Treatment of waste for landfill

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Overview
All waste must be treated before it can be landfilled, with a few exceptions. This requirement comes from the Landfill Directive (LfD), which aims to reduce our reliance on landfill as a waste management option and minimise the environmental impact of landfill sites. To meet this aim it is important that waste producers find better ways to manage their waste. Waste producers should continually review how best to manage their waste, including whether it needs to be produced at all and whether what they do produce can be reused or recycled.

What we expect from industry
We want waste producers to take responsibility for their waste and make simple improvements in the way they handle resources and waste for a better environment. It is now a legal requirement to consider the waste hierarchy when making decisions about what to do with your waste.

There are many straightforward ways to treat waste that give real environmental benefits. For example, by collecting waste streams separately and recycling one or more of the separated components or submitting them for re-use or recovery. Alternatively waste management companies can treat or recover the waste on behalf of waste producers before it is sent to landfill. Again, for many wastes a suitable treatment might be to sort the waste at a transfer station with a proportion of the sorted waste being recycled. For waste that is sent to landfill a written declaration should be given to landfill operators to confirm that treatment has taken place.

What industry can expect from us
We will concentrate our efforts towards the top end of the waste management chain by advising waste producers on the best ways to manage their waste, emphasising the opportunity this presents to improve their overall environmental performance and reduce costs. For the waste management industry our focus is on improving management systems and waste acceptance procedures across the sector rather than seeking out minor technical breaches at individual facilities.

Status of guidance
This document is intended to help both waste producers and waste management companies by giving practical examples of how waste can be treated. The document consists of two parts:

- Part A: sets out the regulatory framework and responsibilities. It also addresses the most frequent questions that have been raised with us.
- Part B: provides practical examples of how to treat waste based on the experiences of waste producers and waste managers.

This guidance supplements our guidance on waste acceptance at landfills which was revised in September 2010. This guidance is available on our website and is referred to here as WAL (Waste Acceptance at Landfill).

We will review this document in the light of practical experience and will update it as necessary. This review will involve looking more closely at waste management practices within particular industry sectors and identifying opportunities to drive improvements in their environmental performance.

Contents

List of acronyms

ABPR	Animal By-products Regulations
AD	anaerobic digestion
C&D	construction and demolition
C&I	commercial and industrial
CHP	combined heat and power
EfW	energy-from-waste
ELV	end-of-life vehicle
EMS	environmental management system
EWC	European Waste Catalogue
FEL	front end loader
HACCP	Hazard Analysis Critical Control Points
HSAC	Health Services Advisory Committee
LTTD	low temperature thermal desorption
MBT	mechanical biological treatment
MFSU	manufacture, formulation, supply and use
MHT	mechanical heat treatment
MRF	materials recovery facility
MSW	municipal solid waste
NOS	not otherwise specified
RDF	refuse-derived fuel
REL	rear end loader
VOC	volatile organic compound
WAC	waste acceptance criteria
WAL	Waste Acceptance at Landfills [guidance document]
WEEE	waste electrical and electronic equipment

Part A: Regulatory Framework and responsibilities

Section 1 - Introduction

Part A of this guidance explains the legal framework and summarises what waste producers and waste management companies are expected to do. It also answers the most commonly raised questions on how the requirements apply. Part B gives practical examples of treatment options for commonly-occurring waste streams.

What is the requirement?

All waste must be treated before it is disposed of at landfill. There are two exceptions to this rule that are explained in section 2.

Who is affected?

Landfill operators cannot accept untreated waste. Waste producers therefore have a choice. They can treat the waste themselves or ensure that it is treated elsewhere before being sent to landfill. In practice, everyone involved in the decision to send waste to landfill must understand who is going to treat it. This issue is dealt with in more detail below.

What is the legislation behind this?

This is a European–wide requirement in the Landfill Directive (LfD), applied by the Environmental Permitting (England and Wales) Regulations 2010 ('the Regulations'). The Regulations transpose the requirements of the LfD and an associated Council Decision (2003/33/EC) into law in England and Wales.

European legislation is driving a more sustainable approach to waste management across the EU. The LfD is intended to reduce our reliance on landfill and ensure that any future landfill has less impact on our health and the environment. These aims will be achieved in a number of ways. The requirement to treat waste before it is landfilled is just one of them.

The LfD, article 1 sets out its aims as:
"With a view to meeting the requirements of Directive 75/442/EEC [The Waste Framework Directive[1]], and in particular Articles 3 [encourage the prevention, recycling and processing of waste] and 4 [ensure that waste is disposed of without endangering human health and without harming the environment] 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 waste, during the whole life-cycle of the landfill."

Domestic legislation[2] requires that anyone who produces or handles waste must apply the waste hierarchy. This means taking all such measures as are reasonable in the circumstances to apply the waste hierarchy to prevent waste, and to apply the

[1] Now revised (2008/98/EC)
[2] The Waste (England and Wales) Regulations 2011

hierarchy as a priority order when you transfer your waste to another person.' Government has issued guidance on the waste hierarchy and how to comply.

Section 2 - Choice of treatment method
This section explains the legal aspects of choosing a treatment option. Section 7 deals with the environmental, practical and technical considerations of this choice.

Regulatory requirements
The LfD, article 6 requires:

"Member States shall take measures in order that:

(a) only waste that has been subject to treatment is landfilled. This provision does 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;"

Government agrees that this means 'during the whole life-cycle of the landfill', in line with the objectives of the Directive. The life-cycle of a landfill begins with the preparation of the site and continues through closure and aftercare to surrender. This is not the same as the life-cycle of the waste. Any test of 'reduction of hazards to human health or the environment' applies only to waste acceptance and placement in the landfill, and to any subsequent effects of the landfill. It does not apply to any hazards from transportation.

In summary, wastes must be treated if a treatment is available which will reduce either the amount of waste to be landfilled and/ or the hazards to human health or the environment. We expect a treatment will be available in most cases, although there may be exceptions (such as asbestos).

You can only decide that treatment would not contribute to the objectives of the LfD after a thorough evaluation of the treatment options and bearing in mind the need to consider the waste hierarchy.

Although the LfD places the obligation on the landfill operator, they will need to liaise with waste carriers and producers to ensure that this requirement has been met. This is discussed further in sections 4–6.

Compliance with the LfD
Guidance on what the LfD means is given in:

- Defra guidance; Environmental permitting – the Landfill Directive,
- Our EPR LFD1,Understanding the landfill Directive

The LfD defines treatment as:

'the physical, thermal, chemical or biological processes, including sorting, that change the characteristics of waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery'.

To help clarify what this means, we have broken this requirement down into the 'three-point test', that is explained in more detail in Section 3.

Section 3 - Interpretation of the three-point test

A treatment option for waste destined for landfill, must comply with the definition of treatment. This involves a 'three-point test' against which you must assess the proposed treatment option:

1. It must be a physical, thermal, chemical or biological process including sorting.
2. It must change the characteristics of the waste; and
3. It must do so in order to:
   a. reduce its volume; or
   b. reduce its hazardous nature; or
   c. facilitate its handling; or
   d. enhance its recovery.

Treatment is to:

- reduce the amount of waste going to landfill
- reduce the impact of waste when it is landfilled

This purpose originates from the overall aims of the LfD and should be kept in mind when applying the 3-point test to potential treatment options. This will ensure that the treatment delivers appropriate environmental outcomes.

Meeting the first bullet can have the effect of increasing the impact of the residual waste when you send it to landfill. For example, in diverting a fraction of a waste away from landfill, polluting substances may be more concentrated in the residual waste. This may make the residual waste hazardous. Anyone treating waste must therefore carefully consider the disposal options for the residual waste. In determining if something has been treated, it is therefore important to consider the total waste steam (i.e. before and after treatment) not just the impact of the residual waste.

Principles

It is for waste producers and their managers to satisfy landfill operators that waste has been treated and this means meeting the 3-point test. All three need to be satisfied. The following principles should help in applying the test.

- All of the waste must have been treated. Collection services that mix treated and untreated waste are not meeting the requirement and all the waste will need further treatment before landfill. In many cases it will be easier to treat the waste before collection or undertake separate collection rounds. If the treatment option is to separate out certain recyclable material, one could reasonably expect all of that material to have been removed, not just one or two items.
- Sorting is an acceptable form of treatment because if it is carried out properly it will change the characteristics of the waste and meet one of the four strands of point 3 of the test, e.g. reducing volume to landfill. Source segregation meets the same criteria and is acceptable treatment. Where the sorted or segregated waste is then recovered or re-cycled, it also moves that waste up the waste hierarchy.
- Compaction is not an acceptable treatment, as it does not change the characteristics of the waste that will have the same impact on the environment as un-compacted waste.

