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Guidance on applying the waste hierarchy to hazardous waste

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This guidance is produced under regulation 15(1) of the Waste (England and Wales) Regulations 2011 and any person subject to the regulation 12 duty must have regard to it (regulation 15(2)).

The Waste (England and Wales) Regulations 2011 came into force on 29 March 2011. The regulation 12 duty came into force on 29 September 2011.

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Glossary

Waste Hierarchy definitions

Taken from Article 3 of the revised Waste Framework Directive[1]:

Prevention means measures taken before a substance, material or product has become waste, that reduce:

(a) the quantity of waste, including through the re-use of products or the extension of the life span of products;

(b) the adverse impacts of the generated waste on the environment and human health; or,

(c) the content of harmful substances in materials and products.

Re-use means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.

Preparing for re-use means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.

Recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. Includes the reprocessing of organic material but not energy recovery or the reprocessing into materials that are to be used as fuels or for backfilling operations.

Recovery means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.

Disposal means any operation which is not recovery even where the operation has a secondary consequence, the reclamation of substances or energy.

Other Recovery is not specifically defined in the revised Waste Framework Directive, although 'energy recovery' is referenced as an example. It can be assumed by their exclusion in the definition of recycling, that processing of wastes into materials to be used as fuels or for backfilling can be considered 'other recovery'.

[1] Directive 2008/98/EC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0003:EN:PDF

Section 1: What is this guidance?

1.1 Background

The Waste (England and Wales) Regulations 2011[2] and The Waste (Miscellaneous Provisions) Wales Regulations 2011[3] implement the revised Waste Framework Directive[4]. One of the important elements of the legislation is the requirement to apply the '**waste hierarchy**' as a priority order in the prevention and management of waste.

Everyone in the waste management chain from the producer to final disposer has a role in the consideration and application of the waste hierarchy.

1.2 Who should read this guidance?

This guidance will help anyone carrying out any of the following activities in England and Wales to understand their obligations in relation to hazardous waste and the waste hierarchy. You should read this guide if you are:

- any person who produces hazardous waste, or
- any person who holds, carries, keeps, treats or imports hazardous waste, or
- a dealer or broker who has control of hazardous waste, or
- any person responsible for the transfer of hazardous waste

1.3 What does this guidance cover?

This guidance is for hazardous wastes only. Defra has published separate guidance on the waste hierarchy for non-hazardous wastes in relation to England[5]. The Welsh Government will publish its own guidance on the waste hierarchy for non-hazardous wastes.

This guidance supports Defra's Hazardous Waste Strategy[6] (see Section 2) and the Welsh Government's proposals for the management of hazardous wastes in Wales as set out in the Welsh Government's Collection Infrastructure and Markets Plan. The guidance will help considered decisions to be made about the management of hazardous waste in terms of waste hierarchy.

Although the waste hierarchy applies to healthcare waste, this guidance does not discuss hazardous healthcare waste. The Department of Health document guides producers and waste managers on the management of healthcare wastes[7].

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2 http://www.legislation.gov.uk/uksi/2011/988/contents/made. These regulations will be called the Waste Regulations in this document.
3 http://www.legislation.gov.uk/wsi/2011/971/contents/made.
4 Directive 2008/98/EC. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0003:EN:PDF
5 http://www.defra.gov.uk/environment/waste/legislation/waste-hierarchy/
6 http://archive.defra.gov.uk/environment/waste/topics/hazwaste/documents/policy.pdf
7 Health technical memorandum 07-01: safe management of healthcare waste. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_063274.

1.4 Legal obligations

If you produce or handle waste (see Section 1.2 above), then you need to take all measures as are reasonable in the circumstances to prevent waste, and to apply the hierarchy as a priority order when waste is transferred to another person.

This duty will also apply to those who operate under waste exemptions from the Environmental Permitting Regime.

A declaration will need to be included on Hazardous Waste Consignment Notes[8] confirming compliance with this duty. Here is the text that is included on a consignment note:

'*I confirm that I have fulfilled my duty to apply the waste hierarchy as required by regulation 12 of the Waste (England and Wales) Regulations 2011.*'

The duties are set out in Regulations 12, 15 and 35 of the Waste Regulations and Schedule 4 of the amended Hazardous Waste Regulations 2005[9].

It is best practice to keep a record of all decisions based on the hierarchy as the regulator may ask for a justification.

For those operating waste sites that require a permit under the Environmental Permitting Regulations (England and Wales) Regulations 2010, in addition to the duties described above, a condition in **new or revised permits** will place a duty on the permit holder to apply the hierarchy. For example, process loss could be minimised through improvements to the way a business operates and recovery options for any waste produced at the site should be considered.

For existing permit holders, this new condition will apply when permits come up for review. For more details, see Environmental Permitting Guidance.

1.5 Review of guidance

Defra and the Welsh Government will seek to review the guidance on an annual basis with the support of the Hazardous Waste Steering Group, which comprises Defra, BIS, Welsh Government, Environment Agency, Chartered Institute of Wastes Management, Environmental Services Association and the Oil Recycling Association. However, annual meetings of the Steering Group would only be necessary if new technologies were put forward for consideration. Deadlines for applicants to put forward technologies for discussion at potential annual meetings would be circulated well in advance.

[8] For non-hazardous waste Duty of Care Waste Transfer Notes are used.

[9] The Hazardous Waste Regulations 2005 for England can be found at: http://www.legislation.gov.uk/uksi/2005/894/contents/made, and for Wales at http://www.legislation.gov.uk/wsi/2005/1806/contents/made they will be referred to as the Hazardous Waste Regulations in this document

1.6 Other sources of support

- Environment Agency's guidance on classification of hazardous waste: Hazardous Waste technical guidance WM2 [10]
- WRAP's website offers help on waste prevention: www.wrap.org.uk
- The Environment Agency has developed WRATE, a piece of software which allows businesses to calculate the environmental impacts of their systems including waste management impacts: www.environment-agency.gov.uk/research/commercial/102922.aspx

[10] http://publications.environment-agency.gov.uk/PDF/GEHO0411BTRD-E-E.pdf

Section 2: The Hazardous Waste Strategy

2.1 What is the Hazardous Waste Strategy?

In March 2010, Defra published a Hazardous Waste Strategy for England which set out a methodology for the sound management of hazardous wastes. Within the Strategy six principles for managing hazardous waste have been identified and four decision trees have been included to assist with choosing appropriate waste management options.

The Welsh Government does not have a separate strategy covering hazardous waste in Wales. The management of hazardous waste is set out in the Collection Infrastructure and Markets Sector Plan [11], which is one of several plans that implement Towards Zero Waste [12], the Overarching Waste Strategy Document for Wales. However it concurs with the principles and the decision trees (see Section 2.2) set out in the Hazardous Waste Strategy for England.

2.2 The Principles

Please note the published Hazardous Waste Strategy provides more detail on the Principles than given in the following summary. The Strategy should be read for a more complete and thorough understanding of its aims and objectives.

This guidance focuses in particular on Principles 1, 3, 4 and 5.

Principle 1 – the waste hierarchy

a. Hazardous waste should be managed by waste producers and waste managers in accordance with the EU waste hierarchy. In applying the hierarchy, hazardous waste producers and waste managers shall opt for hazardous waste management that takes into account the resource value of hazardous wastes, and the need for health and safety to be maintained and delivers the best overall environmental outcome. This may require specific hazardous waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste.

b. The hierarchy shall apply as a priority order in line with the Waste Framework Directive (2008/98/EC):

Prevention

Preparing for re-use

Recycling

Other recovery, e.g. energy recovery and

Disposal.

Prevention includes measures that reduce the adverse impact of hazardous waste on the environment and human health and reduce the content of harmful substances in materials and products before they become waste, as well as a reduction in the quantity of hazardous waste produced.

Principle 2 – Infrastructure provision

[11] The consultation can be found at: http://wales.gov.uk/consultations/environmentandcountryside/cimwasteplan/?lang=en

[12] http://wales.gov.uk/topics/environmentcountryside/epq/waste_recycling/zerowaste/?lang=en

We look to the market for the development of hazardous waste infrastructure, which implements the hierarchy for the management of hazardous waste and meets the needs of the UK to ensure that the country as a whole is self sufficient in hazardous waste disposal, facilities are put in place for hazardous waste recovery in England, and the proximity principle is met.

Principle 3 – Reduce our reliance on landfill

We must continue to reduce our reliance on landfill for hazardous waste, which should only be used where, overall, there is no better recovery or disposal option.

Principle 4 – No mixing or dilution

Where hazardous waste cannot be prevented, waste producers and waste managers:

a. shall not mix different categories of hazardous waste, or mix hazardous waste with other waste, substances or materials, unless under the terms of an environmental permit, and the mixing operation conforms to Best Available Techniques, (as identified in Article 2 of the Integrated Pollution Prevention and Control Directive[13])

b. shall not treat hazardous waste by the dilution of hazardous substances and,

c. must keep organic hazardous waste fractions separate from other streams to assist with their subsequent management in line with the hierarchy.

Principle 5 – Treatment of hazardous organic waste

Hazardous organic wastes that cannot be reused, recycled or recovered shall be subject to destruction using best available techniques, with energy recovery for all appropriate treatments. No hazardous organic waste shall be landfilled unless the requirements of the Landfill Directive[14] are met.

Principle 6 - End reliance on the use of Landfill Directive waste acceptance criteria derogations

The practice of relying on higher Landfill Directive waste acceptance criteria (derogation for 3x WAC) to enable hazardous waste to continue to be landfilled must end.

[13] Directive 2008/1/EC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:0029:en:PDF
[14] Directive 1999/31/EC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:182:0001:0019:EN:PDF

2.3 Decision Trees

The Hazardous Waste Strategy also includes four decision trees to help waste producers understand how to apply the waste hierarchy to organic wastes[15], inorganic wastes[16], waste articles and wastes which are classed as mixed. Mixed wastes are wastes that could be separated to facilitate further treatment. These decision trees are reproduced in Appendix A. It should be noted that the decision trees have been amended slightly since the Hazardous Waste Strategy was produced. Those changes are explained in Appendix A.

This guidance will explain the steps in the waste hierarchy, with prevention being the most important option (whenever possible), followed by preparing for re-use, recycling, other recovery (including energy recovery) and finally disposal (of which the least favoured option is landfill). It will also show, using examples, how the decision trees may be used to demonstrate circumstances where it might be more appropriate to depart from the waste hierarchy in order to achieve the 'best overall environmental outcome'. It will show, using examples, how the decision trees can be used to choose the most appropriate waste management option for hazardous waste. It will also show, using examples, how the decision trees may be used to demonstrate circumstances where it might be more appropriate to depart from the waste hierarchy in order to achieve the 'best overall environmental outcome'

[15] Organic wastes are those that predominately contain covalently-bonded carbon compounds usually in association with hydrogen, such as methane but also in association with halides such as tetrachloromethane. Some carbon compounds such as graphite, diamond, carbon monoxide, carbon dioxide, carbides, carbonates, cyanides and similar are classified as inorganic.

[16] Inorganic wastes are generally salts, consisting of cations and anions joined by ionic bonding.

Section 3: The Waste Hierarchy

3.1 What is the Waste Hierarchy?

Regulation 12 of the Waste Regulations sets out the requirements of the waste hierarchy.

> An establishment or undertaking which imports, produces, collects, transports, recovers or disposes of waste, or which as a dealer or broker has control of waste must, on the transfer of waste, take all such measures available to it as are reasonable in the circumstances to apply the following waste hierarchy as a priority order—
>
> (a) prevention;
>
> (b) preparing for re-use;
>
> (c) recycling;
>
> (d) other recovery (for example energy recovery);
>
> (e) disposal.

The definitions of each of the stages to the hierarchy are reproduced in the Glossary to this guidance.

The Hazardous Waste Strategy sets out the hierarchy as shown in Figure 1[17].

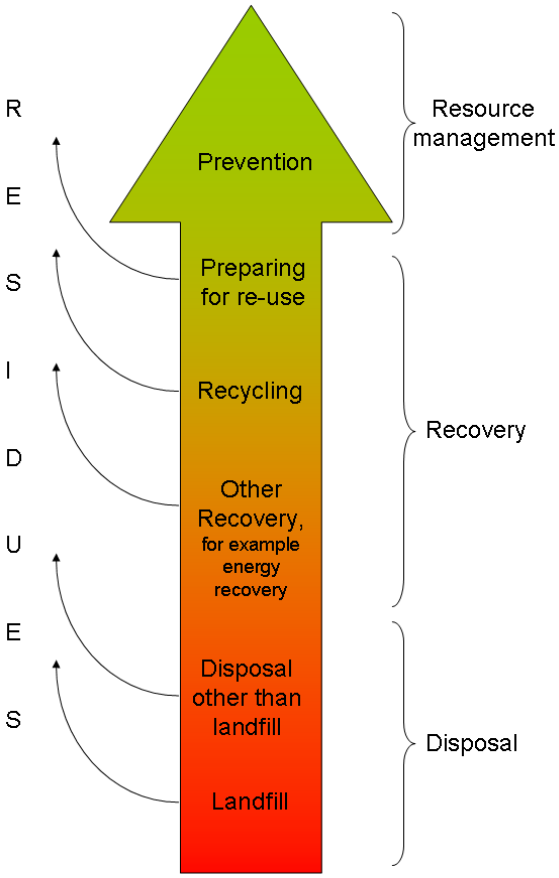


Figure 1 The Waste Hierarchy

[17] Figure 1 is slightly amended from the Hazardous Waste Strategy to make it clear that 'preparing for re-use' is a recovery activity.

Figure 1 shows landfill below other disposal methods to indicate that landfill is considered to be the least desirable waste management option. This is detailed in the Hazardous Waste Strategy, for example in Principle 3. Most hazardous wastes that are landfilled will require treatment prior to landfill in accordance with Article 6 of the Landfill Directive (Directive 99/31/EC). The 'Residues' arrows indicate that a new waste may have been generated for which the hierarchy must be considered.

3.2 Impact considerations

When considering the waste hierarchy, the highest option in the priority order must be chosen wherever possible. To help the decision-making process, impact considerations must be taken into account. This may result in a lower option in the hierarchy being chosen but results in a better overall environmental outcome.

Regulation 12(3) of the Waste Regulations sets out the following impact considerations that must be taken into account when deciding on a waste management option:

(a) The general environmental protection principles of precaution and sustainability;

(b) Technical feasibility and economic viability;

(c) Protection of resources;

(d) The overall environmental, human health, economic and social impacts

Lack of infrastructure availability for an option is an example of one that is not 'technically feasible'.

Two options at the same level of the hierarchy (for example two recycling options) should be considered to be equivalent.

