

MANUAL ON LANDFILL SITE ASSESSMENT AND SELECTION IN GEORGIA



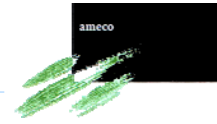
*Using SEA as a
powerful instrument*

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Picture cover: *landfill next to the road between Borjomi and Akhaltsikhe*

Colophon	
Title:	Manual on Landfill Site Assessment and Selection in Georgia
Project framework:	Introduction of SEA in the Southern Caucasus, Phase 1: Georgia
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Date:	Second edition, June 2011
Outline:	In Georgia, a number of existing landfills will, when assessed according to international standards, have to be closed in the coming years. Subsequently, new locations have to be selected. Other landfills could be optimised at their current location, by taking appropriate measures. This manual describes the steps to be taken in these processes. The mechanisms suggested in this manual are an improved and adapted version of those currently available and used by many private and public sector organisations in assessing and selecting landfill sites. Broad involvement of relevant actors in Georgia, such as municipalities (Sakrebulo), the business-sector and the general public, in relation to proposals for a landfill, should be one of the primary objectives of its proponents. These guidelines comply with the obligations of the 'Aarhus Convention' on access to environmental information and participation in decision-making, by providing a publicly available framework for the assessment and selection of landfill sites in Georgia.



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1 Introduction

This manual on site assessment and selection is intended to be a nationally adopted manual for use by those involved in the assessment and selection of landfill sites in Georgia. Proper landfill site assessment and selection is a fundamental step in sound waste disposal and the protection of the environment, public health and quality of life. Moreover, it determines many of the subsequent steps in the landfill process, which, if properly implemented, should ensure against nuisances and adverse long-term effects.

The criteria involved in landfill site assessment and selection include environmental, economic and socio-political criteria, some of which may conflict. With increased environmental awareness, new legislation and certain other developments over time, the landfill site assessment and selection process in Georgia will become more sophisticated, as new procedures and tools are being developed.

1.1 Landfilling: a necessary practice

Landfilling is the oldest and most widely practised method for disposing of solid waste and there will always be a need to find new places to dispose of waste. Also in countries that have focused on developing contemporary waste treatment systems, there will be a continuous need for landfill capacity. Compared to other disposal options, properly constructed and operated landfill sites offer a safe disposal route for municipal solid waste, typically at the lowest cost. In Georgia, it is important to gain broad political, scientific and social consensus on this need, and to define measures needed to ensure progressive development of standards.

Landfilling forms the basis of every waste management strategy. There are a number of alternative treatment options for waste – e.g. incineration, recycling and composting – but none of these treatment options can function alone. All require landfilling as a necessary complement. Most alternative waste treatment options, such as recycling and incineration, rely on landfilling for disposing wastes which are unsuited to the process or for residual wastes. Therefore, some landfill capacity is essential for every region or country, and will continue to be necessary in the future despite technological advances being made.

1.2 The Landfill Paradox

The development of new landfill sites is almost universally a difficult task, both practically and politically. For instance, it can be expected that communities neighbouring proposed landfill sites will voice strong objections, and will typically show very little faith that what is being proposed will be anything other than an uncontrolled dumpsite.

In general, societies around the world face complex problems in attempting to improve and develop their waste management system. Whereas new or rehabilitated landfill sites offer the promise of higher standards and less political problems, there is in fact often very little capacity to actually deliver on the promise of a 'sanitary' landfill. This can often result in relatively well-engineered sites falling into disrepair as a result of a lack of operational budget and expertise, having poor environmental performance, and provoking local communities into taking direct action against the site.

The conclusion from these experiences is that, wherever possible, it is better to establish good operations at existing sites before constructing new facilities. This allows operation expertise to develop, (local) decision-makers to get used to providing budgets, and confidence to develop, so that good standards of landfilling can be achieved at modest cost. Demonstrating that proper management of landfill sites can be established also significantly boosts the credibility of the authorities responsible for the landfill site and helps to depoliticise the process of selecting further sites.

The improvement of landfill practice in Georgia will be a step-by-step process. There is no one correct design towards a sanitary landfill. Designs vary widely depending on local conditions, but all should represent a progressive improvement over open dumping. It should be noted that the immediate adoption and implementation of a sophisticated design and highly mechanised operation cannot be expected, as this needs more time and substantial investments.

What is important is to acknowledge those parts of the present landfilling operation in Georgia that are unsanitary and look for ways to improve them. For example, most wastes are left in open, uncontrolled dumps which pollute water sources and pose serious health risks. For these reasons, it is essential to raise the standard of such dumps.

1.3 Applying SEA in the assessment and selection of landfill sites

A poorly chosen landfill site is likely to require unnecessarily high expenditure on waste transport, site development, site operations, or environmental protection. It may also cause long-term political problems from public opposition. Therefore, it is important to select the most appropriate site when a decision has been made to construct a new – or rehabilitate an existing – landfill site.

To ensure that an appropriate site is identified by the responsible authority, a systematic process of assessment and selection needs to be followed. The assessment criteria are themselves subject to prioritization according to local climatic, political, and cultural circumstances. A comprehensive Strategic Environmental Assessment (SEA) is valuable to gain a thorough understanding of the receiving environment. An SEA also ensures transparency and opportunities for public participation in the assessment process through public review of interim or draft documents, status reports, public meetings, and other information at certain critical steps. The SEA must examine the impact of the landfill on an array of aspects, and suggest relevant waste- and environmental management practices.



Strategic Environmental Assessment

Strategic Environmental Assessment (SEA) can be defined as a way to bring all stakeholders together in the planning process and to structure and feed the debate on the consequences of choices to be made in the planning process. Public participation, transparency and good quality information are key principles. When needed, SEA can also include social and economic issues.

It is important to obtain sufficient information about possible sites. Desk and field studies can identify a short list of candidates. The majority of this information needs to be qualitative. For the preferred site(s) only, it will be necessary to carry out investigations at the site(s) to confirm their geological and hydrogeological characteristics, develop conceptual design(s), and establish likely costs.

Measures to collect and treat leachate are often expensive. To reduce costs, priority should be given to areas where leachate would likely have little or no impact on the environment. The impact in travel time and the implications for

modes of transport on the waste collection service must also be considered, as this may have a dominant influence on the choice of site. This is most likely to be the case if a regional or remote site is considered.

Figure 1 visualises the various levels of decision-making and indicates where Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) should play a role.

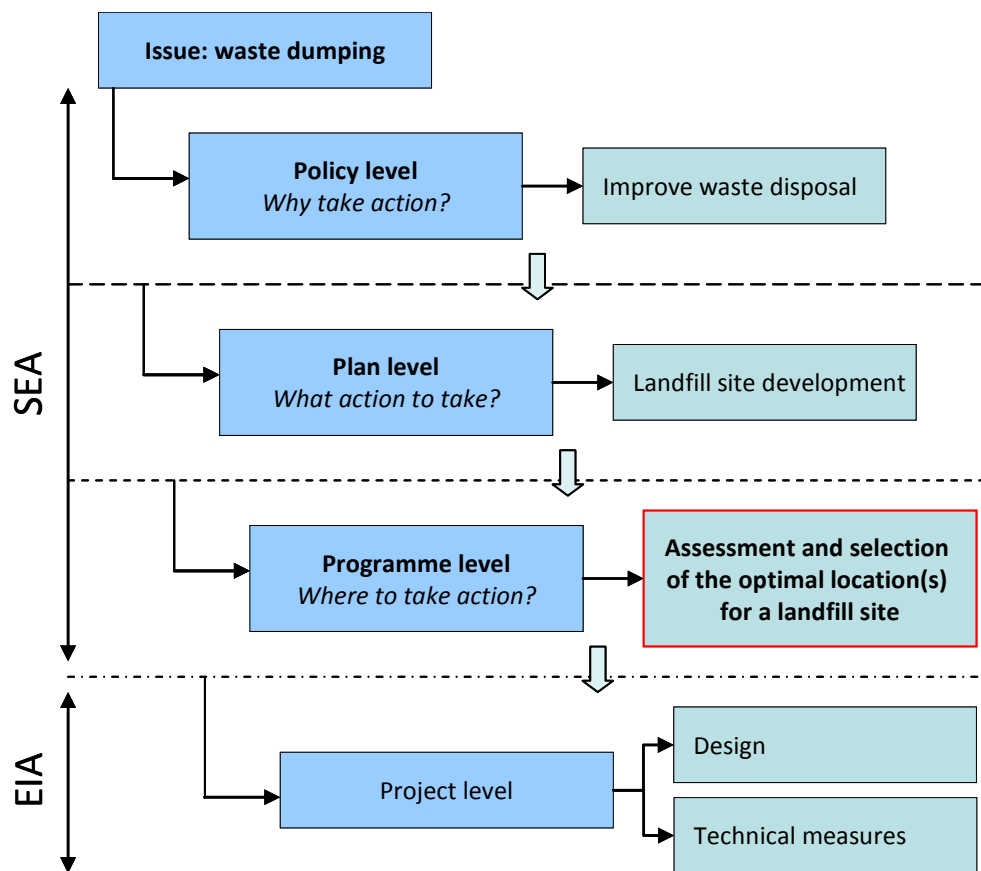


Figure 1: Various levels of decision-making in relation to SEA and EIA (based on Looijen 2009)

1.4 Purpose of this manual

The criteria for assessing and selecting landfill sites and the methods used have been developed and modified over the years, as more is learned about what goes on inside a landfill site and about the environmental, economic and health impacts associated with landfilling. The following guidance on using Strategic Environmental Assessment (SEA) as a powerful decision-support tool is primarily aimed at municipal waste landfills in Georgia, falling into the non-hazardous waste landfill category. The guidance herein is generic in nature; therefore landfill site proposers and decision-makers may be faced with additional site-specific criteria that impact on the assessment and/or choice of the landfill location. The three Boxes below highlight some of the most important aspects in the process and should be kept in mind whilst utilising this manual.

→ *Transparent selection procedure*

It is important to ensure that the methodology for assessing and selecting the site is rigorous and transparent; otherwise these decisions may be ‘unravelling’ later and cause significant delay in the introduction of improved health and environmental practices. Finding and obtaining consensus on appropriate landfill sites can take lengthy periods of time, and is often extremely challenging politically.

→ *Clear assessment and selection criteria*

Care should be taken to ensure that all potential sites have been identified (including existing sites), and for the short-list and final selection to be based on an agreed and widely communicated set of criteria. More involved studies of the short-listed sites are required before the final selection of preferred landfill sites. Detailed technical, economic and environmental evaluation, in tandem with a structured programme of consultation with key stakeholder groups, can ensure that the best, and most acceptable site is selected for development.

→ *Accepted by local communities*

A solid waste disposal site should address the demands of the local population and it should also guarantee safety of human health and the environment. It requires geological and engineering expertise together with local community’s acceptability.

2 Assessing existing landfill sites

Since many landfills exist in Georgia, partly legal and partly illegal, it is of utmost importance to firstly assess these existing sites and determine whether operations could continue there – by implementing optimisation measures – previous to deciding on the selection and development of new landfill sites. In order to properly assess existing landfills, Chapter 3 and 4 of this manual should be considered and the criteria mentioned herein should be applied for determining the suitability of the location of current landfills. The assessment ought to be carried out as if it were a selection of a completely new site for landfilling.

Three options are applicable with regard to an existing landfill site, as illustrated in Figure 2:

- *Immediate closure*
- *Closure in 5 years*
- *Optimisation*

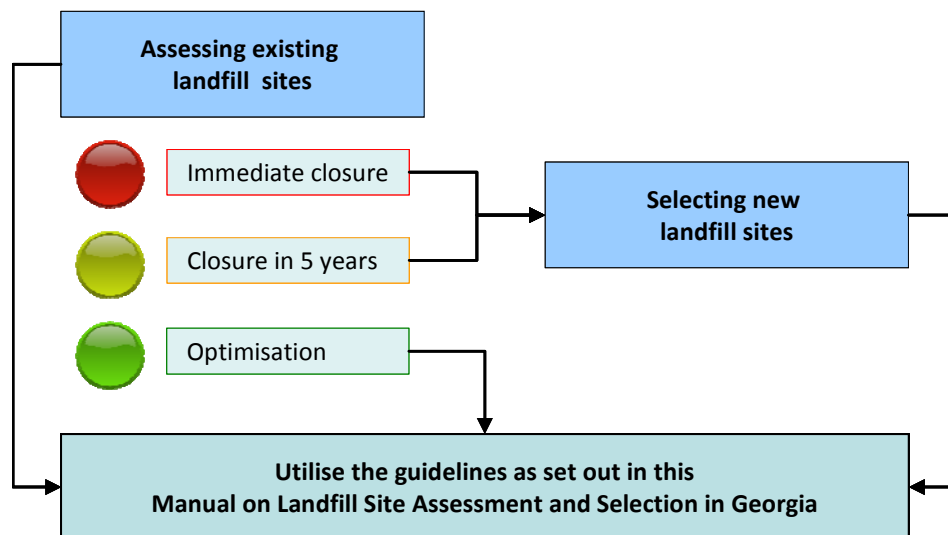


Figure 2: Assessing existing landfill sites

▪ *Immediate closure*

Some landfill sites may be in such a deteriorated condition or located on such an unsuitable location that only immediate closure (and preferably remediation) would prove to be a viable option. For example, locations proximate to:

- existing or planned residential development or educational facilities;
- wetlands (swamps or marshes);
- groundwater extraction sites;
- floodplains;
- places of special interest, such as high amenity areas; and
- Nature Reserves, National Parks, Managed Reserves, Protected Landscapes, Planned Protected Areas (see Figure 3).

