the management system at the site would be the '*best practicable environmental option*';**
4. **There has been no capacity assessment to demonstrate that there is a local or regional need for the site;**
5. **Approval of the development would present unknown risks to public health, the environment, local amenity and groundwater. The uncertainties regarding current national waste policies, and the safety of landfills, require that the precautionary principle is applied in this case.**

I do not believe that suggesting conditions is appropriate in this case. I do not believe that, in terms of the guidance in PPG1, the site is allowable even if conditions were applied. However, should the planning authority be minded to approve this development I wouldf recommend to the local community that a review is sought of that decision at the earliest possible date.

Paul Mobbs
28th Sept., 1998

5. Appendices

A1. The Safety and Effectiveness of Modern Landfill Design

There is a significant pollution problem relating to landfills, both in terms of the gases emitted and the emission of leachate into ground and surface wasters, which can cause health impacts. According to the information presented by the Department of the Environment, Transport and the Regions (DETR), landfill sites can be satisfactorily developed across all parts of the country, meeting 'modern' landfill standards. Unfortunately these 'standards', defined within Waste Management Papers 26, 26A and 26B[18], do not prevent pollution of the environment, they merely slow down the period over which it takes place.

Construction considerations and landfill liner failures.

The US. Environmental Protection Agency (EPA) has paid for a series of engineering studies[19] to find out the best way to make a landfill. They wanted to know what was the "*best demonstrated available technology*" (BDAT) for making landfills. These studies reach some surprising conclusions.

'Dry tomb' contained landfills can be made of a huge sheet of plastic underlain by ordinary soil, or it can be a huge sheet of plastic underlain by a layer of compacted soil (usually clay soil). The third combination, plastic liner and compacted clay soil, is called a "*composite liner*". A composite liner is not a double liner - it is a single liner made up of two parts. To create a double liner, you would use two composite soil liners together, separated by a layer of sand or gravel. Geoservices did not examine the second type of liner (plastic sheet on ordinary soil) because ordinary soil provides poor support for a plastic liner carrying many tonnes of weight, so they restricted their analysis to compacted clay liners vs. composite liners. Very simply, the EPA wanted to know which liners were the best ones available - compacted clay liners or composite soil liners.

Geoservices didn't have much good to say about clay liners. The flow of liquids through a liner (the liner's permeability) is measured in metres per second (m/s). The EPA's (and the UK's) current requirement for a liner for a hazardous waste landfill is that it pass liquids through it no faster than $1.0x10^{-9}$m/s. However, based on actual experience in the field, Geoservices concludes that this ideal permeability is often not achieved for a variety of reasons. Therefore, they assume that the actual permeability in the real world lies between $1.0x10^{-9}$ and $1.0x10^{-8}$m/s-1.

Geoservices concludes that the most significant observation is that, with compacted clay bottom liners, leakage out of the landfill will be larger if there is leakage through the top liner, even in landfills meeting current EPA design requirements, including permeability of $1.0x10^{-9}$ m/s. By "*large*" leakage, Geoservices means nearly 1,000 litres of fluid leaking through each hectare each day, or 10,000 litres per day leaking from a average 10ha landfill. Their calculations show that, with 12.5cm of water standing on the bottom liner, it will take 15 years for leakage to break through a 1 metre thick compacted clay bottom liner, but once break through has occurred, 1000 litres per hectare per day will pass through the liner continuously thereafter (this is just a basic working of D'Arcy's law on fluid flow through porous soils).

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[18] Waste Management Paper 26 - '*Landfilling Waste*', Department of the Environment 1986
Waste Management Paper 26A - '*Landfill Completion*', Department of the Environment 1993
Waste Management Paper 26B - '*Landfill Design, Construction and Operating Practice*', Department of the Environment 1995.

[19] Geoservices Inc. - "*Background Document on Bottom Liner Performance in Double Lined Landfills and Surface Impoundments*". National Technical Information Service, April 1987.

Geoservices reports that all plastic liners (also called Flexible Membrane Liners, or FML's) always have some leaks:

"*A common misconception regarding FML's is that they are impermeable, that is, no fluid will pass through an intact FML. However, it is important to realize that all materials used as liners are at least slightly permeable to liquids or gases and a certain amount of permeation through liners should be expected. Additional leakage results from defects such as cracks, holes, and faulty seams*."

It is this concept in the minds of decision makers - that the liners are 'impermeable', which is leading to landfills being sited near or over major aquifers, and risking the future of that aquifer as a potable water resource.

FML's often develop defects called "*pinholes*" during manufacture. These result from thin places ("*fisheyes*"), bubbles, foreign material, or lumps of carbon in the raw molten plastic from which the FML is rolled ("*calendered*") into sheets. Furthermore, when a large landfill liner is created by joining strips of FML together with glue or by welding, the resulting seams often leaks. Geoservices provides some data on typical seam defect rates.

They look at six case studies. Based on these six case studies, they drew the following "*tentative conclusions*":

- "*An average of one leak per 30 feet of seam can be expected if there is no quality assurance program* (quality assurance being a third party coming along behind with special equipment to check the adequacy of the seams)."
- "*Even with good quality assurance, 'an average of one leak per 300 metres of seam can be expected with reasonably good installation, adequate quality assurance, and repair of noted defects'. That is to say, under the best circumstances, you will get one leak per 300 metres of seam - if the landfill liner is made up of FML that are 7 to 10 metres wide, you can expect three or four defective seams in every hectare the liner covers*."
- "*Based on actual data, Geoservices conclude that a 'standard' leak in a FML has an area of one square centimetre, and that the 'standard' number is two holes per hectare. They point out that the 'standard' hole size and 'standard' number per hectare are based on the assumption that 'intensive quality assurance monitoring' will be performed during liner installation, so clearly we are talking about the best case, not the worst case, here.*"
- "*Design flaws, poor construction practice, or poor quality assurance would result in larger holes, greater numbers of holes, or even large tears.*"

It should be noted that this approach to assessing the leakage rate through liners has been accepted by the Department of the environment in Appendix H of Waste Management Paper 26B.[20]

Geoservices then goes on through an elaborate mathematical analysis to figure out how much fluid will pass through a composite liner under the best possible conditions and under less than ideal (but still optimistic) conditions. They conclude that the "*best demonstrated available technology*" (BDAT) for composite landfill liners will allow leakage rates somewhere between 0.25 and 11 litres per hectare per day. Thus they conclude that an average 25 hectare landfill site will have a leak rate somewhere between 6.25 and 275 litres per day, or between 2280 and 100,450 litres per year. And this is the "*best demonstrated available technology*" - the very best we can have when everything we do goes right.