The three point test

1. Process applied

You must determine whether one or more physical, thermal, chemical or biological process is involved.

Some simple physical treatments could pass the first criterion of the three-point test but may not pass the other criteria. All three parts of the three-point test must be applied to a treatment process for it to be considered valid.

You will also need to consider other landfill requirements before deciding that a treatment method is valid. For example, shredding used tyres is a physical treatment, but shredded used tyres are banned[3] from landfill disposal. Precipitation and subsequent dewatering of a waste might be an adequate physico-chemical treatment but the solid fraction must meet the relevant waste acceptance criteria before it is landfilled and the liquid fraction is prohibited.

2. Change characteristics

The characteristics of a waste are those key properties that affect its potential impact on human health or the environment in a landfill. Examples of the characteristics which may be changed during a treatment are shown Table 1:

Table 1

Characteristic	Comments and example treatments
Solubility	Changing the solubility of a substance is usually a physico-chemical treatment, for example chrome reduction / precipitation / dewatering or neutralisation / precipitation / dewatering. In these treatments the substance is chemically changed to one which is of lower solubility.
Leachability	Lowering the leachability of a waste can be done by physico-chemical means, for example cement stabilisation. Absorption of the waste, whilst being a physical process, is not acceptable, because dilution is not an acceptable treatment method and the chemical remains unchanged and therefore has the same characteristics as the original waste.
Biodegradability	This might include anaerobic decomposition or other biological treatment, for example composting.
Combustibility	Thermal treatments like incineration, pyrolysis and thermal desorption can lower the combustibility of a waste. Waste which is flammable is not allowed in a landfill.
Volatility	This could be a separation treatment to remove volatile substances from a waste, for example using thermal desorption, or a thermal treatment to destroy the volatile chemicals.
Chemical composition	A fundamental characteristic which may affect all the above. May include specific aspects such as content of Hazardous substances or potential evolution of trace components of landfill gas.
Physical form	Changing the physical form of a waste is not a valid treatment unless that treatment involves a change in the characteristics of a waste. For example wetting a dusty waste, compacting a waste, absorbing a

[3] Excluding tyres used for engineering purposes, bicycle tyres and tyres with an external diameter >1400mm

	liquid into a solid are not acceptable treatments because they do not change the characteristics of a waste. Additionally bagging or otherwise containerising a waste does not change its characteristics.
Hazardousness	Hazardousness is related to the hazardous properties given in the Hazardous Waste Regulations, for example ecotoxic, flammable, corrosive.
Homogeneity/Heterogeneity	Separation processes are likely to lead to the ability to recover one or more of the separated streams. Homogenous wastes are also often more amenable to chemical treatment, and homogenous biodegradable wastes will decompose more rapidly.

To meet the treatment requirement, the change in characteristics must bring about compliance with the third criteria. This means that although changing a specific characteristic of one waste may satisfy the LfD, the same change for another waste may not. For example, a change in particle size may enhance recovery of landfill gas for some wastes, but not for others.

3. Outcome

a. Reduce volume

We consider that processes that reduce the volume of the waste by compaction - such as compacting household waste in a refuse collection vehicle (or elsewhere) - do not change the characteristics of the waste so don't meet the second criterion.

The intent of the LfD is to reduce the quantity of waste landfilled. Examples of processes that change the characteristics of the waste in order to reduce the quantity landfilled include: the incineration of waste; the sorting of waste to divert a stream from landfill; or the composting of waste to remove organic matter. Reducing volume is therefore most likely to be achieved by removing an element of the waste for preparation for re-use, recycling or other forms of recovery.

b. Reduce hazardous nature

You must interpret this criterion in relation to the waste being landfilled. A separation process may result in a concentrated hazardous stream for further treatment and a less hazardous stream for landfill. This will reduce the hazardousness of the landfilled waste.

We accept that reducing a wastes 'hazardous nature' can apply to the wider concept of environmental hazardousness as advocated by the LfD, article 6(a) (and article 1). The simplest way to demonstrate a reduction in hazardousness is to treat hazardous waste, for example to,

- remove one or more of the hazards associated with the waste
- reduce one of the hazards to a lower hazard
  - corrosive to irritant
  - very toxic to harmful
  - toxic to harmful

For non-hazardous waste, reducing hazardous nature may include removing biodegradable waste to reduce the residual wastes impact on methane production and thus on climate change.

In reducing hazardous nature, dilution is not acceptable. The LfD, article 5(4) states that, 'the dilution or mixture of waste solely in order to meet the waste acceptance criteria is prohibited'

c. Facilitate handling

Government's view is that when the LfD refers to a treatment changing the characteristics of waste in order to facilitate handling, this means:

- the handling which takes place during the placement of the waste in the landfill; or
- any foreseeable subsequent handling; but
- **not** handling prior to landfilling.

Where the proposed treatment is to facilitate handling, the change in characteristics that will facilitate handling should reduce the negative effects on the environment or health arising from landfilling the waste. Examples include treatments that cause long-term change in the characteristics of the source term in terms of leachability, generation of gas, volatile compounds or odour.

d. Enhance recovery

The key provision is that the requirement is 'in order to' enhance recovery. Sorting or segregation does not of itself enhance recovery – you must intend to recover part or all of the waste. It is not acceptable to sort wastes and then landfill all the sorted materials as none of the waste would be recovered. Sorting, then disposal will also not meet objectives of the waste hierarchy.

Some wastes being landfilled may already be the product of a treatment process, e.g. bottom ash from incineration. You do not have to provide additional treatment for such wastes.

There are two exceptions to the need for treatment (as outlined by the LfD, article 6(a)) because there are sometimes no treatments available that would contribute towards the aim of the LfD. These exceptions are:

a. inert waste for which treatment is not technically feasible;
b. waste other than inert waste where treatment would not reduce its quantity or the hazards that it poses to human health or the environment.

Sorting and segregation - the need to meet all three criteria

Sorting is specified in the LfD as an acceptable process. For example, if paper and plastic are mixed at source and are then sorted at a materials recovery facility (MRF), this clearly meets the first criterion. In our view, it would defeat the purposes of the LfD if ensuring that the waste streams are not mixed at the outset were not regarded as a treatment. Therefore, subject to the following considerations, we regard source segregation in such circumstances as an acceptable physical treatment process.

We do not regard sorting or segregation as an acceptable process if the wastes would not normally be expected to be mixed in the first place. Similarly, we would not accept the deliberate mixing and subsequent separation of wastes.

Sorting or segregation must still meet the other two criteria. The characteristics of the waste will change (second criterion) because two or more wastes will replace the single mixed waste, each of them less heterogeneous than that single waste.

With regard to the third criterion (for both sorting and segregation), one or more of the separated streams must then be further treated before landfill. If the separate streams are all landfilled without treatment, then the third criterion will not have been met — there will have been no reduction in quantity or hazardousness, no enhancement of recovery. In rare circumstances a treatment may meet the third criterion by facilitating handling (see below). An example might be a dusty waste, where the dust was separated and landfilled with additional controls.

Some wastes arise as a single, uncontaminated stream and therefore cannot be segregated. For example, a waste might consist wholly of plastic off-cuts. Such plastic from a segregated source or materials recovery facility (MRF) could, assuming the other waste fraction is treated, be landfilled. It might therefore be suggested that it is unreasonable to require treatment of the single waste stream. However, it will normally be appropriate to recover or treat this waste whether or not it has been segregated or sorted. Failure to recover or otherwise treat (for example, by incineration) such a waste must be justified because it is not technically feasible or does not contribute to the objectives of the LfD. The justification can be included in the duty of care written declaration.

How much waste must be segregated?

Does the segregation of a small proportion of material for recovery make the rest of the waste stream a treated waste? In such cases a landfill operator is likely to be faced with residual waste which shows no physical evidence of treatment and a declaration by the holder that the waste is treated waste. As the aim of the legislation is to encourage re-use, recycling and recovery and reduce the amount of waste being landfilled you should aim to recover as much as possible. This will also reduce the amount of landfill tax you pay.