These and other area exclusion criteria are discussed in more detail in the following Chapters.

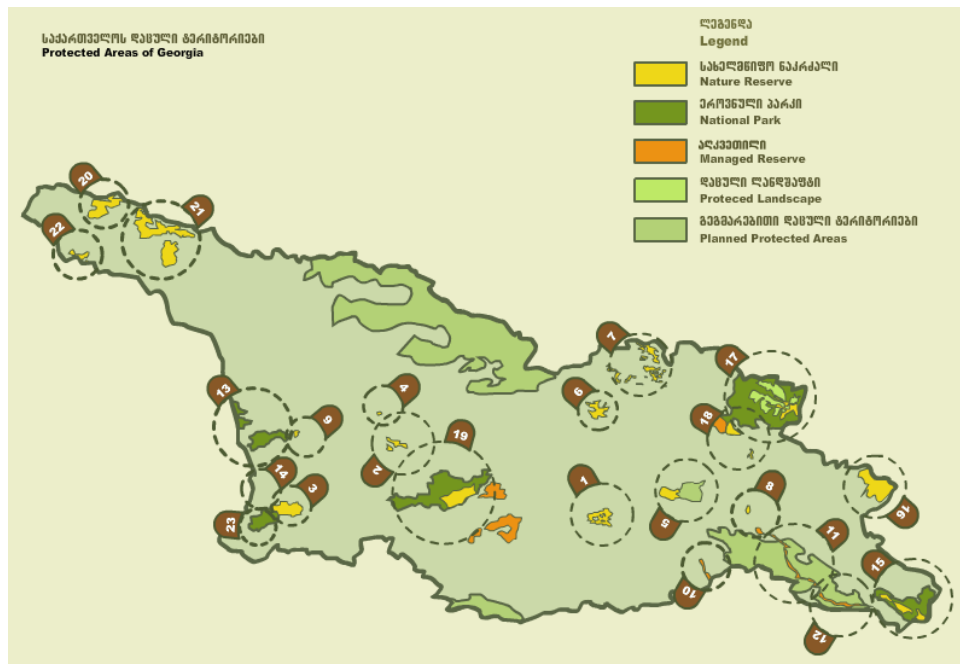


Figure 3: Protected Areas of Georgia

▪ *Closure in 5 years*

Some sites may be in a poor condition and situated on a suboptimal location, but due to circumstances have to be kept operational for a certain amount of time. These sites should be closed within approximately 5 years, and after that be remediated as much as practically feasible. Before closure, a proper

alternative ought to be identified and selected. This could be an acceptable, existing site in the surrounding area or be an all new site, which has yet to be constructed.

- *Optimisation*

In case a landfill is located on a suitable location, as concluded from the application of the various selection criteria mentioned in this manual, it could be decided to continue operations at the site. In all probability, optimisation and mitigation measures should be implemented in order to upgrade the standards of the landfill site. For example, building a fence to keep out cattle or provide sufficient cover material (e.g. sand or other soil) to cover the waste on a regular basis.

3 Identification of exclusionary areas

3.1 Introduction

When the need for a new landfill site has been established, there are a number of steps to be undertaken before selecting a site (see also Figure 4, page 21).

At an early stage in the site selection process, exclusionary areas (i.e. areas considered to be generally unsuitable for landfill) should be identified. This step should be carried out at a regional or catchment level, as a desk exercise and using GIS (geographic information system) where appropriate.

A site's natural characteristics will greatly determine its acceptability for landfill in terms of environmental impact. Engineering measures can be used to alleviate or minimise risks to the environment – having regard to the principles of BAT (best available technique), however, not all sites can be engineered to a satisfactory standard and hence exclusionary areas should apply. This approach also allows unsuitable areas to be identified at an early stage in the siting process.

The factors detailed in the Sections below are to be taken into account in order to determine areas generally unsuitable for landfill.

3.2 European Landfill Directive

When examining locations for a landfill in Georgia, the requirements below (as detailed in Annex I of the European Landfill Directive, 1999/31/EC) should preferably be taken into consideration:

- the distances from the boundary of the site to residential and recreation areas, waterways, water bodies and other agricultural or urban sites;
- the existence of groundwater, coastal water or nature protection zones in the area;
- the geological and hydro-geological conditions in the area;
- the risk of flooding, subsidence or landslides; and
- the protection of the nature or cultural patrimony in the area.

The Landfill Directive is included in Annex 1 of this manual.

3.3 Aquifers

It is recommended that landfills should, where possible, not be placed on aquifers (an underground layer of water-bearing permeable rock or unconsolidated material) of high vulnerability rating. In some very site specific circumstances this restriction can be overcome through the application of exceptional technical measures.

The legislation of Georgia forbids allocating landfills in the 'I and II belt zone'¹ of the sanitarian protection of water reservoirs and mineral waters, or at locations with cracked bedrock. The use of marshes deeper than 1 meter and areas in which ground water flows (as spring water) for the purpose of landfilling is not allowed.

3.4 Geologically unstable areas

Geologically unstable areas are defined as locations where natural or man-made features pose a substantial risk to the integrity of the landfill structure. Landfills should generally not be sited within these areas.

Typical unstable areas would comprise:

- areas directly underlain by karstified limestone;
- areas prone to subsidence caused by previous mining activity;
- areas underlain by weak or unstable sub-soils not capable of remediation;
- areas prone to landslip or slope failure;
- coastal areas prone to erosion; and
- areas prone to flooding.

3.5 Flood plains

Developers of landfills should ensure that the landfill is not located within the 50 year floodplain of rivers. The area is defined as the floodplain covered in water for return periods of less than 1 in 50 years. The only exception is where the containment levels and access roads are constructed above the anticipated flood levels.

¹ Sanitarian protection zones of water reservoirs and mineral waters are defined in compliance with the Decree # 297 of August 16, 2001 of the Minister of Labour, Healthcare and Social Protection of Georgia.

3.6 Airports

As may be relevant in siting landfills, developers shall have regard to the recommendations of the International Civil Aviation Authority (ICAO). Whether or not a landfill creates a potential hazard to aircrafts depends on the location of the landfill in relation to airport flight paths, the nature of waste deposited, and the types of birds expected in the vicinity of the landfill.

The opening of a landfill in the immediate vicinity of an airport can create a hazard even with strict controls in place. Therefore, its location should be carefully considered and the advice of bird control specialists should be sought. The type of landfill should also be taken into consideration. Landfills, which accept only one type of waste such as inert waste, should not attract birds and therefore would not constitute a hazard.

3.7 Designated areas for conservation

The Agency of Protected Areas is responsible for providing information on the conservation sites in Georgia. The Agency reports to the Minister of Environment Protection and Natural Resources. Designating such areas is the responsibility of the Parliament of Georgia.

The main types of sites are (see also Figure 3, page 14):

- State Reserves;
- National Parks;
- Monuments of Nature;
- Managed Reserves;
- Protected Landscapes; and
- Protected Areas of Multifaceted Use.

All developments likely to have a negative impact on these sites must be assessed to determine their likely impact on their conservation interest. If the assessment indicates significant negative impacts alternative solutions must be sought. Planning authorities are required to assess the implications of granting planning permission, on the conservation interest of the sites. Mixed waste landfills should not, as a general rule, be located within the boundaries of designated areas for conservation.

3.8 Archaeological heritage

The Law of Georgia on Cultural Heritage and subsequent amendments provide the formal legal mechanisms to protect monuments in Georgia.² This Law states that the policy for protecting cultural heritage is elaborated, executed and supervised by the Ministry of Culture, Monument Protection and Sports. The Ministry is also responsible for an overall information system and database concerning culture heritage in Georgia.³

As a desk exercise, all recorded archaeological sites and monuments within the study area should be identified and mapped and their legal status recorded.

3.9 Areas of high amenity

The laws of Georgia on Cultural Heritage and on the System of Protected Areas of Georgia make statutory provisions for designation of areas of special amenity (by way of the outstanding natural beauty or special recreational value) and landscape conservation areas. Where development plans identify such areas, landfills should not be placed within the boundaries so defined. Consideration should also be given to the need for a buffer zone around such areas.

3.10 Area exclusion criteria

A list of main area exclusion criteria is summarised in Annex 2. Of the criteria, certain relaxations (in *italic*) may be considered in order to bring sites – which have positive attributes – out of the excluded areas. For example, in certain circumstances, it may be acceptable to sacrifice a small area of unused groundwater (provided the area can be predetermined and future use of that water resource avoided), rather than invest large sums of money in landfill development in order to protect groundwater for its own sake. This approach may lead to the consideration of some sites which might otherwise be excluded.

² Sub-item L of Article 3 of the Law provides a definition for material cultural heritage as architectural, arts, urban construction, rural, archaeological, anthropological, ethnographic, monumental movable or immovable objects, documental materials, also gardens, parks, landscape architecture objects, developed by human beings or as a result of human beings impact upon nature, that possess artistic, aesthetic, historical, memorial value; also historical settlements, historically formed environment related to the development of the country's history, its folklore, faith and traditions, previous or current civilization.

³ Article 5 of the Law of Georgia on Cultural Heritage.

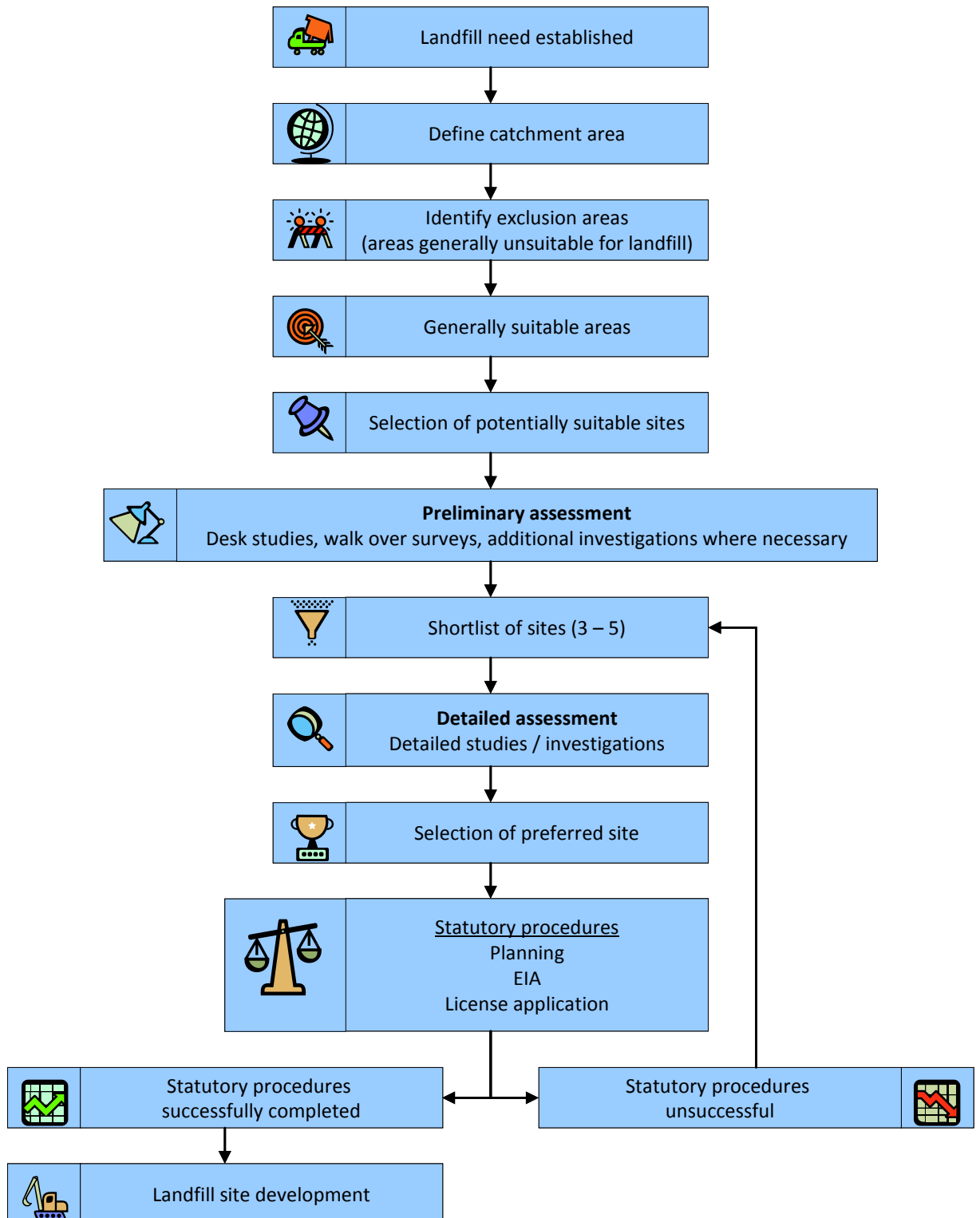


Figure 4: Site selection process (based on EPA 2006)

4 Criteria for site assessment and selection

4.1 Introduction

The principal aims of the overall site selection process from an environmental perspective are to find a landfill site, which will safeguard public health, have minimal impact on the environment and provide for safe disposal of waste.