Often, landfill site applications assert that proper construction materials will be used, the correct construction procedures will be followed, and a comprehensive construction quality assurance (CQA)

[20] Waste Management Paper 26B - '*Landfill Design, Construction and Operating Practice*', Department of the Environment 1995.

program will be implemented. However, from the literature it seems that even the best liner and leachate collection system will ultimately fail due to natural deterioration and result in leachate leakage from a lined landfill. Further, from the published literature, it is found that even double-lined, including composite-lined, landfills with good CQA (not so common in the UK, but there is a long experience of this design in the USA) are expected to leak leachate at over 200 litres per hectare per day shortly after being placed in service.

Applicants often assert that if the landfill liners leak, the leakage would be detected by the under-drain and groundwater monitoring systems. However, evidence from published studies leads to the conclusion that the groundwater monitoring systems incorporated with today's lined landfills have a low probability of detecting groundwater pollution by landfill leachate at the earliest possible moment. Further, leakage through the liner can occur without being intercepted by the under-drain system when present - liner leakage into the under-drain system can occur without its being detected by monitoring of under-drain waters.

It is frequently asserted by landfill applicants and their consultants that any leachate generated in the landfill will be removed via the leachate collection and removal system with the result that there would be no pollution of groundwater. A leachate collection and removal system typically consists of a highly permeable layer (such as sand or other permeable material) under the waste; the liner system is beneath the sand. Theoretically, leachate generated in the waste passes down through the sand until it reaches the liner; it then flows along the top of the liner to a sump for removal by gravity flow or pumping. In the real world, however, flexible membrane liners have holes and imperfections in them at the time of construction (placing the landfill in service) that allow leachate to pass through the liner.

Bonaparte and Gross[21] reported, for example, that at the time of construction double-lined landfills with good quality control in liner construction can be expected to leak at a rate of 20 gallons/acre/day. This means that the leachate collection and removal system will not achieve the theoretical performance (zero leakage) at the time of construction much less over the time that municipal solid waste constituents represent a threat to the beneficial uses of groundwater. Further, an important factor that is now becoming widely recognised is that the porous layers in leachate collection and removal systems used for municipal landfills tend to become clogged or blocked by biological growths, thereby leading to ponding of leachate behind clogged areas; such ponding contributes to greater rates of leakage transport through holes in the liners.

The US EPA[22] stated with regard to problems with clogging of leachate collection and removal systems:

"*Clogging is the primary cause of concern for the long-term performance of leachate collection and removal systems. Particulate clogging can occur in a number of locations. First, the sand filter itself can clog the drainage gravel. Secondly, the solid material within the leachate can clog the drainage gravel or geonet. Third, and most likely, solid suspended material within the leachate can clog the sand filter or geotextile filter.*"

The EPA also stated:

"*Biological clogging can arise from many sources including slime and sheath formation, biomass formation, sulphide deposition, and carbonate deposition. Sand filters and geotextile filters are the most likely to clog, with gravel, geonets, and geocomposites next in order from most to least likely.*"

If a landfill begins to fill up with fluid, the weight of the fluid puts pressure on the bottom of the landfill, increasing the likelihood of bottom liner failure, so any fluid inside a landfill is a potential source of

[21] R. Bonaparte, B. Gross, "*Field Behaviour of Double Liner Systems*", in 'Waste Containment Systems: Construction, Regulation and Performance', pp52-83, Geotechnical Special Publication No.26, ASCE, New York, 1990.

[22] US EPA, "*Requirements for Hazardous Waste Landfill Design, Construction and Closure*", EPA/625/4-89/022, US EPA Centre for Environmental Research Information, Cincinnati, August 1989.

trouble. To prevent fluid from causing problems, every modern landfill has a system for draining liquids out of the landfill. Perforated pipes run over the bottom of the site, just above the liner, to collect the leachate in the same manner as drainage pipes are used to lower the water table in fields. In theory, these pipes carry off the leachate to a wastewater treatment plant, where the leachate is processed to remove the toxic chemicals.

One of the least-studied aspects of landfill design is how to make a leachate collection system that will work for many decades (much less many hundreds of years). The fact is, leachate collection systems can clog up in less than a decade and, when that happens, fluids begin to build up inside the landfill - a dangerous situation, as noted above.

Leachate collection systems fail in several known ways. First, they can clog up from silt or mud. Second, they can clog up because of the growth of micro-organisms in the pipes. Third, they can clog because of a chemical reactions leading to the precipitation of minerals in the pipes. Fourth, the pipes themselves can be weakened by chemical attack (acids, solvents, oxidising agents, or corrosion) and may then be crushed by the tons of waste piled above them.

The book, "*Avoiding Failure of Leachate Collection and Cap Drainage Systems*"[23], discusses these four failure mechanisms. The first problem, silt, can sometimes be avoided, or at least reduced, by installing a "filter layer" above the leachate collection system. The filter layer may be made up of gravel or of a rug-like plastic material called "geotextile". Since the oldest leachate collection systems date from the early 1970's, there is very little available experience with the long-term performance of leachate collection systems. The hope is that a "filter layer" will solve the silt-clogging problem, but after many decades the entire filter layer itself may clog. Only time will tell.

The growth of micro-organisms seems to be an uncontrollable problem. The conditions for growth of slime forming micro-organisms are not well understood. Even if they were understood, we could not control chemical and physical conditions (temperature, pH, etc.) at the bottom of a landfill because of the thousands of tons of wastes heaped up in the landfill. The problem of chemical precipitation also appears to be uncontrollable. The chemical conditions that lead to precipitation may be known, but again the conditions in the leachate collection system cannot be controlled because the system is not accessible once wastes have begun to be dumped into the landfill.

Finally, there is the straightforward problem of loading many tonnes of waste onto the leachate collection pipes. As more waste is piled into the site, the ground beneath the landfill settles to accommodate the stress. This can cause bending, splitting or complete fracture of the pipes.