3.3 Departure from the hierarchy

Regulation 12(2) of the Waste Regulations states that 'an establishment or undertaking may depart from the priority order … so as to achieve the best overall environmental outcome where this is justified by life-cycle thinking on the overall impacts of the generation and management of the waste'.

This allows the person in control of a waste to depart from the hierarchy in some circumstances. The holder of a waste must show that where they deviate from the hierarchy that deviation is based on the impact considerations given above.

If a decision on a waste management option is made that does not comply with the waste hierarchy because of the impact considerations, **you must be able to justify them**. It is good practice to keep a record of all decisions.

Section 4: How this guidance should be used

Businesses and public bodies should use this guidance when they make decisions on options for dealing with hazardous waste, including preventing it from arising in the first place. Overall this guidance sets out how Defra and Welsh Government expect hazardous wastes to be managed in line with the waste hierarchy in the revised Waste Framework Directive. **You should look at the following questions carefully in turn:**

PREVENTION Can the waste be prevented? Can the hazardous nature of any waste be reduced or eliminated?	Can for example, the process or raw materials be changed to produce no waste, no hazardous waste, or a waste with a lower hazard? For example, can an aqueous degreaser be used rather than a solvent based one? Could a material be re-used rather than produce a waste? For more information on prevention go to www.wrap.org.uk.
SEGREGATION – DON'T MIX Can the waste be kept segregated? Is it mixed already and can it be separated?	Any waste produced should be kept segregated from other wastes streams and non-wastes where possible. Dilution or mixing a hazardous waste with hazardous waste in a different category, non-hazardous wastes or non-wastes should not be carried out unless authorised with a permit that ensures compliance with Best Available Techniques. Keeping wastes in their own separate containers is often preferable to putting them into one container. Bulking up should only be carried out with the same category of wastes, that is waste of essentially the same type. There are potential risks associated with mixing wastes, even in the same category and awareness of these risks is essential[18]. In addition, mixing might affect the later management of that waste (especially recycling and recovery). Example: two separate acid waste drums contain different metals. Consideration must be given to the recovery possibilities were these acid wastes to be mixed. Although the acids are the same and they are compatible this does not mean that mixing them is acceptable. For example, the opportunity for metal recovery could be greatly reduced. Where mixing can negatively impact on recovery, wastes should be considered to be in different categories, and not mixed. If a mixed waste is produced for example as a normal part of a production process, separation of that waste should be considered. This is especially important where that separation leads to recycling or recovery of one or more of the separated constituents. For example, a soil (predominately inorganic) is contaminated by an organic waste (for example, oil); the first step might be separation of the two – the outcome could be that both the soil and the oil can be recovered. Further details on mixing restrictions including how to determine if one hazardous waste is in the same category as another can be found at:

[18] See http://www.environment-agency.gov.uk/business/sectors/34862.aspx

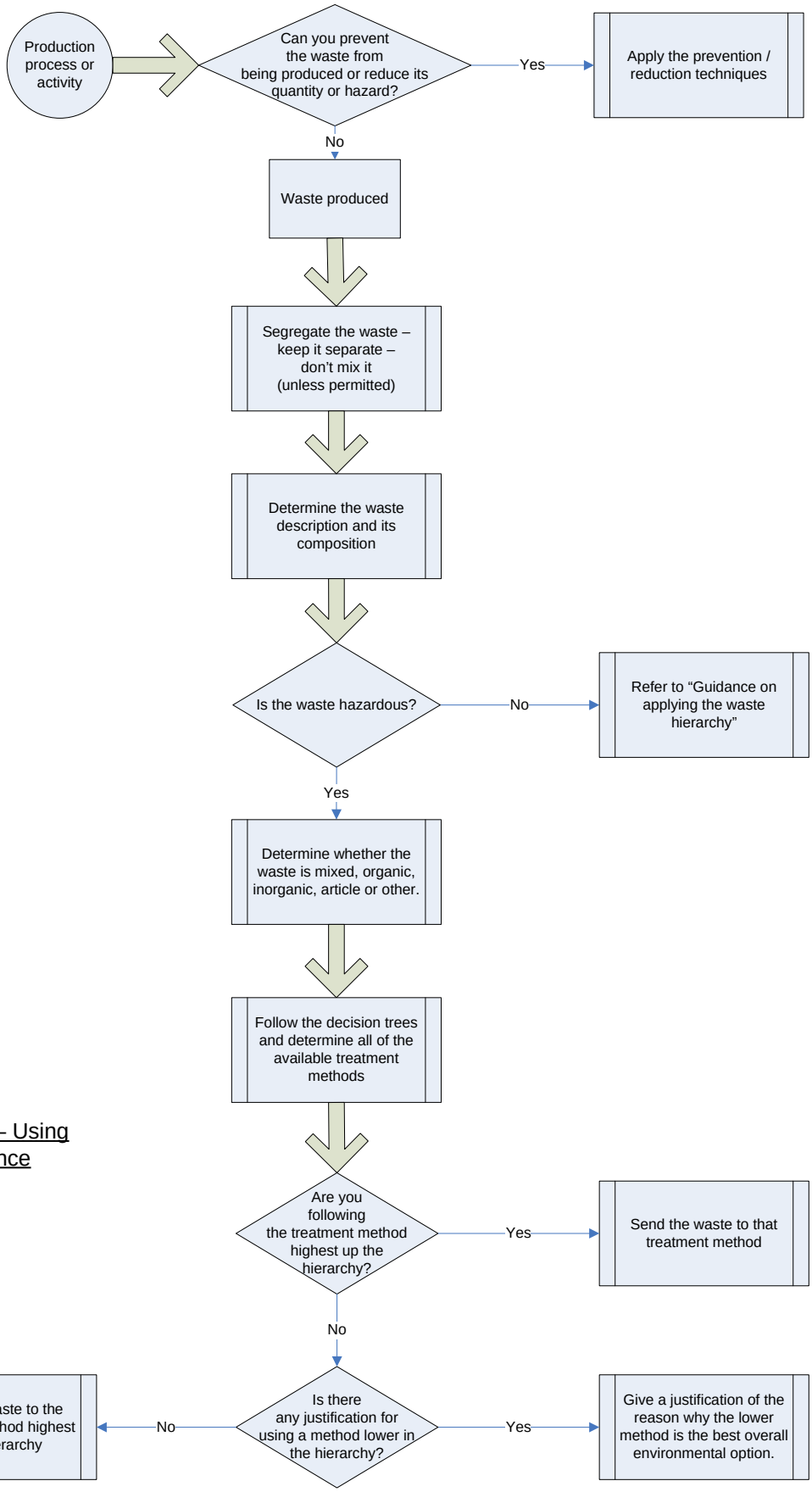
	http://archive.defra.gov.uk/environment/waste/topics/hazwaste/documents/hwrmixing-guide.pdf.
IDENTIFYING THE WASTE What is the waste and what does it contain?	It is very important that waste is correctly described and its composition is known (that is, what is in it). Any decision on classifying and coding the waste, assessing its hazardous properties, and deciding on the most appropriate waste management options, are dependent on good waste characterisation. Some wastes cannot be recycled or recovered if they are contaminated with certain substances. For example Persistent Organic Pollutants (dioxins or PCB) above the threshold set in the Persistent Organic Pollutants Regulation[19], heavy metals and so on will affect recovery.
HAZARDOUS NATURE OF WASTE Is it hazardous?	It is a producer's or holder's responsibility to classify a waste and determine if it is hazardous. The Environment Agency guidance WM2 on hazardous waste[20] provides assistance, to determine if your waste is hazardous or non-hazardous. If the waste is non-hazardous refer to non-hazardous waste hierarchy guidance[3].
DECISION TREES What type of waste is it – mixed, organic, inorganic, article, other?	There are four decision trees: a general one that includes the decisions to be taken for mixed wastes, then a decision tree if the waste is organic, inorganic or an article. A hazardous waste should be categorised as mixed, organic, inorganic or an article and the respective decision trees followed. If it is unclear what type a waste is the mixed decision tree should be considered first.
HIERARCHY What waste management options are available following the relevant decision trees?	After looking at the decision trees, all of the available options for managing a particular hazardous waste should be noted giving the greatest consideration to those at the top of the waste hierarchy. Checks should be made to ensure that there are no other new waste management techniques available that could be considered.

[19] Regulation (EC) No 850/2004 as amended http://ec.europa.eu/environment/pops/index_en.htm.

[20] WM2 Hazardous Waste: Interpretation of the definition and classification of hazardous waste, which can be found via www.environment-agency.gov.uk/hazwaste.

DEPARTURE FROM THE WASTE HIERARCHY Considering all the impacts of the waste management option, is there a valid reason why an option lower in the hierarchy should be seen as giving the 'Best Overall Environmental Outcome'?	In most circumstances, the option that is highest up the waste hierarchy for a particular waste stream should be chosen. Sometimes it may be possible to show, using an impact assessment, as discussed in Section 2.2, that an option lower down the waste hierarchy gives a better outcome than one higher.
DECIDING ON THE MANAGEMENT OPTION Are you choosing the best option for your hazardous waste?	After establishing the composition and classification of a particular waste, the hierarchy must be applied in a priority order to give the best outcome for that waste. If the priority order is not applied, an explanation of the reasons for this is required, with reasoning based on the impact considerations. It is best practice to keep a record of any deviations from the hierarchy together with the reason. The Hazardous Waste Regulations require a waste producer or holder to state in a declaration on their hazardous waste consignment notes (or waste transfer notes if the waste is non-hazardous) that they have considered the waste hierarchy before they transfer their waste to an appropriate person.

These questions are summarised in Flow Chart 1 below.



Flow Chart 1 – Using this guidance

Section 5: Hazardous wastes examples and the Decision Trees

In 2009, approximately 4.4 million tonnes of hazardous wastes were consigned to waste facilities in England and Wales, comprising 385 different types of wastes. It is not possible to provide guidance on all individual hazardous waste streams due to the number and variety generated.

Consultation and discussion with industry representatives and regulators prior to the publication of 'A Strategy for Hazardous Waste Management in England' highlighted some key hazardous waste streams where guidance on the application of the hierarchy would be welcomed. The criteria used when choosing waste examples were:

- that they were identified by industry as key waste streams
- that significant volumes are generated annually
- that they allow demonstration of each Decision Tree featured in the Hazardous Waste Strategy

5.1 Hazardous waste categories

Seven broad categories of waste were chosen:

Waste categories	Type of Decision Tree
Gas treatment residues (for example air pollution control residues)	Inorganic
Asbestos (for example asbestos sheet)	Inorganic
Hazardous electronic and electrical equipment (for example a television) and hazardous components from that equipment (such as mercury switches)	Articles
Oily sludges	Mixed
Organic solvents	Organic
Metal finishing acids	Inorganic
Waste Oils	Organic

Appendix B below shows how the decision trees can be used for each of these waste categories, assessing the best option for managing hazardous waste in line with the hierarchy. It provides a template for the decisions that will have to be made for all wastes produced or held.

The examples are given to demonstrate what options are available for achieving options in line with the hierarchy. Sometimes disposal may be the only option and the guidance will show where this may be appropriate.

This guidance does not make definitive hierarchy decisions, even for the example waste categories chosen. The composition of waste will have a major bearing on its management. Consideration should be given to all available options in the hierarchy. The best outcome, highest up the hierarchy as possible, should be chosen for a particular waste stream. Now is a good time to reassess what waste management options are currently appropriate.

Additional wastes may be explored when this document is reviewed.

APPENDIX A

Decision Trees

A.1 Introduction

The decision trees on the next four pages are based on those in the Hazardous Waste Strategy guide.

Departures form those in the hazardous waste strategy guide are set out below:

Decision tree	Type	Change
Figure 4	Organic decision tree	Disposal bracket on right hand side covers only the treatment section and not the other recovery sections.
Figure 5	Inorganic decision tree	Now includes two new decision boxes for ‘other recovery’ which were omitted from the original. The term ‘checking’ has been included in the ‘preparing for re-use’ section. It replaces the term ‘cleaning’ which is the same as ‘washing’ a term already in the tree.