The site selected should be of a sufficient size to justify the expenditure necessary to develop, operate and maintain the site to the highest standards over an extended period.

Having taken account of the exclusion areas identified in Chapter 3, the areas, which may be suitable for landfill development, can be identified. In a phased approach the areas selected are then reduced to a list of potential sites and eventually to the preferred site using the siting criteria detailed herein.

4.2 Assessment framework

The criteria to be considered in the SEA for site selection are outlined in the following sections. These criteria are generally the basis for overall comparison of sites and for selection of the preferred site, subject to statutory procedures. See also Figure 4 (page 21), which shows the step by step approach for site selection.

4.3 Land use

The effect of siting a landfill on the existing land use, together with the proposed after use of the site, must be subject to detailed consideration and assessment. Land use information is available from the Department of Integrated Environmental Management of the Ministry of Environment Protection. Information can also be based on satellite imagery or aerial photography.

Reference should be made to the local development plan, if any, in relation to land use zoning and objectives. Zoning can include residential, agricultural, industrial or high amenity lands.

Population trends and proposed changes in the transportation network also need to be taken into consideration. Sites in areas of lower population density are generally preferable, but other factors including the extent of screening and the value of these areas in terms of amenity and tourism must also be taken into account.

4.4 Land area requirements / availability

A number of factors will influence the area of land needed for a landfill. Amongst the factors which can vary for different sites are:

- land to act as a buffer zone and to screen off residential or other developments;
- visual and aesthetic impact;
- availability of cover material;
- surface water, groundwater, geological and hydrogeological setting of the landfill; and
- the availability of civic amenity and transfer/collection facilities.

4.5 Local community

Landfill operations are a source of concern to the local community, because of issues such as water pollution, litter, vermin, flies, dust, odour, fire, traffic and noise. Each of these can, however, be controlled and their effect minimised by modern engineering and design, good operating practices and effective management. Reservations about landfill operations tend to fall into the following categories:

- impacts on public health and on the environment;
- the competence and operating standards of the operator;
- reduction in property values and impact on the community in general;
- impacts on future development near the landfill;
- impacts on agriculture; and
- impacts on road safety.

Developers should consider how local community involvement in site selection can be facilitated and how liaison might be maintained during subsequent landfill operation. As stated before, where there are downstream advantages, these should be identified and communicated to the local community.

4.6 Buffer zones for sensitive receptors

The principle purpose of a buffer zone is to assist mitigation of environmental problems. Buffers or ‘cordon sanitaires’ are intended to provide space or distance between an activity and a sensitive receptor for the purpose of mitigating an actual or potential environmental risk to that receptor, in the knowledge that not all receptors are sensitive to the same impact.

For example, in a landfill situation where potential impacts might include noise, dust, odour, visual, gas migration, etc., a receptor such as a commercial tree plantation will not be as sensitive to these potential impacts as may a local house. So the concept of a buffer will mean different things depending on the circumstances in the area.

The distance provided between an identified receptor and a landfill site will depend on, inter alia:

- the nature of the waste (inert, municipal, etc.);
- the design of the landfill (containment, emissions control, etc.);
- the landfilling sequence;
- the scale of operations;
- the environmental controls exercised during the operation of the landfill;
- the direction of prevailing wind, groundwater and surface water flow;
- the geology of the area;
- the topography of the area vis-à-vis the elevation of housing areas and the final profile of the landfill;
- the level of screening and landscaping provided; and
- the type of receptor.

4.7 Geology and hydrogeology

It is essential to have an accurate understanding of the local geological setting of the sites involved in order to evaluate site suitability and the capability to provide protection from contamination. This will include aspects of the topography, details of the structure and characteristics of the solid strata, the composition and distribution of the sub-soils and the distribution and characteristics of the hydrogeology.

Topographical data are used in the assessment of the likelihood of slope failure, failure over unstable ground and in the interpretation of the topographical expressions of the geology, hydrology and hydrogeology.

The factors of interest in the solid strata include the type of rock, the state of weathering, the extent and distribution of structural features such as faults, joints and bedding planes, the effects of karstification and the permeability of strata. For sub-soils, it is necessary to know the composition, the lateral and vertical continuity of the strata, the permeability, resistance to erosion and the stress deformation behaviour.

Hydrogeological investigations should include assessment of the type and distribution of aquifers. The importance of the groundwater distribution, thickness and depth of the aquifers together with the permeability or transmissivity of the aquifers also need consideration. The importance of the groundwater resource should be established including protection zones, beneficial uses and the interaction between groundwater and surface water resources. Data on water levels and water quality should also be collected at this stage.

Landfill gas migration requires both a motive force and a pathway to facilitate movement towards the landfill boundary. The accessibility and permeability of any natural pathway beyond the site boundary will be governed by geological factors.

4.8 Geological faults

In locating areas suitable for landfill, it is difficult to avoid being on, or close to geological 'faults'. Even though the majority of faults increase the permeability of the bedrock in the fault zone, it would normally not be appropriate to rule out or downgrade a site because of the presence of faults. Equally, the absence of faults should not be taken as an absolute assurance that a site is geologically suitable.

Fault zones in permeable rocks (generally regionally important aquifers) are usually more significant than in low permeability rocks (generally poor aquifers). The terms 'major' and 'minor' fault are relative and have no absolute significance and, in any case, have no particular hydrogeological significance.

It is recommended that there should be no general prohibition of landfill siting on areas with geological faults. Rather, attention should be drawn to them by noting firstly that they are ubiquitous in Georgian bedrock; that they often increase the permeability somewhat; and that investigations should take account of their possible presence. Construction of potentially polluting landfills in direct contact with faults should be avoided in situations where investigations show that the fault zone is excessively permeable.

4.9 Hydrology and surface water protection

Potential effects due to landfill siting can include effects on water quality, quantity and aquatic ecology (habitat loss, disturbance or alteration). Impacts may be due to leachate contamination or increased surface runoff.

Under the European Freshwater Fish Directive (78/659/EEC), although not in force in Georgia, rivers are designated as salmonid (salmon and trout) waters for the protection of fisheries. These and non-designated waters are important for salmonids and their water quality and fish habitat should be maintained.

Surface water bodies (streams, rivers, lakes, estuarine and coastal) within the impact zone of a possible landfill site should be recorded including any designations. Account should be taken of the importance of water bodies in terms of ecological, amenity, fisheries or commercial value.

4.10 Topography

Topography refers to the physical features of the land surface, or the terrain. These features are represented on maps by means of contour lines. A contoured map can be used to identify areas with steep slopes that may complicate construction or access to the site. The watershed that drains into or across a particular area can be determined from the contours. The watershed area determines the amount of run-off a site will receive from upstream areas. Existing natural depressions may also be identified which offer an advantage for landfill development with respect to visual screening and noise attenuation.

4.11 Site visibility / natural confines

As part of the site selection process, areas with natural confines, isolated settings, or existing natural depressions would be preferable. Confining landfill sites can also be accomplished through construction of berms, fences, planting, or enhancement of existing vegetation. Siting at remote locations must also take into consideration longer distances for transporting waste.

Consideration must be given to significant or designated views, natural features and the assessment of potential impacts on sites in relation to their landscape character and value.

4.12 Biodiversity

Each potential landfill site will have a different ecological value. A landfill operation can have an adverse effect on the biodiversity of the site and its immediate surroundings. It can also result in the destruction of existing vegetation and can disrupt the habitat of aquatic and terrestrial life. A study of the biodiversity of potential sites must be carried out if there are:

- any relevant designations (e.g. areas of special interest having regard to Section 3.7);
- any rare species of plants and/or animals occurring;
- any particular features of habitats (terrestrial and aquatic) which should be protected; and
- any records of protected plants at the sites.

Any adverse impacts on ecology must be balanced against the advantages that will increase once the site has been restored, or against other compensatory measures. Restoration should aim at integrating the landfill site into the existing landscape and establishing a viable ecology, possibly more valuable than the one it replaces. Landfill operations should be engineered to take account of effects on biodiversity.

4.13 Archaeological heritage

Potential landfill sites should be assessed in relation to potential impacts on archaeological heritage. All recorded archaeological sites and monuments in the area should be identified. Sources to be consulted include: the Ministry of

Culture, Monument Protection and Sports, and – within the territory of the city of Tbilisi – Tbilisi City Hall.

Additional sources of information include early Ordnance Survey Mapping, topographical files, aerial photography and other relevant published sources. Investigations can also include field inspections, walkover and aerial surveys.

In addition to recorded sites and monuments, there is the potential for previously unknown features or monuments hidden beneath the soil surface. The archaeological potential of an area can be indicated by environmental characteristics or by archaeological testing. Landfill siting should also have regard to local development plan objectives, if any, and policies for the protection of archaeological and architectural heritage.

4.14 Areas of high amenity

As mentioned earlier, the Law of Georgia on the Systems of Protected Areas made statutory provisions for areas of special amenity and landscape conservation areas. Local development plans, if any, must be consulted for the landscape and amenity objectives, and designations. These may include the preservation of views and prospects, and the amenities of places and features of natural beauty or interest.

4.15 Airports

In siting landfills, developers shall, as may be relevant, have regard to the recommendations of the International Civil Aviation Authority (ICAO). When considering potential landfill sites the advice of bird control specialists should be sought and the potential hazard to aircraft due to bird strike assessed. Whether or not a landfill would create a potential hazard depends on the location of the landfill in relation to airport flight paths, the nature of waste deposited, and the types of birds expected in the vicinity.

There are many methods available to prevent birds from feeding at landfills. The method likely to be most acceptable near high risk areas such as airports is to enclose the tipping area by a net or enclosure to limit bird incursions. The proper siting of landfills and the type of landfill can reduce the risk of hazard near airports.

4.16 Meteorology

At the site selection stage, consideration should be given to meteorological factors and information should be obtained from the Georgian National Environmental Agency on precipitation and evapotranspiration for the areas in question. The annual rainfall is an important factor as all new sites must preferably collect and contain any leachate generated. Wind strength and wind patterns must also be examined and windbreaks considered to avoid blowing or flying litter and to determine the zone of odour hindrance.

4.17 Traffic / access

Landfill generated traffic (during construction and operation) can give rise to noise, vibration, exhaust emissions, dust, dirt and visual intrusion. Heavy vehicles on narrow roads may create traffic management issues, including delays to other traffic, damage to roads and can be a source of complaint.

The following should be evaluated as part of the site selection process:

- distance of potential sites from waste generation areas; regard should be taken to the 'proximity principle';
- proximity to the existing national / regional road or rail network and expected vehicle movements; siting of landfills with good access to national or regional road routes is preferable;
- any required upgrading or new road infrastructure to accommodate additional traffic;
- the residential nature of potential access routes; and
- objectives of local development plans.

4.18 Availability of cover material

The availability of suitable cover for the duration of the landfilling operation is important. This includes daily cover material and cover for final restoration.

In considering an area for landfill, information must be obtained on the characteristics of the soils in the area. If suitable cover material were not available at the site, it would have to be imported and/or alternative cover systems employed.

Daily cover material should be permeable to aid rainfall penetration and assist waste degradation. It must also be suitable to reduce localised odour at the tipping face and reduce nuisance associated with insects and vermin.

4.19 Services and security

Site selection should take account of the services that would be necessary to develop and operate a landfill to the required standards. For example, water supply (including on-site storage), proximity to sewerage system and suitable wastewater treatment, power supply and telephone connections should be considered.

It may be necessary to transport leachate off-site for treatment and if this is the case, the location with respect to off-site treatment facilities should be taken into consideration.

Access to landfill sites must be controlled in order to prevent unauthorised vehicular traffic and illegal dumping of waste. When selecting a site, security should be considered and attention should be paid to natural barriers or suitability for artificial barriers.



Iagluja landfill near Rustavi



Landfill near Akhaltsikhe

5 Consultative framework

5.1 Introduction

The selection of a landfill site through the application of SEA requires a participatory process. Adoption of a consultative framework early in the process is essential to achieve a successful outcome to site selection. In order to address concerns of the general public, innovative approaches are required in relation to public participation. At the earliest possible stage the public must be given the opportunity to:

- participate in / contribute to the selection process;
- understand the issues and the possible solutions;
- understand the approach being suggested;
- participate in scoping of the SEA (and later the EIA) report; and
- comment on potential impacts, both positive and negative.