Koerner and Koerner[24] presented the results of a study of biological growth-induced clogging of geotextile filters used in municipal solid waste landfill leachate collection and removal systems. They indicated that municipal landfill leachate is particularly prone to cause biological growth-induced clogging of leachate collection and removal systems because of the warm temperatures and abundant food sources for micro-organisms.

Some landfill applicants and their consultants assert that the leachable components of municipal solid wastes will be removed from the waste during the operation period when the landfill is open and during the 30 years after closure, by the functioning of the leachate collection and removal system. However, it is well-known that for a landfill at which there is no attempt to restrict moisture from entering the waste to generate leachate, the leaching period is much greater than the typical 20 years

[23] Jeffrey Bass - "*Avoiding Failure of Leachate Collection and Cap Drainage Systems*", 1989, Noyes Data Corporation, Park Ridge, NJ07656.

[24] G. Koerner, R. Koerner, "*Biological Activity and Potential Remediation Involving Geotextile Landfill Leachate Filters*", in 'Geosynthetic Testing for Waste Containment Applications', ASTM STP 1081, American Society for Testing Materials, Philadelphia, 1990.

of operation plus 30 years of post-closure settlement (i.e., 50 years). This has been widely discussed in recent years in industry publications - for example Surveyor magazine[25].

Belevi and Baccini[26] reported on the concentrations of heavy metals and other constituents that would be expected to be present in municipal solid waste leachate over extended periods of leaching in such a landfill. They projected that hazardous chemicals such as lead in municipal solid waste could occur in municipal landfill leachate at concentrations that are above US EPA drinking water standards for more than 2,000 years. This means that in order to protect groundwater quality, the leachate collection and removal system for such a landfill must work perfectly for thousands of years. However, as noted above, Belevi and Baccini's projections were for landfills at which moisture was allowed to enter. The period of time over which chemical contaminants would be expected to leach from a landfill with a so-called "*impermeable*" cover of the type being constructed today in the US, would extend throughout the period over which the wastes are, in fact, kept dry, plus the leaching period.

For example, if society could keep all moisture out of a landfill for only 50 years, after which time cover maintenance is terminated and moisture is allowed to enter the landfill, the leaching period would begin in the 51st year and extend until all constituents that could impair beneficial uses of groundwater were leached (potentially a further 2,000 years). In order to protect groundwater quality during that leaching period, the liner and leachate collection/removal system would have to work perfectly throughout that period - which would mean that it would have had to have been maintained in good working order for the 50 years prior to the leaching. Clearly, today's liner technology will not provide that level of performance. Therefore, a leachate collection and removal system cannot be considered to be a reliable means of ensuring prevention of leachate pollution of groundwater.

The USA's mandatory 30 year post-closure period evolved from regulatory requirements in which US EPA representatives incorrectly assumed that the cessation of gas production from fermentation of degradable organics in a municipal landfill resulted in cessation of the threat of groundwater pollution. However, as discussed by Lee and Jones[27], the 30 year period was developed from experience with fermentation-gas production in unlined landfills, with permeable covering (no attempt to restrict water infiltration), in wet climates, with greater than about 30 inches/year of precipitation.

Lee and Jones[28] note that municipal solid wastes and their leachates contain a wide variety of non-degradable constituents (such as heavy metals, salts, non-fermentable organics, and fermentation residues that are soluble in water and that could pollute groundwater). Those constituents do not degrade. Lined landfills of the type that are be constructed today with plastic sheeting and compacted soil liners, and covers, are intended to keep the wastes dry. Since moisture is the key to the fermentation, and is the key to the leaching of chemical constituents from the wastes, as long as the wastes are in fact kept dry (moisture less than about 20%) no fermentation or leaching of the wastes occurs[29].

However, if at any time in the future - ad infinitum, or more importantly when the 'containment' breaks

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[25] "*Timescales for Completion*", Surveyor, 6th May 1993.

[26] H. Belevi, P. Baccini, "*Water and element Fluxes from Sanitary Landfills*", in 'Sanitary Landfilling: Process, Technology and Environmental Impact', pp391-397, Academic Press San Diego, 1989.

[27] G.F. Lee, R.A. Jones, "*Municipal Solid Waste Management: Long-Term Public Health and Environmental Protection*", University of California, 1991.

[28] G.F. Lee, R.A. Jones, "*Groundwater Pollution in Municipal Landfills: Leachate Composition, Detection and Water Quality Significance*", in Proceedings of the Fifth Action conference on Aquifer Restoration, Groundwater Monitoring and Geophysical Methods, National Water Well Association, Dublin, Ohio, 1991, pp257-271; and G.F. Lee, R.A. Jones, "*Landfills and Groundwater Quality*", in 'Groundwater' No.29, pp482-486, 1991.

[29] T. Christensen, P. Kjeldsen, "*Basic Biochemical Processes in Landfills*", in 'Sanitary Landfilling: Process, Technology and Environmental Impact', pp29-49, Academic Press San Diego, 1989.

down - moisture enters the landfill, fermentation of the degradable organic component of the waste will begin with gas production and, most importantly, leachate generation; groundwater pollution would then be expected to result. Thus the concept of the sufficiency of a 30 year post-closure period was developed on the basis of technically inappropriate assumptions and has no relationship to insurance of groundwater quality protection from contaminants in buried municipal solid waste. The perpetuation of the myth that a 30 year post-closure period will provide groundwater quality protection is irresponsible and not in accord with the information known today about the potential threats that chemical contaminants in municipal and many industrial solid wastes buried in 'dry tomb' landfills represent to groundwater quality.

In order for landfill applicants' conjectures - that liner systems can be designed, constructed, and operated without failure - to be factual, and in order to meet the requirements for protection of groundwater quality, the landfill cover must be impervious to moisture forever and/or the landfill liner system must work perfectly forever, i.e. for as long as the wastes represent a threat to groundwater quality. However, Bonaparte and Gross[30], reported:

"*Liquid flows have been observed from the leakage detection layers of many double-lined landfill and surface impoundment facilities.*"

They concluded from their review of the behaviour of double-lined systems:
"*Based on the data in this study, an action leakage rate of 50 litres per hectare per day (l/ha/d) is too restrictive and presents a performance standard that, if promulgated by US. EPA, frequently will not be met by facilities that were constructed to present standards with rigorous CQA programs. An action leakage rate of 200l/ha/d appears to be reasonable for landfills that have been constructed using rigorous third-party CQA.*"

This means that thousands of litres of leachate can pass through a hectare of a landfill's liner at the time of construction and placement of the landfill in service. For a large landfill, that leakage rate has the potential to pollute large amounts of groundwater, especially if that landfill is located in high permeability strata. The liner "*action leakage rate*" referred to by Bonaparte and Gross is the rate of liner leakage that is considered to represent "*failure*" of the liner system. As Bonaparte and Gross indicated, the US EPA has proposed a liner "*threshold action leakage rate*" of 50 l/ha/d. Bonaparte and Gross found that even new landfills with the best liner construction cannot be expected to meet that performance standard and recommend that it be quadrupled in order that landfills can be in "*compliance*" with the US EPA regulations.