A.2 General and mixed waste decision tree

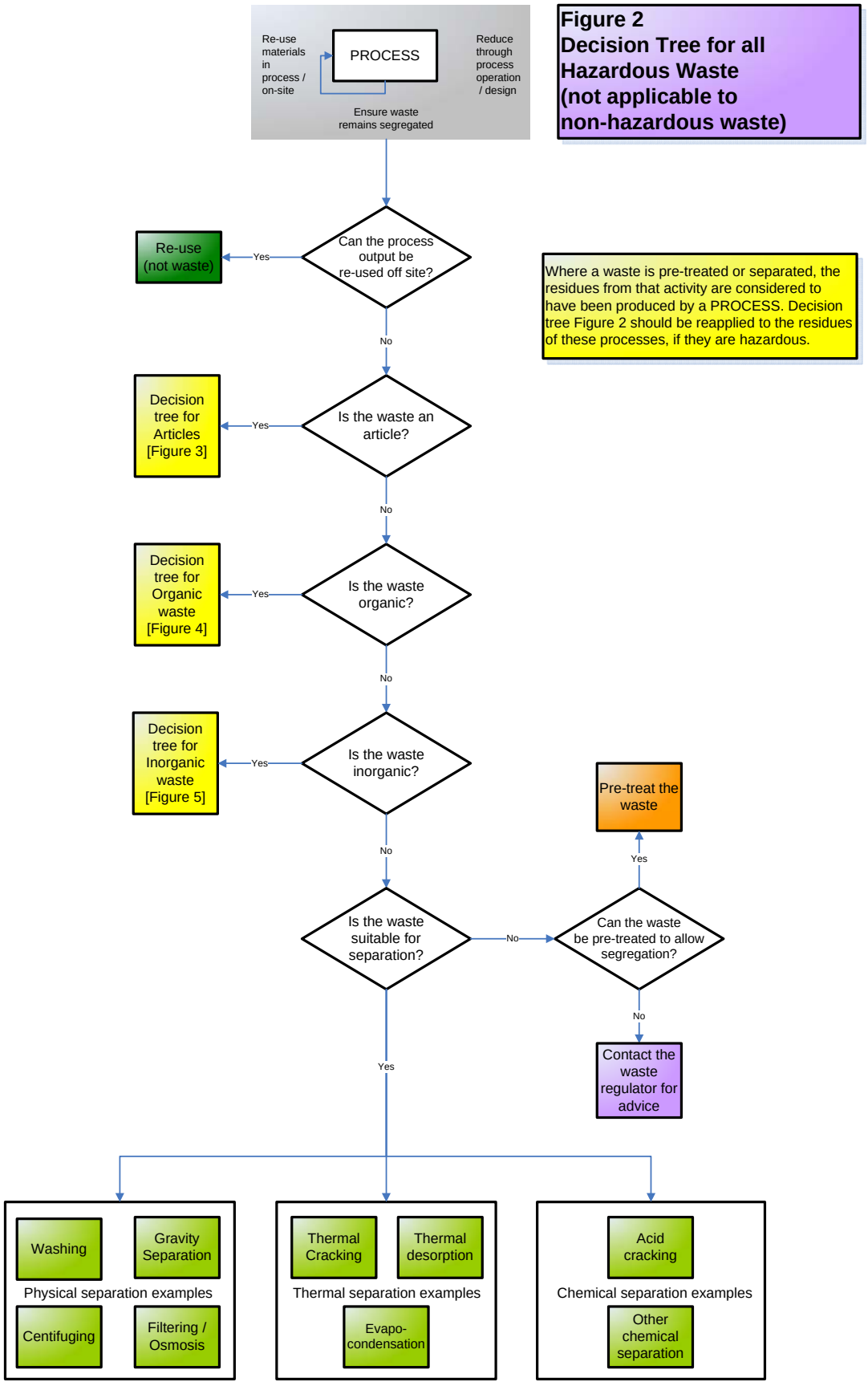


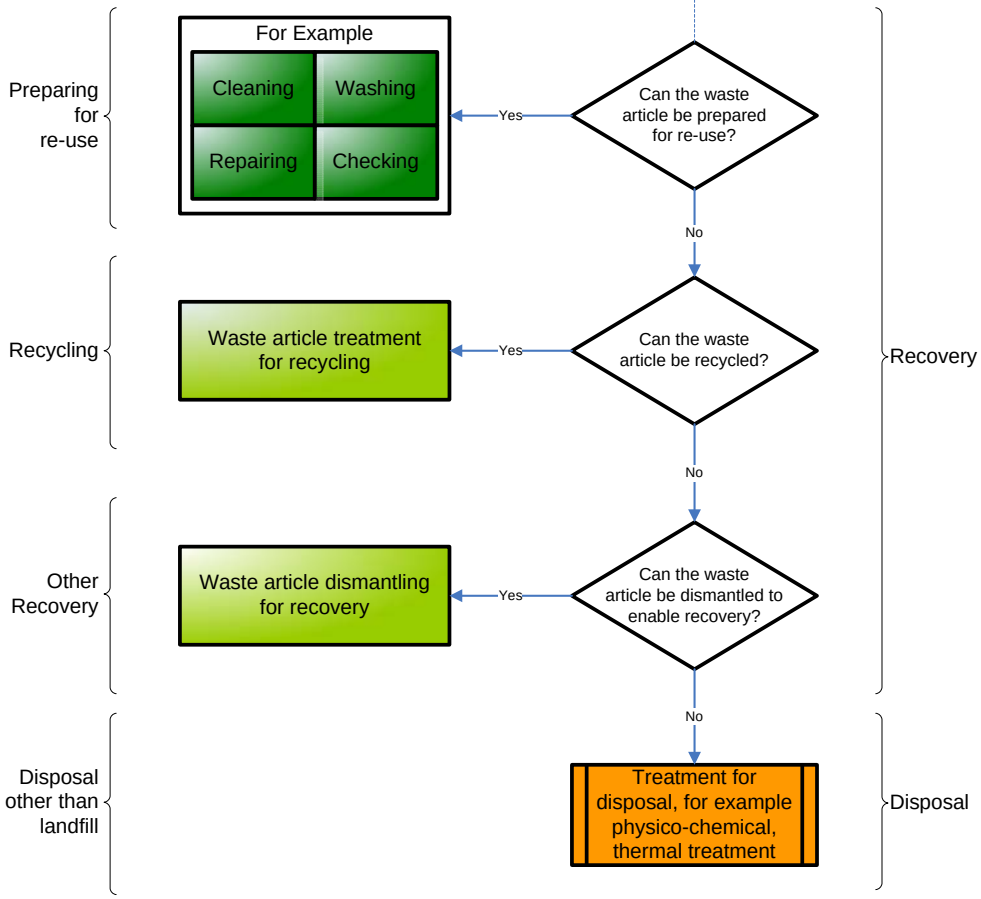
Figure 2
Decision Tree for all Hazardous Waste (not applicable to non-hazardous waste)

Where a waste is pre-treated or separated, the residues from that activity are considered to have been produced by a PROCESS. Decision tree Figure 2 should be reapplied to the residues of these processes, if they are hazardous.

A.3 Articles decision tree

Where a waste is prepared for re-use, recycled, or treated for disposal, the residues from that activity are considered to have been produced by a PROCESS. Decision tree Figure 2 should be reapplied to the residues of these processes, if they are hazardous.

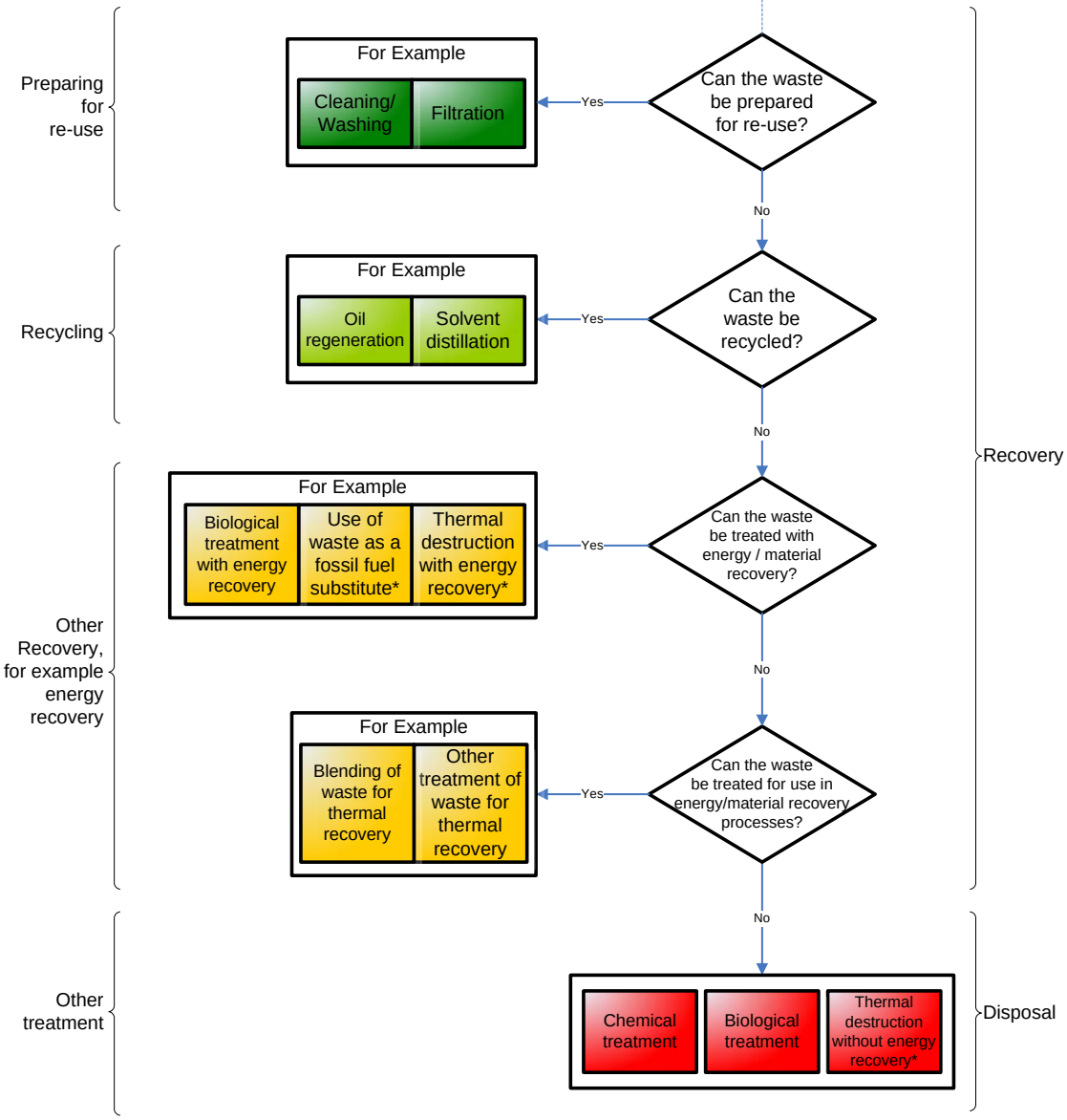
Figure 3
Waste Decision Tree for Hazardous Waste Articles



A.4 Organic decision tree

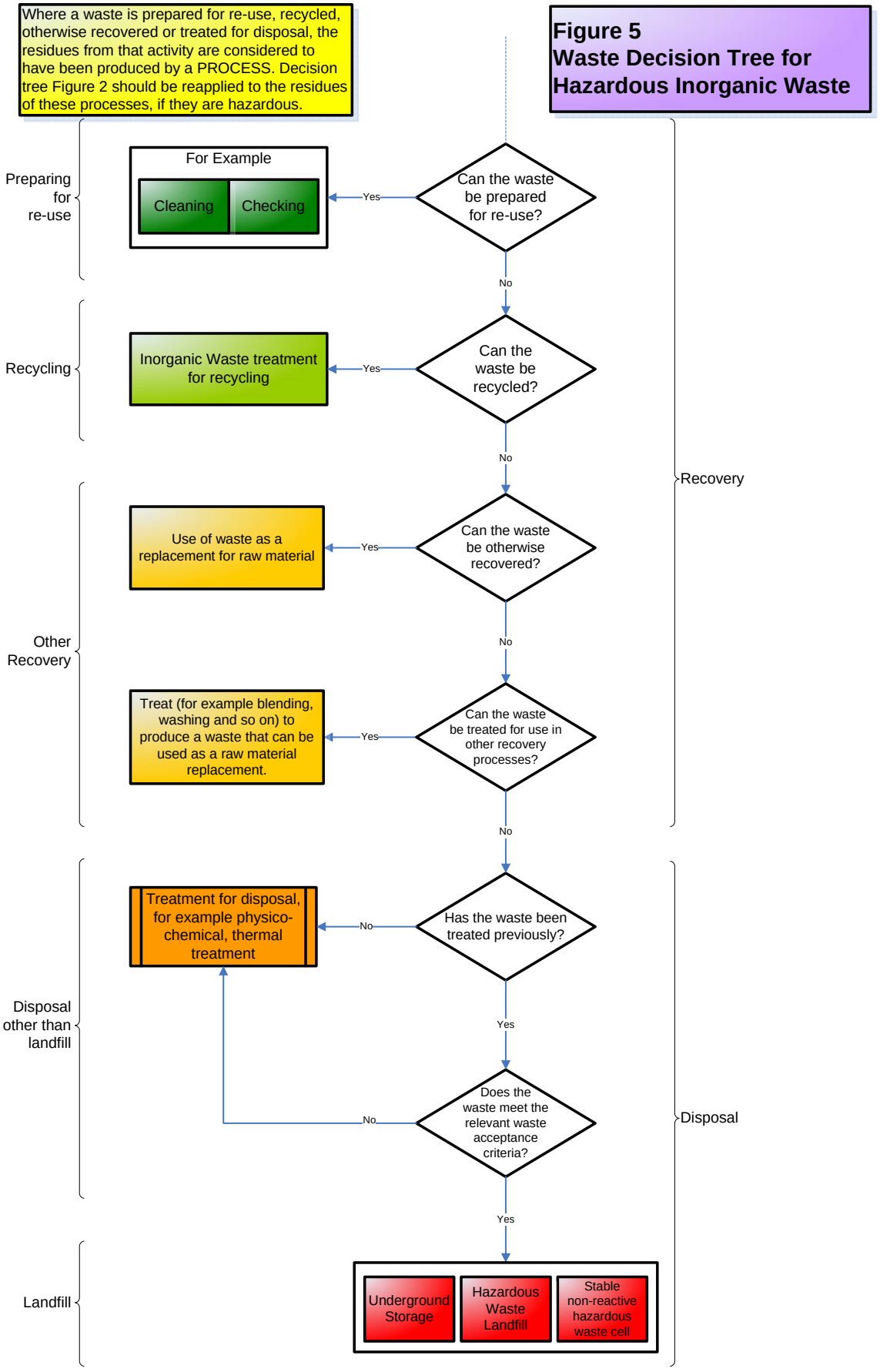
Where a waste is prepared for re-use, recycled, or blended/treated for recovery or disposal, the residues from that activity are considered to have been produced by a PROCESS. Decision tree Figure 2 should be reapplied to the residues of these processes, if they are hazardous.

Figure 4
Waste Decision Tree for Hazardous Organic Waste



* Thermal recovery and disposal treatment processes, such as use of wastes as a fossil fuel substitute, thermal destruction with energy recovery and thermal destruction without energy recovery must be compliant with the requirements of the Waste Incineration Directive.

A.5 Inorganic decision tree



APPENDIX B

Hazardous wastes: using the decision trees

B.1 Gas treatment residues (for example air pollution control residues, APCR)

In 2009, 175,000 tonnes of solid wastes from gas treatment were reported to the Environment Agency as consigned in England and Wales[21]. Of this 79,000 tonnes were reported as directly landfilled (including permanent storage).

This waste is generated with the purpose of removing substances from gases released from a thermal process before they are allowed to be emitted to the atmosphere. This could be the removal of acid gases, such as hydrogen chloride, using an alkaline material, or dusty materials like cement kiln dusts that are removed from the gas stream by, for example, filters or precipitators. This processing of the gas stream is very important for environmental protection. Some of these wastes may contain dioxins and heavy metals which may be captured in the gas treatment residues.

The Environment Agency provides guidance on deciding which EWC code is the most appropriate in WM2.

The most relevant gas treatment wastes are listed in the table below (entries in red and marked with an '(A)' are absolute hazardous waste and entries in blue and marked with an '(M)' are mirror entries – for further details see WM2):

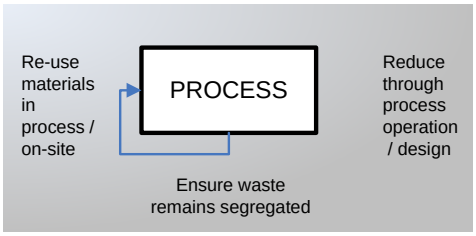
EWC	EWC description	Comments and composition
10 02 07*	solid wastes from gas treatment containing dangerous substances (M)	This is a mirror entry hazardous waste from the iron and steel industry. It can contain heavy metals, dioxins and furans.
10 03 23*	solid wastes from gas treatment containing dangerous substances (M)	This is a mirror entry hazardous waste from aluminium thermal processes. It can contain heavy metals, dioxins and furans.
10 04 06*	solid wastes from gas treatment (A)	This is an absolute entry hazardous waste from lead thermal metallurgy. There was no waste with this code consigned in 2009.
10 11 15*	solid wastes from flue-gas treatment containing dangerous substances (M)	This is a mirror entry hazardous waste from glass manufacturing. It can contain lime, acid gas salts or heavy metals.
10 12 09*	solid wastes from gas treatment containing dangerous substances (M)	This is a mirror entry hazardous waste from manufacture of ceramics, bricks, tiles and other construction materials. It can contain heavy metals and lime.

