Waste Sampling and Testing for Disposal to Landfill

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Executive summary

We have written this guidance for waste producers and waste management operators so that they can show that their wastes are acceptable for disposal at an appropriate class of landfill in accordance with the Landfill Directive[1] and Council Decision[2]. This document updates and supersedes our Technical Guidance on sampling and testing of waste to meet landfill waste acceptance procedures, 2005.

Waste producers must apply the waste hierarchy[3] in the management of their wastes. If waste must be disposed of to landfill it has to be characterised to ensure that waste management operators fully understand the nature of the wastes they will be receiving.

This guidance is companion guidance to the Environment Agency's Hazardous Waste Technical Guidance WM2, which waste producers must follow for wastes that may contain dangerous substances. Waste producers must apply Waste Acceptance Criteria (WAC) to all waste destined for disposal to landfill once they have decided whether their waste is hazardous or non-hazardous.

This guidance covers:

- Classification and characterisation requirements for waste;
- Responsibilities of each party within the waste characterisation, sampling and testing regime (Section 3);
- Sampling schedules and testing requirements (Sections 4 and 5);
- Supporting information (Sections 3 and 4);
- Actions that could be undertaken in the event of failing a test criterion (Section 6);
- Key laboratory process steps (Appendix 3).

Responsibilities

This guidance details the sampling and testing waste producers have to undertake to ensure their wastes are properly characterised. Landfill operators must receive sufficient information to make an informed decision about whether they can accept the waste.

[1] The Council Directive 1999/31/EC of 26th April 1999 on the landfill of waste
[2] The Council Decision of 19th December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II to Directive 1999/31/EC
[3] http://www.defra.gov.uk/environment/waste/legislation/waste-hierarchy/

The following three levels of testing are defined:

Testing Level	Responsibility	Objective
Level 1: Basic Characterisation	Waste Producer	Full understanding of the waste.
Level 2: Compliance with Basic Characterisation (i.e. consistency testing for regularly generated wastes)	Waste Producer	Periodic sampling to demonstrate consistency with original understanding of a regularly generated waste (i.e. the basic characterisation) using key characteristics. For singularly produced waste streams, Level 2 testing is not required.
Level 3: On-site Verification	Landfill Operator	Consistency / compliance with basic characterisation for visually non-conforming wastes and 'quick check' of key relevant characteristics where appropriate.

Level 1 Basic Characterisation

Waste producers are responsible for describing their waste in detail. This will include background information on the source and origin of the waste that they should have access too. They may also need specific chemical test data unless there is a justifiable reason why testing is not required. The Basic Characterisation must include:

- Waste source and origin.
- The code applicable to the waste under the European Waste Catalogue (EWC)[4] .
- Determination if the waste has any hazardous properties as per WM2.
- In the case of hazardous waste, the properties which render it hazardous.
- The process producing the waste (including a description of the process, its SIC code and characteristics of its raw materials and products which may affect its behaviour under landfill conditions).
- The waste treatment applied, or a statement of why treatment is not considered necessary.
- The appearance of the waste (including smell, colour, consistency and physical form).
- Confirmation that the waste is not prohibited from disposal to landfill (for example liquid waste and whole used tyres).
- The class of landfill the waste can be disposed at.
- Confirmation of whether the waste requires testing. If the waste producer decides that he cannot[5] or should not[6] test, he must agree why with the Environment Agency.

4 In England, the EWC is transposed into domestic legislation by The List of Wastes (England) Regulations 2005 SI 2005/895. We refer to the EWC here to reflect the requirements of the Council Decisions annex, paragraph 1.1.2(f). However, the lists are essentially the same so references are interchangeable.

We expect the following for wastes that require sampling and testing:

- The full composition of the waste including hazardous constituents / properties based on the known composition of the waste and likely contaminants. The suite analysed should be informed by the requirements of WM2.

- The likely behaviour of the waste in a landfill and any additional precautions the landfill operator must take. This may include short term leaching effects if highly leachable components are present.