5.2 Consultation on landfill siting

In relation to selection of a landfill site, the following forms of public consultation are available for use. Landfill developers are advised to use a combination of these methods to inform and collect public opinion. There is no requirement to use all of these methods and neither is this list intended to be exhaustive:

- public notices concerning waste strategy or project planning in local/national press circulating in area;
- briefings to elected members and local representative groups;
- information leaflets / newsletters;
- meetings with interested groups;
- meetings with landowners, either separately or in groups;
- public meetings;
- local seminars / conferences / workshops / exhibitions;
- public information videos and other audiovisual aids;
- site visits to other landfills operating to a higher standard;
- informational website;
- public information centres;
- correspondence with interested parties;
- public information programmes directed at schools, resident associations and other community groups;

- panel discussions and interviews on local or national media;
- private house visits;
- setting up of public liaison group / committee; and
- establishment of a local authority committee (for local authority applications) to hear concerns.

Where a public liaison group / committee is proposed, its membership could include:

- the community, its representatives and local politicians;
- representatives of the local authority;
- representatives of waste collection, recovery companies;
- representatives of local industry;
- representatives of (informal) recycling organisations operating in the area;
- representatives of non-governmental environmental organisations (NGOs);
- representatives of the farming community; and,
- representatives of the relevant Chambers of Commerce.

Developers should consider how local community involvement in site selection can be facilitated and how liaison might be maintained during subsequent landfill operation. In case of downstream advantages, these should be identified and communicated to the local community.

The development of facilities should only take place when:

- they are in compliance with existing statutory procedures (SEA/EIA, planning permission, licence application, etc.); and
- the public has been consulted during the process.

Public health risk is a perceived issue for many communities in cases of proposed landfill development / operation. The SEA-process must endeavour to collect these concerns and address them in consultation and in the EIA for the application. Both assessments can play a role in distinguishing facts from perceptions.

6 Short listing of sites and site selection

6.1 Introduction

Investigation or assessment of potential landfill sites is an essential part of the overall SEA-process. The purpose is to determine the most suitable site or sites for landfill development. The step-by-step process describes the sequence and extent of preliminary and detailed assessments required to progress the selection, construction and operation of a landfill site.

6.2 Preliminary assessment

Having taken account of the exclusionary areas identified in Chapter 3, the areas, which may be suitable for landfill development, can be identified. As indicated earlier, the selection should seek to avoid regionally important aquifers, flood plains of major rivers, designated conservation areas, areas of high amenity and archaeological interest, etc.

The areas considered suitable for landfill are further reduced to a number of potential sites based on the criteria identified in Chapter 4. A preliminary assessment is undertaken to allow comparison between sites and to provide information on these. This will usually involve a desk study and walk-over surveys.

Through the process the number of sites being considered is reduced progressively as desk studies and preliminary investigations are completed. The siting criteria herein are used to form a shortlist of sites, which would then allow for a more detailed assessment.

6.3 Detailed assessment

At the conclusion of the preliminary assessment, a maximum of three to five sites should remain. Detailed investigations and assessment are required to further characterise these sites and to either reject sites or confirm their suitability.

The detailed investigations should have regard to depth of overburden, bedrock type, groundwater protection, land use, likely impact on local population,

quality of road access, quality of natural screening, and other factors of local importance. Aerial surveys and GIS systems may be of use at this stage. Annex 3 includes a schedule of information sources available.

The assessment and site selection phases operate in parallel and overlap to some extent.

6.4 Short listing process

It is important to emphasise that neither the short-listing process nor the final site selection lend themselves to precise mathematical determination. In addition, the preliminary investigations process of screening potential areas and sites needs to be a flexible one as the acquisition of site specific information may be slow. The process should therefore allow for consideration of shortlisted areas until there is sufficient relevant information to narrow down suitable sites within these areas.

Early investigations in shortlisted areas may also suggest adjacent areas of particular suitability, which were not obvious at desk study or preliminary stage. The purpose of the overall exercise is to find a suitable site. This should be the result of an informed judgement over the period of the investigations based on consideration of national and international standards on the one hand and local enabling factors on the other.

The principal factor likely to determine the degree of impact of a landfill on the local environment will be the natural qualities of the site itself and the mitigation measures adopted. It is also important to remember that with a decreasing number of sites, the level of investigative technique and the degree of intensification of study is greater and therefore flexibility must be maintained such that sites can be interchanged on the shortlist as a greater degree of information becomes available.

Also, a site should not be rejected too early because it does not appear to fully meet all criteria. Consideration should be given to design and operational techniques that could overcome initial reservations.

6.5 Site selection

Using information from the preliminary and detailed investigations and the siting criteria a comparative assessment should be carried out on the shortlisted sites.

The assessment should be in sufficient detail to allow decision making in technical, environmental and financial terms based on:

- the likely degree of impact due to each site;
- the site suitability in terms of technical and environmental factors; and
- the estimated costs of the landfill development for each site.

With regard to siting criteria, it is necessary to consider each site in terms of positive and negative implications. Positive aspects can include good national or regional road access, location on a poor aquifer, good quality natural screening, and other considerations likely to assist the acceptable integration of a landfill site into a particular area. Typical negative aspects would include poor access to regional or national routes, proximity to ecologically sensitivity areas, high population density and other features, which would make landfill siting difficult to substantiate or defend.

It is unlikely that any site will be favourable in relation to all siting criteria. Therefore, the decision making process and the selection of the preferred site becomes a balance of trade-offs based on the judgement of those involved.

6.6 Preferred site

A landfill site is deemed to be 'selected' when statutory procedures have been successfully completed. The site should preferably also meet all aforementioned criteria, including the requirements of the European Landfill Directive (1999/31/EC) (see Annex 1), which states that:

"Member states shall take measures in order that ... the competent authority does not issue a landfill permit unless it is satisfied that ... the landfill project complies with all the relevant requirements of this Directive, including the annexes".

Annex I of the Directive also states that the landfill can be authorised only if the characteristics of the site and/or the corrective measures to be taken, indicate that the landfill does not pose a serious environmental risk.

The preferred site will be subject to an Environmental Impact Assessment (EIA) (where required) before any landfill development can commence on that site. The Environmental Impact Statement (EIS), which documents the assessment of the effects on the environment, should also shortly outline the alternatives considered, based on the SEA report. If the preferred site is rejected by the planning or licensing authority, the developer may seek approval for another site on the shortlist, which would also be subject to an EIA.

It is emphasised that any landfill approval must, as far as protection of the environment is concerned, be based on sound scientific and engineering principles first and foremost. Many site factors can be improved by engineering design and potential impacts can be mitigated by appropriate methods of operation.

Annexes

Annex 1

EU Landfill Directive 1999/31/EC

I

(Acts whose publication is obligatory)

COUNCIL DIRECTIVE 1999/31/EC

of 26 April 1999

on the landfill of waste

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 130s(1) thereof,

Having regard to the proposal from the Commission⁽¹⁾,

Having regard to the opinion of the Economic and Social Committee⁽²⁾,

Acting in accordance with the procedure laid down in Article 189c of the Treaty⁽³⁾,

(1) Whereas the Council resolution of 7 May 1990⁽⁴⁾ on waste policy welcomes and supports the Community strategy document and invites the Commission to propose criteria and standards for the disposal of waste by landfill;

(2) Whereas the Council resolution of 9 December 1996 on waste policy considers that, in the future, only safe and controlled landfill activities should be carried out throughout the Community;

(3) Whereas the prevention, recycling and recovery of waste should be encouraged as should the use of recovered materials and energy so as to safeguard natural resources and obviate wasteful use of land;

(4) Whereas further consideration should be given to the issues of incineration of municipal and non-hazardous waste, composting, biomethanisation, and the processing of dredging sludges;

(5) Whereas under the polluter pays principle it is necessary, *inter alia*, to take into account any damage to the environment produced by a landfill;

(6) Whereas, like any other type of waste treatment, landfill should be adequately monitored and managed to prevent or reduce potential adverse effects on the environment and risks to human health;

(7) Whereas it is necessary to take appropriate measures to avoid the abandonment, dumping or uncontrolled disposal of waste; whereas, accordingly, it must be possible to monitor landfill sites with respect to the substances contained in the waste deposited there, whereas such substances should, as far as possible, react only in foreseeable ways;

(8) Whereas both the quantity and hazardous nature of waste intended for landfill should be reduced where appropriate; whereas the handling of waste should be facilitated and its recovery enhanced; whereas the use of treatment processes should therefore be encouraged to ensure that landfill is compatible with the objectives of this Directive; whereas sorting is included in the definition of treatment;

(9) Whereas Member States should be able to apply the principles of proximity and self-sufficiency for the elimination of their waste at Community and national level, in accordance with Council Directive 75/442/EEC of 15 July 1975 on waste⁽⁵⁾ whereas the objectives of this Directive must be pursued and clarified through the establishment of an adequate, integrated network of disposal plants based on a high level of environmental protection;

(10) Whereas disparities between technical standards for the disposal of waste by landfill and the lower costs associated with it might give rise to increased disposal of waste in facilities with low standards of

⁽¹⁾ OJ C 156, 24.5.1997, p. 10.

⁽²⁾ OJ C 355, 21.11.1997, p. 4.

⁽³⁾ Opinion of the European Parliament of 19 February 1998 (OJ C 80, 16.3.1998, p. 196), Council common position of 4 June 1998 (OJ C 333, 30.10.1998, p. 15) and Decision of the European Parliament of 3 February 1999 (OJ C 150, 28.5.1999, p. 78)

⁽⁴⁾ OJ C 122, 18.5.1990, p. 2.

⁽⁵⁾ OJ L 194, 25.7.1975, p. 39. Directive as last amended by Commission Decision 96/350/EC (OJ L 135, 6.6.1996, p. 32).

- environmental protection and thus create a potentially serious threat to the environment, owing to transport of waste over unnecessarily long distances as well as to inappropriate disposal practices;
- (11) Whereas it is therefore necessary to lay down technical standards for the landfill of waste at Community level in order to protect, preserve and improve the quality of the environment in the Community;
- (12) Whereas it is necessary to indicate clearly the requirements with which landfill sites must comply as regards location, conditioning, management, control, closure and preventive and protective measures to be taken against any threat to the environment in the short as well as in the long-term perspective, and more especially against the pollution of groundwater by leachate infiltration into the soil;
- (13) Whereas in view of the foregoing it is necessary to define clearly the classes of landfill to be considered and the types of waste to be accepted in the various classes of landfill;
- (14) Whereas sites for temporary storage of waste should comply with the relevant requirements of Directive 75/442/EEC;
- (15) Whereas the recovery, in accordance with Directive 75/442/EEC, of inert or non-hazardous waste which is suitable, through their use in redevelopment/restoration and filling-in work, or for construction purposes may not constitute a landfilling activity;
- (16) Whereas measures should be taken to reduce the production of methane gas from landfills, *inter alia*, in order to reduce global warming, through the reduction of the landfill of biodegradable waste and the requirements to introduce landfill gas control;
- (17) Whereas the measures taken to reduce the landfill of biodegradable waste should also aim at encouraging the separate collection of biodegradable waste, sorting in general, recovery and recycling;
- (18) Whereas, because of the particular features of the landfill method of waste disposal, it is necessary to introduce a specific permit procedure for all classes of landfill in accordance with the general licensing requirements already set down in Directive 75/442/EEC and the general requirements of Directive 96/61/EC concerning integrated pollution prevention and control⁽¹⁾ whereas the landfill site's compliance with such a permit must be verified in the course of an inspection by the competent authority before the start of disposal operations;
- (19) Whereas, in each case, checks should be made to establish whether the waste may be placed in the landfill for which it is intended, in particular as regards hazardous waste;
- (20) Whereas, in order to prevent threats to the environment, it is necessary to introduce a uniform waste acceptance procedure on the basis of a classification procedure for waste acceptable in the different categories of landfill, including in particular standardised limit values; whereas to that end a consistent and standardised system of waste characterisation, sampling and analysis must be established in time to facilitate implementation of this Directive; whereas the acceptance criteria must be particularly specific with regard to inert waste;
- (21) Whereas, pending the establishment of such methods of analysis or of the limit values necessary for characterisation, Member States may for the purposes of this Directive maintain or draw up national lists of waste which is acceptable or unacceptable for landfill, or define criteria, including limit values, similar to those laid down in this Directive for the uniform acceptance procedure;
- (22) Whereas for certain hazardous waste to be accepted in landfills for non-hazardous waste acceptance criteria should be developed by the technical committee;
- (23) Whereas it is necessary to establish common monitoring procedures during the operation and after-care phases of a landfill in order to identify any possible adverse environmental effect of the landfill and take the appropriate corrective measures;
- (24) Whereas it is necessary to define when and how a landfill should be closed and the obligations and responsibility of the operator on the site during the after-care period;
- (25) Whereas landfill sites that have been closed prior to the date of transposition of this Directive should not be subject to its provisions on closure procedure;
- (26) Whereas the future conditions of operation of existing landfills should be regulated in order to take the necessary measures, within a specified period of time, for their adaptation to this Directive on the basis of a site-conditioning plan;

⁽¹⁾ OJ L 257, 10.10.1996, p. 26.