[21] http://www.environment-agency.gov.uk/research/library/data/123744.aspx

EWC	EWC description	Comments and composition
10 13 12*	solid wastes from gas treatment containing dangerous substances (M)	This is a mirror entry from the manufacture of cement, lime and plaster and articles and products made from them. An example is Cement Kiln By-Pass Dust (BPD) which is a high pH material that can contain highly caustic sodium and potassium oxides, heavy metals and chlorides from burning of chlorinated organics. This waste may also contain dioxins and furans.
19 01 07*	solid wastes from gas treatment (A)	This is an absolute hazardous entry from the incineration or pyrolysis of waste. Lime-based Air Pollution Control residues (APC residues) are high pH wastes that contain residual lime content (calcium oxide), heavy metals and salts of acid gases (such as calcium chloride). This waste may also contain dioxins and furans. Activated carbon may be added to the lime to capture dioxin and furan from the gas stream.
Reason why the waste is hazardous		
The waste can be highly alkaline and therefore irritant. Also, it may be ecotoxic due to the presence of heavy metals. Whilst the waste may contain dioxins and furans, they will be in very low concentration and will not contribute to making the waste hazardous.		

Considering the decision trees – Part 1 General and mixed waste tree (Figure 2, Appendix A)

<u>Prevention and reduction</u>



Consideration could be given to using less hazardous materials for the removal of acid gases but the disposal or recovery of the alternatives must be taken into account. For example, sodium bicarbonate can be used instead of lime to remove acid gases but the disposal of bicarbonate can be difficult giving rise to carbon dioxide.

Contamination of the material could be minimised by looking at input materials. For example, sorting of waste prior to incineration can minimise the potential for heavy metals to be present in the gas treatment residues. The amount of heavy metal in gas treatment residues is an important factor in further processing and can impede recovery and recycling.

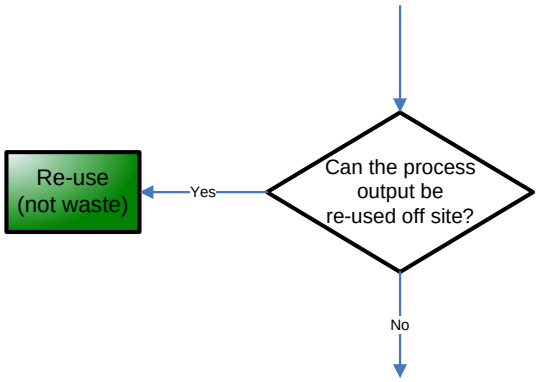
For recovery purposes, it is important to limit the amount of dioxins and furans in the gas treatment waste; however it is also vital to limit the amount of dioxin and furan in the atmosphere. This can be achieved and controlled by:

- minimising the ‘chlorine’ content of the input materials. This may reduce dioxin and furan formation, minimising contamination of the gas treatment residues.

- carefully managing the temperatures in parts of the combustion process
- adding activated carbon to the acid-gas scrubbing lime which removes additional dioxin and furan. This activated carbon and its captured dioxin / furan will be present in the waste gas treatment residues.

Dioxin and furan levels in the gas treatment residues will not make them hazardous but could have an effect on recovery and where possible their formation should be minimised.

Re-use off site



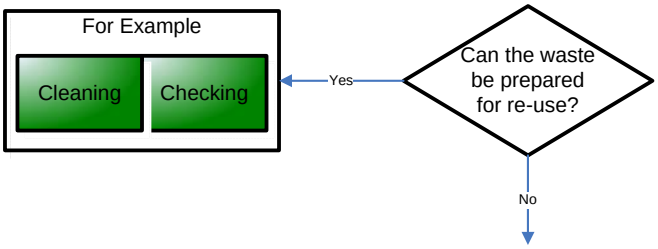
There are no direct re-use options for these process outputs.

Which Decision Tree?

This waste is considered predominately **inorganic** so you should use the **inorganic** decision tree.

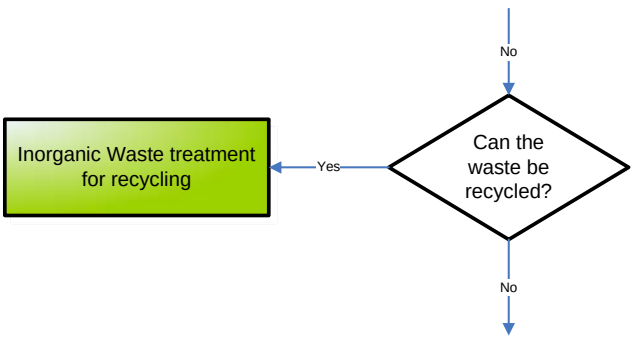
Considering the decision trees – Part 2 Inorganic decision tree (Figure 5, Appendix A)

Preparing for re-use



Cleaning and checking in the flowchart are simple processes that produce as an output a non-waste product and are therefore not appropriate in this case. Washing of gas treatment residues should be considered under recycling, recovery or disposal options.

Recycling

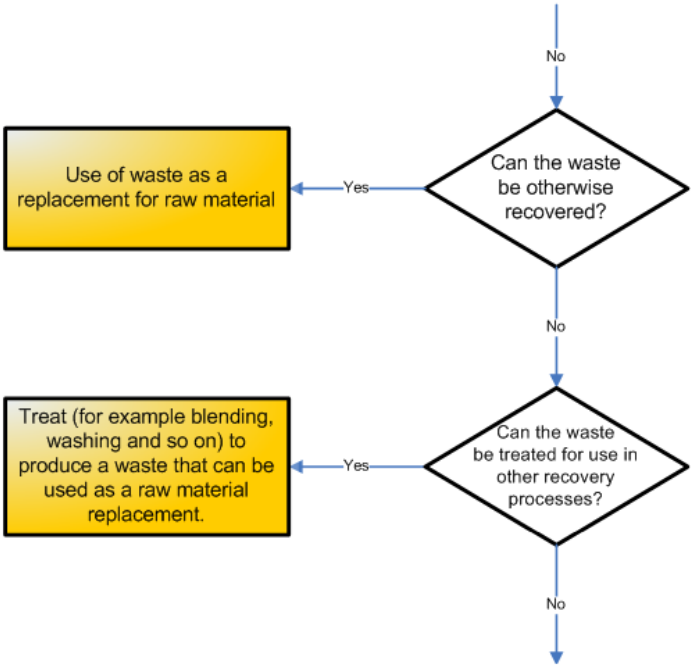


Recycling is a form of complete recovery by which waste materials are reprocessed into products that can be used for the original or another purpose. The recycling process needs to be sufficient to ensure that any contamination is adequately managed so that the material can reach product standard.

Gas treatment residues contain mineral components that can be treated for use in

construction. These include compounds of calcium in the form of calcium hydroxide and calcium carbonate, silica, aluminium and iron. Facilities exist and processes are being continually developed to recycle thermal residues into products.

Other Recovery



It is unlikely that gas treatment residues can be used as a direct replacement for raw materials in a recovery process without first being treated.

However, it may be possible to treat gas treatment residues so that the output of the treatment can be used a raw material replacement.

This treatment is considered an interim step towards 'other recovery' but only where the waste is strictly intended to be used as a raw material replacement in a recovery process.

For example consider a hazardous cement kiln bi-pass dust (BPD) from a cement works. The BPD is washed with water, then pressed to remove excess water and aqueous contaminants such as chlorides. The outcome of this washing activity is a lime-based waste. The lime-based waste, could, for example, be used in cement manufacture as a replacement for raw material lime.

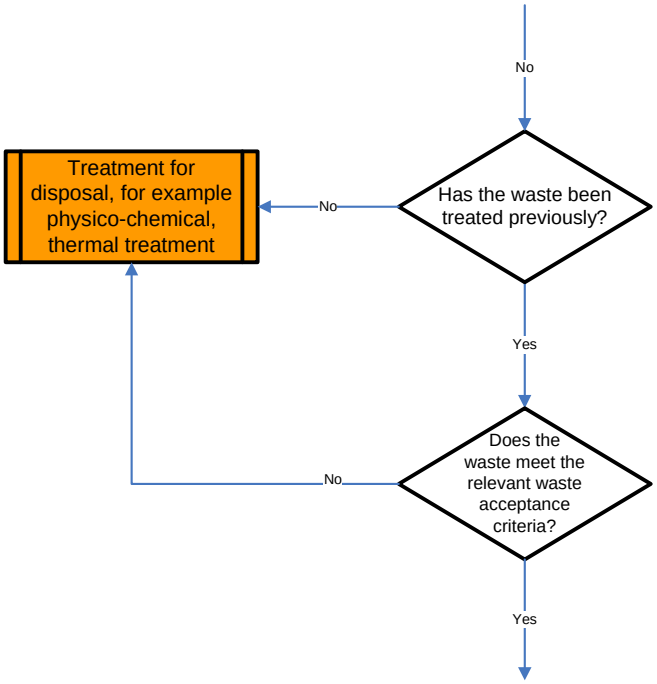
Whether this waste material can be used as a lime replacement, under a permit will depend on contaminants (such as dioxins) remaining in it. The use of this waste will probably be managed by a specification agreed with the recovery site and must be in accordance with the permit.

The use of the lime-based waste in the cement process is the 'other recovery' step. The washing process itself is a step towards that recovery but relies on the final process to be performed; it is an interim step in the overall recovery operation.

Another example is the production of a gypsum-based waste resulting from the washing of air pollution control residues and subsequent treatment of the lime-based output with sulphuric acid. The 'use' of this gypsum-based waste, on its own or blended with other calcium sulphate based waste (such as plaster board), in, for example, an authorised construction activity is 'other recovery'.

The contamination of BPD or APC residues with, for example sodium and potassium hydroxide, heavy metals, chlorides, dioxins and so on will impact on the potential for the waste to be treated in an interim step towards an 'other recovery' process.

Disposal other than landfill



Sometimes gas treatment residues cannot be recycled or recovered due to contamination by heavy metals, dioxins or other substances. 'Disposal' then becomes an option.

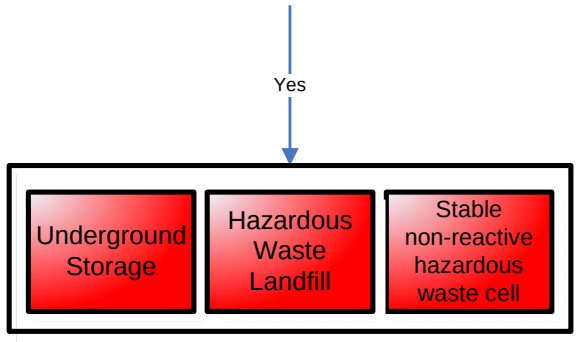
Landfill is a 'disposal' option, however in accordance with Principle 3 in the Hazardous Waste Strategy, landfill 'should only be used where, overall, there is no better recovery or disposal option'. Furthermore, in accordance with the Landfill Directive, hazardous waste must not be disposed to landfill unless it is first treated.

Gas treatment residues such as APC residues are considered to be treated waste as they are produced from the treatment of effluent gases from a thermal process. They do not need to be treated again prior to landfill unless they fail landfill waste acceptance criteria (WAC).

The WAC for deposit in a salt mine relies on its stability in the mine conditions. If the waste fulfils the stability criteria then the waste could be deposited in the salt mine without further treatment. For hazardous waste landfills and stable non-reactive hazardous waste landfills, the WAC relies on chemical species being below threshold levels. If this numeric WAC is exceeded the waste will need to be treated further before landfill is allowed.

Treatment methods for lime-based gas treatment residues, that fail hazardous waste WAC, include neutralisation with acid, neutralisation of acids, use in stabilisation/solidification processes as a co-binder with cement, and so on. Treatment may produce a hazardous or non-hazardous waste output. However the treatment of the material so that it is not, for example, irritant or ecotoxic must not be effected solely by dilution as this is prohibited under Article 5(4) of the Landfill Directive.

Landfill



Some gas treatment residues, that meet the requirements of the Landfill Directive[22], can be sent directly to underground storage without further treatment; this is in line with the Hazardous Waste Strategy[23]. Such wastes are usually bagged and deposited in salt mines. Where this is disposal method is chosen the producer must justify this decision based on the nature or composition of the waste.

It is unlikely that hazardous gas treatment residues

[22] http://ec.europa.eu/environment/waste/landfill_index.htm

[23] The Strategy states 'Landfill is the disposal option of last resort, and is at the bottom of the hierarchy. Deep underground storage of hazardous waste which is also a disposal operation, and is permitted in the UK as a landfill operation, is an option for certain difficult-to-manage hazardous waste streams such as … air pollution control residues.'

can be landfilled elsewhere directly without further processing due to hazardous waste landfill WAC. However the residues from a treatment process may be landfilled if they meet the relevant landfill WAC.

Summary

There are options that lead to ‘other recovery’. Therefore consider whether the gas treatment residues can be treated to produce a material that can then be used in an ‘other recovery’ operation as a replacement for a raw material.

Where the contamination of the waste justifies not treating the waste for ‘other recovery’ purposes, disposal and landfill can be considered. Where the waste meets the requirement for disposal in a salt mine the waste may go directly to that landfill site. For other landfills the waste is likely to require some form of treatment to fulfil the hazardous waste landfill WAC. In this case, where possible, the operator of the treatment process should consider making use of the stabilisation/solidification and neutralisation capacity of the material, which has the potential to replace raw binder materials used in treatment such as cement (in for example stabilisation treatment) or sodium hydroxide or lime (in for example neutralisation / precipitation treatment).

B.2 Cement asbestos and fibrous asbestos

In 2009, 223,696 tonnes of asbestos were reported to the Environment Agency as directly landfilled in England and Wales[24].

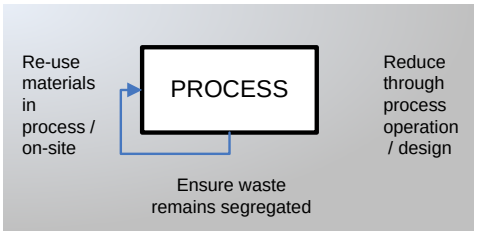
The Environment Agency provides guidance on deciding which EWC code is the most appropriate in WM2.