- An assessment against any relevant limit values and its other characteristic properties.

- Identification of key variables for compliance testing for regularly generated wastes.

WAC testing and limits

Waste producers may have to test waste to determine if it is hazardous or non-hazardous. They may also have to test waste to confirm to all parties that the waste has been fully characterised. The characterisation must be representative of the wastes physical and chemical properties and consider any variability in the waste stream. The Basic Characterisation must also be representative of each individual load sent to the disposal site. The waste producer should develop a sampling plan using Best Practice with reference to BS EN 14899 (and supporting technical guidance CEN/TR 15310) to ensure samples are representative of the waste.

The Council Decision sets specific limits, commonly referred to as 'WAC leaching limits', for a sub-set of the components that the waste producer must consider in the Basic Characterisation. These apply to all wastes destined for disposal in a landfill for hazardous, stable non-reactive hazardous and inert waste. These limits are independent of the test data used to determine if a waste is hazardous or non-hazardous. Waste producers cannot use them to decide whether their waste is hazardous or non-hazardous, which they must do before they can decide which class of landfill is suitable for their waste.

The WAC limits are based on:

- Total concentration limits for the organic components and pH; as well as

- Leachable components.

The Environmental Permitting Regulations (2010)[7] dictates that the 10 l/kg leaching test (to EN 12457-2002) is carried out for all waste types, unless there is any reason to suspect that short term leaching will occur. For such highly leachable wastes, the

5 i.e. a physical form that makes testing impractical. A testing laboratory should be consulted for confirmation and justification agreed with the Environment Agency

6 i.e. specific wastes which have known detailed composition and properties that would cause undue health and safety concerns when tested. By definition, these wastes contain dangerous substances and would be classified as hazardous. A testing laboratory should be consulted for confirmation and justification agreed with the Environment Agency

[7] The Environmental Permitting (England and Wales) Regulations 2010, schedule 10, paragraph 7(e)

waste producer can apply column leaching or lower L/S ratio tests identified in the Council Decision (BS EN 12457-2002 Part 1 and prEN 14405).

Level 2 Compliance with Basic Characterisation

The waste producer may undertake Compliance testing to show that a 'regularly generated waste' remains consistent with the original Basic Characterisation. Testing is therefore to demonstrate that variability is within an acceptable range. Council Decision 2003/33/EC requires that Compliance Testing is carried out at least once per year and to the scope and frequency determined by the Basic Characterisation for regularly generated wastes.

Level 3 Verification

Verification testing is for the landfill operators to confirm that the waste he accepts conforms to the Basic Characterisation at the point of disposal. Checks at this stage are primarily visual and through verification of the accompanying documentation for each load received. However, we expect landfill operators to routinely sample and test the waste they receive to confirm the Basic Characterisation. Landfill operators must ensure that samples are retained either at the receiving site or at the testing laboratory for at least one month after they receive the test results to ensure that they can verify failures across a larger sample population.

Test failures

Where sample results exceed WAC leaching limits at the site of production (that is, with the Basic Characterisation or Compliance testing for regularly generated wastes) these must be resolved before the waste producers send their waste off site.

If a landfill operator accepts and deposits waste in his landfill prior to the receipt of test results that exceed a WAC leaching limit, he must report that to the waste producer. He must also provide a risk assessment (or reference to a suitable existing risk assessment) to the Environment Agency to show that the substance that exceeded the limit will not result in a significant environmental threat.

Once a failure has been identified, the landfill operator must not continue to accept deliveries of the waste until the characterisation data has been reviewed and measures taken to stop a reoccurance.

Statistical approaches

We will accept statistical analysis of data sets where the waste producer or landfill operator believe that a test result that exceeds a WAC leaching limit is due to analytical uncertainty or is not representative of the waste population. Where results exceed WAC leaching limits at the site of production, the waste producer can use this information to decide the most appropriate management option for his waste that may include further treatment before he sends his waste off site.