- (27) Whereas for operators of existing landfills having, in compliance with binding national rules equivalent to those of Article 14 of this Directive, already submitted the documentation referred to in Article 14(a) of this Directive prior to its entry into force and for which the competent authority authorised the continuation of their operation, there is no need to resubmit this documentation nor for the competent authority to deliver a new authorisation;
- (28) Whereas the operator should make adequate provision by way of a financial security or any other equivalent to ensure that all the obligations flowing from the permit are fulfilled, including those relating to the closure procedure and after-care of the site;
- (29) Whereas measures should be taken to ensure that the price charged for waste disposal in a landfill cover all the costs involved in the setting up and operation of the facility, including as far as possible the financial security or its equivalent which the site operator must provide, and the estimated cost of closing the site including the necessary after-care;
- (30) Whereas, when a competent authority considers that a landfill is unlikely to cause a hazard to the environment for longer than a certain period, the estimated costs to be included in the price to be charged by an operator may be limited to that period;
- (31) Whereas it is necessary to ensure the proper application of the provisions implementing this Directive throughout the Community, and to ensure that the training and knowledge acquired by landfill operators and staff afford them the necessary skills;
- (32) Whereas the Commission must establish a standard procedure for the acceptance of waste and set up a standard classification of waste acceptable in a landfill in accordance with the committee procedure laid down in Article 18 of Directive 75/442/EEC;
- (33) Whereas adaptation of the Annexes to this Directive to scientific and technical progress and the standardisation of the monitoring, sampling and analysis methods must be adopted under the same committee procedure;
- (34) Whereas the Member States must send regular reports to the Commission on the implementation of this Directive paying particular attention to the national strategies to be set up in pursuance of Article 5; whereas on the basis of these reports the Commission shall report to the European Parliament and the Council;

HAS ADOPTED THIS DIRECTIVE

Article 1

Overall objective

1. With a view to meeting the requirements of Directive 75/442/EEC, and in particular Articles 3 and 4 thereof, the aim of this Directive is, by way of stringent operational and technical requirements on the waste and landfills, to provide for measures, procedures and guidance to prevent or reduce as far as possible negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk to human health, from landfilling of waste, during the whole life-cycle of the landfill.

2. In respect of the technical characteristics of landfills, this Directive contains, for those landfills to which Directive 96/61/EC is applicable, the relevant technical requirements in order to elaborate in concrete terms the general requirements of that Directive. The relevant requirements of Directive 96/61/EC shall be deemed to be fulfilled if the requirements of this Directive are complied with.

Article 2

Definitions

For the purposes of this Directive:

- (a) 'waste' means any substance or object which is covered by Directive 75/442/EEC;
- (b) 'municipal waste' means waste from households, as well as other waste which, because of its nature or composition, is similar to waste from household;
- (c) 'hazardous waste' means any waste which is covered by Article 1(4) of Council Directive 91/689/EEC of 12 December 1991 on hazardous waste ⁽¹⁾
- (d) 'non-hazardous waste' means waste which is not covered by paragraph (c);
- (e) 'inert waste' means waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater;

⁽¹⁾ OJ L 377, 31.12.1991, p. 20. Directive as last amended by Directive 94/31/EC (OJ L 168, 2.7.1994, p. 28);

- (f) 'underground storage' means a permanent waste storage facility in a deep geological cavity such as a salt or potassium mine;
- (g) 'landfill' means a waste disposal site for the deposit of the waste onto or into land (i.e. underground), including:
- internal waste disposal sites (i.e. landfill where a producer of waste is carrying out its own waste disposal at the place of production), and
 - a permanent site (i.e. more than one year) which is used for temporary storage of waste,
- but excluding:
- facilities where waste is unloaded in order to permit its preparation for further transport for recovery, treatment or disposal elsewhere, and
 - storage of waste prior to recovery or treatment for a period less than three years as a general rule, or
 - storage of waste prior to disposal for a period less than one year;
- (h) 'treatment' means the physical, thermal, chemical or biological processes, including sorting, that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery;
- (i) 'leachate' means any liquid percolating through the deposited waste and emitted from or contained within a landfill;
- (j) 'landfill gas' means all the gases generated from the landfilled waste;
- (k) 'eluate' means the solution obtained by a laboratory leaching test;
- (l) 'operator' means the natural or legal person responsible for a landfill in accordance with the internal legislation of the Member State where the landfill is located; this person may change from the preparation to the after-care phase;
- (m) 'biodegradable waste' means any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard;
- (n) 'holder' means the producer of the waste or the natural or legal person who is in possession of it;
- (o) 'applicant' means any person who applies for a landfill permit under this Directive;
- (p) 'competent authority' means that authority which the Member States designate as responsible for performing the duties arising from this Directive;
- (q) 'liquid waste' means any waste in liquid form including waste waters but excluding sludge;
- (r) 'isolated settlement' means a settlement:
- with no more than 500 inhabitants per municipality or settlement and no more than five inhabitants per square kilometre and,
 - where the distance to the nearest urban agglomeration with at least 250 inhabitants per square kilometre is not less than 50 km, or with difficult access by road to those nearest agglomerations, due to harsh meteorological conditions during a significant part of the year.

Article 3

Scope

1. Member States shall apply this Directive to any landfill as defined in Article 2(g).
2. Without prejudice to existing Community legislation, the following shall be excluded from the scope of this Directive:
 - the spreading of sludges, including sewage sludges, and sludges resulting from dredging operations, and similar matter on the soil for the purposes of fertilisation or improvement,
 - the use of inert waste which is suitable, in redevelopment/restoration and filling-in work, or for construction purposes, in landfills,
 - the deposit of non-hazardous dredging sludges alongside small waterways from where they have been dredged out and of non-hazardous sludges in surface water including the bed and its sub soil,
 - the deposit of unpolluted soil or of non-hazardous inert waste resulting from prospecting and extraction, treatment, and storage of mineral resources as well as from the operation of quarries.
3. Without prejudice to Directive 75/442/EEC Member States may declare at their own option, that the deposit of non-hazardous waste, to be defined by the committee established under Article 17 of this Directive, other than inert waste, resulting from prospecting and extraction, treatment and storage of mineral resources as well as from the operation of quarries and which are deposited in a manner preventing environmental pollution or harm to human health, can be exempted from the provisions in Annex I, points 2, 3.1, 3.2 and 3.3 of this Directive.

4. Without prejudice to Directive 75/442/EEC Member States may declare, at their own option, parts or all of Articles 6(d), 7(i), 8(a)(iv), 10, 11(1)(a), (b) and (c), 12(a) and (c), Annex I, points 3 and 4, Annex II (except point 3, level 3, and point 4) and Annex III, points 3 to 5 to this Directive not applicable to:

- (a) landfill sites for non-hazardous or inert wastes with a total capacity not exceeding 15 000 tonnes or with an annual intake not exceeding 1 000 tonnes serving islands, where this is the only landfill on the island and where this is exclusively destined for the disposal of waste generated on that island. Once the total capacity of that landfill has been used, any new landfill site established on the island shall comply with the requirements of this Directive;
- (b) landfill sites for non-hazardous or inert waste in isolated settlements if the landfill site is destined for the disposal of waste generated only by that isolated settlement.

Not later than two years after the date laid down in Article 18(1), Member States shall notify the Commission of the list of islands and isolated settlements that are exempted. The Commission shall publish the list of islands and isolated settlements.

5. Without prejudice to Directive 75/442/EEC Member States may declare, at their own option, that underground storage as defined in Article 2(f) of this Directive can be exempted from the provisions in Article 13(d) and in Annex I, point 2, except first indent, points 3 to 5 and in Annex III, points 2, 3 and 5 to this Directive.

Article 4

Classes of landfill

Each landfill shall be classified in one of the following classes:

- landfill for hazardous waste,
- landfill for non-hazardous waste,
- landfill for inert waste.

Article 5

Waste and treatment not acceptable in landfills

1. Member States shall set up a national strategy for the implementation of the reduction of biodegradable waste going to landfills, not later than two years after the date laid down in Article 18(1) and notify the Commission of this strategy. This strategy should include measures to achieve the targets set out in paragraph 2 by means of in particular, recycling, composting, biogas production or materials/energy recovery.

Within 30 months of the date laid down in Article 18(1) the Commission shall provide the European Parliament and the Council with a report drawing together the national strategies.

2. This strategy shall ensure that:

- (a) not later than five years after the date laid down in Article 18(1), biodegradable municipal waste going to landfills must be reduced to 75 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available
- (b) not later than eight years after the date laid down in Article 18(1), biodegradable municipal waste going to landfills must be reduced to 50 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available;
- (c) not later than 15 years after the date laid down in Article 18(1), biodegradable municipal waste going to landfills must be reduced to 35 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available.

Two years before the date referred to in paragraph (c) the Council shall reexamine the above target, on the basis of a report from the Commission on the practical experience gained by Member States in the pursuance of the targets laid down in paragraphs (a) and (b) accompanied, if appropriate, by a proposal with a view to confirming or amending this target in order to ensure a high level of environmental protection.

Member States which in 1995 or the latest year before 1995 for which standardised EUROSTAT data is available put more than 80 % of their collected municipal waste to landfill may postpone the attainment of the targets set out in paragraphs (a), (b), or (c) by a period not exceeding four years. Member States intending to make use of this provision shall inform in advance the Commission of their decision. The Commission shall inform other Member States and the European Parliament of these decisions.

The implementation of the provisions set out in the preceding subparagraph may in no circumstances lead to the attainment of the target set out in paragraph (c) at a date later than four years after the date set out in paragraph (c).

3. Member States shall take measures in order that the following wastes are not accepted in a landfill:

- (a) liquid waste;
- (b) waste which, in the conditions of landfill, is explosive, corrosive, oxidising, highly flammable or flammable, as defined in Annex III to Directive 91/689/EEC;

- (c) hospital and other clinical wastes arising from medical or veterinary establishments, which are infectious as defined (property H9 in Annex III) by Directive 91/689/EEC and waste falling within category 14 (Annex I.A) of that Directive.
 - (d) whole used tyres from two years from the date laid down in Article 18(1), excluding tyres used as engineering material, and shredded used tyres five years from the date laid down in Article 18(1) (excluding in both instances bicycle tyres and tyres with an outside diameter above 1 400 mm);
 - (e) any other type of waste which does not fulfil the acceptance criteria determined in accordance with Annex II.
4. The dilution of mixture of waste solely in order to meet the waste acceptance criteria is prohibited.

Article 6

Waste to be accepted in the different classes of landfill

Member States shall take measures in order that:

- (a) only waste that has been subject to treatment is landfilled. This provision may not apply to inert waste for which treatment is not technically feasible, nor to any other waste for which such treatment does not contribute to the objectives of this Directive, as set out in Article 1, by reducing the quantity of the waste or the hazards to human health or the environment;
- (b) only hazardous waste that fulfils the criteria set out in accordance with Annex II is assigned to a hazardous landfill;
- (c) landfill for non-hazardous waste may be used for:
 - (i) municipal waste;
 - (ii) non-hazardous waste of any other origin, which fulfil the criteria for the acceptance of waste at landfill for non-hazardous waste set out in accordance with Annex II;
 - (iii) stable, non-reactive hazardous wastes (e.g. solidified, vitrified), with leaching behaviour equivalent to those of the non-hazardous wastes referred to in point (ii), which fulfil the relevant acceptance criteria set out in accordance with Annex II. These hazardous wastes shall not be deposited in cells destined for biodegradable non-hazardous waste,
- (d) inert waste landfill sites shall be used only for inert waste.

Article 7

Application for a permit

Member States shall take measures in order that the application for a landfill permit must contain at least particulars of the following:

- (a) the identity of the applicant and of the operator when they are different entities;
- (b) the description of the types and total quantity of waste to be deposited;
- (c) the proposed capacity of the disposal site;
- (d) the description of the site, including its hydrogeological and geological characteristics;
- (e) the proposed methods for pollution prevention and abatement;
- (f) the proposed operation, monitoring and control plan;
- (g) the proposed plan for the closure and after-care procedures;
- (h) where an impact assessment is required under Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment ⁽¹⁾, the information provided by the developer in accordance with Article 5 of that Directive;
- (i) the financial security by the applicant, or any other equivalent provision, as required under Article 8(a)(iv) of this Directive.

Following a successful application for a permit, this information shall be made available to the competent national and Community statistical authorities when requested for statistical purposes.

Article 8

Conditions of the permit

Member States shall take measures in order that:

- (a) the competent authority does not issue a landfill permit unless it is satisfied that:
 - (i) without prejudice to Article 3(4) and (5), the landfill project complies with all the relevant requirements of this Directive, including the Annexes;

⁽¹⁾ OJ L 175, 5.7.1985, p. 40. Directive as amended by Directive 97/11/EC (OJ L 73, 14.3.1997, p. 5).