The findings of Bonaparte and Gross on this issue are in accord with those reported in 1989 by the US EPA. In a discussion of the requirements for hazardous waste landfill liner design construction and closure, the US EPA[31] stated,

"*EPA realizes that even with a good construction quality assurance plan, flexible membrane liners (FML's) will allow some liquid transmission either through water vapour permeation of an intact FML, or through small pin holes or tears in a slightly flawed FML. Leakage rates resulting from these mechanisms can range from less than 1 to 300 gallons per acre per day.*"

The conclusion of Bonaparte and Gross based on their review of the data, as well as the statements of the US EPA, strongly contradicts the position taken by landfill applicants that liner systems will not fail. In fact what was shown by Bonaparte and Gross, and acknowledged by the US EPA, is that landfills lined with compacted soil and plastic sheeting are expected to fail at the time of construction, and will not meet the US EPA's proposed limits on liner leakage rates.

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[30] R. Bonaparte, B. Gross, "*Field Behaviour of Double Liner Systems*", in 'Waste Containment Systems: Construction, Regulation and Performance', pp52-83, Geotechnical Special Publication No.26, ASCE, New York, 1990.

[31] US EPA, "*Requirements for Hazardous Waste Landfill Design, Construction and Closure*", EPA/625/4-89/022, US EPA Centre for Environmental Research Information, Cincinnati, August 1989.

In addition, Haxo and Haxo[32] listed, "*areas of concern that may affect the service life of components of liner systems and the functioning of the liner system as originally designed*".

Those areas included:
"*The combined mechanical and chemical stresses under which the liner system functions may cause cracking and breaking of the components due to environmental stress-cracking or possibly to mechanical fatigue under long service.*"

"*Seams of FML's continue to be an area of concern, as none of the test methods truly assess the effects of long-term exposure in landfills.*"

"*Clogging of drainage and detection systems continues to present a problem. The clogging can be by biological clogging due to growth or sedimentation or through precipitation of dissolved constituents.*"

Mitchell and Jaber[33], addressed the issue of the stability of compacted clay-soil liners used in landfills and questioned the reliability of clay liners to function as effective landfill containment systems over long periods of time. They stated:

"*By their very nature most clay soils are quite stable materials in their natural state because the are towards the end point of the degradation phase of the weathering and rock-forming cycle. Thus, if a naturally occurring clay soil is compacted to high density, thereby producing a material with very low hydraulic conductivity, and if it is maintained within the same ranges of temperature, pressure, and chemical and biological environment, it would be expected to function well as a seepage barrier indefinitely. In waste containment applications, however, conditions do not remain the same. The permeation of a compacted clay liner by chemicals of many types is inevitable, since no compacted clay or any other type of liner material is either totally impervious or immune from chemical interactions of various types. In addition, most clay liner systems are subjected to distortional stresses that may cause deferential movement. If these movements lead to formation of open cracks, then the liquid retention ability of the system will be lost.*"

A further problem with the use of clay in general as a fill medium has emerged recently. The extraction of clay for use as fill of any kind exposes it to natural bacteria in the air. These bacteria 'feed' on the pyrite minerals in the clay, producing iron compounds. In turn the clay undergoes a volume reduction of between 2 to 8%. Where clay is used as a liner, this shrinkage has obvious implications for its permeability. Also, it is likely that similar biogenic reactions from the bacteria in the leachate could cause similar shrinkage problems.

The US EPA[34], stated with regard to problems with clay liners in landfills:

"*while clays do not experience degradation or stress cracking (compared with FML's) they can have problems with moisture content and clods. High concentrations of organic solvents, and severe volume changes and desiccation also cause concern at some sites.*"

In addition, the US EPA[35] stated with reference to lined municipal solid waste landfills:

"*Once the unit is closed, the bottom layer of the landfill will deteriorate over time and, consequently, will not prevent leachate transport out of the unit.*"

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[32] H. Haxo, P. Haxo, "*Consensus Report of the Ad Hoc Meeting on the Service Life in Landfill Environments of Flexible Membrane Liners and Other Synthetic Polymeric Materials of Construction*", prepared for US. EPA Hazardous Waste Engineering Research Laboratory, Cincinnati, May 1988.

[33] J. Mitchell, M. Jaber, "*Factors Controlling the Long-Term Properties of Clay Liners*", in 'Waste Containment Systems: Construction, Regulation and Performance', pp52-83, Geotechnical Special Publication No.26, ASCE, New York, 1990, pp84-105.

[34] R. Bonaparte, B. Gross, "*Field Behaviour of Double Liner Systems*", in 'Waste Containment Systems: Construction, Regulation and Performance', pp52-83, Geotechnical Special Publication No.26, ASCE, New York, 1990.

[35] Geoservices Inc. - "*Background Document on Bottom Liner Performance in Double Lined Landfills and Surface Impoundments*". National Technical Information Service, April 1987.

While applicants assertions that the landfill liner will be constructed so that it will not fail to prevent migration of leachate from the proposed landfill, manufacturers of landfill liners provide only 10-20 year warranties against defects in their liners. Even those warranties are pro-rated over that period, and require that the landfill owner/operator identify the location of liner defect and remove the wastes above the defective area so that the liner company can make repairs. Therefore, it may be concluded that despite the comprehensive construction quality assurance (CQA) program that many applicants claim will be adhered to in the construction of the proposed landfill, it like all others of that type, will be expected to leak from the time of construction and the liner performance will deteriorate over time. I know of no manufacturer who will guarantee a liner for even 30 years. However, the evidence from DoE[36] indicates that:

"*It is now widely accepted amongst landfill scientists that complete degradation of domestic waste in a typical, large, high density modern landfill site is likely to be measured in centuries rather than decades*".