Any statistical analysis must be justified and agreed between the waste producer, the receiving landfill operator and the Environment Agency as part of the process that shows that the waste is acceptable at a particular class of landfill.

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Contents

1 Introduction

1.1 Background

The Landfill Directive (Article 11) and Annex II, requires that waste is properly characterised and meets specific Waste Acceptance Criteria (WAC) prior to disposal at a landfill site. For the purposes of this guidance, we assume that waste producers have considered the waste hierarchy[8] (that is to recover, re-cycle and re-use waste in preference to landfilling it) and no practical alternative treatments are available.

This guidance updates and supersedes our guidance on, 'Sampling and testing of wastes to meet landfill waste acceptance procedures' (Environment Agency, 2005). We have produced this guidance, following consultation with industry (Appendix 1) to clarify the sampling and testing requirements for wastes to ensure that when you must dispose of your waste to landfill you send it to the appropriate class[9] of site. The information you gather as a waste producer will also ensure you provide sufficient information to any waste management operator to help him decide the most appropriate treatment prior to disposal to landfill and to inform the post-treatment waste characterisation.

We have primarily targeted this guidance towards waste producers, once they have decided whether their waste is hazardous or non-hazardous and where there is a requirement to test against a specific acceptance limit for disposal at a landfill. A number of wastes types do not require testing. However, where a waste producer decides not to test their waste, they must justify why they consider testing is unnecessary (see section 3.2). .

A waste producer must only send his waste to the class of landfill designed and operated to protect the environment from the contaminants within his waste. The Landfill Directive identifies a set of Waste Acceptance Criteria (WAC), which includes screening to determine what analytical testing is required. It also includes a combination of concentration limits for total composition and leachable content to ensure that waste is properly characterised. The European Commission developed the WAC limit values (reproduced in Table 5.3) by running model scenarios, to reflect how they expect the contaminants within a landfill to respond to water infiltration over time. They set leaching limits at a concentration that is unlikely to lead to emissions resulting in harm to the environment against World Health Organisation (WHO) and Drinking water standards (DWS). We therefore use WAC limit values to decide which class of landfill is appropriate for a particular type of waste.

Within this guidance the primary relevant legislation referred to as the 'Landfill Directive' and 'Council Decision' are;

Landfill Directive refers to

- EC Council Directive 1999/31/EC of 26th April 1999 as applied under the Environmental Permitting (England and Wales) Regulations 2010 http://www.environment-agency.gov.uk/business/regulation/31867.aspx

Council Decision refers to

[8] http://www.defra.gov.uk/environment/waste/legislation/waste-hierarchy/
[9] Landfill Directive, Article 4

- EC Council Decision 2003/33/EC of 19th December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of Directive 1999/31/EEC on the landfill of waste. Official Journal of the European Communities L11 16.1.2003 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:011:0027:0049:EN:PDF

We expect waste producers and landfill operators to be familiar with the requirements of this legislation so that they understand the conditions and limitations of their use.

1.2 Objectives of the sampling and analysis programme

The Landfill Directive and associated Council Decision set out the waste acceptance procedures for landfill. We summarise these as four overarching objectives:

- To ensure that waste is disposed of at a site permitted to accept it in compliance with European and UK legislation.
- To demonstrate that there is insufficient organic material within the waste to produce landfill gas in inert, hazardous or stable non reactive hazardous waste (SNRHW) cells.
- To ensure that leachable substances are only accepted at landfills that are designed and operated to manage them.
- To inform appropriate treatments of waste from leachable and total waste concentrations prior to the deposit of wastes within landfills. Relevant source content information may also be required for the treatment operator to compile an appropriate characterisation prior to final disposal.

The first objective above relates to the compliance limits established by the Council Decision to meet the subsequent three objectives.

The second and third objectives are to demonstrate that the waste is suitable for disposal at a specific class of site, while the fourth objective summarises the Landfill Directive requirement (to pre-treat wastes prior to disposal), to reduce the volume and potential harm that could occur following landfilling.