The most relevant asbestos wastes are listed in the table below (entries in red and marked with an '(A)' are absolute hazardous waste and entries in blue and marked with an '(M)' are mirror entries – for further details see WM2):

EWC	EWC description	Comments and composition
17 06 01*	insulation materials containing asbestos (M)	Carcinogenic inorganic material, used for insulation (e.g. lagging), usually in fibrous form but possibly bound
17 06 05*	construction materials containing asbestos (M)	Carcinogenic inorganic material, used for fire protection, usually bound in cement or other binder
Reason why the waste is hazardous		
Asbestos is both a toxic and carcinogenic material – its cementation or otherwise bound nature does not affect the classification as hazardous.		

Considering the decision trees – Part 1 General and mixed waste tree (Figure 2, Appendix A)

Prevention and reduction

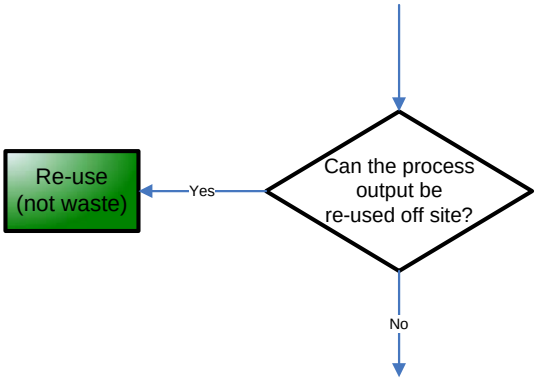


Fibrous asbestos and asbestos cement sheet are not produced nor used any more within the European Union. Items that once were produced containing asbestos, for example tiles and wall coverings, no longer contain asbestos.

Waste asbestos is generated when removing from the environment a toxic and carcinogenic substance and replacing it with a safer alternative. The only option for waste prevention of this material is to leave the asbestos products where they are, but this may not always be practical. Reduction of asbestos-based wastes is mainly achieved by ensuring that they are kept separate from other wastes to prevent cross contamination. This can be achieved using well-managed removal or demolition processes; these processes are controlled by the HSE.

[24] http://www.environment-agency.gov.uk/research/library/data/123744.aspx

Re-use off site



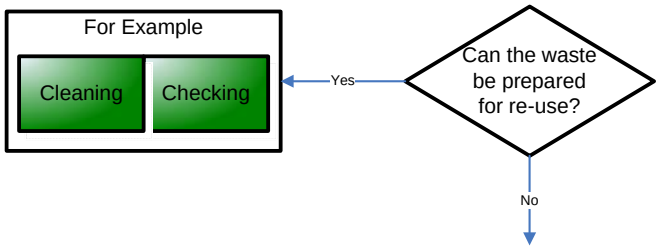
There are no direct re-use options for these process outputs.

Which Decision Tree?

This waste is considered predominately **inorganic** so you should use the **inorganic** decision tree.

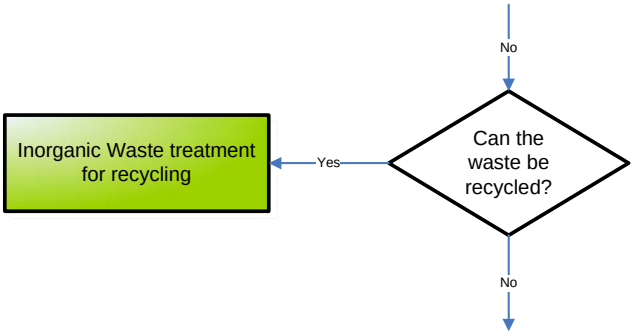
Considering the decision trees – Part 2 Inorganic decision tree (Figure 2, Appendix A)

Preparing for re-use



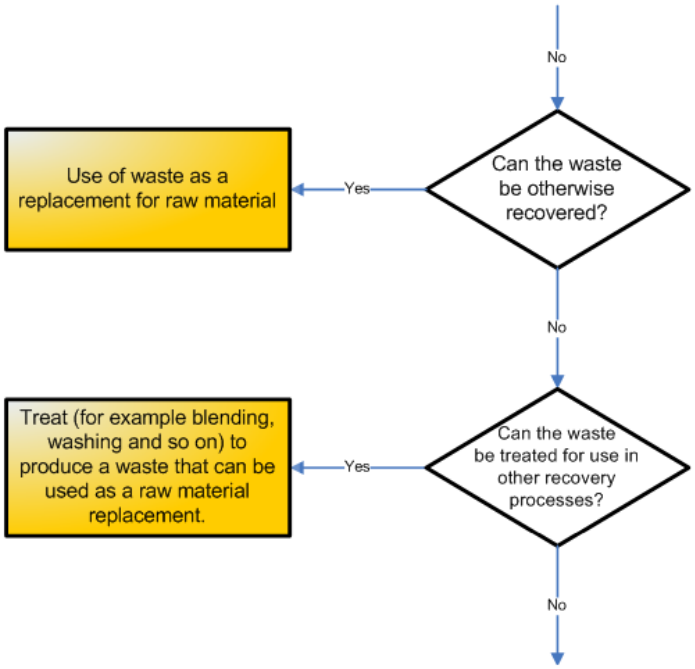
There are no preparing for re-use options for these wastes because they cannot be re-used.

Recycling



At this time there are no processes that produce a recycled product from asbestos. This may change and this document will be updated accordingly.

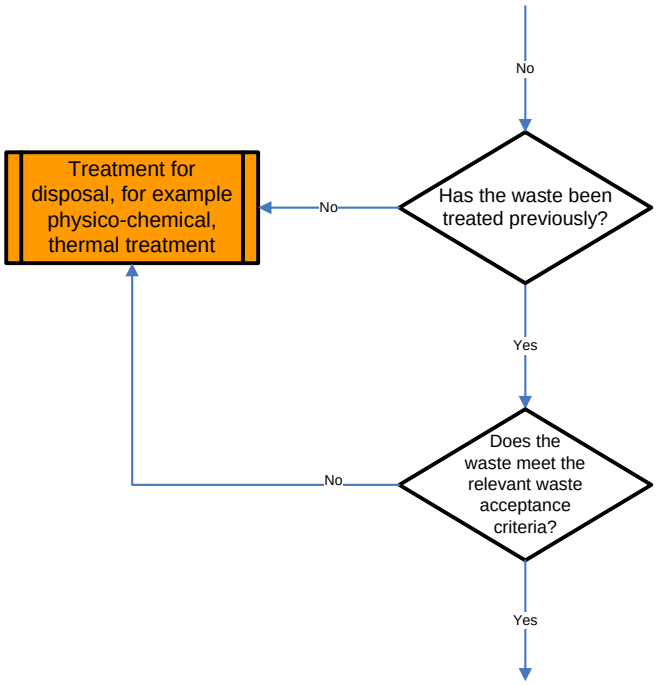
Other Recovery



The only option that could be considered recovery for fibrous asbestos is plasma vitrification, although this is a high energy activity and there is potential for land, water and air pollution and harm to human health using this treatment method. The waste glassy output from the process might be used in construction as a replacement for glass. At this time there are no facilities undertaking plasma vitrification in the UK.

Asbestos cement products are unlikely to be recovered due to the presence of the binder material used in its manufacture.

Other disposal except landfill

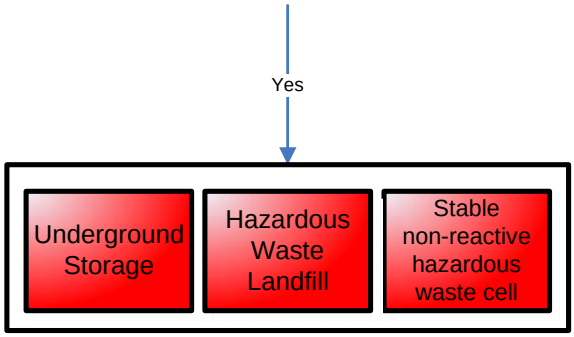


Waste fibrous asbestos could be solidified, by mixing with cement or resins to bind the asbestos fibres in a solid matrix. This process requires raw material use and energy input. It also has the potential for fibre release (impacting on air, water, land and human health) due to storage prior to, during and after processing. The treated asbestos waste will still need to be landfilled.

Asbestos cement is by its nature bound in cement so treatment using cement (or any similar material) is not necessary.

There are specific WAC for asbestos to be landfilled.

Landfill



There are currently no viable recycling, recovery or treatment options in the UK so asbestos cement can therefore be double bagged and landfilled into a separately engineered cell; there are specific requirements for the landfill of asbestos in the Landfill Directive. Similarly asbestos fibres may also be double bagged and landfilled in a separately engineered cell.

Summary

As there are currently no viable recovery options readily available in the UK, landfill is the only available option.

For more details on the safe handling of asbestos wastes see http://www.hse.gov.uk/asbestos/index.htm

B.3 Hazardous electronic and electrical equipment and hazardous components from that equipment

In 2009, 258,957 tonnes of waste electronic and electrical equipment (WEEE) were reported to the Environment Agency as consigned in England and Wales[25].

The Environment Agency provides guidance on deciding which EWC code is the most appropriate in WM2.

The most relevant types of WEEE wastes and wastes from WEEE are listed in the table below. (entries in red and marked with an '(A)' are absolute hazardous waste and entries in blue and marked with an '(M)' are mirror entries – for further details see WM2):

EWC	EWC description	Comments and composition
16 02 11*	discarded equipment containing chlorofluorocarbons, HCFC, HFC (M)	This waste is fridges and freezers and other equipment used for cooling – it will contain chlorinated and/or fluorinated gases.
16 02 13*	discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12 (M)	This waste is other electrical or electronic equipment that contains a hazardous component. This will include televisions and monitors which contain activated glass or mercury back-lights. This entry also includes equipment containing batteries, mercury switches or other hazardous components. This entry does not include lighting tubes which are classified under chapter 20.
16 02 15*	hazardous components removed from discarded equipment (A)	When a hazardous component such as a mercury switch is removed from WEEE and there is no specific entry in the catalogue for the removed component (e.g. batteries should be classified elsewhere) this entry is used for the waste. The waste could be composed of a number of different hazardous substances.
20 01 21*	fluorescent tubes and other mercury-containing waste (A)	This waste includes mercury.
20 01 23*	discarded equipment containing chlorofluorocarbons (M)	This waste is household fridges and freezers and other equipment used for cooling – it will contain chlorinated and/or fluorinated gases.

[25] http://www.environment-agency.gov.uk/research/library/data/123744.aspx

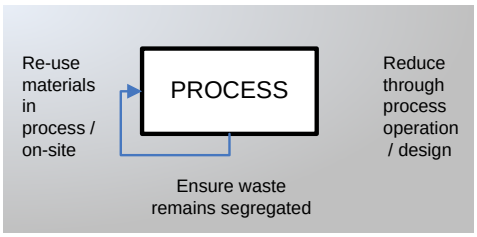
EWC	EWC description	Comments and composition
20 01 35*	discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components (M)	This waste is other household electrical and electronic equipment that contains a hazardous component. This will include televisions and monitors which contain activated glass or mercury back-lights. This entry also includes equipment containing batteries, mercury switches or other hazardous components.
Reason why the waste is hazardous		
WEEE and components removed from WEEE will be hazardous because for example they containing hazardous substances such as chlorofluorocarbons or a hazardous component such as a mercury switch. When hazardous components are removed from hazardous WEEE, they remain classified as hazardous waste. Some components removed from WEEE will also be WEEE, for example a tube removed from a television. Some components of WEEE, for example chlorofluorocarbons from a fridge, are not WEEE.		

Any WEEE which is treated must be done so in accordance with Best Available Treatment, Recovery and Recycling Techniques (BATRRT) which has the meaning given in the document published jointly by the Department for Environment, Food and Rural Affairs, the Welsh Government and the Scottish Executive on 27th November 2006, entitled 'Guidance on Best Available Treatment, Recovery and Recycling Techniques (BATRRT) and Treatment of Waste Electrical and Electronic Equipment (WEEE)'[26].

This requires certain components or substances to be removed from WEEE and disposed of or recovered separately before further treatment of the WEEE takes place. Examples include the removal of the phosphor coating from CRTs, removal of CFCs, HCFCs and HFCs from fridges, or removal of Liquid Crystal Displays (LCDs)[27] from, for example, computer screens.

Considering the decision trees – Part 1 General and mixed waste tree (Figure 2, Appendix A)

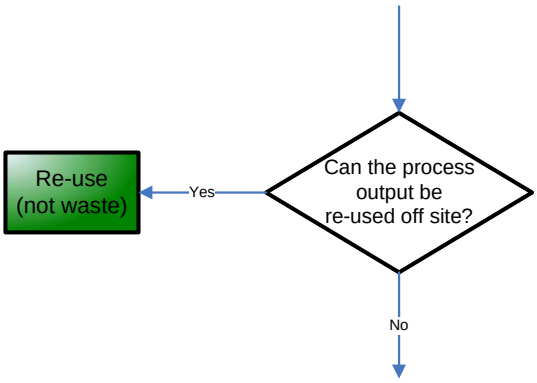
Prevention and reduction



As with the waste hierarchy, the primary objective of the WEEE Directive [28] is to prevent WEEE being produced in the first place. Where possible, measures should be taken to reduce the amount of WEEE produced. This would include choosing electrical equipment which is proven to have greater longevity than comparable equipment, or replacing parts or upgrading software of electrical equipment rather than discarding the whole appliance or unit. Manufacturers of WEEE should where possible minimise the hazard nature of WEEE for example by reducing mercury levels.

[26] http://www.defra.gov.uk/environment/waste/producer/electrical/documents/weee-batrrt-guidance.pdf
[27] http://www.environment-agency.gov.uk/static/documents/Business/Flatscreen_Brief__Mar2010.pdf
[28] Directive 2002/96/EC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0024:0038:EN:PDF

Re-use off site



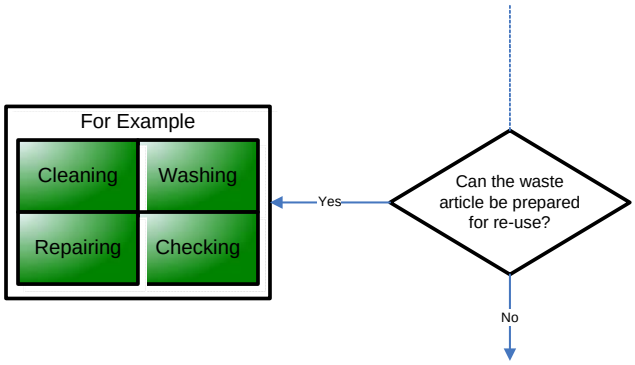
Opportunities for re-use of Electrical and Electronic Equipment (EEE) should always be sought. Quite often EEE in working condition can be passed or sold on to other users. Evidence should be provided that EEE has been tested for functionality and is ready for re-use and that it is packaged to protect it during transport.

