

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 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,

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- 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.

^{F1}3.5.

Textual Amendments

F1 Deleted by [Directive \(EU\) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste \(Text with EEA relevance\).](#)

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.

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.

[F2g. Temporary storage of metallic mercury

For the purposes of temporary storage for more than 1 year of metallic mercury, the following requirements shall apply:

- Metallic mercury shall be stored separately from other waste.
- Containers shall be stored in collecting basins suitably coated so as to be free of cracks and gaps and impervious to metallic mercury with a containment volume adequate for the quantity of mercury stored.
- The storage site shall be provided with engineered or natural barriers that are adequate to protect the environment against mercury emissions and a containment volume adequate for the total quantity of mercury stored.
- The storage site floors shall be covered with mercury-resistant sealants. A slope with a collection sump shall be provided.
- The storage site shall be equipped with a fire protection system.

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— Storage shall be arranged in a way to ensure that all containers are easily retrievable.]

Textual Amendments

F2 Inserted by [Council Directive 2011/97/EU of 5 December 2011 amending Directive 1999/31/EC as regards specific criteria for the storage of metallic mercury considered as waste.](#)

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.

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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 at 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 or 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 : only inert waste as defined in Article 2(e) can be accepted on the list.
landfills
- Non-hazardous waste : in order to be accepted on the list a waste type must not be covered by
waste landfills Directive 91/689/EEC.
- Hazardous waste : a preliminary rough list for hazardous waste landfills would consist of
landfills 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.

^{F1}5. Sampling of waste

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^{F2}6. Specific requirements for metallic mercury

For the purposes of temporary storage for more than 1 year of metallic mercury, the following requirements shall apply:

A. Composition of the mercury

Metallic mercury shall comply with the following specifications:

- mercury content greater than 99,9 % per weight,
- no impurities capable of corroding carbon or stainless steel (e.g. nitric acid solution, chloride salts solutions).

B. Containment

Containers used for the storage of metallic mercury shall be corrosion- and shock-resistant. Welds shall therefore be avoided. The containers shall comply in particular with the following specifications:

- container material: carbon steel (ASTM A36 minimum) or stainless steel (AISI 304, 316L),
- containers shall be gas and liquid tight,

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- the outer side of the container shall be resistant against the storage conditions,
- the design type of the container shall successfully pass the drop test and the leakproofness tests as described in Chapters 6.1.5.3 and 6.1.5.4 of the UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria.

The maximum filling ratio of the container shall be 80 % by volume to ensure that sufficient ullage is available and neither leakage nor permanent distortion of the container can occur as a result of an expansion of the liquid due to high temperature.

C. Acceptance procedures

Only containers with a certificate complying with the requirements set out in this Section shall be accepted.

Acceptance procedures shall comply with the following:

- only metallic mercury which fulfils the minimum acceptance criteria set out above shall be accepted,
- containers shall be visually inspected before storage. Damaged, leaking or corroded containers shall not be accepted,
- containers shall bear a durable stamp (made by punching) mentioning the identification number of the container, the construction material, its empty weight, the reference of the manufacturer and the date of construction,
- containers shall bear a plate permanently fixed to the container mentioning the identification number of the certificate.

D. Certificate

The certificate indicated in subsection C shall include the following elements:

- name and address of the waste producer,
- name and address of the responsible for the filling,
- place and date of filling,
- quantity of the mercury,
- the purity of the mercury and, if relevant, a description of the impurities, including the analytical report,
- confirmation that the containers have been used exclusively for the transport/storage of mercury,
- the identification numbers of the containers,
- any specific comments.

Certificates shall be issued by the producer of the waste or, in default, by the person responsible for its management.]

ANNEX III

CONTROL AND MONITORING PROCEDURES IN OPERATION AND AFTER-CARE PHASES

1. Introduction

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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

[^{F1}

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)^a	daily	daily, added to monthly values
1.5. Atmospheric humidity (14.00 h CET)	daily	monthly average

a 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^c
2.1. Leachate volume	monthly ^{ac}	every six months

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2.2. Leachate composition^b	quarterly ^c	every six months
2.3. Volume and composition of surface water^a	quarterly ^c	every six months
2.4. Potential gas emissions and atmospheric pressure^d(CH₄, CO₂, O₂, H₂S, H₂ etc.)	monthly ^{ce}	every six months ^f

a 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.

b 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.

c 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.

d These measurements are related mainly to the content of organic material in the waste.

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

f Efficiency of the gas extraction system must be checked regularly.

g 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⁽²⁾.

	Operation phase	After-care phase
a	If there are fluctuating groundwater levels, the frequency must be increased.	
b	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.	
c	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.	

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Level of groundwater	every six months ^a	every six months ^a
Groundwater composition	site-specific frequency ^{bc}	site-specific frequency ^{bc}
a	If there are fluctuating groundwater levels, the frequency must be increased.	
b	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.	
c	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.	

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^a	yearly	
5.2. Settling behaviour of the level of the landfill body	yearly	yearly reading
a	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.	

[F26. Specific requirements for metallic mercury

For the purposes of temporary storage for more than 1 year of metallic mercury, the following requirements shall apply:

A. Monitoring, inspection and emergency requirements

A continuous mercury vapour monitoring system with a sensitivity of at least 0,02 mg mercury/m³ shall be installed in the storage site. Sensors shall be positioned at ground level and head level. This shall include a visual and acoustic alert system. The system shall be maintained annually.

The storage site and containers shall be visually inspected by an authorised person at least once a month. Where leaks are detected, the operator shall immediately take all necessary action to avoid any emission of mercury to the environment and restore the safety of the storage of the mercury. Any leaks shall be considered to have significant adverse environmental effects as referred to in Article 12(b).

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Emergency plans and adequate protective equipment suitable for handling metallic mercury shall be available on site.

B. Record keeping

All documents containing the information referred to in Section 6 of Annex II and in point A of this Section, including the certificate accompanying the container, as well as records concerning the destocking and dispatch of the metallic mercury after its temporary storage and the destination and intended treatment shall be kept for at least 3 years after the termination of the storage.]

[^{F3}ANNEX IV

IMPLEMENTATION PLAN TO BE SUBMITTED PURSUANT TO ARTICLE 5(6)

Textual Amendments

F3 Inserted by [Directive \(EU\) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste \(Text with EEA relevance\)](#).

The implementation plan to be submitted pursuant to Article 5(6) shall contain the following:

1. assessment of the past, current and projected rates of recycling, landfilling and other treatment of municipal waste and the streams of which it is composed;
2. assessment of the implementation of waste management plans and waste prevention programmes in place pursuant to Articles 28 and 29 of Directive 2008/98/EC;
3. reasons for which the Member State considers that it might not be able to attain the relevant target laid down in Article 5(5) within the deadline set therein and an assessment of the time extension necessary to meet that target;
4. measures necessary to attain the targets set out in Article 5(8) of this Directive applicable to the Member State during the time extension, including appropriate economic instruments and other measures to provide incentives for the application of the waste hierarchy as set out in Article 4(1) of, and Annex IVa to, Directive 2008/98/EC;
5. a timetable for the implementation of the measures identified in point 4, determination of the body competent for their implementation and an assessment of their individual contribution to attaining the targets applicable in the event of a time extension;
6. information on funding for waste management in line with the polluter-pays principle;
7. measures to improve data quality, as appropriate, with a view to better planning and monitoring performance in waste management.]

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- (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](#)).
- (2) Recommended parameters: ph, TOC, phenols, heavy metals, fluoride, AS, oil/hydrocarbons.