1.3 Supporting guidance

We have produced supporting regulatory guidance that provides overlapping information for specific waste types and pre-acceptance procedures that you can use for further reference, context and industry specific factors:

1. **Waste acceptance at landfills http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho1110btew-e-e.pdf**

2. **Technical Guidance WM2 on hazardous waste (April 2011) http://publications.environment-agency.gov.uk/PDF/GEHO0411BTRD-E-E.pdf (an updated development draft was issued for review in August 2012 and includes discussion of the statistical techniques which could be used as part of WAC). Herein referred to as WM2 or Technical Guidance WM2**

3. **Using the List of Wastes to code wastes.** http://www.environment-agency.gov.uk/static/documents/Business/low_guide_v1.2_1397222.pdf

4. **Classifying and coding wastes from physico-chemical treatment facilities (HWR06)** http://www.environment-agency.gov.uk/business/topics/waste/104765.aspx

5. **Guidance on WAC and treatment:** http://www.environment-agency.gov.uk/business/sectors/108918.aspx

6. **Treatment of waste for landfill (November 2011)** http://publications.environment-agency.gov.uk/PDF/GEHO1111BVDF-E-E.pdf

7. **Guidance on hazardous waste** http://www.environment-agency.gov.uk/business/topics/waste/32200.aspx

8. **Guidelines for Ash Sampling and Analysis (March 2011)** http://publications.environment-agency.gov.uk/PDF/GEHO0311BTPZ-E-E.pdf

This is not an exhaustive list and we will add to it as further guidance is published.

2 Waste classification

2.1 European waste catalogue (List of Wastes)

Prior to waste destined for landfill leaving the premises of production, waste producers must classify their waste using the List of Wastes (LoW) (formerly commonly identified using the European Waste Catalogue[10] (EWC)). This provides a range of codes based on the process that produces the waste. Taken alongside the further interpretation given in WM2, these can fall within one of five potential classifications:

- Absolute Hazardous (AH).
- Mirror-entry* Hazardous (MH) (to be confirmed by testing and/or source material knowledge as per WM2).
- Mirror-entry Non-hazardous (MN) (to be confirmed by testing and/or source material knowledge as per WM2).
- 'Absolute' Non-hazardous (AN) (i.e. wastes not classified by a hazardous or mirror-entry code).
- Inert[11].

The waste producer should assess and sample his waste to determine its status and classification in accordance with our Hazardous Waste Technical Guidance (WM2). While the WM2 guidance is for assessing hazardous waste, you can use the same processes to characterise any waste. This will inform you what waste management options you should consider.

Where a 'waste population'* is composed of more than one waste type, for example when two or more wastes or a mixed waste are placed in a single container, then more than one waste is present. You must classify and describe each separately at the premises of production. The use of mixed waste codes is acceptable if justified for non-hazardous wastes. Equally, you must consider the sampling of each waste type to be a different sub-population[12] for separate assessment.

If you intend to dispose of the mixed waste at a landfill, you may need to undertake additional testing to decide what pre-treatment is required.

2.2 Waste characterisation

Waste classification includes allocation of an EWC code and a detailed evaluation of the waste properties using a combination of a detailed knowledge of any source process in combination with chemical testing (Basic Characterisation).

You can use the combination of EWC code and Basic Characterisation to refine the waste description to a level of detail that can inform landfill operators and regulators. This description must accompany the waste in accordance with your Duty of Care[13] to

[10] Commission Decision 2000/532/EC
[11] Sub-classification of non-hazardous waste from Landfill Directive, Article 2(e) and Council Decision Annex, Section 2.1
[12] as defined in Technical Guidance WM2 and See Glossary for definition
[13] The Environmental Protection (Duty of Care) Regulations 1991 (as amended)

ensure that the waste is disposed of legally and within the risk-based operational framework of the receiving landfill site.

Any subsequent testing is to confirm that the Basic Characterisation remains valid for that particular waste stream disposed of via a particular route. Mixing of waste populations prior to compliance testing would invalidate the original Basic Characterisation.