Other commentators arrive at similar conclusions. We must also consider that 'total containment' landfill sites are really "*pollution bank*" holding toxic material for millennia to come. For example the heavy metals in a site will never go away - they will eventually either contaminate the rivers (either from direct discharge or via a sewage treatment works from leachate treatment) or contaminate the groundwater. At the 1992 Institute of Waste and Environmental Management Conference, a paper was presented entitled, "The Environmental Management of Landfill Sites" (reproduced in the Journal of the Institute of Waste and Environmental Management, 7/4/93). This paper stated that...

"*the long-term integrity of synthetic liners is not known, and the potential for a point source release from a ruptured liner during the early period of leachate production is potentially serious. The perpetual containment of all inorganic contaminants, especially heavy metals, is considered neither viable nor desirable*".

In the UK, the leading conference of academics and industry officials is the Harwell Waste Management Symposium. At the meeting in May 1993, there was complete disagreement amongst the various delegates about what the true situation was regarding the safety of landfill liners. While some delegates suggested that current standards were sufficient, others produced new research showing that the lifetimes of liners is uncertain, and evidence from AEA Harwell has shown that membrane liners do not prevent the migration of landfill gases.

While the experts cannot agree, it is up to local authorities to apply the precautionary principle and judge each case on the merits of the information provided. No blanket guarantee can be given by DETR about the safety of landfill as a waste management option. The local planning authority must prevent the construction of any landfill over water bearing strata which are, our could potentially be used in the future, for the abstraction of groundwater for public, private, industrial or agricultural purposes. Stewponey Landfill is one such site.

[36] DoE Report CWM 072/93 "*A Review of the Composition of Leachates from Domestic Waste in Landfill Sites*".

A2. Landfill and Health Impacts

Landfill Gas

Landfill gas is usually made up primarily of carbon dioxide (CO_2 - from 60% to 40%) and methane (CH_4 - between 40% and 60%). Additionally there are a wide variety of other gases that are present in relatively small amounts (3 to 5% by volume). These gases include nitrogen and occasionally a small percentage of hydrogen and oxygen. Hydrogen sulphide and a wide range of specific organic compounds and inorganic products are also found. It is estimated[37] that as many as 350 different trace compounds may be found and most published research studies indicate that 100 to 200 compounds can be encountered at each site.

The risk from CO_2 and CH_4 is essentially that:

- CH_4 presents a risk of fire should it build up in any enclosed space or explosion should the concentrations be between 5% and 15% by volume.
- Both CH_4 and CO_2 represent a risk of asphyxiation should concentrations build up above 20%. This is particularly a problem in underground voids such as sewers.

The production of methane and other landfill gases is unpredictable. The Energy Technology Support Unit claimed[38] that "*no two sites are the same and prediction remains to a large extent a black art*." A study for the Department of Energy undertaken by the consultants Aspinwalls in 1984 concluded[39] that the average gas yield was 135 m^3 per tonne of biodegradable refuse. Gas yields varied between less than 10 m^3/ tonne to over 200 m^3/ tonne. A later study[40] by consultants ERL (Now ERM) in 1990 found a mean specific gas production rate of 222 m^3/tonne (comprising 50% methane). The Department of Energy estimated that up to 400 m^3/tonne is theoretically possible if the microbiological processes was optimised but indicated that much more research would be required in this area. Calculations supporting the DOE figure. However it is not only the gas production rate which is important but also the efficiency of gas capture.

Claims for the efficiency of gas capture vary widely. Independent critics have pointed out [41],[42] that 30-50% of methane leaks over the lifetime of a well-engineered site. Professor Ludwig Kramer, Head of Waste for DGXI supported this in his evidence to the House of Lords European Committee. ENDS reported[43], "*The Euro-Commission's waste policy chief, Ludwig Krämer is disputing the UK claims that landfill gas capture can be as high as 90%, giving a best performance of 60-70%. He also why there is no programme of retro-fitting landfills with gas collection systems, in his appearance before the House of Lords inquiry".*

Whilst no evidence has been presented in support of the claimed high levels of capture, either to this inquiry or to the Lords it is notable that Professor Kramer **did** provide papers to the Lords to support his position. It is notable also that a recent report for the Department of Trade and Industry[44] comes to

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[37] Schneider quoted in Landfill Gas – From Environment to Energy, Final report for the Directorate General Energy, Commission of the European Communities, A Gendebein et al, 1992 (p112)

[38] Prospects for Renewable energy in the Norweb area ETSU/NORWEB 1989

[39] Reported in National Assessment of Landfill Gas production, Department of Energy October 1990

[40] National Assessment of Landfill Gas production, Department of Energy October 1990

[41] ENDS 1990 ENDS Report 189, (p18-21), Environmental Data Services, London

[42] Wallis M K 1995 Reassessing methane from UK Landfills, in Waste Disposal by Landfill, ed. RW Sarsby, Balkema, Rotterdam

[43] *ENDS 276, p.33, January 1998*

[44] Methodologies for the assessment of the UK Landfill gas resource, ETSU BWM/00452/REP, Consultants in Environmental Sciences Ltd 1997

similar conclusions. The Authors wrote that: *"It has been shown in a previous study (CES 1995[45]), that economically viable power generation may exploit only between 30% and 50% of the potentially extractable LFG production over its cycle (i.e. only about 18% to 30% of the total LFG production*." Or alternatively 70% to 82% of gas would not be used for power generation and at least 40% would escape as fugitive emissions.

This low capture rate, even on modern landfill sites, is important in terms of the trace gases as large volumes are likely to leave the site. Toxicity is raised as an issue in paragraph 3.5 of WMP27:

> '*Some of the minor constituents of landfill gas could have toxic effects, if present in high enough concentrations. Operators should undertake an assessment of risk and where necessary apply control measures as required by the control of Substances Hazardous to Health Regulations 1988. Trace gases do not usually represent a health hazard following normal atmospheric dilution. Hydrogen sulphide is toxic at low concentrations, having occupational exposure standards of 10ppm (8 hour time Weighted Average reference period) and 15ppm (short term exposure, 10 minute reference period) (HSE Guidance EH40).*'

Adverse health effects have been reported by those working on landfill sites. In the State of New York, USA, employees currently working at a large municipal landfill expressed concern that they experience higher rates of illness than other municipal sanitation workers. Therefore, a study[46] was designed to examine acute health effects among employees working at the New York City Department of Sanitation, with special emphasis upon the landfill workers. Interviews conducted with 238 landfill and 262 off-site male employees asked questions about health symptoms experienced in the six months prior to the interview and about workplace exposures. This study found a higher prevalence among landfill employees of work-related dermatologic, neurologic, hearing, and respiratory symptoms, and sore and itching throats than among off-site employees. The respiratory and dermatologic symptoms were not associated with any specific occupational title or work task, other than working at the landfill. Off-site labourers experienced more neuromuscular symptoms and injuries.