Which Decision Tree?

This waste is considered as **articles** so you should use the **articles** decision tree.

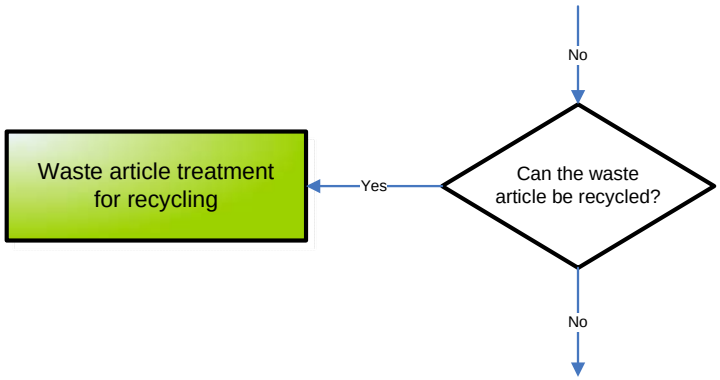
Considering the decision trees – Part 2 Articles decision tree (Figure 3, Appendix A)

Preparing for re-use



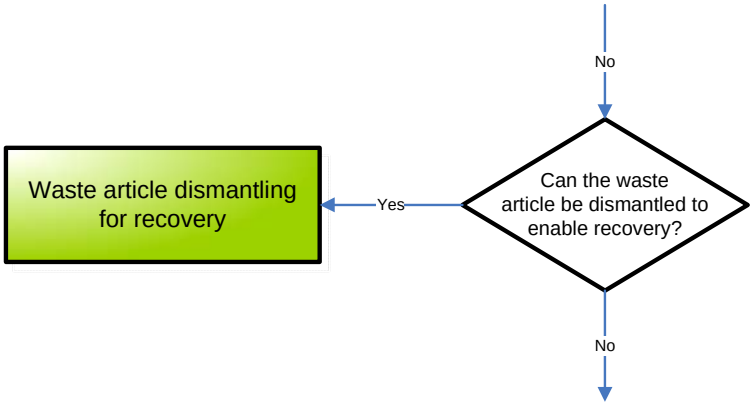
Some WEEE may be prepared for re-use with minimal effort. This may include refurbishment or repair of an electrical appliance that would make it suitable for re-use in the UK market or overseas. Evidence should be provided that fully refurbished WEEE has been tested for functionality and is ready for re-use and that it is packaged to protect it during transport.

Recycling



Where WEEE cannot be repaired or refurbished it may be dismantled in order to use the components to maintain or repair other WEEE, or supplied to other uses of those components.

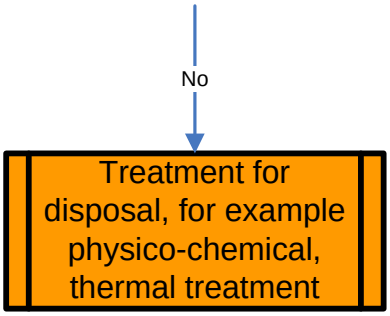
Other Recovery



Where WEEE cannot be recycled it may be recovered in other ways. An example is where the screen glass from a Cathode Ray Tube (CRT) from a television set is crushed to a certain particle size once the phosphor coating from the screen has been removed. In this instance it can be used as an aggregate replacement or in the manufacture of tiles or worktops.

Thermal treatment with energy recovery would also be considered 'other recovery'.

Other disposal except landfill



Any residues from recovery operations (including dismantling) that cannot undergo further recovery will have to be disposed. Options include thermal treatment (for example incineration)

Summary

There are many opportunities for prevention of WEEE wastes including re-use which should be promoted where possible. Preparing for re-use options (for example refurbishment and repair) are the next best alternative. Recycling of WEEE resulting in a good quality product should also be considered where prevention and re-use are not possible. If a good standard of recycling cannot be achieved, material recovery is an option. As far as possible the amount of WEEE wastes or wastes from WEEE treated for disposal should be minimised.

B.4 Oily sludges

In 2009, 27,528 tonnes of oily sludges were reported to the Environment Agency as consigned in England and Wales (excluding soil, dredging spoil, track ballast and remediation wastes)[29]. Of this 1,081 tonnes were reported as directly landfilled.

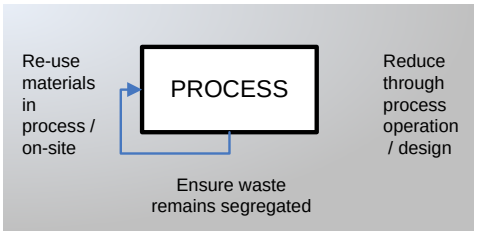
The Environment Agency provides guidance on deciding which EWC code is the most appropriate in WM2.

The most relevant oily sludge wastes are listed in the table below (entries in red and marked with an '(A)' are absolute hazardous waste and entries in blue and marked with an '(M)' are mirror entries – for further details see WM2):

EWC	EWC description	Comments and composition
01 05 05*	oil-containing drilling muds and wastes (M)	These wastes from a variety of sources are sludges that are hazardous by virtue of containing oil. Entry 01 05 05* is hazardous if oil is present. 12 01 08* will be classified as hazardous only where it contains oil above a threshold (they may contain other dangerous substances but are hazardous specifically due to its oil content).
05 01 06*	oily sludges from maintenance operations of the plant or equipment (M)	
12 01 18*	metal sludge (grinding, honing and lapping sludge) containing oil (M)	
13 05 02*	sludges from oil / water separators (A)	
Reason why the waste is hazardous		
Oil is a hazardous substance and is usually harmful / toxic, irritant, carcinogenic or ecotoxic. Oily sludges may also contain metals or other contaminants that may also have hazardous properties. Soil and stones (17 05 03*), dredging spoil (17 05 05*) and track ballast (17 05 07*) can also be contaminated by oil. Where they are the principles given below will also be appropriate to those wastes.		

Considering the decision trees – Part 1 General and mixed waste tree (Figure 2, Appendix A)

Prevention and reduction

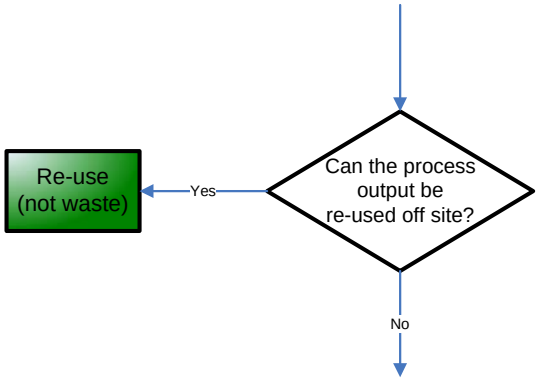


Oil-containing drilling muds, grinding sludges and maintenance sludges are produced as part of a production or maintenance process and will be difficult to prevent.

Oil / water separator sludges are produced when interceptors are contaminated by oil. Where possible spillages and other sources of oil contamination should be minimised.

[29] http://www.environment-agency.gov.uk/research/library/data/123744.aspx

Re-use off site



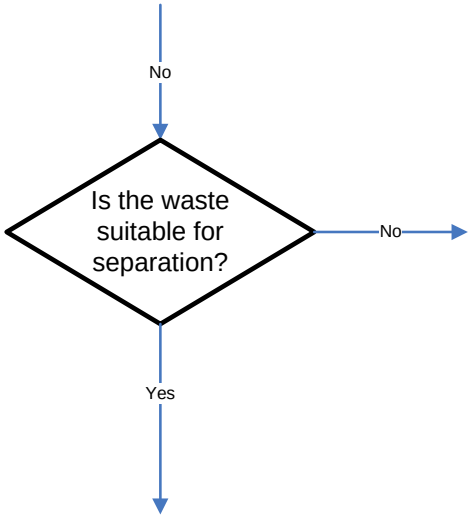
There are no direct re-use options for these process outputs.

Which Decision Tree?

This waste is considered predominately **mixed**, being a mixture of an inorganic part (soil, sand, stone or similar) and oil so you should use the separation section of the **all hazardous waste** decision tree (Figure 2, Appendix A).

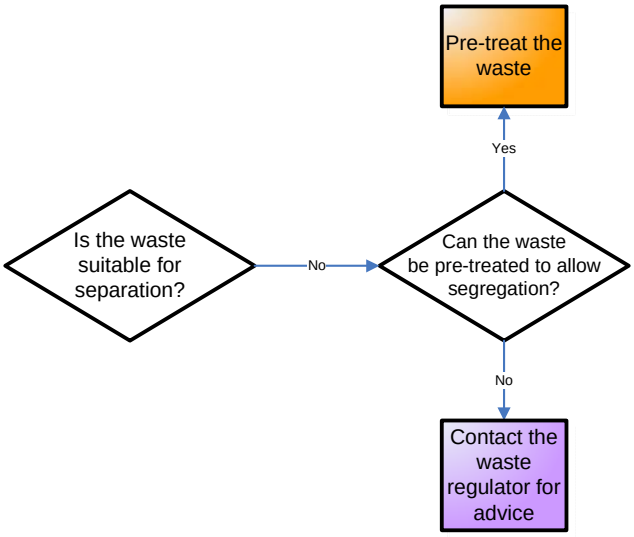
Considering the decision trees – Part 2 'Mixed' decision tree (Figure 2, Appendix A)

Suitable for separation?



Any mixed waste that can be separated should be treated by a separation technique. This technique, where possible, should allow the subsequent recovery of each of the separated wastes. Wherever possible this should be done to recover both the inorganic 'mineral' part, which may not be hazardous when separated, and the oil. Sometimes other substances in the waste may make this impractical (for example mercury contamination).

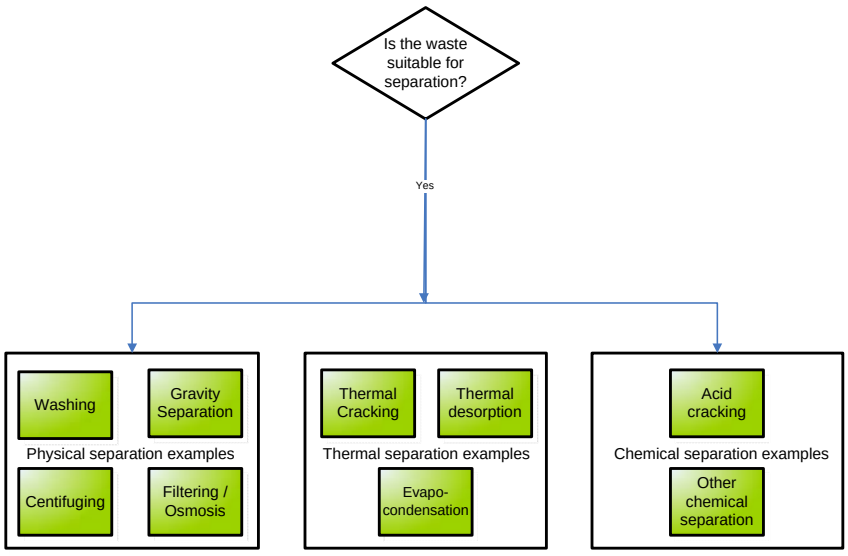
Not suitable for separation



If a waste is contaminated so that separation is impractical then consideration should be made to pre-treat the waste so that separation can take place. For example, if mercury is the contaminant preventing effective oil separation, can it be removed in a pre-treatment step to allow the separation to take place?

Sometimes it is not possible to consider a waste for separation. In such cases you might contact the waste regulator, waste manager or consultant for advice. If a 'mixed' waste could be **recovered** in accordance with either the 'inorganic' or 'organic' decision trees, it would be acceptable to treat the mixed waste as 'inorganic' or 'organic'. For example if separation is impractical but the waste could be treated thermally with energy recovery as the best outcome then the waste could be considered 'organic'. Landfill disposal should not be an option at this stage.

Suitable for separation



There are a number of separation techniques that can be used to remove oil from oily sludges. This includes physical, thermal and chemical processes (and biological treatment if recovery of the inorganic or organic part is possible). The aim should be to recover as much of the mixture as possible. For example, the separation of an oily metal sludge is optimised if the metal and the oil are recovered. Any residual hazardous wastes produced from separation processes should follow the decision trees once more starting at the top of Figure 2.

Summary

Any oily sludge waste that can be separated should be treated by a separation technique. Where possible this should be a technique that allows the subsequent recovery of each of the separated wastes. Any separated waste that is hazardous should then be considered to be waste produced by a process, and the decision tree given by Figure 2 should be followed for any hazardous separated waste produced.

B.5 Organic solvents

In 2009, approximately 163,000 tonnes of organic solvents were consigned in England and Wales. This figure was calculated using statistics from the 7 major recycling companies operating in England and Wales.

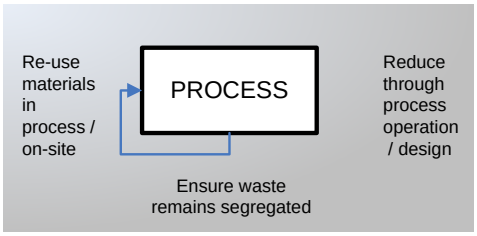
The Environment Agency provides guidance on deciding which EWC code is the most appropriate in WM2.

The most relevant solvent wastes are listed in the table below: (entries in red and marked with an '(A)' are absolute hazardous waste and entries in blue and marked with an '(M)' are mirror entries – for further details see WM2)

EWC	EWC description	Comments and composition
Various depending upon the industry of production but predominantly from chapters 07, 08 and 14 of the EWC	Examples include 14 06 02* other halogenated solvents and solvent mixtures (A) 14 06 03* other solvents and solvent mixtures (A) 07 01 03* other organic solvents, washing liquids and mother liquors (A) 20 01 13* solvents (A)	Wastes from these chapters are either Absolute or Mirror, with all chapter 14 entries being absolute. The concentration of the desired solvent will often be in excess of 80% due to the nature of the process producing the waste.
Reason why the waste is hazardous		
The waste could be hazardous for a number of reasons but most likely flammable, harmful / toxic, irritant / corrosive, and ecotoxic. Chlorinated solvents are included as the techniques used for recovery are normally consistent with those used for non-chlorinated solvents. Chlorinated wastes are included in the estimate of arisings given above.		