Testing to WAC limit values is required for wastes disposed of to landfills for hazardous and inert waste as well as all wastes disposed of in cells for stable non-reactive hazardous waste.

While the EU has not set WAC limit values for non-hazardous wastes, non-hazardous waste producers that wish to dispose of their waste to landfill must still fully characterise their waste to show that it is not hazardous and to ensure they send it to the appropriate class of landfill. Where a waste is within the WAC limit value for a particular class of landfill or a site where limits set at the EU level do not apply, the behaviour of the waste must be within the requirements of the risk based framework used to permit the landfill. That is, the waste received must not adversely affect the environment as predicted by the site specific hydrogeological and landfill gas risk assessments.

3 Waste sampling and testing responsibilities

3.1 Introduction

There are three levels of waste assessment:

- Level 1. Basic Characterisation.
- Level 2. Compliance with the Basic Characterisation for regularly generated waste.
- Level 3. Verification at the disposal site.

The test methods undertaken at each level for substances analysed are similar. However, we accept that the sampling frequency and suite will reduce from Level 1 (Basic Characterisation) to Level 3 (Verification) testing as set out in Table 3.1.

Table 3.1 Waste sampling and testing responsibilities

Testing Level	Responsibility	Objective
Level 1: Basic Characterisation	Waste Producer	Full understanding of the waste.
Level 2: Compliance with Basic Characterisation (i.e. consistency testing for regularly generated wastes)	Waste Producer	Periodic sampling to demonstrate consistency with original understanding of a regularly generated waste (i.e. the basic characterisation) using key characteristics. For singularly produced waste streams, i.e. where the entire waste stream has been considered as part of the Basic characterisation, Level 2 testing is not appropriate.
Level 3: On-site Verification	Landfill Operator	Consistency / compliance with basic characterisation and 'quick check' of key relevant characteristics where appropriate.

Sampling undertaken for the Level 1 Basic Characterisation and Level 2 Compliance with Basic Characterisation should be carried out at the site of waste production (Sections 4 and 5). Waste producers should use the Basic Characterisation information to design a strategy for how they will manage their waste and, for regularly generated wastes, ensure that the selected management strategy remains appropriate. Where Level 2 Compliance testing or Level 3 Verification testing indicates variation from the original Level 1 Basic Characterisation, the waste must be re-characterised in full and the management strategy reappraised.

WAC testing (Section 5) of wastes for both total and leachable concentrations from the site of production is important. We consider that where testing is required, waste should remain at the site of production until the test data confirms which class of landfill can accept it. Minimum laboratory turnarounds between sampling and receipt of results for Level 1 or Level 2 tests are typically 7 to 14 days. Waste producers must make provisions for keeping their waste on site pending receipt of the test results,

unless there are over riding environmental or amenity reasons why the waste must be moved sooner (for example, waste is odorous), or we have agreed that the waste is sufficiently homogeneous that it can be moved sooner. Waste producers must comply with their Duty of Care obligations prior to moving their waste to ensure that the receiving landfill operator can accept the waste in accordance with the permit.

The waste producer's primary responsibility is to fully assess the waste as part of the Level 1 Basic Characterisation. Based on their knowledge of the pollution potential of his waste, the waste producer may need to test for substances other than those where specific limits are set in the Council Decision Annex to demonstrate no significant impact once the waste is within the body of the landfill. The analytical suite must use information from the producing industrial source or known historical practices during site redevelopments in order to provide landfill operators with details of a fully characterised waste. This may include components such as solvents, ammonium, cyanide, metals and petroleum products.

Waste producers should use Best Practice to sample the waste for example to BS EN 14899:2005 (Characterisation of Waste - Sampling Waste Materials (2006) (previously referred to from the European standard CEN/TR15310)

- Part 1: Guidance on selection and application of criteria for sampling under various conditions.
- Part 2 Guidance on sampling techniques.
- Part 3 Guidance on procedures for sub-sampling in the field.
- Part 4 Guidance on procedures for sample packaging, storage, preservation, transport and delivery.
- Part 5 Guidance on the process of defining the sampling plan (see section 5.2).