Section 4 - Responsibilities of waste producers

The waste producer should either:

- treat their own waste and provide information about the treatment for subsequent holders; or
- ensure that a subsequent holder will treat the waste before it is landfilled.

Producers are not obliged to treat their waste themselves and many will buy this service from a waste contractor. They are however, required to consider the waste hierarchy. Producers will need to decide the option that best suits their waste and their circumstances. In some cases, the producer may opt to have the waste treated elsewhere for practical reasons such as lack of space for storing separated materials.

If a producer wants to send their waste to landfill they will need to provide confirmation to the landfill operator that the waste has been treated. In some cases, other parties may be involved between the original waste producer and the landfill operator.

Waste producers must describe their waste under the Duty of Care[4]. It is also good practice for the waste producer or holder to always complete a written declaration stating:

- the type of treatment; and
- if relevant, the amount of waste sorted for recovery or alternative treatment;

If it is unclear, the landfill operator should assume that the waste **has not** been treated. It will therefore be in the producer's or current waste holder's own interest to provide a written declaration to confirm the treatment. This can be incorporated into a waste transfer note or a declaration of the kind provided in Annex 1.

The landfill operator is also responsible for checking the 'basic characterisation' of the waste (see WAL). Basic characterisation includes information about the waste treatment applied or reasons why the waste has not been treated. The landfill operator needs to be able to rely on the producer or holder for this information. This reinforces the need for written evidence such as a declaration of the kind provided in Annex 1.

The responsibility for basic characterisation of the waste lies with the producer.[5]

[4] The Environment Protection (Duty of Care) Regulations 1991. See also the Duty of Care, code of practice published by Defra.
[5] Council Decision annex, paragraph 1

Section 5 - Responsibilities of landfill operators

The LfD requires landfill operators to ensure that waste is treated prior to landfill and they have a duty to reject waste unless they are sure it has been treated. But unless they are treating the waste for the producer, landfill operators have to rely on others for the information to allow them to be confident that the waste has been treated.

In some cases, it will be obvious at the landfill that the waste has been treated. For example, it might be from an incinerator and it will be clear from looking at it that the waste is incinerator ash. But in other cases, particularly the product of sorting and segregation, the waste may show no outward sign of having been treated.

The following options should be included in the landfill's Waste Acceptance Procedures and will help operators to check whether a waste has been treated:

- initial discussions with the waste producer or contractor about the nature of the waste and any contractual arrangements regarding its treatment;
- checking the paperwork accompanying the load (including the declaration on treatment which is suggested good practice);
- initial visual inspection of waste;
- inspection when loads are deposited;
- periodic 'audit' of the producer's arrangements for treatment.

Waste producers and landfill operators will need to agree the administrative arrangements, including any charges, for checking compliance with the law. For example, landfill operators will need to decide whether they require a declaration in respect of each load (See Annex 1), or they will accept a 'season ticket' arrangement similar to those for transfer notes under the Duty of Care.

Where waste has passed through a treatment plant (including thermal, biological or chemical treatment, or mechanical sorting), then the landfill operator can be confident that the waste has been treated. Further checks are not needed unless the operator has good reason to suspect that the waste has simply been passed on rather than subjected to the treatment process.

It is good practice to obtain a written declaration from the producer or holder that the waste is treated.

Where waste has been segregated at source or hand-sorted, it will be more important to verify treatment. Again, a written declaration would be acceptable evidence.

Waste characterisation and testing have a key role to play. Landfill operators must be satisfied with the evidence presented about the load in terms of its waste acceptance criteria before they accept it for disposal. Basic characterisation includes identifying the treatment applied, or a statement of reasons why it is not considered necessary.

Section 6 - Responsibilities of waste collectors and other waste holders

The advice given in sections 4 and 5 assumes that the landfill operator is in contact with the waste producer. In practice, there may be a chain of holders including, for example, a collector, transfer station or treatment plant.

All holders should liaise to ensure that the landfill operator is provided with sufficient evidence that the waste has been treated.

If concern over commercial confidentiality stops the landfill operator receiving a declaration of the kind shown in Annex 1 from the producer, then each waste holder in the chain can reasonably:

- ask for a declaration for their own benefit; and
- provide the next holder with his or her own declaration.

Where multiple collections are being made, the collector can check whether any untreated waste is included. The collector will therefore determine whether the load should be treated or can go to landfill.

More guidance on some common waste streams, including, inert, municipal and commercial and industrial waste is included in Section 8.

Part B: Examples of treatment options

Section 7 - Choosing a suitable treatment option

This is not a comprehensive guide to all the technicalities of waste treatment. It provides some examples of available treatment methods applicable to a number of common waste streams. There are many other sources of technical guidance available to help you decide on the best treatment option for your waste. If you are a waste producer your waste contractor should also be able to advise you further.

Choosing a treatment option: environmental considerations

We expect you to comply with the Regulations as explained in Part A of this document. But when deciding how best to comply and in selecting treatment options we recommend that you consider the aims of the LfD to:

- encourage the prevention, recycling and processing of waste;
- ensure that, where landfill is used for the disposal of waste, measures are taken to reduce as far as possible negative effects on the environment as well as any resulting risk to human health during the whole life cycle of the landfill.

Government policy and strategy for waste management should also be a considered in the decision-making process. Regulations require waste to 'move up the waste hierarchy'. In order of preference, the waste hierarchy is:

- prevention
- preparation for reuse
- recycling
- other recovery
- disposal

Treatment considerations provide an opportunity to review the overall chain of production and management of the waste - in particular whether it is possible to recover more value from it. See government guidance on the waste hierarchy and how to comply.

Choosing a treatment option: practical considerations

You need to consider the following practical aspects of the available treatments – what is the best available technology?

- availability
- reliability
- sensitivity to waste composition changes
- technical difficulty

For example, the options for treating biodegradable food waste might be in-vessel composting or incineration.

Choosing a treatment option: technical considerations

A suitable treatment for your waste is likely to depend on:

- the exact physical form and chemical composition of your waste;
- whether a particular treatment facility can accept it.

It may also depend on the amount you produce in relation to the other wastes being accepted by the treatment plant. For example, a composting process may be able to accept a small proportion of animal waste or wood shavings, but this may be limited.

The composition of the waste

Considering the composition of the components of the waste will give you a broad indication of the types of process that will meet the first criterion of the three point test (see section 2). This may narrow the range of possible treatments to consider. The examples provided in Table 1 are intended to be used for early treatment, preferably at or just after the waste is produced.

Table 1 Example early treatment processes for different types of waste

Composition of the waste	Potential treatment processes
Insoluble inorganic (e.g. concrete, bricks)	Direct reuse (e.g. as bricks) Physical treatment (e.g. size reduction or screening) to make the waste suitable for use (e.g. as aggregate). If there is no outlet for reuse even after such treatment, then the waste may be landfilled without treatment.
Soluble /partially soluble inorganic (e.g. soils or thermal process residues that are not hazardous waste)	For non-hazardous inorganic wastes, consider reuse or recovery. If this is not possible and if the waste contains no treatable organic fraction, it would not contribute to the LfD objective to treat the waste unless the risk assessment shows a clear benefit. For example, if a waste contains heavy metals below the hazard thresholds, then it is not necessary for the heavy metals to be immobilised to comply with the treatment requirement unless risk assessment shows that their acceptance for landfilling would result in a risk to groundwater.
Biodegradable organic (e.g. food waste)	Biological treatment: There are a range of treatment options available for treating biodegradable waste and the technology is developing all the time. They include; composting and anaerobic digestion. Thermal treatment: usually incineration.
'dry' recyclable materials (e.g. paper, plastic, glass, metal)	Preparing for reuse to a product again – either for the same purpose or another with only minimal processing (e.g. washing). These options generally apply to single component wastes and mixtures will usually have to be separated before reuse or recycling.
Mixture (e.g. household waste)	Separation (including dewatering) (see below)

Examples of the waste entries in the List of Wastes Regulations (2005) are reproduced in Table A1 in Annex 2 to illustrate how these principles can identify the technical possibilities for treating each waste. Where there is more than one possibility, section 2 gives advice on issues you should consider in choosing between them.

Most wastes are mixtures for which you will have two options:

- to separate the components; or
- to treat the whole waste stream.

For example, the options for general waste might include separate collection at source or separation of the waste components at a materials recovery facility (MRF).

Alternatively, all the mixed general waste could be incinerated.