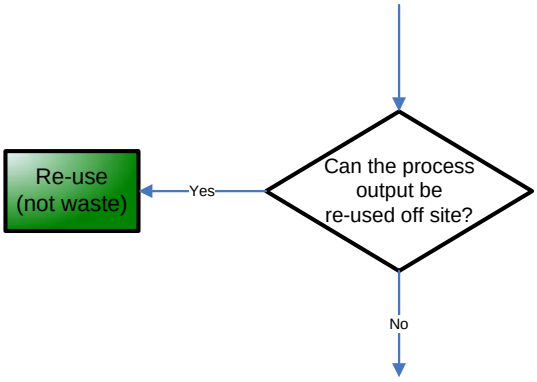
Considering the decision trees – Part 1 General and mixed waste tree (Figure 2, Appendix A)

Prevention and reduction



Some organic solvents could be replaced by aqueous-based materials. The transfer to aqueous-based solvents with the lower hazard potential of their use, and of any waste produced, needs to be carefully weighed against the efficiency, and recovery potential, of using an organic solvent in a process. A life cycle analysis comparing organic solvent against an aqueous based one will allow you to choose the best option for your particular process.

Re-use off site



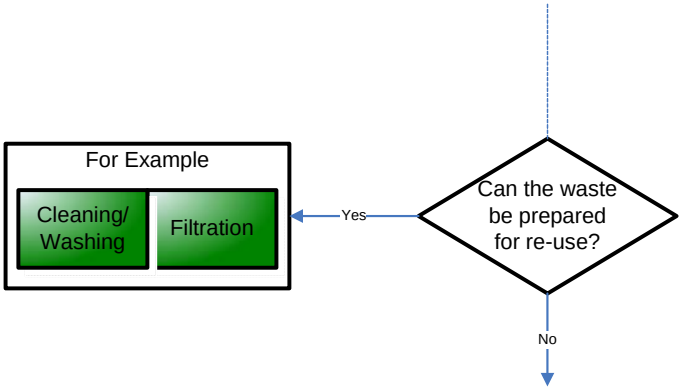
There are no direct re-use options for these process outputs.

Which Decision Tree?

This waste is considered predominately **organic** so you should use the **organic** decision tree (Figure 4, Appendix A).

Considering the decision trees – Part 2 'Organic' decision tree (Figure 4, Appendix A)'

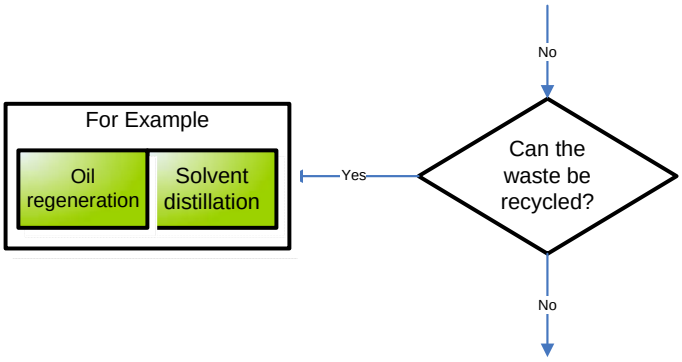
Preparing for re-use



While it is possible, simple cleaning, washing or filtration processes are not generally capable of returning an organic solvent to its virgin state, for its original purpose, in terms of purity and quality.

For example, a large proportion of organic solvents are used in the manufacture of pharmaceutical and agricultural products where regulatory control of the method of manufacture and quality is paramount and any level of contamination arising from re-use is unacceptable.

Recycling



Waste solvents can be recycled to make a non-waste solvent, if that solvent is not used as a fuel – see the definition of 'recycling' in the glossary to this guide. This is usually and readily achieved through distillation processes.

Where a waste organic solvent can be recycled by distillation, this process should be performed.

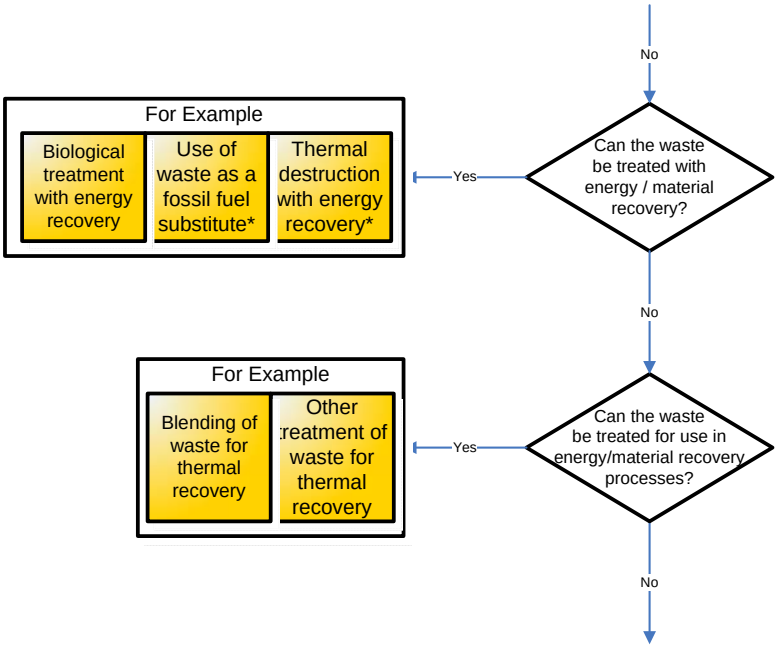
Recycling of organic solvents, in addition to being higher up the hierarchy, has obvious advantages over the use of 'other recovery' or 'disposal' treatment options within the hierarchy, for example:

- it can help to ensure the most efficient use of raw materials;
- it reduces the use of virgin materials deriving benefits from both product regeneration and energy consumption perspectives and therefore provides a reduced impact on the carbon cycle;
- it is consistent with the objectives of the Solvent Emissions Directive[30] in that it reduces both the use and emissions of Volatile Organic Compounds;
- it keeps solvents within the provisions of the REACH Regulation[31] and hence enhances the protection of human health and the environment.

[30] Directive 1999/13/EC http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:085:0001:0022:EN:PDF

[31] See http://ec.europa.eu/enterprise/sectors/chemicals/reach/index_en.htm

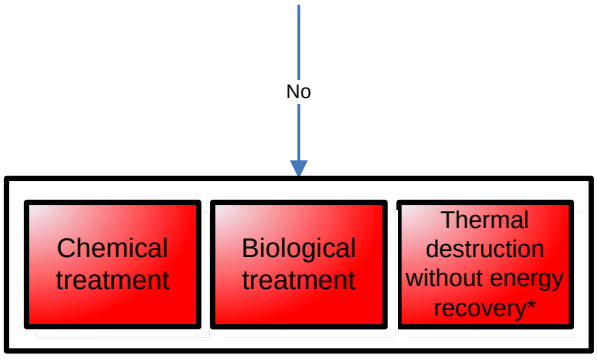
Other Recovery



There will be circumstances where energy recovery could be an option. This will be the case, for example, for highly contaminated solvents or chlorinated materials with few natural outlets where it could be distilled to product specification. There are a number of options available for energy recovery, most notably in the manufacture of cement. For this purpose, solvents from different sources and other organic materials such as paints, fuels and oils can be blended to a specification for use as a fuel. Here, complete recovery takes place when the energy is recovered. Any steps on the road to the final recovery, such as blending are intermediate processes to the recovery of the waste.

For more information on the recovery of waste solvents see:
http://esrg-online.eu/files/Benefits_Recycling_ESRG-Paper_April_2010_final.pdf

Other disposal except landfill



Organic solvents cannot be landfilled. In some cases thermal destruction (high temperature incineration without energy recovery), chemical treatment or biological treatment would be necessary possibly due to contamination or the nature of the substance preventing recycling or recovery.

Summary

Whilst ‘preparing for re-use’ is the most desirable management option for solvents it is limited in its applicability. Therefore, ‘recycling’ of materials will generally be the most desirable management option for most waste solvents. Use of ‘other recovery’ or ‘disposal’ treatment may sometimes be justified, if for example solvent wastes are contaminated or the nature of the material excludes recycling.

B.6 Metal finishing acids

In 2009, 75,766 tonnes of Metal Finishing Acids were reported to the Environment Agency as consigned in England and Wales[32].

The Environment Agency provides guidance on deciding which EWC code is the most appropriate in WM2.

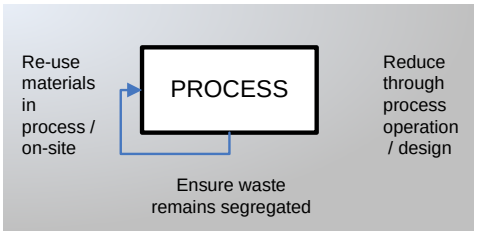
The most relevant metal finishing acid wastes are listed in the table below (entries in red and marked with an '(A)' are absolute hazardous waste and entries in blue and marked with an '(M)' are mirror entries – for further details see WM2):

EWC	EWC description	Comments and composition
06 01 02*	Hydrochloric Acid (A)	Hydrochloric acid is a corrosive solution used as a pre-treatment in hot galvanising process. This EWC code is commonly used for acids arising from this process that contain chloride salts of iron and zinc.
06 03 13*	Solid salts and solutions containing heavy metals (M)	Solutions arising from the metal plating are low pH solutions containing mineral acids and residual heavy metals, These typically comprise salts of zinc, copper and nickel.
11 01 05*	Pickling acids (A)	Pickling acids are low pH solutions containing mineral acids and their metal salts arising from the cleaning of metals and alloys to remove surface oxidation and scale.
11 01 06*	Acids not otherwise specified (A)	Other acids are low pH solutions containing mineral acids and their metal salts arising from the cleaning of metals and alloys to remove surface oxidation and scale they may also arise from the passivation of non ferrous metals.
11 01 11*	Aqueous rinsing liquids containing dangerous substances (M)	Aqueous rinsing liquids are low pH solutions containing mineral acids and their metal salts arising from the removal of acid solutions from the metal surfaces prior to further treatment.
Reason why the waste is hazardous		
The waste predominantly comprises mineral acids that are classified as corrosive. The solutions often contain heavy metal contaminants that are classified for example as toxic or ecotoxic. Certain nickel compounds have the potential to be classified as carcinogenic, mutagenic and sensitizing.		

[32] http://www.environment-agency.gov.uk/research/library/data/123744.aspx

Considering the decision trees – Part 1 General and mixed waste tree

Prevention and reduction

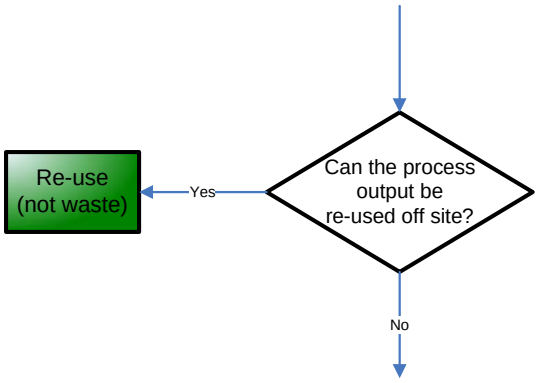


Waste is generated from the cleaning and plating of metals to render the base metal suitable for further processing or to apply a corrosion resistant surface coating to the base metal.

Consideration could be given to replacing some of the chemical processes with mechanical cleaning and de-scaling techniques. In addition, the use of less hazardous solutions in metal cleaning should be considered. Where surface coatings are applied through both electroless and electrolytic techniques, less hazardous metals should be investigated and alternative coating techniques employed. The minimisation of rinse waters should be given careful consideration.

Aqueous rinsing solutions will contain corrosive mineral acids and heavy metal salts which have been substantially diluted through the rinsing process. It is often possible to recover the rinsing waters from these solutions using ion exchange techniques to provide a closed loop rinse water system.

Re-use off site



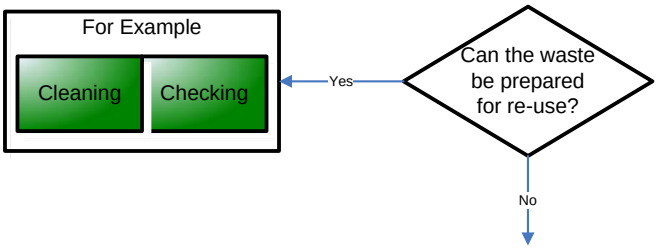
There are no direct re-use options for these process outputs.

Which Decision Tree?

This waste is considered predominately **inorganic** so you should use the **inorganic** decision tree.

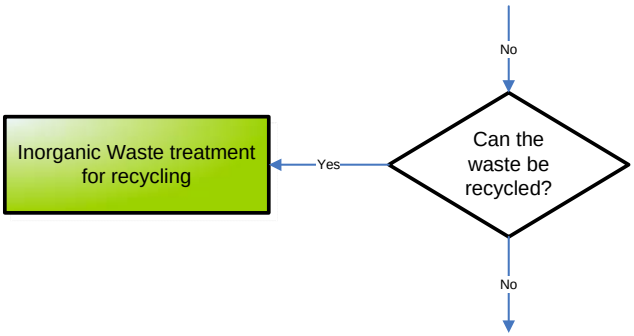
Considering the decision trees – Part 2 Inorganic decision tree (Figure 5, Appendix A)

Preparing for re-use



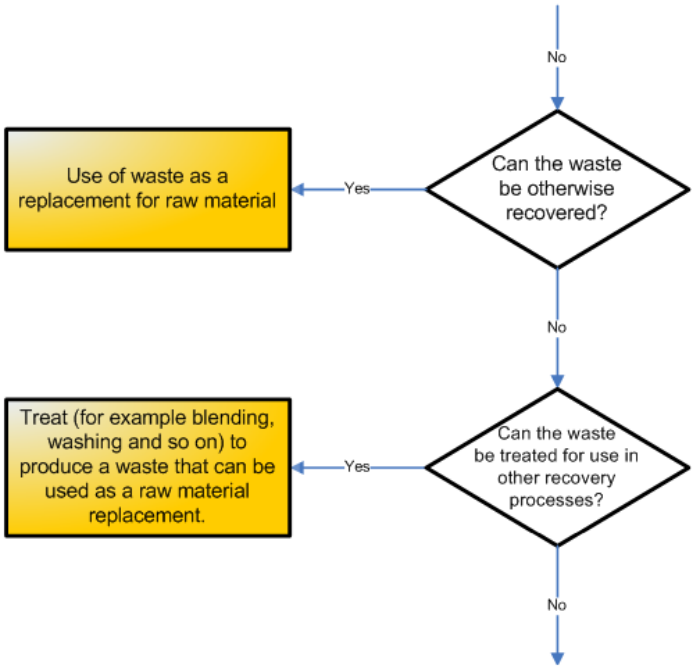
There are no preparing for reuse options for these wastes.