More detail on landfill gas and development is given in chapter 9 of WMP27. This considers the development of land around landfill sites. WMP27 does not specifically consider development of a landfill next to existing land uses but we should assume that the same precautionary assessment procedure must apply. In practice the development of a new landfill near existing developments is more problematic because it can be difficult to retrofit gas protection measures into old buildings.

The composition of the gas also varies over time as the different stages of decomposition take place. The initial stages of decomposition, lasting only a few weeks or months, is an aerobic process, leading primarily to the production of carbon dioxide and water, and of course light volatile compounds boiled off by the heat generated by decomposition. Over the years the waste in the landfill undergoes further degradation until it reaches an advanced state of anaerobic decomposition when methanogenic bacteria begin to break down the organic content of the landfill to produce methane. The rate of breakdown and changes in the reactions are difficult to predict and depend upon a range of variables.

In addition to the production of a number of different chemical compound by the direct breakdown of substances in the waste, and by the action of bacteria, volatile substances in the waste fill can be driven off as gas by the heat generated during decomposition. The heavier fraction of these substances will actually condense in the landfill gas collection system. Particular problems in terms of volatilisation are organic and chlorinated organic solvents, and the heavier hydrocarbons. Although

[45] A review of Landfill Gas Modelling Techniques, Environmental Technology Support Unit Report ETSU B/EW/00497/10REP

[46] '*Health Study of New York City Department of Sanitation Landfill Employees*', Kitty H. Gelberg PhD MPH, Journal of Occupational Medcine 39:11 (November 1997) pp 1103-1110

obviously hazardous materials such as solvents are usually dealt with as '*special waste*', such hazardous substances can legally be incorporated within ordinary wastes which is exempted from the Special Waste Regulations (such as domestic wastes), or provided the content falls below specified threshold criteria. Domestic, commercial and industrial waste is also very likely to contain some material that, in isolation, would be classed as 'special'.

WMP27 gives a brief breakdown of the compounds that make up trace gases in Appendix A (p.57). This is in fact extracted from Table 2.1 (p.134) of WMP26[47]. However a more detailed breakdown of landfill gas concentrations is given in Appendix 1 of WMP26 (p152-154).

For this review I have used the data from Appendix 1 of WMP26 – this is a fairly comprehensive list although the ranges reported may be limited as only six sites are included in the study. Levels of hydrogen sulphide are not given in Appendix 1, although there is a volumetric figure given in Annex 2,Table 2.1. This has been converted[48] to a gas concentration assuming standard pressure, molecular weight 34 and an ambient temperature of 20ºC. The figures in Table 2.1 are therefore changed as follows:

- Typical value, 0.00002% v/v == 0.2 ppm == 0.28 mg m^{-3}
- Maximum value, 0.0014% v/v == 14 ppm == 19.8 mg m^{-3}

Occupational vs. Long Term Exposure

As noted in the reference to WMP27 given above, the emphasis on toxicity is related to occupational exposure. This is accepted by the industry since there are many situations where operators could come into contact with landfill gas. In these situations the Health and Safety Executive set the occupational exposure standards. '*Occupational Exposure Limits*' are published every year in the '*EH40 series*' report[49]. However in relation to assessing the effects of emissions on public health these limits are not acceptable as they are based on an 8 hour per day or 10 minute exposure over the course of a working lifetime. There are no long term exposure levels (LTELs) set for the type of pollutants found in the trace gas from landfills. 'Standards' are commonly derived by adjusting the occupational figures by a compensating factor. This is chosen to allow for the longer exposure times and increased sensitivity to pollution of local residents who may, for example, be housebound:

- Where EH40 sets an '*occupational exposure limit*' (OEL), we take the OEL and divide it by 100;
- Where EH40 set a '*maximum exposure limit*' (MEL), we take the MEL and divide it by 500 (in recognition that the MEL should never be exceeded).

There are a number of different practices for producing LTELs from OELs or MELs. Consultants such as Environmental Resources Management also use the format I use. Others, for example AEA Technology, have used lower figures in past studies such as OEL/40 and MEL/100.

The exception to the above is the MEL for vinyl chloride. The EH40 document sets this as a volumetric (v/v) figure. As with the examples before I have converted this to a gas concentration assuming standard pressure, molecular weight 62 and 20ºC…

- 7ppm == 18.1 mg m^{-3}

In the table below I list a number of figures from Appendix 1 of WMP26, the MEL/OEL and the LTEL (the MEL/500 or OEL/100 figure). A factor comparing these figures in then calculated by dividing the WMP26 level by the LTEL.

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[47] Waste Management Paper 26 - '*Landfilling Wastes - A Technical Memorandum for the Disposal of Wastes on Landfill Sites*', DoE 1986.

[48] From Appendix B, HMIP Technical guidance Note D1… mg m^{-3} = level in ppm * (molecular weight / 24) * (293 / 293)

[49] Current version, EH40/98 - '*Occupational Exposure Limits 1998*', HSE 1998.

Table 1: Comparison of Occupational and Long Term Standards

Compound	WMP26 level mg m^{-3}	EH40 OEL mg m^{-3}	EH40 MEL mg m^{-3}	Derived LTEL mg m^{-3}	WMP26 ÷ LTEL
Benzene	0.4 to 114		16	0.032	12.5 to 3,562
Toluene	8 to >460	191		1.91	4.2 to >240
Xylene	34 to 470	441		4.4	7.7 to 107
Hydrogen sulphide	0.28 to 19.8	14		0.14	2 to 141
Ethyl benzene	17 to 330	441		4.4	3.98 to 75
Styrene	<0.1 to 7		430	0.86	0.1 to 8.1
Tricholoroethylene	<0.1 to 170		550	1.1	0.1 to 155
Vinyl chloride	0.1 to 177		18.1	0.036	2.6 to 4,658
Tetrachloroethylene	0.1 to 350	345		3.45	0.02 to 1

The important thing to note here is that although the lower '*WMP26÷LTEL*' figure is in some cases smaller than 1, all the higher figures are greater then or equal to 1. If the public were exposed to poorly diluted gases for a long period of time - as noted in paragraph 3.5 of WMP27 - this would pose a health risk. We have other examples in the UK where there have been warnings about the health effects of landfill gas. For example the consultants Entec said of the Nant y Gwyddon landfill that, "*exposure to undiluted landfill gas in some areas of the site… could* [be] *expected to result in rapid death*"[50].