3.2 Cases where testing is not required

Section 1.1.4 of the Annex to the Council Decision identifies the conditions where laboratory testing for the Basic Characterisation is not required:

(a) the waste is on a list of wastes not requiring testing as laid down in Section 2 of the annex to the Council Decision.

(b) all necessary information, for the basic characterisation, is known and duly justified to the full satisfaction of the competent authority.

(c) certain waste types where testing is impractical or where appropriate testing procedures and acceptance criteria are unavailable. This must be justified and documented, including the reasons why the waste is deemed acceptable at the landfill class.

In all cases where testing is not required, the Basic Characterisation must contain the source, origin and all descriptive requirements for the waste as well as a reference to the precise sub-section(s) of the Council Decision which justifies the dispensation in testing.

Although WAC limit values are not set at the EU level for non-hazardous wastes received at a landfill for non-hazardous waste, the waste must conform to the requirements of the site specific hydrogeological, landfill gas and amenity risk assessments. Basic characterisation is therefore necessary to ensure that the waste

producer sends their waste to the appropriate class of landfill. The Environment Agency may accept a Basic Characterisation based on evidence from an industry sector or specific waste stream under (b) above.

3.3 Waste producers (land development)

Information from commercial laboratories indicates that the majority of samples sent to them for WAC testing are soil-forming materials from land development / redevelopment schemes. For many of these samples, the testing programme is undertaken for the dual purpose of risk assessment to determine if they can remain on-site as well as to establish disposal options. Where there is an intention to dispose of material's to landfill, then a site investigation and desk study should be designed to inform the sampling and testing plan for waste classification to identify the appropriate EWC codes and to identify which 'waste types' you will consider separately.

We do not expect additional testing if the waste producer has obtained sufficient total and leaching data for each waste type, carried out as part of a recent comprehensive site investigation.

The land developer must separate waste from areas containing hazardous waste from non-hazardous waste. The developer must recover or dispose of these wastes under separate EWC codes. The developer must keep auditable records relating site investigation locations to the classified waste. Land development is likely to comprise one, or a combination of the following schemes:

Contaminated land redevelopments

Developers should design their site investigation programmes to distinguish contaminated ground from non-contaminated ground. A properly designed sampling and analysis programme, including desk study information should be capable of designating the site into four classification types, namely:

- Materials which can be reused on-site and do not require disposal or testing under WAC for disposal purposes;
- Hazardous soils or materials, which require treatment and separate disposal;
- Non-hazardous or inert soils which can be disposed of to non-hazardous waste landfills;
- Non-hazardous soils which can be disposed of to inert waste landfills with WAC testing to inert limits;
- Soils that the developer can recover or dispose of directly to a landfill for inert waste without testing.

Waste from each designated area will require a separate Basic Characterisation based on site investigation data. Land developers must not mix waste materials classified as hazardous mirror-entries with those classified as non-hazardous to ensure that they can identify appropriate treatment routes.

It is the land developer's responsibility to segregate the hazardous from non-hazardous waste at source using site investigation information. Where the land developer cannot confirm segregation, we expect them to classify the waste using the most hazardous classification prior to excavation. The land developer must not dilute hazardous components, for example by mixing with less or non-hazardous waste on site to meet WAC limit values. It is in the land developer's interests to fully identify contaminated

areas to reduce the quantity of waste sent for treatment or disposal as hazardous waste.

Once the developer has undertaken an initial Basic Characterisation on each waste stream, he can manage the soils as part of the on-site processing programme (for example, stockpiling, treatment, screening and separation). The producer and landfill operator can then agree the suite of Level 2 Compliance testing for regularly generated waste to demonstrate compliance with the initial Basic Characterisation prior to disposal.