- (ii) the management of the landfill site will be in the hands of a natural person who is technically competent to manage the site; professional and technical development and training of landfill operators and staff are provided;
 - (iii) the landfill shall be operated in such a manner that the necessary measures are taken to prevent accidents and limit their consequences;
 - (iv) adequate provisions, by way of a financial security or any other equivalent, on the basis of modalities to be decided by Member States, has been or will be made by the applicant prior to the commencement of disposal operations to ensure that the obligations (including after-care provisions) arising under the permit issued under the provisions of this Directive are discharged and that the closure procedures required by Article 13 are followed. This security or its equivalent shall be kept as long as required by maintenance and after-care operation of the site in accordance with Article 13(d). Member States may declare, at their own option, that this point does not apply to landfills for inert waste;
- (b) the landfill project is in line with the relevant waste management plan or plans referred to in Article 7 of Directive 75/442/EEC;
- (c) prior to the commencement of disposal operations, the competent authority shall inspect the site in order to ensure that it complies with the relevant conditions of the permit. This will not reduce in any way the responsibility of the operator under the conditions of the permit.

Article 9

Content of the permit

Specifying and supplementing the provisions set out in Article 9 of Directive 75/442/EEC and Article 9 of Directive 96/61/EC, the landfill permit shall state at least the following:

- (a) the class of the landfill;
- (b) the list of defined types and the total quantity of waste which are authorised to be deposited in the landfill;
- (c) requirements for the landfill preparations, landfilling operations and monitoring and control procedures, including contingency plans (Annex III, point 4.B), as well as provisional requirements for the closure and after-care operations;
- (d) the obligation on the applicant to report at least annually to the competent authority on the types and quantities of waste disposed of and on the results of the monitoring programme as required in Articles 12 and 13 and Annex III.

Article 10

Cost of the landfill of waste

Member States shall take measures to ensure that all of the costs involved in the setting up and operation of a landfill site, including as far as possible the cost of the financial security or its equivalent referred to in Article 8(a)(iv), and the estimated costs of the closure and after-care of the site for a period of at least 30 years shall be covered by the price to be charged by the operator for the disposal of any type of waste in that site. Subject to the requirements of Council Directive 90/313/EEC of 7 June 1990 on the freedom of access to information on the environment ⁽¹⁾ Member States shall ensure transparency in the collection and use of any necessary cost information.

Article 11

Waste acceptance procedures

1. Member States shall take measures in order that prior to accepting the waste at the landfill site:

- (a) before or at the time of delivery, or of the first in a series of deliveries, provided the type of waste remains unchanged, the holder or the operator can show, by means of the appropriate documentation, that the waste in question can be accepted at that site according to the conditions set in the permit, and that it fulfils the acceptance criteria set out in Annex II;
- (b) the following reception procedures are respected by the operator:

- checking of the waste documentation, including those documents required by Article 5(3) of Directive 91/689/EEC and, where they apply, those required by Council Regulation (EEC) No 259/93 of 1 February 1993 on the supervision and control of shipments of waste within, into and out of the European Community ⁽²⁾;

- visual inspection of the waste at the entrance and at the point of deposit and, as appropriate, verification of conformity with the description provided in the documentation submitted by the holder. If representative samples have to be taken in order to implement Annex II, point 3, level 3, the results of the analyses shall be kept and the sampling shall be made in conformity with Annex II, point 5. These samples shall be kept at least one month;

- keeping a register of the quantities and characteristics of the waste deposited, indicating origin, date of delivery, identity of the producer or collector in the case of municipal waste, and, in the case of hazardous

⁽¹⁾ OJ L 158, 23.6.1990, p. 56.

⁽²⁾ OJ L 30, 6.2.1993, p. 1. Regulation as amended by Regulation (EC) No 120/97 (OJ L 22, 24.1.1997, p. 14).

waste, the precise location on the site. This information shall be made available to the competent national and Community statistical authorities when requested for statistical purposes;

- (c) the operator of the landfill shall always provide written acknowledgement of receipt of each delivery accepted on the site;
- (d) without prejudice to the provisions of Regulation (EEC) No 259/93, if waste is not accepted at a landfill the operator shall notify without delay the competent authority of the non-acceptance of the waste.

2. For landfill sites which have been exempted from provisions of this Directive by virtue of Article 3(4) and (5), Member States shall take the necessary measures to provide for:

- regular visual inspection of the waste at the point of deposit in order to ensure that only non-hazardous waste from the island or the isolated settlement is accepted at the site; and
- a register on the quantities of waste that are deposited at the site be kept.

Member States shall ensure that information on the quantities and, where possible, the type of waste going to such exempted sites forms part of the regular reports to the Commission on the implementation of the Directive.

Article 12

Control and monitoring procedures in the operational phase

Member States shall take measures in order that control and monitoring procedures in the operational phase meet at least the following requirements:

- (a) the operator of a landfill shall carry out during the operational phase a control and monitoring programme as specified in Annex III;
- (b) the operator shall notify the competent authority of any significant adverse environmental effects revealed by the control and monitoring procedures and follow the decision of the competent authority on the nature and timing of the corrective measures to be taken. These measures shall be undertaken at the expense of the operator.

At a frequency to be determined by the competent authority, and in any event at least once a year, the operator shall report, on the basis of aggregated data, all monitoring results to the competent authorities for the purpose of demonstrating compliance with permit conditions and increasing the knowledge on waste behaviour in the landfills;

- (c) the quality control of the analytical operations of the control and monitoring procedures and/or of the analyses referred to in Article 11(1)(b) are carried out by competent laboratories.

Article 13

Closure and after-care procedures

Member States shall take measures in order that, in accordance, where appropriate, with the permit:

- (a) a landfill or part of it shall start the closure procedure:
- (i) when the relevant conditions stated in the permit are met; or
 - (ii) under the authorisation of the competent authority, at the request of the operator; or
 - (iii) by reasoned decision of the competent authority;
- (b) a landfill or part of it may only be considered as definitely closed after the competent authority has carried out a final on-site inspection, has assessed all the reports submitted by the operator and has communicated to the operator its approval for the closure. This shall not in any way reduce the responsibility of the operator under the conditions of the permit;
- (c) after a landfill has been definitely closed, the operator shall be responsible for its maintenance, monitoring and control in the after-care phase for as long as may be required by the competent authority, taking into account the time during which the landfill could present hazards.

The operator shall notify the competent authority of any significant adverse environmental effects revealed by the control procedures and shall follow the decision of the competent authority on the nature and timing of the corrective measures to be taken;

- (d) for as long as the competent authority considers that a landfill is likely to cause a hazard to the environment and without prejudice to any Community or national legislation as regards liability of the waste holder, the operator of the site shall be responsible for monitoring and analysing landfill gas and leachate from the site and the groundwater regime in the vicinity of the site in accordance with Annex III.

Article 14

Existing landfill sites

Member States shall take measures in order that landfills which have been granted a permit, or which are already in operation at the time of transposition of this Directive, may not continue

to operate unless the steps outlined below are accomplished as soon as possible and within eight years after the date laid down in Article 18(1) at the latest:

- (a) with a period of one year after the date laid down in Article 18(1), the operator of a landfill shall prepare and present to the competent authorities, for their approval, a conditioning plan for the site including the particulars listed in Article 8 and any corrective measures which the operator considers will be needed in order to comply with the requirements of this Directive with the exception of the requirements in Annex I, point 1;
- (b) following the presentation of the conditioning plan, the competent authorities shall take a definite decision on whether operations may continue on the basis of the said conditioning plan and this Directive. Member States shall take the necessary measures to close down as soon as possible, in accordance with Article 7(g) and 13, sites which have not been granted, in accordance with Article 8, a permit to continue to operate;
- (c) on the basis of the approved site-conditioning plan, the competent authority shall authorise the necessary work and shall lay down a transitional period for the completion of the plan. Any existing landfill shall comply with the requirements of this Directive with the exception of the requirements in Annex I, point 1 within eight years after the date laid down in Article 18(1);
- (d) (i) within one year after the date laid down in Article 18(1), Articles 4, 5, and 11 and Annex II shall apply to landfills for hazardous waste;
- (ii) within three years after the date laid down in Article 18(1), Article 6 shall apply to landfills for hazardous waste.

Article 15

Obligation to report

At intervals of three years Member States shall send to the Commission a report on the implementation of this Directive, paying particular attention to the national strategies to be set up in pursuance of Article 5. The report shall be drawn up on the basis of a questionnaire or outline drafted by the Commission in accordance with the procedure laid down in Article 6 of Directive 91/692/EEC ⁽¹⁾ The questionnaire or outline shall be sent to Member States six months before the start of the period covered by the report. The report shall be sent to the Commission within nine months of the end of the three-year period covered by it.

The Commission shall publish a Community report on the implementation of this Directive within nine months of receiving the reports from the Member States.

⁽¹⁾ OJ L 377, 31.12.1991, p. 48.

Article 16

Committee

Any amendments necessary for adapting the Annexes to this Directive to scientific and technical progress and any proposals for the standardisation of control, sampling and analysis methods in relation to the landfill of waste shall be adopted by the Commission, assisted by the Committee established by Article 18 of Directive 75/442/EEC and in accordance with the procedure set out in Article 17 of this Directive. Any amendments to the Annexes shall only be made in line with the principles laid down in this Directive as expressed in the Annexes. To this end, as regards Annex II, the following shall be observed by the Committee: taking into account the general principles and general procedures for testing and acceptance criteria as set out in Annex II, specific criteria and/or test methods and associated limit values should be set for each class of landfill, including if necessary specific types of landfill within each class, including underground storage. Proposals for the standardisation of control, sampling and analysis methods in relation to the Annexes of this Directive shall be adopted by the Commission, assisted by the Committee, within two years after the entry into force of this Directive.

The Commission, assisted by the Committee, will adopt provisions for the harmonisation and regular transmission of the statistical data referred to in Articles 5, 7 and 11 of this Directive, within two years after the entry into force of this Directive, and for the amendments of such provisions when necessary.

Article 17

Committee procedure

The Commission shall be assisted by a Committee composed of the representatives of the Member States and chaired by the representative of the Commission.

The representative of the Commission shall submit to the Committee a draft of the measures to be taken. The Committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 148(2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the Member States within the Committee shall be weighted in the manner set out in that Article. The chairman shall not vote.

The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the Committee.

If the measures envisaged are not in accordance with the opinion of the Committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

If on the expiry of a period of three months from the date of referral to the Council, the Council has not acted, the proposed measures shall be adopted by the Commission.

*Article 18***Transposition**

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than two years after its entry into force. They shall forthwith inform the Commission thereof.

When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such a reference shall be laid down by Member States.

2. Member States shall communicate the texts of the provisions of national law which they adopt in the field covered by this Directive to the Commission.

*Article 19***Entry into force**

This Directive will enter into force on the day of its publication in the *Official Journal of the European Communities*.

*Article 20***Addressees**

This Directive is addressed to the Member States.

Done at Luxembourg, 26 April 1999.

For the Council
The President
J. FISCHER

ANNEX I

GENERAL REQUIREMENTS FOR ALL CLASSES OF LANDFILLS**1. Location**

1.1. The location of a landfill must take into consideration requirements relating to:

- (a) the distances from the boundary of the site to residential and recreation areas, waterways, water bodies and other agricultural or urban sites;
- (b) the existence of groundwater, coastal water or nature protection zones in the area;
- (c) the geological and hydrogeological conditions in the area;
- (d) the risk of flooding, subsidence, landslides or avalanches on the site;
- (e) the protection of the nature or cultural patrimony in the area.

1.2. The landfill can be authorised only if the characteristics of the site with respect to the abovementioned requirements, or the corrective measures to be taken, indicate that the landfill does not pose a serious environmental risk.

2. Water control and leachate management

Appropriate measures shall be taken, with respect to the characteristics of the landfill and the meteorological conditions, in order to:

- control water from precipitations entering into the landfill body,
- prevent surface water and/or groundwater from entering into the landfilled waste,
- collect contaminated water and leachate. If an assessment based on consideration of the location of the landfill and the waste to be accepted shows that the landfill poses no potential hazard to the environment, the competent authority may decide that this provision does not apply,
- treat contaminated water and leachate collected from the landfill to the appropriate standard required for their discharge.

The above provisions may not apply to landfills for inert waste.

3. Protection of soil and water

3.1. A landfill must be situated and designed so as to meet the necessary conditions for preventing pollution of the soil, groundwater or surface water and ensuring efficient collection of leachate as and when required according to Section 2. Protection of soil, groundwater and surface water is to be achieved by the combination of a geological barrier and a bottom liner during the operational/active phase and by the combination of a geological barrier and a top liner during the passive phase/post closure.