Another issue with regard to chemical mixtures is the effect of '*addition*' and '*synergism*':

- Where two chemicals have broadly similar physiological or toxicological effects they can be considered to be the same for the purposes of risk assessment. They are considered to be 'additive'. For example benzene and ethyl benzene act in a similar manner and the figures for these pollutants could be summed as indicated in EH40[51].
- Synergism is where two chemicals act together to promote the effect of one or both. This is a very problematic thing to assess because work on the effects of chemical mixtures has only recently started. But there are some effects that are known, such as the combination of chloroform and carbon tetrachloride which produces an effect 4 times greater then the sum. Other industrial emissions and background pollutants, particularly combustion pollutants such as nitrogen oxides or sulphur oxides, also further complicates the issue of synergism.
- The Environment Agency report 'Guidance on the emission from different types of landfill gas flares'[52] notes that: "*Combinations of odorous compounds can affect the olfactory senses in unpredictable ways, but in view of the large number of such compounds in LFG – less in flare emissions – there exists a significant potential for additive and synergistic effects*".

Additionally, the tipping of wastes in a landfill site, in particular bioactive wastes such as sewage sludge, gives rise to the emission of pathogens into the air. These can be carried on the wind some distance and can be inhaled or deposited on the body and clothing, or deposited on foodstuffs growing outdoors. Another hazard would be disposable nappies which, because of inoculations, can contain a live form of the polio virus. There is very little information on this aspect of landfill pollution. But unlike chemical pollution the issue here is not the level but merely the presence of these agents. This is because if they remain viable during transport they can multiply if deposited on the right type of media and pose a risk to health.

[50] '*Investigation into Odour Problems, Nant y Gwyddon, South Wales: Final Report*', P.E. Scott et. al., Entec Consulting for the Environment Agency, Report no.97194, Jan. 1998.

[51] Paragraphs 67 to 75 and Part 3, EH40/98

[52] p49, '*Guidance on the emission from different types of landfill gas flares*' Report No CWM 142/96A, R.C. Frost, J.E. Pearson and J. Sykes, AEA Technology 1997

In conclusion, it can be clearly shown that exposure to landfill gas that has undergone little dilution does potential pose a health risk. There are many substances in landfill gas which are present above their occupational exposure limits, and certainly above long-term exposure limits.

Health Effects and 'The Lancet' Study

The publication of the EUROHAZCON study in *The Lancet* of the possible effects of landfill on foetal development was timely for consideration of this application. The results of the paper[53] are based on an epidemiological study looking at the incidence of certain birth defects on live and still born babies carried by parents living near landfills. The study shows a positive association between proximity to a landfill and the incidence of birth defects for a wide range of landfills around Europe.

Whilst epidemiology cannot prove causality I am aware of few publicly available data examining association between emissions and health effects. The reasons for this are:

- The regulatory bodies are reluctant to sponsor such detailed research. The North West Region of the Environment Agency recently commissioned a study from the London School of Hygiene and Tropical Medicine[54] which reviewed other health studies and The DoE waste technical division has published a paper on a modelling methodology. These reports add weight to the concerns raised in the Lancet paper.
- The industry has tried to lay down the potential problems of health effect, and certainly have made little effort to undertake the necessary studies to prove/disprove a causal link. Most applications, like this one, simply avoid addressing the issue for fear of fuelling public anxiety.

The Lancet paper is somewhat limited in that in looks only at birth defects. This is a useful indicator but one for which it will always be difficult to provide a model demonstrating causation because there is little toxicological data on the exposure levels which may cause, for example, gastroschesis. Other studies indicate that health effect such as cancer, neurological problems and respiratory problems are also significant but sceptics will no doubt argue that other confounders may explain some of these effects.

The evidence now available, including the EUROHAZCON study gives us valuable new evidence for health effects from landfill sites. The decision on how to react to this information is essentially political rather than scientific and ultimately depends upon the risk that the authorities are prepared to allow the public to be exposed to

Developing a Source-Receptor Model for Landfills

It is clear of course that to demonstrate a link between landfill emissions and health we must develop a model that shows how the emissions enter the environment, how they are transported, and their fate… *a source-receptor model*. It is very difficult to undertake this for landfill, as the required standard of data does not exist as one body of evidence. However, it is possible to produce a simple model that can give indications about the potential effects of landfill emissions.

Even having defined our '*system*' - a representation of the landfill and its emissions - the next problem is to find a model to actually calculate the dispersion of pollutants in air. Most of the dispersion modelling systems available are intended for larger scale emissions, and are often not ideal for use in near field applications (less than 250 metres). For this reason I have used a dispersion model for this

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[53] '*Risk of Congenital Abnormalities Near Hazardous Waste Landfill Sites in Europe: the EUROHAZCON Study*', The Lancet, vol.352, p423-427, 8th August 1998. A copy of the article is provided in Appendix 1.

[54] '*Potential Human Health Effects of Landfill Sites*'. Report to the North West Region of The Environment Agency. Martine Vrijheid, Environmental Epidemiology Unit, London School of Hygiene and Tropical Medicine. March 1998.

study based on the 'R91' model, but without the more complex features that later models take account of such as terrain, mixing heights and gas density. In any case given that we are considering near-field effects issues such as mixing height and atmospheric stability are not so critical.

The model is not intended to produce precise results - this would be inappropriate in any case given the uncertainties in the data upon which the model operates. But the model does have sufficient accuracy to give an indicative result of the likely dispersion of pollutants. In setting up the data to run the model I have assumed no particular wind direction or meteorological conditions. Wind speeds are taken as an average for the year. Many of the parameters relating to the flares, temperatures, etc. are assumed.

The model essentially considered two types of releases from a landfill site:

- Landfill gas that is released from a single point on a site;
- Landfill gas that is flared from a single point on a landfill site.