Separation of the waste components may allow some components to be reused or recycled, and/ or to be further treated. For example, washing a contaminated soil may result in an aggregate for reuse and an organic fraction for thermal treatment. For separation to meet the third criterion of the three-point test (see section 2) will usually require one or more of the separated fractions to be diverted from landfill.

The treatment of some common waste types is discussed in section 3.

Products of a treatment process

Certain wastes sent to landfill are themselves the product of a waste treatment. For example, acid is used during the surface treatment of metals. This is then a waste that is an unwanted substance that the holder intends or is required to discard. Such waste is commonly treated by the addition of lime either in-house or at a waste treatment facility. The addition of the lime is a chemical process. It changes the characteristics of the waste and reduces the hazardous nature of the waste. The resulting precipitated sludge or filter cake is therefore a treated waste. Note however that a proportion may be liquid waste which would be prohibited from landfill.

The key requirements are that a material recognised as a waste has been subject to a process that meets the three criteria for treatment.

Future developments

Developments in the waste industry are expected to result in a wider range of treatments becoming available at a greater number of facilities. Waste producers and holders need to:

- be aware of such developments;
- review regularly whether new options have become available for waste sent to landfill.

A range of technologies is available or being developed to treat those wastes that cannot be recycled or composted. These include:

- Thermal treatment. This includes incineration, usually with energy recovery and preferably at a combined heat and power (CHP) facility. It also includes pyrolysis and gasification. The technology is usually referred to as energy-from-waste (EfW); although other processes such as landfill gas utilisation and burning refuse-derived fuel (RDF) from mechanical biological treatment, processes (see below) are also sometimes referred to as EfW.

- Mechanical biological treatment (MBT). This covers a range of technologies. They involve combinations of shredding and screening the waste, and then treating it biologically by composting or anaerobic digestion (see below). A

variation is mechanical heat treatment (MHT), where the waste is heated by hot air or steam to sterilise it and prepare the organic content for further treatment. Such MHT systems are sometimes described as thermal, but they operate at a lower temperature than the processes mentioned above. MBT and MHT aim to separate further recyclables and to produce a bio-organic material that can be used in a variety of ways such as reuse of the fibre, production of bioethanol, use as a fuel, application to land, or disposal to landfill of a material with a reduced biodegradable content.

- Anaerobic digestion (AD). This is sometimes grouped with MBT. It processes mixed and shredded waste to produce useable gas and a bio-organic residue, which can be used as described above for MBT.

- Thermal desorption (TD). This is a remediation technology that utilises heat to volatilise contaminants such that they can be removed (separated) from the solid matrix (typically soil, sludge or filter cake). Thermal desorption is not incineration. The volatilised contaminants are then either collected or thermally destroyed. A thermal desorption system therefore has two major components; the desorber itself and the off-gas treatment system.

These processes are designed to:

- extract value;
- separate/ remove biodegradable material from highly mixed wastes.

They are therefore appropriate for similar C&I wastes that are mixed but are not suitable for simple segregation and sorting.

Section 8 - Guidance on some common waste streams

This section provides generic treatment advice for common types of waste. Where relevant, reference is provided to guidance given above about the interpretation of the three-point test, responsibilities and checking up.

Inert wastes

Inert waste is insoluble mineral matter that is uncontaminated by, for example, organic matter, soluble salts, combustible material or biodegradable matter. In most cases, inert wastes will already be suitable for recycling as aggregate or fill material or for recovery at a site that does not need a disposal permit. Treatments for inert waste generally involve physical sorting or conditioning processes that render the inert waste suitable for use. A waste may be inert and not suitable for use even following such a treatment. In such cases, we would accept that treatment is not technically feasible and the waste may be landfilled without further treatment. Treatment may be undertaken at the point of production or by a contractor at a suitably permitted site.

Municipal waste

Local authorities may have a scheme in place to ensure that municipal waste[6] is source segregated by providing for the separate collection of recyclable materials. This may apply to waste produced by householders or similar waste from commercial premises. Any residual municipal waste from such schemes can be regarded as treated for the purposes of the LFD. Where there is no source segregation of household or similar commercial waste, this waste will need to be separately treated prior to landfill (e.g. at a materials recovery facility). Similarly, where the LA carries out dedicated commercial mixed waste collections at premises where there are no commercial recycling services provided, this waste will need to be treated prior to landfill. A duty of care waste transfer note or declaration (see Annex 1) can be used to confirm to landfill operators how the local authority is treating municipal waste. They may also be used by commercial waste producers to confirm how they are treating their waste collected by a local authority.

Mixed commercial and industrial waste

It is for individual producers to ensure the waste is treated prior to landfill.

Options will be:

- source segregation;
- sorting the waste elsewhere;
- processing the waste elsewhere using the types of treatment described in section 7.

The process of sorting or segregating C&I waste should be optimised to remove as many recyclables as possible (see section 3).

[6] The LFD, Article 2(b) states that; “municipal waste” means waste from households, as well as other waste which, because of its nature or composition, is similar to waste from household;

Mixed construction and demolition waste

Construction waste typically contains materials such as bricks, concrete, plasterboard, timber, plastic film, packaging and surplus materials. It may contain site clearance waste such as soil and vegetation. Demolition waste may also include the contents of buildings and the residues from the provision of services.

Mixed waste can either be separated or the waste stream treated as a whole. The latter will not usually be appropriate because of the high content of material such as bricks and concrete, and the low content of readily combustible or biodegradable material.

Government policy, supported by research and guidance, strongly favours the minimisation and recycling of C&D wastes. Separation is therefore the normal option. Example 4 in section 9 explains separation and the role that Site Waste Management Plans have in encouraging the recovery of construction and demolition waste. Government is reviewing the use of site waste management plans.

Our views on the source segregation wastes are set out in section 3. If producers segregate waste at source, segregation should be optimised to remove as many recyclables as possible.

Contaminated soil

Contaminated soils are often classed as hazardous waste, but may not be. Example 5 in section 9 provides a more detailed discussion and an example of options for contaminated site clearance.

As the waste is usually a mixture, the options are to separate the components or to treat the bulk soil.

As stated in Section 7, if wastes are non-hazardous and inorganic, it may not always contribute to the objectives of the LfD to treat them. The example declaration in Annex 1 includes a space for recording why a waste has not been treated. The landfill operator should be satisfied that the reason is valid; if necessary, they should investigate the options further with the waste holder or producer.

If a contaminated soil is non-hazardous, treatments should aim to either recover some fraction such as aggregate or to deal with any organic fraction.

Contaminated packaging

It is difficult to give generic advice about contaminated packaging due to the range of packaging materials and types (drums, sacks, pallets, jars, etc.) and potential contaminants.

The treatment options will be either to separate the contaminant from the packaging or to treat the whole waste stream. This might be thermal treatment, but not necessarily.

Another example relates to treating hazardous waste contaminants in packaging by adding a catalyst to harden the residues or by air-drying them. This is a process. It does change the characteristics of the waste from hazardous to non-hazardous, and it does reduce the hazardousness of the waste. It therefore is a treatment. Air-drying implies there may be fugitive emissions of volatile organic compounds (VOCs) from the process, which could be subject to other statutory controls. If the residues are non-hazardous, it is possible that the three-point test can be met, but this would have to be assessed on a case-by-case basis. For example, it may be possible to show that the hardened product results in some reduction in the negative impact on the environment or health arising from the landfilling of the particular waste.

Sewage sludge

Sewage is waste water for the purposes of the Waste Framework Directive and therefore not 'Directive waste'. However, where residual sludge arising from the treatment of waste water is destined for disposal to landfill, it is Directive waste and must be treated. Treatment of that sludge, for example by settlement or thickening, is treatment of a waste so the resulting thickened sludge can be considered to be treated waste. Any liquid waste arising form the process cannot be accepted in landfill.

The dewatering of sludge is treatment provided the characteristics of the waste are changed.

Sewage screenings

Sewage screenings usually consist of a mixture of materials from the foul sewer and surface water systems. As these materials entered the treatment works combined with waste water it is not Directive waste on entry to the works. It is however, Directive waste when it is disposed of. We consider this waste to be non-hazardous waste that will require appropriate treatment in accordance with the 3-point test prior to landfill.

Section 9 - Industry examples of good practice

These examples provided by industry illustrate good practice and some of the principles discussed above. They mainly show simple source segregation in practice, with one example involving sorting of waste at transfer stations. You can also follow the guidance on source segregation given in section 3.