3.2. The geological barrier is determined by geological and hydrogeological conditions below and in the vicinity of a landfill site providing sufficient attenuation capacity to prevent a potential risk to soil and groundwater.

The landfill base and sides shall consist of a mineral layer which satisfies permeability and thickness requirements with a combined effect in terms of protection of soil, groundwater and surface water at least equivalent to the one resulting from the following requirements:

- landfill for hazardous waste: $K \leq 1,0 \times 10^{-9}$ m/s; thickness ≥ 5 m,
- landfill for non-hazardous waste: $K \leq 1,0 \times 10^{-9}$ m/s; thickness ≥ 1 m,
- landfill for inert waste: $K \leq 1,0 \times 10^{-7}$ m/s; thickness ≥ 1 m,

m/s: meter/second.

Where the geological barrier does not naturally meet the above conditions it can be completed artificially and reinforced by other means giving equivalent protection. An artificially established geological barrier should be no less than 0,5 metres thick.

- 3.3. In addition to the geological barrier described above a leachate collection and sealing system must be added in accordance with the following principles so as to ensure that leachate accumulation at the base of the landfill is kept to a minimum:

Leachate collection and bottom sealing

Landfill category	non hazardous	hazardous
Artificial sealing liner	required	required
Drainage layer $\geq 0,5$ m	required	required

Member States may set general or specific requirements for inert waste landfills and for the characteristics of the abovementioned technical means.

If the competent authority after a consideration of the potential hazards to the environment finds that the prevention of leachate formation is necessary, a surface sealing may be prescribed. Recommendations for the surface sealing are as follows:

Landfill category	non hazardous	hazardous
Gas drainage layer	required	not required
Artificial sealing liner	not required	required
Impermeable mineral layer	required	required
Drainage layer $> 0,5$ m	required	required
Top soil cover > 1 m	required	required.

- 3.4. If, on the basis of an assessment of environmental risks taking into account, in particular, Directive 80/68/EEC⁽¹⁾, the competent authority has decided, in accordance with Section 2 ('Water control and leachate management'), that collection and treatment of leachate is not necessary or it has been established that the landfill poses no potential hazard to soil, groundwater or surface water, the requirements in paragraphs 3.2 and 3.3 above may be reduced accordingly. In the case of landfills for inert waste these requirements may be adapted by national legislation.
- 3.5. The method to be used for the determination of the permeability coefficient for landfills, in the field and for the whole extension of the site, is to be developed and approved by the Committee set up under Article 17 of this Directive.

4. Gas control

- 4.1. Appropriate measures shall be taken in order to control the accumulation and migration of landfill gas (Annex III).
- 4.2. Landfill gas shall be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and used. If the gas collected cannot be used to produce energy, it must be flared.
- 4.3. The collection, treatment and use of landfill gas under paragraph 4.2 shall be carried on in a manner which minimises damage to or deterioration of the environment and risk to human health.

⁽¹⁾ OJ L 20, 26.1.1980, p. 43. Directive as last amended by Directive 91/692/EEC (OJ L 377, 31.12.1991, p. 48).

5. Nuisances and hazards

Measures shall be taken to minimise nuisances and hazards arising from the landfill through:

- emissions of odours and dust,
- wind-blown materials,
- noise and traffic,
- birds, vermin and insects,
- formation and aerosols,
- fires.

The landfill shall be equipped so that dirt originating from the site is not dispersed onto public roads and the surrounding land.

6. Stability

The emplacement of waste on the site shall take place in such a way as to ensure stability of the mass of waste and associated structures, particularly in respect of avoidance of slippages. Where an artificial barrier is established it must be ascertained that the geological substratum, considering the morphology of the landfill, is sufficiently stable to prevent settlement that may cause damage to the barrier.

7. Barriers

The landfill shall be secured to prevent free access to the site. The gates shall be locked outside operating hours. The system of control and access to each facility should contain a programme of measures to detect and discourage illegal dumping in the facility.

ANNEX II

WASTE ACCEPTANCE CRITERIA AND PROCEDURES

1. Introduction

This Annex describes:

- general principles for acceptance of waste at the various classes of landfills. The future waste classification procedure should be based on these principles,
- guidelines outlining preliminary waste acceptance procedures to be followed until a uniform waste classification and acceptance procedure has been developed. This procedure will, together with the relevant sampling procedures, be developed by the technical Committee referred to in Article 16 of this Directive. The technical Committee shall develop criteria which have to be fulfilled for certain hazardous waste to be accepted in landfills for non-hazardous waste. These criteria should, in particular, take into account the short, medium and long term leaching behaviour of such waste. These criteria shall be developed within two years of the entry into force of this Directive. The technical Committee shall also develop criteria which have to be fulfilled for waste to be accepted in underground storage. These criteria must take into account, in particular, that the waste is not to be expected to react with each other and with the rock.

This work by the technical Committee, with the exception of proposals for the standardisation of control, sampling and analysis methods in relation to the Annexes of this Directive which shall be adopted within two years after the entry into force of this Directive, shall be completed within three years from the entry into force of this Directive and must be carried out having regard to the objectives set forth in Article 1 of this Directive.

2. General principles

The composition, leachability, long-term behaviour and general properties of a waste to be landfilled must be known as precisely as possible. Waste acceptance at a landfill can be based either on lists of accepted or refused waste, defined by nature and origin, and on waste analysis methods and limit values for the properties of the waste to be accepted. The future waste acceptance procedures described in this Directive shall as far as possible be based on standardised waste analysis methods and limit values for the properties of waste to be accepted.

Before the definition of such analysis methods and limit values, Member States should at least set national lists of waste to be accepted or refused at each class of landfill, or defined the criteria required to be on the lists. In order to be accepted at a particular class of landfill, a type of waste must be on the relevant national list or fulfil criteria similar to those required to be on the list. These lists, or the equivalent criteria, and the analysis methods and limit values shall be sent to the Commission within six months of the transposition of this Directive or whenever they are adopted at national level.

These lists or acceptance criteria should be used to establish site specific lists, i.e. the list of accepted waste specified in the permit in accordance with Article 9 of this Directive.

The criteria for acceptance of waste on the reference lists or at a class of landfill may be based on other legislation and/or on waste properties.

Criteria for acceptance at a specific class of landfill must be derived from considerations pertaining to:

- protection of the surrounding environment (in particular groundwater and surface water),
- protection of the environmental protection systems (e.g. liners and leachate treatment systems),
- protection of the desired waste-stabilisation processes within the landfill,
- protection against human-health hazards.

Examples of waste property-based criteria are:

- requirements on knowledge of total composition,
- limitations on the amount of organic matter in the waste,

- requirements or limitations on the biodegradability of the organic waste components,
- limitations on the amount of specified, potentially harmful/hazardous components (in relation to the abovementioned protection criteria),
- limitations on the potential and expected leachability of specified, potentially harmful/hazardous components (in relation to the abovementioned protection criteria),
- ecotoxicological properties of the waste and the resulting leachate.

The property-based criteria for acceptance of waste must generally be most extensive for inert waste landfills and can be less extensive for non-hazardous waste landfills and least extensive for hazardous waste landfills owing to the higher environmental protection level of the latter two.

3. General procedures for testing and acceptance of waste

The general characterisation and testing of waste must be based on the following three-level hierarchy:

- Level 1:** *Basic characterisation.* This constitutes a thorough determination, according to standardised analysis and behaviour-testing methods, of the short and long-term leaching behaviour and/or characteristic properties of the waste.
- Level 2:** *Compliance testing.* This constitutes periodical testing by simpler standardised analysis and behaviour-testing methods to determine whether a waste complies with permit conditions and/or specific reference criteria. The tests focus on key variables and behaviour identified by basic characterisation.
- Level 3:** *On-site verification.* This constitutes rapid check methods to confirm that a waste is the same as that which has been subjected to compliance testing and that which is described in the accompanying documents. It may merely consist of a visual inspection of a load of waste before and after unloading at the landfill site.

A particular type of waste must normally be characterised at Level 1 and pass the appropriate criteria in order to be accepted on a reference list. In order to remain on a site-specific list, a particular type of waste must a regular intervals (e.g. annually) be tested at Level 2 and pass the appropriate criteria. Each waste load arriving at the gate of a landfill must be subjected to Level 3 verification.

Certain waste types may be exempted permanently to temporarily from testing at Level 1. This may be due to impracticability to testing, to unavailability of appropriate testing procedures and acceptance criteria or to overriding legislation.

4. Guidelines for preliminary waste acceptance procedures

Until this Annex is fully completed only Level 3 testing is mandatory and Level 1 and Level 2 applied to the extent possible. At this preliminary stage waste to be accepted at a particular class of landfill must either be on a restrictive national or site-specific list for that class of landfill or fulfil criteria similar to those required to get on the list.

The following general guidelines may be used to set preliminary criteria for acceptance of waste at the three major classes of landfill or the corresponding lists.

Inert waste landfills: only inert waste as defined in Article 2(e) can be accepted on the list.

Non-hazardous waste landfills: in order to be accepted on the list a waste type must not be covered by Directive 91/689/EEC.

Hazardous waste landfills: a preliminary rough list for hazardous waste landfills would consist of only those waste types covered by Directive 91/689/EEC. Such waste types should, however not be accepted on the list without prior treatment if they exhibit total contents or leachability of potentially hazardous components that are high enough to constitute a short-term occupational or environmental risk or to prevent sufficient waste stabilisation within the projected lifetime of the landfill.

5. **Sampling of waste**

Sampling of waste may pose serious problems with respect to representation and techniques owing to the heterogeneous nature of many wastes. A European standard for sampling of waste will be developed. Until this standard is approved by Member States in accordance with Article 17 of this Directive, the Member States may apply national standards and procedures.

ANNEX III

CONTROL AND MONITORING PROCEDURES IN OPERATION AND AFTER-CARE PHASES**1. Introduction**

The purpose of this Annex is to provide the minimum procedures for monitoring to be carried out to check:

- that waste has been accepted to disposal in accordance with the criteria set for the category of landfill in question,
- that the processes within the landfill proceed as desired,
- that the environmental protection systems are functioning fully as intended,
- that the permit conditions for the landfill are fulfilled.

2. Meteorological data

Under their reporting obligation (Article 15), Member States should supply data on the collection method for meteorological data. It is up to Member States to decide how the data should be collected (*in situ*, national meteorological network, etc.).

Should Member States decide that water balances are an effective tool for evaluating whether leachate is building up in the landfill body or whether the site is leaking, it is recommended that the following data are collected from monitoring at the landfill or from the nearest meteorological station, as long as required by the competent authority in accordance with Article 13(c) of this Directive:

	Operation phase	After-care phase
1.1. Volume of precipitation	daily	daily, added to monthly values
1.2. Temperature (min., max., 14.00 h CET)	daily	monthly average
1.3. Direction and force of prevailing wind	daily	not required
1.4. Evaporation (lysimeter) ⁽¹⁾	daily	daily, added to monthly values
1.5. Atmospheric humidity (14.00 h CET)	daily	monthly average

⁽¹⁾ Or through other suitable methods.

3. Emission data: water, leachate and gas control

Sampling of leachate and surface water if present must be collected at representative points. Sampling and measuring (volume and composition) of leachate must be performed separately at each point at which leachate is discharged from the site. Reference: general guidelines on sampling technology, ISO 5667-2 (1991).

Monitoring of surface water if present shall be carried out at not less than two points, one upstream from the landfill and one downstream.

Gas monitoring must be representative for each section of the landfill. The frequency of sampling and analysis is listed in the following table. For leachate and water, a sample, representative of the average composition, shall be taken for monitoring.

The frequency of sampling could be adapted on the basis of the morphology of the landfill waste (in tumulus, buried, etc). This has to be specified in the permit.

	Operating phase	After-care phase ⁽³⁾
2.1. Leachate volume	monthly ⁽¹⁾ ⁽³⁾	every six months
2.2. Leachate composition ⁽²⁾	quarterly ⁽³⁾	every six months
2.3. Volume and composition of surface water ⁽⁷⁾	quarterly ⁽³⁾	every six months
2.4. Potential gas emissions and atmospheric pressure ⁽⁴⁾ (CH ₄ , CO ₂ , O ₂ , H ₂ S, H ₂ etc.)	monthly ⁽³⁾ ⁽⁵⁾	every six months ⁽⁶⁾

⁽¹⁾ The frequency of sampling could be adapted on the basis of the morphology of the landfill waste (in tumulus, buried, etc.). This has to be specified in the permit.

⁽²⁾ The parameters to be measured and the substances to be analysed vary according to the composition of the waste deposited; they must be laid down in the permit document and reflect the leaching characteristics of the wastes.

⁽³⁾ If the evaluation of data indicates that longer intervals are equally effective, they may be adapted. For leachates, conductivity must always be measured at least once a year.

⁽⁴⁾ These measurements are related mainly to the content of organic material in the waste.

⁽⁵⁾ CH₄, CO₂, O₂, regularly, other gases as required, according to the composition of the waste deposited, with a view to reflecting its leaching properties.