Recycling



Recycling is a form of complete recovery by which waste materials are reprocessed into products that can be used for the original or another purpose. The recycling process needs to be sufficient to ensure that any contamination is adequately removed so that the material can reach product standard. An example of recycling is the electrolysis of a nickel or copper plating solution where the metal can be extracted from the solution using electrolytic plating to produce a high grade metal cathode which can be classified as a non-waste product. Purity of the material is critical.

Other Recovery



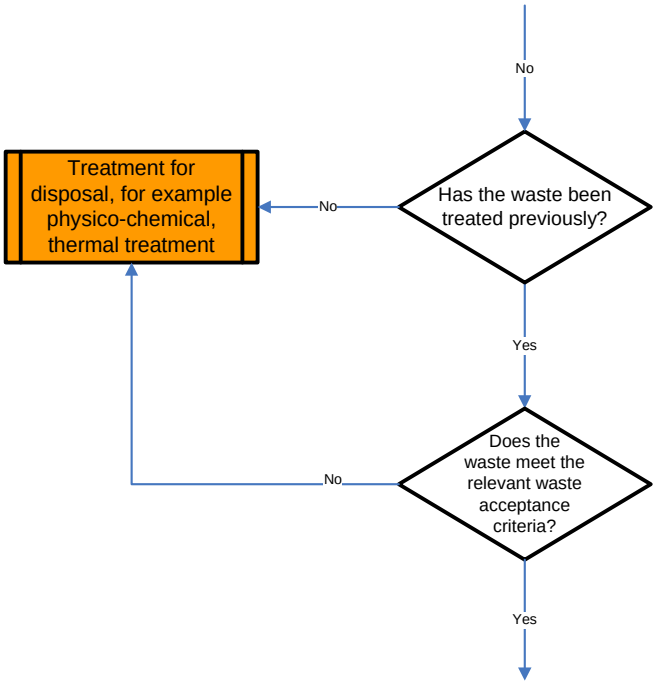
The authorised treatment activity during which waste is fully recovered will be considered the 'other recovery' activity. Any steps leading to that 'other recovery' activity are considered intermediate steps towards full recovery.

For example, a steel pickling acid might contain residual hydrochloric acid and ferric chloride. There is an exemption in the Environmental Protection (England and Wales) Regulations 2010, **Use of waste for a specified purpose (U8)**, that allows for the direct recovery of waste acid in 'water effluent and in water treating processes' under certain conditions. Use of waste in this way is 'other recovery' but the recovery takes place only when the waste is used for the specified purpose.

A metal rich acid can also be treated in an intermediate stage before being fully recovered. For example, a waste copper pickling solution will contain residual sulphuric acid and copper (II) sulphate. Copper metal can be extracted as a finely divided powder using a treatment technique

utilising scrap iron. This technique has the potential to produce a copper free acid solution and finely divided sludge containing high concentrations of copper metal which could be subjected to further thermal or electrolytic processes to recover the copper metal. This reclamation step is an intermediate step to full recovery. The full recovery however will only take place when the waste, being a replacement for a raw material copper source, undergoes thermally or electrolytic treatment.

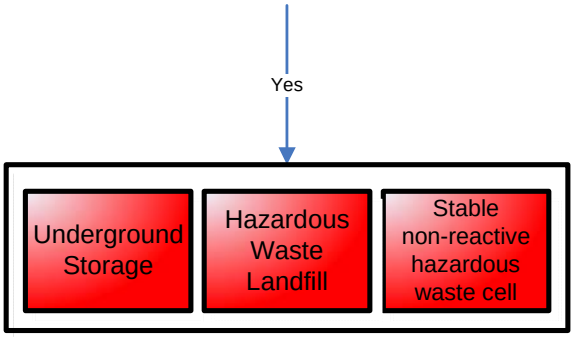
Disposal other than landfill



If the waste acid is not recoverable, it must be treated. The following treatments are suitable for most metal treatment acids.

The waste can, for example, be treated by, alkaline raw materials and/or alkaline wastes (in which case both waste acid and waste alkaline are treated). This treatment neutralises the acid and then precipitates the metals (at approximately pH 8 to 10 depending on the metals present). The mixed metal precipitates are commonly separated using filtration or centrifuging techniques to yield a sludge / solid residue suitable for landfill disposal, and an aqueous fraction that should be suitable for discharge to sewer as a waste water. Depending on the metal (or other dangerous substances) content of the treated waste it may be considered hazardous or non-hazardous. WAC needs to be fulfilled before disposal at landfill.

Landfill



Metal finishing acids will not be suitable for direct landfill disposal as they are liquids and are generally corrosive, both of which are banned under the Landfill Directive. They will invariably need treatment to render the residues suitable for landfill disposal.

Summary

There are a number of prevention strategies that can be used to minimise waste arisings of metal-rich acids which should be considered.

'Recycling' of materials should be considered the most appropriate treatment process.

B.7 Oils – mineral oils, fuels and non-halogenated, non-biodegradable recoverable lubricating oils (not emulsions)

In 2009, 327,326 tonnes of oils were reported to the Environment Agency as consigned in England and Wales[33].

The Environment Agency provides guidance on deciding which EWC code is the most appropriate in WM2.

The most relevant oil wastes are listed in the table below (entries in red and marked with an '(A)' are absolute hazardous waste and entries in blue and marked with an '(M)' are mirror entries – for further details see WM2):

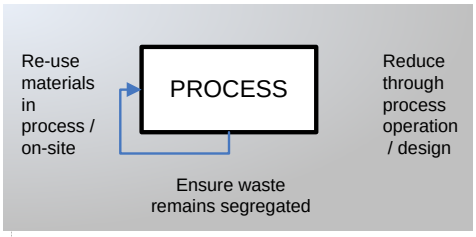
EWC	EWC description	Comments and composition
12 01 07*	mineral-based machining oils free of halogens (except emulsions and solutions) (A)	These wastes are mainly mineral or synthetic oil based, not emulsions and are not readily biodegradable. They may be mixed together only under permitted conditions, where the mixing improves the opportunity for recycling or energy recovery. The waste may contain water, metals or metal compounds, Their use may have changed the nature of the organic components – for example introducing or increasing the presence of potentially carcinogenic poly-aromatic hydrocarbon (PAH) levels.
12 01 10*	synthetic machining oils (A)	
13 01 10*	mineral based non-chlorinated hydraulic oils (A)	
13 01 11*	synthetic hydraulic oils (A)	
13 01 13*	other hydraulic oils (A)	
13 02 05*	mineral-based non-chlorinated engine, gear and lubricating oils (A)	
13 02 06*	synthetic engine, gear and lubricating oils (A)	
13 02 08*	other engine, gear and lubricating oils (A)	
13 03 07*	mineral-based non-chlorinated insulating and heat transmission oils (A)	
13 03 08*	synthetic insulating and heat transmission oils (A)	
13 07 01*	Fuel oil and diesel (A)	

[33] http://www.environment-agency.gov.uk/research/library/data/123744.aspx

EWC	EWC description	Comments and composition
13 07 02*	Petrol (A)	
13 07 03	Other fuels (including mixtures) (A)	See above.
13 08 99*	wastes not otherwise specified (A)	
Reason why the waste is hazardous		
Oil is a hazardous substance that is usually harmful / toxic, carcinogenic or ecotoxic. Oils may also contain metals or other contaminants that may also have hazardous properties. Fuels will probably also be flammable.		

Considering the decision trees – Part 1 General and mixed waste tree (Figure 2, Appendix A)

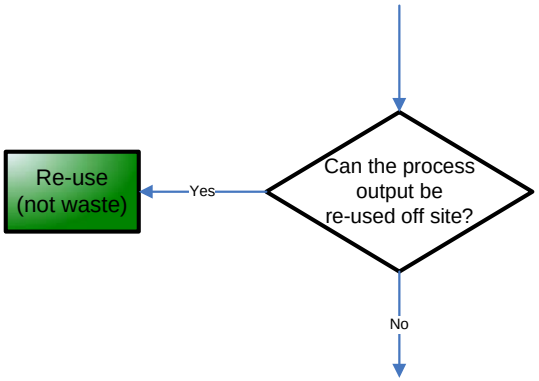
Prevention and reduction



Fuels - the minimisation of waste fuels is driven by users striving for efficiencies so that they can reduce their costs. This will result in relatively little fuel waste being produced, the exception being mis-fuelling at petrol stations.

Lubricants - changes in engineering and lubricant technology has resulted in a significantly reduced volumes of waste oils being produced. The move to synthetic oils has also led to oils being produced that are less hazardous.

Re-Use off site



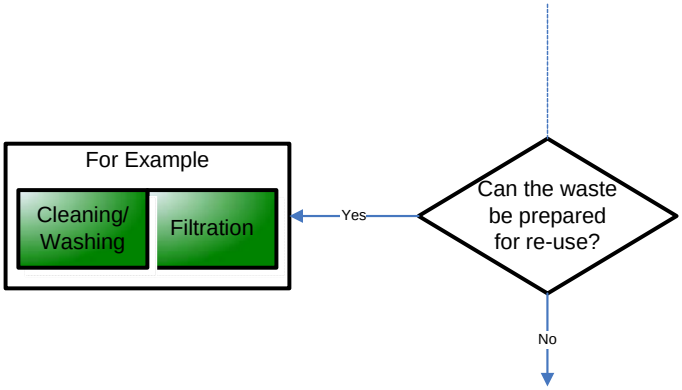
There are no direct re-use options for these process outputs.

Which Decision Tree?

This waste is considered predominately **organic** so you should use the **organic** decision tree (Figure 4, Appendix A).

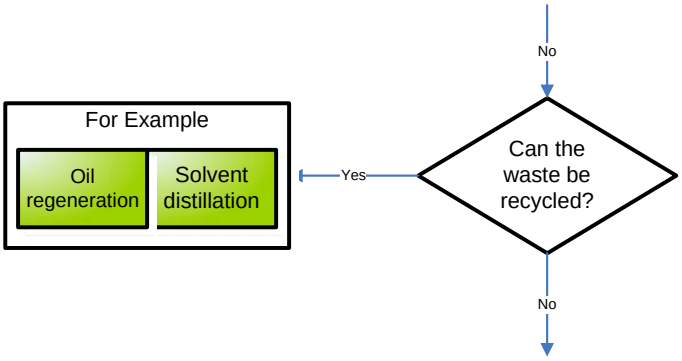
Considering the decision trees – Part 2 'Organic' decision tree (Figure 4, Appendix A)

Preparing for re-use



There are very few options for fuels or lubricants to be prepared for re-use. An example is backup generator diesel oil wastes which can be simply filtered and put back into the generator.

Recycling

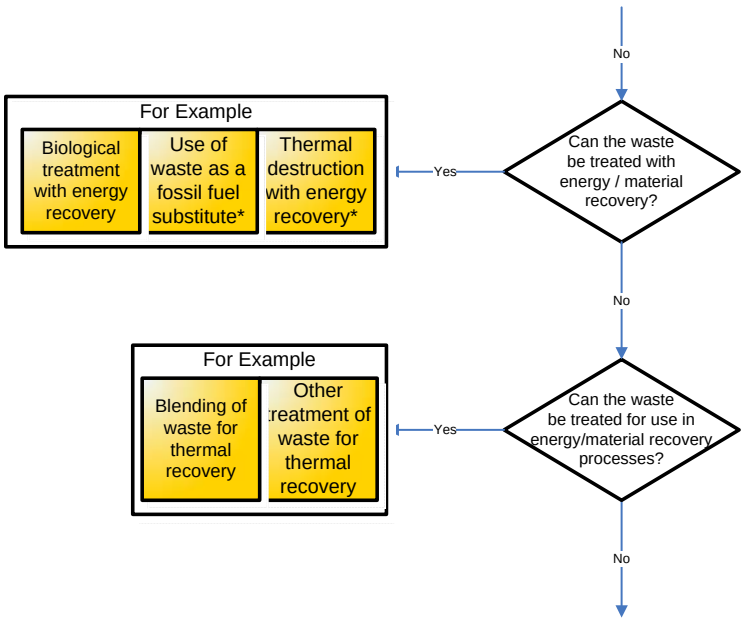


Lubricants - it is possible to recycle, regenerate or re-refine lubricants to virgin equivalent quality.

Other oils – it is possible to recycle electrical oils to virgin equivalent quality.

End of Waste conditions must apply to products and the impact of REACH should be taken into proper consideration.

Other Recovery

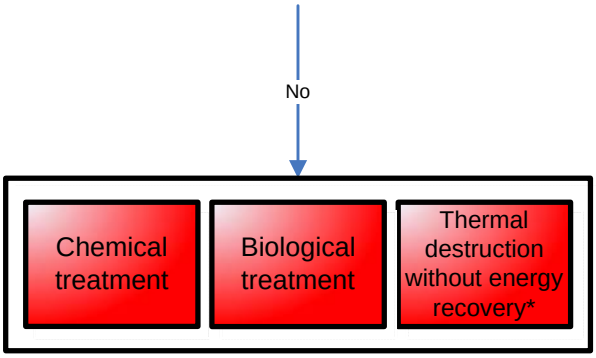


A fuel waste can be recovered either as a product fuel or as a waste fuel. The waste is fully recovered where:

- it is converted to product fuel;
- used as a waste fuel as a fossil fuel substitute;
- thermally destroyed using energy recovery.

Intermediate recovery steps include blending of waste, such as oils or other organic wastes, to a specification. Full recovery is only complete when the energy is recovered or the waste is converted to a product.

Other disposal except landfill



Waste oils must not be landfilled. In some cases, thermal destruction (high temperature incineration without energy recovery), chemical treatment or biological treatment may be justified for particular wastes. This could be due to contamination or the nature of the substances in the oil which prevents recycling or recovery. This might be the case if the oil is contaminated with very hazardous materials like PCBs that render recovery illegal or impractical.

Summary

Wherever possible lubricating oils, and speciality oils such as electrical oils, should be recycled.

The definition of recycling in the revised Waste Framework Directive does not include the reprocessing of waste into materials that are to be used as fuels. The practice, however, of treating contaminated fuels, for example from mis-fuelings at petrol stations to produce an original fuel product, is regarded as the best outcome.

If recycling is not an option, or not practicable, then use as a fuel substitute (product or waste), destruction with energy recovery, or blending for these ‘other recovery’ activities may be the best outcome. The blending of waste to produce a product is detailed in a WRAP/Environment Agency Quality Protocol for Processed Fuel Oil (PFO) which can be found at: http://www.environment-agency.gov.uk/PFO.