Segregation and sorting both help to minimise and recover waste. But waste holders should not forget that there are other opportunities for treating waste, which can also be considered.

It is good practice to keep the management of residual waste under review to see whether, as markets and national treatment infrastructure evolve, it can be moved up the waste hierarchy. For example, there may be scope for further separation of the mixed waste. Alternatively, the mixed waste could be treated outside the site by biological treatment, MBT or thermal treatment (see section 7).

An environmental management system (EMS) reinforces the need to keep the site's waste management under review. EMS documentation normally incorporates waste

handling and disposal methods, including treatment requirements for waste. If there is no site EMS, you can consult appropriate internal documentation on waste handling and disposal. In the food industry, for example, site HACCP7 documentation will cover the separation of cooked from non-cooked waste as appropriate.

Example 1
This is an example of retail compliance. Table 2 summarises how a major grocery retailer has implemented source segregation with only a small amount of mixed residual waste going to landfill.

Example 2
This example is also from the retail sector (Table 3). Many smaller shops and offices have separate collections, in particular for waste paper and toner cartridges from printers. The source segregation of such wastes, which are then collected for recycling and not destined for landfill, results in the remaining mixed general waste having satisfied the pre-treatment requirement.

The waste transfer note or written declaration should indicate that the general waste has been pre-treated through source segregation.

Table 2: Example 1 – Multi-outlet national grocery retailer *

1	2	3	4	5	6
Animal by-products (e.g. raw meat, raw fish)	Cardboard (e.g. boxes)	Plastic (e.g. shrink wrap)	Residual non-hazardous mixed waste (e.g. food, packaging)	Plastic carrier bags	Single use cameras
2%	65%	5%	28%	<1%	<1%
Further treatment (composting or incineration)	Removal for recycling	Removal for recycling	Removed for disposal from store	Removal for recycling	Removal for sorting and recycling
Minimal landfill (incinerator ash)	No landfill. Minimal landfill would be allowable (e.g. rejects).	No landfill. Minimal landfill would be allowable (e.g. rejects).	Landfill – accepted as pre-treated since it is the residue from sorting activities.	No landfill. Minimal landfill would be allowable (e.g. rejects).	Minimal landfill – cameras without batteries are non-hazardous and could be landfilled. But they are likely to require prior treatment as it is not reasonable to assume that they would otherwise have been mixed with general waste (collected separately for photo processing).

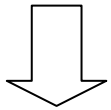
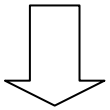
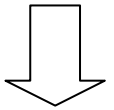
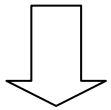
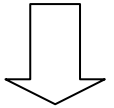
Percentage figures denote fraction of the overall waste production that has been achieved in this specific example.
*Excludes hazardous waste that is also separated at source.

Table 3: Example 2 – Plant bakery

Clean paper/cardboard 21%	Clean plastic 3%	Vegetable oil 1%	General waste including soiled paper/cardboard and plastic 75%
Removal for recycling	Removal for recycling	Removal for reprocessing/use as biofuel	Removal for disposal or recovery
No landfill except rejects	No landfill except rejects	No landfill	Landfill – accepted as pre-treated since it is the residue from sorting activities. Regular review of scope for further treatment.

Percentage figures denote fraction of the overall waste production that has been achieved in this specific example.

Table 4: Example 3: meat pie manufacturer

Clean cardboard 21%	Uncooked meat or waste containing uncooked meat 7.5%	General waste (cooked meat, vegetables, packaging) 71.5%
		
Removal for recycling	Further treatment according to ABPR requirements: rendering, composting, anaerobic digestion incineration.	Removal for disposal or recovery
		
No landfill except rejects	Minimal landfill (e.g. incinerator ash)	Landfill – accepted as pre-treated since it is the residue from segregation/sorting activities. Regular review of scope for further treatment.

Percentage figures denote fraction of the overall waste production that has been achieved in this specific example
ABPR = Animal By-products Regulations

Example 2 and 3
Both these examples illustrate food manufacturer compliance and provide further examples of source segregation.

In example 3 (see Table 4), the ongoing review of the management of the residual waste might, for example, decide that the general mixed waste is suitable for further segregation to allow biological treatment of the cooked product. Alternatively, all this waste might be considered for MBT, AD or thermal treatment (see section 7).

As a simple example, let us assume that the reject product is breakfast cereal packaged in a cardboard box with an inner plastic bag. It is assumed not to be feasible to separate these materials by hand. But in a typical MBT process, the waste would be shredded and treated biologically in bulk, sometimes with energy recovery. Plastic would be extracted mechanically before and/ or after biological treatment and the treatment product used on land or as fuel. Alternatively the waste could be incinerated with recovery of the significant energy content.

Example 4
This example describes the principles for dealing with C&D waste by source segregation. A typical project might involve the demolition of a derelict building and the erection of a new office block. In the past, such a project would have resulted in the creation of a large heap of waste which would have been disposed of to landfill. Today, the first task is a site investigation to determine whether there was any contamination left on the site that might affect, among other things, the workforce, the local environment or the structure and stability of the new building once completed. Example 5 deals with a case in which there is such contamination. Such an investigation enables the developer to budget more effectively, since disposal costs can significantly affect the overall cost of development. Integral to this process is the production of a Site Waste Management Plan. Such a plan identifies the various wastes on the site and considers the most appropriate way to deal with them, including the potential risks that the waste might pose to the environment and the workforce.

The next task might be to demolish the building and break up the concrete slab on which it was founded. If the brickwork and concrete can be kept separate, this material could be crushed and screened and retained on-site for use as hardcore in the forthcoming construction work.

If soils have to be removed for new foundations, etc., then topsoil should be segregated and either stored for subsequent use on-site or exported for reuse elsewhere.

Subsoil can then be removed and dealt with in several ways such as:

- use on-site to construct a landscape or acoustic bund;
- taken to an exempt operation for recovery;
- taken to a landfill for inert or non-hazardous waste for disposal without treatment (as the remaining materials on the site have been segregated and dealt with separately).

Other waste materials (wood, plasterboard, glass, metal, etc.) should also be segregated and recycled where possible; any reduction in the total amount of waste sent to landfill will represent a cost saving and there may even be a small income from the recycled materials.

Because there has already been some segregation of the wastes generated by the project, the remaining waste is considered to have been treated and can be disposed of to a landfill for non-hazardous waste without further treatment. If significant quantities of glass are present in this residual waste, the glass could be segregated and either sent for recycling (e.g. in glasphalt) or disposed of to a landfill for inert waste.

Example 5
This example first discusses the treatment of contaminated soils in general before presenting a specific example.

Contaminated soil
Contaminated soil is a mixture of soil materials with contaminants. The contaminants may be a wide range of substances from the former use of the site. A typical mixture might be complex cyanides, hydrocarbons, heavy metals and asbestos in a matrix of soil, brick and demolition rubble. However, some soils may contain only a single contaminant from a specific spill or leak.

WAL sets out our views on the options of either separating the contaminated soil mixture or treating the whole waste stream. An important question is whether segregation is an acceptable process for the treatment of contaminated soils. Where some component is diverted from landfill (thus reducing volume or hazardousness or enhancing recovery), the three-point test is met. However, this is subject to the views stated in section 3 on the amount of separation that must take place.

Treatment options might be:

- source segregation;
- treatment of the whole waste by:
    - biological treatment;
    - thermal treatment;
    - stabilisation;
    - separation.

Source segregation
You need to consider whether to separate the components or treat the whole waste. There are number of technologies available and in development, for both approaches.

Treatment of the whole waste is usually by simple physical (for example washing), biological, or thermal (for example thermal desorption or incineration) processes. Both may be in-situ or ex-situ, on or off-site. Where the contamination is inorganic stabilisation or other chemical treatment can also be considered.

Contaminants may have been spread around the site during site operations and waste disposal, or they may be confined to limited areas. The site investigation

should identify the potential for segregation by separate excavation of areas with different contaminants and with no contaminants, or their subsequent separation. Waste acceptance criteria tests and leaching limit values in the Council Decision annex are not appropriate for a contaminated land assessment. These tests may need to be carried out later if some of your waste must go to landfill, but they are not designed to identify whether a soil is contaminated. Where the contaminated materials are already clearly separate, for example in tanks or lagoons, no process would be involved in segregating these — the three-point test would not be met (see Section 11.2). The LfD, article 5(4) prohibits the deliberate dilution of contaminated material with uncontaminated material.