The essential difference between the two states we are considering - a flared and an unflared emission - is the plume rise function. Flared gas will be thermally buoyant while unflared gas will rise only as far as its kinetic energy will take it. The practical difference between these two states is that buoyant plumes rise higher, thus reducing ground level concentrations.

The model gives results in terms of a multiplication factor. The pollutant emission is set a 1mg m^{-3} and so to calculate the ground level concentration (GLC) of any pollutant you simply multiply the pollutant concentration in mg m^{-3} by the result of the model at the particular distance required. The results of the two models were plotted on the same graph - figure 1 below - for comparison.

The maxima predicted from the model are:

- For unflared gas, the maximum concentration is 0.0034 mg m^{-3} (per mg m^{-3} release) at 140 metres (equivalent to 3µg/mg, a dilution factor of 333);
- For flared gas, the maximum concentration is 0.00056 mg m^{-3} (per mg m^{-3} release) at 240 metres (equivalent to 0.6µg/mg, a dilution factor of 1,700).

Taking Table 1 given earlier, we can generate a more meaningful set of figures relating to modelled releases and the LTEL - this data is given in Table 2. For each pollutant we take the WMP26 level and multiply by the maximum level from the model to produce the ground level concentration (GLC) this. As with the previous table, this is divided by the LTEL to provide a comparison.

Figure 1:

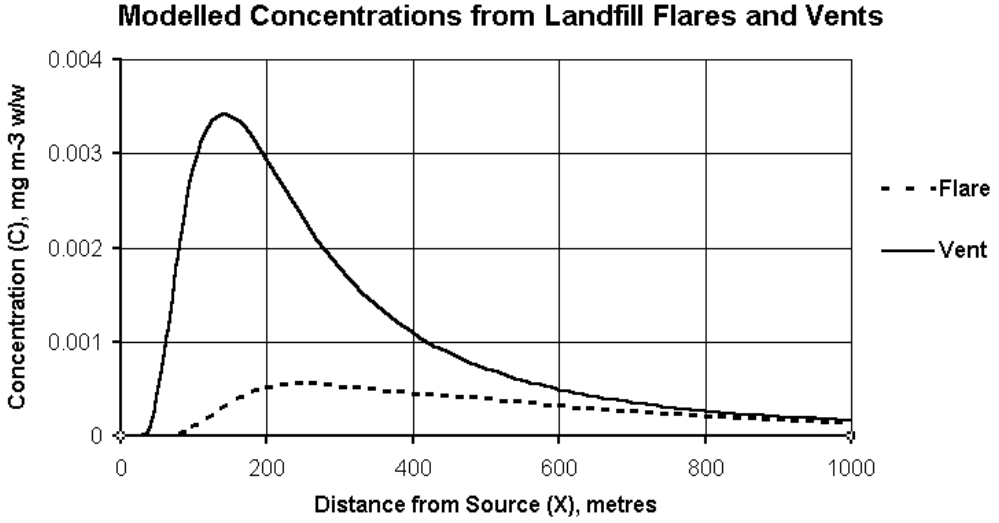

Table 2: Comparison of LTEL and Modelled Levels - Unflared Gas

Compound	**WMP26 levels** mg m^{-3}	**Calculated GLC**, mg m-3	**Derived LTEL**, mg m^{-3}	**GLC ÷ LTEL**
Benzene	0.4 to 114	0.0014 to **0.388**	**0.032**	0.043 to **12.113**
Toluene	8 to 460	0.0272 to 1.564	1.91	0.014 to 0.819
Xylene	34 to 470	0.1156 to 1.598	4.4	0.026 to 0.363
Hydrogen sulphide	0.28 to 19.8	0.0010 to 0.067	0.14	0.007 to 0.481
Ethyl benzene	17 to 330	0.0578 to 1.122	4.4	0.013 to 0.255
Styrene	0.1 to 7	0.0003 to 0.024	0.86	0.000 to 0.028
Tricholoroethylene	0.1 to 170	0.0003 to 0.578	1.1	0.000 to 0.525
Vinyl chloride	0.1 to 177	0.0003 to **0.602**	**0.036**	0.009 to **16.717**
Tetrachloroethylene	0.1 to 350	0.0003 to 1.190	3.45	0.000 to 0.345

Note, the 'pollutant maxima' level used to calculate the GLC is 0.0034 mg m^{-3}

As can be seen, two compounds - benzene and vinyl chloride, both known carcinogens - both exceed the LTEL. While the variability in this model cannot be relied upon to provide an accurate figure, the strength of the assessment procedure enables us to show that there is a possibility for high concentrations of toxins to be produced from landfill gas. There are therefore obvious implications for public health should landfill gas be vented within 400 to 500 metres of any dwelling or occupied structure.

Data on flare emissions is provided in the Environment Agency report '*Guidance on the emission from different types of landfill gas flares*'[55]. The report was undertaken to review the regulatory gap in standards for landfill gas flares and to inform the development of new standards. Concerns are raised about the effectiveness of open flares and recommends that in future no more open flares should be installed on UK landfill sites. AEA Technology, the authors of the report, also recommend that operators of landfill sites should undertake or commission an environmental assessment of the emissions from proposed flares that should use real emissions data and local meteorological data, and consider the impacts of the dispersed emissions in the vicinity. I consider that UK Waste should have undertaken such a study as part of the environmental information provided to this inquiry.

The results of the simple modelling exercise show that for unflared landfill gas the LTEL could be exceeded for two compounds - benzene and vinyl chloride. If we include other effects such as the addition or synergism between substances, or the current exposure levels then it is likely that other groups of chemicals would also exceed the LTEL. This simple assessment demonstrates that there is a possibility for high off-site concentrations of toxins to be produced from landfill gas. There are obvious implications for public health should landfill gas be vented within 400 to 500 metres of any dwelling or occupied structure.

In conclusion

There would be very large volumes of gas released from the site even with the best gas collection and control systems. These gases are likely to contain hundreds of toxic compounds. Modelling indicates that there exists the potential for adverse health effects from the release of landfill gas – this supports the findings of the epidemiological work carried out by many agencies in this country and elsewhere that there is a link between landfill emissions and health. Improved data would improve the accuracy of the assessment. The purpose, however, was mainly to demonstrate the plausibility of a causal relationship.

[55] Report No CWM 142/96A