⁽⁶⁾ Efficiency of the gas extraction system must be checked regularly.

⁽⁷⁾ On the basis of the characteristics of the landfill site, the competent authority may determine that these measurements are not required, and will report accordingly in the way laid down in Article 15 of the Directive.

2.1 and 2.2 apply only where leachate collection takes place (see Annex I(2)).

4. Protection of groundwater

A. Sampling

The measurements must be such as to provide information on groundwater likely to be affected by the discharging of waste, with at least one measuring point in the groundwater inflow region and two in the outflow region. This number can be increased on the basis of a specific hydrogeological survey and the need for an early identification of accidental leachate release in the groundwater.

Sampling must be carried out in at least three locations before the filling operations in order to establish reference values for future sampling. Reference: Sampling Groundwaters, ISO 5667, Part 11, 1993.

B. Monitoring

The parameters to be analysed in the samples taken must be derived from the expected composition of the leachate and the groundwater quality in the area. In selecting the parameters for analysis account should be taken of mobility in the groundwater zone. Parameters could include indicator parameters in order to ensure an early recognition of change in water quality ⁽¹⁾.

	Operation phase	After-care phase
Level of groundwater	every six months ⁽¹⁾	every six months ⁽¹⁾
Groundwater composition	site-specific frequency ⁽²⁾ ⁽³⁾	site-specific frequency ⁽²⁾ ⁽³⁾

⁽¹⁾ If there are fluctuating groundwater levels, the frequency must be increased.

⁽²⁾ The frequency must be based on possibility for remedial actions between two samplings if a trigger level is reached, i.e. the frequency must be determined on the basis of knowledge and the evaluation of the velocity of groundwater flow.

⁽³⁾ When a trigger level is reached (see C), verification is necessary by repeating the sampling. When the level has been confirmed, a contingency plan (laid down in the permit) must be followed.

⁽¹⁾ Recommended parameters: ph, TOC, phenols, heavy metals, fluoride, AS, oil/hydrocarbons.

C. *Trigger levels*

Significant adverse environmental effects, as referred to in Articles 12 and 13 of this Directive, should be considered to have occurred in the case of groundwater, when an analysis of a groundwater sample shows a significant change in water quality. A trigger level must be determined taking account of the specific hydrogeological formations in the location of the landfill and groundwater quality. The trigger level must be laid down in the permit whenever possible.

The observations must be evaluated by means of control charts with established control rules and levels for each downgradient well. The control levels must be determined from local variations in groundwater quality.

5. **Topography of the site: data on the landfill body**

	Operating phase	After-care phase
5.1. Structure and composition of landfill body ⁽¹⁾	yearly	
5.2. Settling behaviour of the level of the landfill body	yearly	yearly reading

⁽¹⁾ Data for the status plan of the concerned landfill: surface occupied by waste, volume and composition of waste, methods of depositing, time and duration of depositing, calculation of the remaining capacity still available at the landfill.

Annex 2
Area Exclusion Criteria

Aspect	Exclusion Criteria
Transport	<p>T1 More than 2 km from a suitable main road <i>Remoteness may well be a positive attribute and the additional cost of longer road access may be more than compensated by reductions in other site-specific costs</i></p> <p>T2 More than an economic travel distance from points of origin of waste collection vehicles</p>
Natural conditions	<p>N1 Flood plains or other areas liable to flooding</p> <p>N2 Extreme morphology (steep or over-steep slopes liable to landslips or avalanches)</p> <p>N3 High or seasonally high water table</p> <p>N4 Wetlands (swamps or marshes) or other areas of ecological significance <i>Saline or other mineral salt saturated, low-lying areas may permit lower leachate discharge standards to be considered, though the demand for significant quantities of cover material are unlikely to be met from within such sites</i></p> <p>N5 Karstic or geologically faulted or unstable areas, or areas containing mine workings, where leachate may migrate rapidly from the site to a potable aquifer <i>This restriction may be relaxed with care, if there are no existing or planned abstraction for potable water use for several kilometres from the site</i></p> <p>N6 Nature Reserves, National Parks, Managed Reserves, Protected Landscapes, Planned Protected Areas</p>
Land use	<p>L1 Designated groundwater recharge, sole source aquifer or surface water catchment areas for water supply schemes</p> <p>L2 Incompatible future land use designations on or adjacent to the site, particularly hard (built) development or mineral extraction <i>Discussions should be held with the planning authority if this criterion excludes otherwise ideally qualified areas</i></p> <p>L3 Within a military exclusion zone</p>
Public acceptability	<p>P1 Within 200 m of existing or planned residential developments or educational facilities (this minimum distance may be larger in some places due to political, geological or social requirements)</p> <p>P2 Within an acceptable distance (desirable minimum distance 200 m) from historical, religious or other important cultural site or heritage <i>The distances may be reduced if visual intrusion is unlikely. In the case of P1, the criterion is also based on protection from landfill gas migration. Reduction of this distance will require the installation and long term maintenance of an appropriate gas control system</i></p>
Safety	<p>S1 Within 5 km of an airport runway in the direction of approach and take-off <i>The local aviation authority may agree to reductions in the minimum required distance from flight paths</i></p> <p>S2 Area of former military activity where buried ordnance may be present</p> <p>S3 Within a microwave transmitter exclusion zone</p> <p>S4 Within a safe buffer distance (approx. 100 m) from an existing or planned quarry, which will undertake blasting with explosives</p> <p>S5 Areas known to contain collapsing soils (such as loess)</p>

(based on ERM for World Bank/SDC 2000)

Annex 3
Information Sources Georgia

Subject	Source	Information
Topography	- National Environmental Agency www.nea.gov.ge	- Relief (approx. ground levels) - Surface water drainage - Proximity of housing - Access
Geology	- National Environmental Agency www.nea.gov.ge	- Geological succession (bedrock and superficial deposits) - Thickness of strata and lateral extent - Geological structure - Mineral resources and utilisation
Aquifers, aquifer protection zones	- National Environmental Agency www.nea.gov.ge	- Location and yield, vulnerability maps. protection zones
Soil types and drainage	- Ministry of Environment Protection (Department of Integrated Environmental Management) www.moe.gov.ge	- Land use
Climate Air quality	- National Environmental Agency www.nea.gov.ge	- Average rainfall and potential evapotranspiration (for calculation of effective rainfall and leachate generation)
Water resources, quality abstraction, flow data	- National Environmental Agency www.nea.gov.ge	- Extent of water utilisation (river and reservoir catchment areas) - Surface and groundwater quality - Significance of on site surface/ groundwater
Planning and development Population	- Ministry of Environment Protection www.moe.gov.ge - Ministry of Economic Development (Department of Statistics) www.economy.gov.ge / www.statistics.ge - Self-governing units	- Areas where landfill would be a permitted development and general considerations - Industrial sites and developments - Infrastructure - Sectoral development proposals - Population data
Human and animal health	- Ministry of Labour, Healthcare and Social Protection www.moh.gov.ge - Ministry of Agriculture (National Department of Food Safety / Veterinary and Plants Protection Unit) www.moa.gov.ge	- Human health statistics and research studies - Animal health
Archaeological and architectural heritage Ecology, biodiversity, flora and fauna, landscape	- Ministry of Culture, Monument Protection and Sports www.mcs.gov.ge - Ministry of Environment Protection www.moe.gov.ge	- National monuments - Areas of archaeological importance - Designated areas for conservation or ecological importance - Landscape designations

Annex 4
Glossary of Terms

Aftercare	Any measures necessary to be taken for the purposes of preventing environmental pollution following the cessation of the activity in question at a facility.
Amenity	Amenities are any tangible or intangible benefits of a property, especially those which increase the attractiveness or value of the property or which contribute to its comfort or convenience.
Aquifer	A permeable geological stratum or formation that is capable of both storing and transmitting water in significant amounts. <i>Confined aquifer:</i> an aquifer in which the water is confined under pressure by overlying and underlying impermeable strata. <i>Unconfined aquifer:</i> where the upper surface of a saturated zone forms a water table.
Attenuation	The decrease in concentration of chemical species present in a liquid, caused by any of a variety of mechanisms, individually or in combination, including dilution, adsorption, precipitation, ion-exchange, biodegradation, oxidation, reduction, etc.
Bedrock	The solid rock underlying soils.
Clay	One of four basic soil groups, along with silt, sand and gravel. Clay is composed of very small particles that make it plastic (mouldable) when wet. Clays are the preferred soils for landfill liner and cap applications, because they are resistant to flow (impermeable).
Closure	The process of completing the landfill operation when it reaches final grade and stops receiving waste. Closure includes installation of the landfill cap. Following landfill closure is the aftercare period.
Collection	Collection in relation to waste is the gathering, sorting, or mixing of waste for the purpose of its being transported and includes the transport of waste and the acceptance of control of waste.
Contour	A line on a topographic map that connects points with the same elevation; or a line on a plan view that identifies common groundwater elevations or equal concentrations of pollutants in the groundwater (contamination plume).
Cover	Material used to cover solid wastes deposited in landfills. Daily cover is used to cover each lift or layer at the end of each working day to prevent odours, windblown litter, insect or rodent infestation, and water ingress. Intermediate cover refers to cover material deposited over wastes at the end of a particular phase of landfilling. Final cover is the layer or layers of material placed on the surface of a landfill.
Effective rainfall	Total rainfall minus actual losses due to evaporation and transpiration. Effective rainfall includes both surface run-off and that which percolates into the ground below the soil zone.

Environmental Impact Assessment	An Environmental Impact Assessment (EIA) ensures that environmental consequences of projects are identified and assessed before authorisation is given. The public can give its opinion and all results are taken into account in the authorisation procedure of the project. The public is informed of the decision afterwards.
Environmental Impact Statement	Environmental Impact Statement (EIS) means a statement of the effects, if any, which a proposed development, if carried out would have on the environment
Estuarine water body	A semi-enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea.
Evapotranspiration	The total water transferred to the atmosphere by evaporation from the soil surface and transpiration by plants.
Geology	The science and study of the solid and liquid matter that constitutes the Earth. The field of geology encompasses the study of the composition, structure, physical properties, dynamics, and history of Earth materials, and the processes by which they are formed, moved, and changed.
Groundwater	Water below the earth's surface, either stored in aquifers, in 'perched' conditions above layers of impermeable soils, or in the unsaturated (vadose) zone above the aquifer.
Hydrology	The study of the movement, distribution, and quality of water throughout the Earth, and thus addresses both the hydrologic cycle and water resources.
Hydrogeology	The area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust, (commonly in aquifers).
Impermeable (impervious)	Used to describe materials, natural or synthetic, which have the ability to resist the passage of fluid through them. This property is not absolute, and a cut-off permeability of 10^{-9} to 10^{-10} m/s for water is often used to describe a landfill liner material as impervious.
Inert waste	Waste which is neither chemically or biologically reactive and will not decompose. Examples of this are sand, drywall, and concrete.
Infiltration	The flow of water, usually as rainfall into the soil. When storm-water percolates through the landfill cap, or cover, it can infiltrate into the waste to produce leachate.
Landfill gas	Landfill gas (LFG) means all the gases generated from landfilled waste.
Leachate	Leachate means any liquid percolating through the deposited waste and emitted from or contained within a landfill.
Mixed waste	Waste comprising two or more of the following waste streams: inert waste, commercial waste, industrial waste, municipal waste, and which has the potential to produce landfill gas, leachate and odour.

Permeability (k)	The rate at which a nominated fluid (usually water) is transmitted through a unit cross sectional area of a geological or synthetic medium under unit hydraulic gradient and at a specified temperature. Also referred to as Hydraulic Conductivity. Units usually quoted as meters per second (this is a reduced dimension from $m^3/m^2/s$). In certain circumstances it may be necessary to distinguish between vertical and horizontal permeability as there can be significant variations in many natural mediums (k_v or k_h).
Proximity principle	The proximity principle advocates that waste should be disposed of (or otherwise managed) close to the point at which it is generated, thus aiming to achieve responsible self-sufficiency at a regional/or sub regional level.
Restoration	Completion of a landfill site to allow planned after-use.
Sensitive receptor	Any house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity, which for its proper enjoyment requires the absence of environmental emissions leading to nuisance.
Strata	A stratum (plural: strata) is a layer of rock or soil with internally consistent characteristics that distinguishes it from contiguous layers.
Subsidence (settlement)	The sinking of the landfill surface due to consolidation of waste as it decomposes and the filling of underground voids.
Transmissivity	The rate at which a nominated fluid (usually water) can pass through the thickness of a saturated medium of unit width under a unit hydraulic gradient.
Treatment	Treatment means the thermal, physical, chemical or biological processes that change the characteristics of the waste in order to reduce its volume or hazardous nature, or facilitate its handling or enhance recovery.
Watershed	The upstream land area that contributes surface water drainage to a (catchment) particular point downstream.

Annex 5
List of References

- Environmental Protection Agency of Australia (2008). *Landfill siting, design, operation and rehabilitation*. Guideline ERA 75 – Waste disposal.
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