If the treatment is segregation, one of the streams must be diverted from landfill. If the wastes are already separate, both are subject to the treatment requirement.

i) Biological

A range of biological treatment technologies is available. Their objective is to reduce the concentrations of biodegradable organic compounds, usually hydrocarbons and derivatives. Typically, biological treatment reduces organic contaminants rather than eliminating them. It will have little or no effect on contaminants such as heavy metals and asbestos and may increase their concentration due to the reduction of the overall waste mass.

ii) Thermal

Thermal treatment is split into non-destructive and destructive options:

- thermal desorption
- incineration

Thermal desorption can be used on site or off to separate the “volatile” organic fraction of the waste from the rest possibly allowing recovery of both parts.

Alternatively the soil can be excavated for high-temperature treatment in a mobile plant or at remote incinerators. The treatment results in the effective removal of organics. Inorganics such as heavy metals will remain and inorganics in general may become more leachable as a result of the removal of organic matter to which they may previously have been adsorbed.

Thermal treatment by in-situ vitrification is possible. However it is little used due to its cost and energy requirements. Thermal desorption has also been used to separate organic compounds (see below). This involves lower temperatures than incineration.

Both biological and thermal treatments can meet the pre-treatment requirements, but result in residues which may require further treatment, depending upon the environmental management techniques of the receiving landfill.

iii) Stabilisation

Stabilisation can be used to immobilise specific insoluble inorganic contaminants, subject to acceptable quality controls. Chemical treatments are also being investigated, but may often be more appropriate for treating separated contaminants.

iv) Separation

Separation usually involves washing the soil with water or solvent and/ or removal of volatiles by heating, steam injection or soil vapour extraction. Organics and heavy metals are often bound to fine particles. This means that size-separation in association with soil-washing can sometimes produce a large-size fraction without significant contamination.

Separation can therefore reduce the levels of volatile and semi-volatile organics. It can also produce a useable aggregate leaving the fine-grained material for landfill as a treated waste, or for further treatment once the large-size material has been removed.

Table 5 Summary of non-hazardous contaminated soil treatment options

Process	Purpose
Physical (separation or segregation)	Enhance recovery* Reduce quantity landfilled* Facilitate handling*
Biological	Facilitate handling** Reduce quantity landfilled (via reuse of treated material)*
Thermal	Facilitate handling** Reduce quantity landfilled** Enhance recovery**
Stabilisation (physicochemical)	Facilitate handling**
Chemical	Facilitate handling**

* Depends on what is done with the separated fractions.

** Depends on the nature of the contaminants, the specific process applied and the effect on contaminant composition and concentration.

Example

The following example is intended to refer to non-hazardous waste. The principles are generally applicable to hazardous wastes, and for hazardous wastes the additional option of "reducing hazardousness" is available as a way of meeting the third criterion of the three point test.

A site investigation found that a disused chemical works consisted of 50 per cent uncontaminated land and 50 per cent contaminated land.

The plan is to segregate the uncontaminated material and reuse it on-site. Since there is no intention to discard this material (i.e. it is not waste), it will not need to be treated.

The remaining half of the site (the contaminated portion) contains areas of:

- general hydrocarbon contamination;
- made ground that consists mostly of brick rubble, ash and broken reinforced concrete;
- remnants of brick bases of disused dipping tanks containing a non-hazardous sludge.

It is decided that these areas are candidates to be removed from the site for disposal. They are waste. The treatment options for this remaining material are outlined below.

Brick rubble
This could be separated to sort out the bricks and concrete for recycling as hardcore. The remaining ash material could then be disposed of to landfill as pre-treated waste, along with the concrete reinforcement – though this material should be considered for recycling (depending on its suitability for reprocessing).

Hydrocarbon contaminated soil
Provided that there is no risk of pollution, contaminated soils not requiring treatment or containment could be used in the same way as uncontaminated soils. Where contaminated materials produced on-site during construction works (including excavated soils and materials resulting from demolition) are used on site according to the planning permission authorising their use as part of the site's development, we do not regard them as being discarded provided:

- they are suitable for that use and require no further treatment;
- only the quantity necessary for the specified works is used (otherwise it becomes a disposal activity);
- their use is a not a mere possibility but a certainty.

Their use on-site can include activities such as:

- site regrading;
- use of materials beneath cover layers, capping layers, buildings and hard-standing.

The hydrocarbon contaminated soil may thus require further investigation. As part of the remediation action plan, a hydrogeological risk assessment and human exposure modelling will produce limits for material that can safely be reused on-site.

Further chemical investigation may show that some of the material meets this specification. Its reuse on-site therefore becomes a possibility. However, its status as a waste will require careful reconsideration at this point.

Soil that fails the reuse specification could be:

- incinerated;
- subjected to vapour extraction;
- treated biologically either in-situ or ex-situ (the ex-situ treatment could be on- or off-site).

Following such treatment, the waste could be disposed of to landfill (provided that the three-point test is met) or be reused on site, or a mixture of both.

Chemically contaminated tanks
The remnants of the brick-built chemical dipping tanks contain a non-hazardous sludge. After the sludge is removed from the tank, the bricks could be decontaminated and then reused, recycled or landfilled.

The sludge could be treated using a chemical, solidification or stabilisation process in order to meet the three-point test, with the residue being landfilled.

Example 6
This example relates to the sorting of wastes at transfer stations. A large proportion of the waste accepted at landfills comes from transfer stations (particularly the landfills serving conurbations). Many of these transfer stations carry out sorting for recycling and recovery. Significant levels of segregation can occur at such transfer stations.

The heavier materials usually collected in skips are the main wastes dealt with in this way. Soils, hardcore and concrete are typically separated together with metals (ferrous and non-ferrous). At many transfer stations, clean wood such as pallets and cardboard are also removed. The inert materials are usually separated using mechanical equipment (including screens with blowers) or picking belts used to separate paper and plastics.

The lighter fractions arriving in collection vehicles tend to be subject to less separation due to the nature of the materials. However, hand sorting offers a potential source of more clean wood, plasterboard and cardboard.

Segregation at the transfer station might remove at least 50 per cent of the heavy materials and perhaps 5 per cent of the lighter materials for recovery. Some recyclable materials will already have been removed by segregation at source.

Annex 1: Example pre-treatment confirmation form

Note: you can also incorporate the information contained within this pre-treatment confirmation form into your Waste Transfer Notes.

Pre Treatment Confirmation Form

Company name

Company address

Waste description

Intended disposal site

LoW Code:

How have you treated the waste?

What processes are employed?

Is there any segregation of waste?	yes	no
Separate collection	yes	no
Screening	yes	no
Hand picking	yes	no
Magnetic segregation	yes	no
Thermal	yes	no

Other (please specify)

What materials are segregated?

Wood	yes	no
Paper	yes	no
Cardboard	yes	no
Glass	yes	no
Plastics	yes	no
Green waste	yes	no
Ferrous	yes	no
Non-ferrous	yes	no
Waste electrical and electronic equipment (WEEE)	yes	no

Other (please specify)

Which of the wastes are sent for recycling or other forms of recovery?

Wood	yes	no
Paper	yes	no
Cardboard	yes	no
Glass	yes	no
Green waste	yes	no
Ferrous	yes	no
Non-ferrous	yes	no
Waste electrical and electronic equipment (WEEE)	yes	no

Other (please specify)

What percentage of the total waste is sent for recovery recycling?

If treatment has not been carried out, please state why treatment is not considered necessary:

I/We confirm that the waste delivered by the above named company and herein described has been treated as detailed above.

Note: Treatment is a physical/ chemical/ thermal or biological process including sorting that also changes the characteristics of the waste and must do so in order to:
i reduce its volume; or
ii reduce its hazardous nature; or
iii facilitate its handling; or
iv enhance its recovery

Name

Signature

Position in the company

Date

Annex 2: Consideration of potential treatment processes

Examples of waste entries from the List of Wastes Regulations (2005) are reproduced in Table A1 to illustrate how these codes can help to identify the technical possibilities for treating each waste type. It is important to use the correct methodology to determine the most appropriate code for your waste. Our guidance: 'Using the list of wastes to code waste' is available from our web-site to support your assessment. Where there is more than one treatment possibility, section 2 of this guidance gives advice on issues you should consider in choosing between them.

Notes on Table A1

i. Table A1 does not include all the entries. Rather a considerable number have been extracted to illustrate the wide range of waste types involved and the range of issues to be considered.
ii. Chapter 13 and 14 wastes are hazardous.
iii. It might be thought that all of Chapter 19 would be 'already treated' wastes, but this is not the case. Some of the entries are for rejects prior to treatment and some are for wastewaters or emissions to atmosphere under the Waste Framework Directive.
iv. '99' codes are not included as their composition is unknown.
v. The first column reproduces the six-digit description, with clarification of the four- and two-digit levels if necessary.
vi. The second column describes what the waste might be.
vii. The third column gives some consideration as to whether the waste might already be a treated waste. If blank, it is not.
viii. The next six columns consider the composition of the waste (as discussed in section 7) as an aid to identifying possible processes. The following column considers whether other legislation might affect treatment selection, for example, the packaging waste, animal by-product, end-of-life vehicle (ELV) or waste electrical or electronic equipment (WEEE) regulations. The key to these columns is provided above the table.
ix. Biodegradable wastes may become subject to further UK implementation of the LfD, article 5.1, which requires diversion of such wastes from landfill. This could affect the selection of a treatment process.
x. Chapter 20 entries relate to MSW and similar C&I wastes. For MSW, our guidance given in WAL and in this document is applicable.
xi. The final column identifies possible treatment processes. Some of these may be an alternative to landfill, while some are a suitable treatment prior to landfill.

For many wastes, there will be several options. Section 2 gives advice on choosing between them. As well as the environmental and practical issues, all three criteria of the three-point test must be met. This is particularly relevant in considering separation of wastes as this must result in the third criterion being met.

Annex 2: Consideration of potential treatment processes for non-hazardous wastes

Table 6 Key to columns 4–10 of Table 1 (see (viii) above)

Table reference	Composition
Mixture	Mixture
Insol inorg	Insoluble inorganic
Sol inorg	Soluble/partially soluble inorganic
Biodeg org	Biodegradable organic
Slow biodeg	Slowly-biodegradable organic
Recyclable	Recyclable
Other	Other legal provisions may affect the decision

Annex 2: Table A1 Examples of entries with consideration of potential treatment processes.

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
02 02 01 sludges from washing and cleaning (from food of animal origin)	Aqueous sludges of blood, excrement, hair, scales, etc. A mixture of water with biodegradable material.		Y			Y			Y	To sewer Dewater before landfill. Biological treatment – probably AD unless small quantities Incineration (preferably with energy recovery) after dewatering
02 02 02 animal tissue waste	Meat or fish inc bones, hair, etc.					Y		Y	Y	Possible rendering and recovery Biological treatment – probably AD Incineration (preferably with energy recovery)
02 02 04 sludges from on-site effluent treatment	Effluent sludge with high organics.	Probably not – effluent is likely to be wastewater under Waste Framework Directive, not waste.	Y			Y			Y	Dewater before landfill. Incineration (preferably with energy recovery)
02 03 01 sludges from washing, cleaning, peeling, centrifuging and separation (from fruit, vegetable, tea, tobacco, etc.)	Aqueous sludges of plant peel, husks, stalks and other plant material with some soil.		Y			Y				Dewater before landfill. Composting or AD Incineration (preferably with energy recovery)
02 03 04 materials unsuitable for consumption or processing unwanted vegetable material or product.						Y				Composting AD Incineration (preferably with energy recovery)

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
02 04 01 soil from cleaning and washing beet	Wet topsoil. Not inert, but not susceptible to biological treatment.					Y		Y		Reuse as topsoil If no reuse outlet, non-hazardous landfill without treatment
03 01 01 waste bark and cork (from wood and furniture production)	Bark and cork					Y		Y		Recovery as mulch Composting Incineration (preferably with energy recovery)
03 01 05 sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04	Wood particles					Y				Recycling (particle board, etc.) Composting Incineration (preferably with energy recovery)
03 03 01 waste bark and wood (from paper production)	Bark and wood					Y				Recovery as mulch Composting Incineration (preferably with energy recovery)
03 03 07 mechanically separated rejects from pulping of waste paper and cardboard	Scraps of plastic with some paper and card. May be on 'wire ropes'.	Yes – from treatment of waste paper and cardboard					Y			Landfill – already treated Incineration (preferably with energy recovery)
03 03 08 wastes from sorting of paper and cardboard destined for recycling	Unsuitable material (e.g. plastic, foil, wire)	Yes – from treatment of waste paper and cardboard	Y							Landfill – already treated Incineration (preferably with energy recovery)

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
03 03 10 fibre rejects, fibre-, filler- and coating-sludge from mechanical separation	'Paper pulp' – short wood fibres, china clay and other fillers, possibly with some ink/dye.	No - if from virgin wood pulp. Yes - if from recycled paper and cardboard	Y							There have been many attempts at reuse or recovery (e.g. landfill cover). Dewater before landfill. High water and clay fines content likely to cause problems in incineration (preferably with energy recovery) – possibly co-incineration (preferably with energy recovery) (e.g. cement kiln) Otherwise landfill without treatment
04 01 04 tanning liquor containing chromium (leather industry)	Liquid waste with both biodegradable and chemical content		Y		Y	Y				Physico-chemical treatment
04 01 05 tanning liquor free of chromium (leather industry)	Liquid biodegradable waste		Y			Y				Sewer Biological treatment at liquid waste treatment plant
04 02 09 wastes from composite materials (impregnated textile, elastomer, plastomer) (textile industry)	Waste composite textiles									Incineration (preferably with energy recovery) Recycle
04 02 10 organic matter from natural products (e.g. grease, wax) (textile industry)	Material from cleaning (e.g. wool – wool scour liquor, grease, wax, excrement, detergents)		Y			Y				Dewater before landfill. Possible biological treatment (e.g. AD) Incineration (preferably with energy recovery)

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
04 02 21 wastes from unprocessed textile fibres	Could be animal, vegetable or synthetic textile fibres.									Vegetable (e.g. cotton) – compost or incineration (preferably with energy recovery) Animal (e.g. wool) – in-vessel composting or incineration (preferably with energy recovery) Synthetic (e.g. rayon) – incineration (preferably with energy recovery) Recycle
04 02 22 wastes from processed textile fibres	As unprocessed. May have been dyed.									As unprocessed
05 01 17 bitumen (from oil refining)	Bitumen									Reuse in coating, etc. Incineration (preferably with energy recovery)
06 13 03 carbon black (inorganic chemicals NOS)	Finely divided carbon									Regeneration of substrate Incineration (preferably with energy recovery)
07 02 13 waste plastic (MFSU plastic)	Plastic									Reuse or recycling Incineration (preferably with energy recovery)
08 01 12 waste paint and varnish other than those mentioned in 08 01 11 (MFSU paint and varnish)	Water-based paint with pigments and fillers		Y				Y			Dewater before landfill. Incineration (preferably with energy recovery)
08 01 14 sludges from paint or varnish other than those mentioned in 08 01 13 (MFSU paint and varnish)	Water-based pigments and fillers		Y				Y			Dewater before landfill. Incineration (preferably with energy recovery)

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
08 01 16 aqueous sludges containing paint or varnish other than those mentioned in 08 01 15 (MFSU paint and varnish)	Water-based pigments and fillers		Y				Y			Dewater before landfill. Incineration (preferably with energy recovery)
09 01 07 photographic film and paper containing silver or silver compounds	Plastic film with silver coating							Y		Processing for silver recovery – film may then be landfilled after that treatment. Incineration (preferably with energy recovery)
09 01 10 single-use cameras without batteries	Composite, mainly dense plastic		Y							May be subject to WEEE regulations (flash and connections). Incineration (preferably with energy recovery)
09 01 12 single-use cameras containing batteries other than those mentioned in 09 01 11	Composite, mainly dense plastic, with alkaline batteries		Y							Is subject to WEEE regulations – crush/ shred and recover batteries and electronic components
10 01 02 coal fly ash	PFA – fine particles of silicates with some soluble inorganics (e.g. boron)			Y	Y					Recover as a construction material. May be wetted to control dust - this does not change characteristics. If co-fired with waste, it is the residue from a treatment process and needs no further treatment.
10 01 17 fly ash from co-incineration (preferably with energy recovery) other than those mentioned in 10 01 16	Fly ash from combustion processes including waste.									It is the residue from a treatment process and needs no further treatment.

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
10 09 08 casting cores and moulds which have undergone pouring other than those mentioned in 10 09 07 (ferrous metallurgy)	Non-hazardous foundry sand			Y	Y					Reuse, recover Non-hazardous landfill without treatment
10 11 03 waste glass-based fibrous materials (glass manufacture)	Glass fibre			Y						Inert – recycle or landfill without treatment.
10 11 12 waste glass other than those mentioned in 10 11 11 (glass manufacture; excluding glass powder/heavy metals)	Glass			Y						Recycle or landfill (possibly inert) without treatment.
10 13 14 waste concrete and concrete sludge (from manufacture of articles from cement and lime)	a) Solid concrete b) Aqueous mixture of cement and sand/gravel			a Y	b Y					a) reuse as aggregate; if no reuse outlet, landfill (possibly inert) without treatment. b) Dewater and non-hazardous landfill.
12 01 05 plastics shavings and turnings	Plastic particles							Y		Recycle Incineration (preferably with energy recovery)
12 01 21 spent grinding bodies and grinding materials other than those mentioned in 12 01 20	Abrasives and non-hazardous binders, with non-hazardous metal particles			Y						No obvious treatment. Possible metal recovery and then landfill abrasives, or landfill without treatment

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
15 01 01 paper and cardboard packaging	Paper and cardboard with adhesives					Y			Y	Packaging waste – recovery targets apply. Recycling Composting with other biodegradable material Incineration (preferably with energy recovery)
15 01 05 composite packaging	Usually coated materials (e.g. plastic coated cardboard, jiffy packs)		Y						Y	Packaging waste – recovery targets apply. Separate and recycle where technology exists Incineration (preferably with energy recovery)
15 02 03 absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02	a) Particles with absorbed contaminants (but not hazardous/oil). Could be biodegradable or mineral particles. b) Textiles with some dirt/contamination	a) Unlikely – if from waste treatment, should be Chapter 19.	a Y b Y							a)Depends on both matrix (absorbent) and contaminant. b) Launder and reuse. Launder and landfill. Incineration (preferably with energy recovery). Possible biodegradation, if textile or contaminants biodegradable.
16 01 03 end-of-life tyres	Tyres						Y			**Prohibited from landfill.** Recovery, including cryogenic, crumb production Shredding and co-incineration (preferably with energy recovery) Pyrolysis or incineration (preferably with energy recovery)
16 01 06 ELVs, containing neither liquids nor other hazardous components	Composite articles of metal, plastic, glass, rubber, etc.		Y					Y	Y	ELV regulation requirements. Dismantling/shredding followed by recycling/ other forms of recovery. Landfill of some residues.

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
16 01 20 glass (from ELVs)	Glass, probably laminated or toughened. Possibly with wire aerials or heating elements.			Y						Possible recovery If not, landfill (possibly inert but must be assessed on a case by case basis).
16 05 09 discarded chemicals other than those mentioned in 16 05 06, 16 05 07 or 16 05 08	Can be either organic or inorganic, but non-hazardous. May often be in small containers.		Y							Sorting and bulking, followed by treatment. Inorganic, probable physico-chemical. Organic probable incineration (preferably with energy recovery).
17 01 01 concrete (from C&D)	Concrete, possible reinforcing wire									Crush and recover as aggregate. If no recovery outlet, inert/non-hazardous landfill without treatment
17 01 07 mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	NB This is mixed inert c.f. 17 09 04									Crush and recover as aggregate. If no recovery outlet, inert/non-hazardous landfill without treatment
17 04 03 lead (from C&D)	Solid lead									Recycling
17 05 04 soil and stones other than those mentioned in 17 05 03 (from C&D)	Soil and stones. As there are no separate categories, this category could be all soil or all stones									Stones – recover as aggregate. If no recovery outlet, inert/ non-hazardous landfill without treatment Subsoil – recover as aggregate. If no recovery outlet, inert/ non-hazardous landfill without treatment Topsoil or peat – reuse as topsoil. If no reuse outlet, non-hazardous landfill without treatment Mixtures – separate and proceed as above.

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
17 05 06 dredging spoil other than those mentioned in 17 05 05 (from C&D)	As soil and stones above. May be wet/ liquid.									As soil and stones above Dewater and landfill.
17 08 02 gypsum-based construction materials other than those mentioned in 17 08 01 (from C&D)	Plaster and plasterboard									Recycle/ reuse Landfill for non-hazardous waste in a cell separate from biodegradable waste http://www.environment-agency.gov.uk/static/documents/Leisure/mwrp007_2163539.pdf
17 09 04 mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	Mixed inert with soil, tarmac, cables, vegetation, plaster, etc.									Separate and recover aggregate. If no outlet for recovered material, non-hazardous landfill without treatment
18 01 02 body parts and organs including blood bags and blood preserves (except 18 01 03)	Animal matter					Y				Follow current HSAC guidance (currently under revision).
18 02 08 medicines other than those mentioned in 18 02 07	Various									Follow current HSAC guidance (currently under revision – see reference at foot of this table).
19 02 03 premixed wastes composed only of non-hazardous wastes	Various	No – presumably have been mixed for treatment, but then not treated.								Depends on reasons for not treating. Main option likely to be incineration (preferably with energy recovery) if the mix was unsuitable for physico-chemical (19 02). Possibly solidification. May be necessary to landfill without treatment. Must be justified.

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
		Although a mixture, would not consider separation.								
19 07 03 landfill leachate other than those mentioned in 19 07 02	Leachate. May be from hazardous or non-hazardous landfill. Liquid waste	No								Sewer Liquid waste treatment – biological, reverse osmosis, electrolytic, etc. Evaporation Incineration (preferably with energy recovery)
19 08 01 screenings (from wastewater treatment)	Solids removed from inflow to works – bricks, wood, plastic, paper, condoms, etc.	No – from wastewater treatment	Y							Cannot be readily sorted due to contaminants, or composted due to plastic, etc. Incineration (preferably with energy recovery)
19 09 01 solid waste from primary filtration and screenings (from potable or industrial water (i.e. not wastewater) treatment	Usually flocculants (e.g. alum) with some soil and biological material	No – from water treatment								May be possible to recover on land. If recovery not possible, non-hazardous landfill without treatment Separate cell from biodegradable if high-sulphate content
19 12 01 paper and cardboard (from mechanical treatment of waste)	Paper and cardboard	Possibly, if third criterion is then met (e.g. by recovering the paper and cardboard).				Y				Recycling Landfill if third criterion has otherwise been met. Composting Incineration (preferably with energy recovery)
19 13 06 sludges from groundwater remediation other than those mentioned in 19 13 05	likely to be organic liquid		Y							Dewater and non-hazardous landfill.

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
20 01 01 paper and cardboard (MSW, household, C&I)	Paper and cardboard					Y		Y		May contribute to packaging waste recovery obligations. Recycling Composting Incineration (preferably with energy recovery)
20 01 02 glass (MSW, household, C&I)	Glass			Y						May contribute to packaging waste recovery obligations. Recycling Recover as aggregate if contamination levels make it unsuitable for use in remelt processes, even after further sorting. Landfill for inert waste without treatment if none of these possible
20 01 41 wastes from chimney sweeping (MSW, household, C&I)	Soot									Recovery on land Composting Landfill for non-hazardous waste if these not available
20 02 01 biodegradable waste (MSW, household, C&I, parks and gardens)	Vegetation and timber					Y				Composting Incineration (preferably with energy recovery)
20 03 02 waste from markets (MSW, household, C&I)	Depends on market – packaging, sawdust, vegetable material, animal/fish material		Y			Y				Composting unless high animal content for the composting facility AD Incineration (preferably with energy recovery)

Code	What is it?	Already treated?	Mixture	Insol inorg	Sol inorg	Biodeg org	Slow biodeg	Recyclable	Other	Conclusion/comment
20 03 07 bulky waste (MSW, household, C&I)	Various furniture, white goods		Y							Maybe WEEE. Reuse Recycling Crushing/ dismantling/ sorting prior to recycling or other forms of recovery Incineration (preferably with energy recovery)

HSAC = Health Services Advisory Committee – see below
MFSU = manufacture, formulation, supply and use
MMMF = man-made mineral fibres
NOS = not otherwise specified

Now :
Safe Management of Healthcare waste. Health Technical Memorandum HTM 07 01, version 2, Department of Health, 2010

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