It is also in the land developer's interests to understand the variability in composition of Made Ground. Land developers should have an understanding of how this variability compares with the threshold limits for disposal to inert class sites. Where there is minimal variability, the waste can be characterised as homogeneous for testing purposes.

Construction / development sites

Developers can apply the same principles that apply to contaminated land sites to construction sites.

Land developers should initially segregate wastes for recovery. Only wastes destined for landfill will require a Basic Characterisation prior to disposal or to identify further treatment requirements, notwithstanding your obligations to describe waste under the Duty of Care.

Utility wastes from highway excavations

Waste producers can apply the same principles that apply to contaminated land sites to wastes from highway excavations.

The primary responsibility of the waste producer will be to segregate recyclables and contaminated materials for treatment from non-contaminated wastes before undertaking the Basic Characterisation.

Greenfield developments

Where the waste producer is confident about the quality of a soil at a greenfield site, we accept that sampling and laboratory testing is not necessary for the Basic Characterisation. This can be limited to visual assessment and written description of the waste in addition to supporting evidence such as a desk study assessment, historical or landuse data of the greenfield status.

The waste producer must separate topsoil prior to disposal at a landfill for inert waste and either set it aside for restoration works, or recover it elsewhere.

3.4 Waste producer (industrial or commercial process)

For any regularly generated waste, industrial or commercial waste producers should:

- Apply a Basic Characterisation based on a suite from knowledge of the source process and the data available for existing processes to establish the underlying variability of his waste as per Section 1.1.3 of the Annex to the Council Decision. The waste producer can then apply the Level 2 testing schedule for that waste stream.

- For new processes the waste producer should use the expected annual production rate to define the Basic Characterisation quantity and an

appropriate number of samples to take for the first 3 batches of wastes to understand variability before proceeding to Level 2 testing (see Section 4).

For the Level 2 testing industrial or commercial waste producers should:

- Identify each 'process' batch sub-population quantity for compliance testing.
- For regularly generated wastes, the waste producer must re-characterise his waste when there is a change in production process that will produce waste that is outside of the original characterisation such that it is a separate population. The waste producer must also re-characterise when the median concentration of the Level 2 Compliance Test data exceeds the 85th percentile of the upper range of the original Basic Characterisation or when the waste exceeds a leaching limit.

For existing processes, the waste producer should be able to define 3) in the list above from a knowledge of the process and ongoing data collation where the variability is understood. Once the producer has collated this Basic Characterisation (Level 1) information, he can apply Level 2 Compliance testing for targeted substances. The waste producer will need to re-characterise their waste where there is a change to the inputs to the process that may affect the quality of the waste produced, or the compliance testing results suggest that the waste quality may not achieve the WAC limit value for the receiving landfill.

3.5 Waste producer (following treatment)

Waste treatment is undertaken, whenever possible, to reduce the hazardous or polluting nature of a waste (or to enhance recovery) and, in the case of disposal, to a level that is acceptable for disposal within a particular class of landfill. Treatment can include a range of techniques from separation to physico-chemical processes that change the properties of the waste. You can find more information in our guidance on the Treatment of waste for landfill.

Where waste producers have classified their waste as hazardous prior to treatment, they should follow the procedures for reclassification of the treated waste in Technical Guidance WM2 and HWR06.

- The original waste producer is required to supply characterisation information to the waste treatment operator based on WM2 requirements and to a suite agreed with the treatment operator. This includes sufficient total concentration data (Section 4) which can be used for process control as well as that required to allow the treatment operator to produce a Basic characterisation following treatment.
- The waste treatment operator must supply a Basic Characterisation to the landfill operator that reflects the changes due to the treatment process.

A waste treatment operator's testing requirements are dependent on the process batch arrangements. For example:

- Where the treatment operator receives waste from a single waste producer, then he can accept successive batches from that producer using the same Basic Characterisation (supplied as part of the first batch disposed to landfill) as long as the received batches are kept physically separate from other wastes prior to or during treatment. In these circumstances we will accept Level 2 testing prior to disposal for successive batches landfilled.

- Where individual wastes are received under separate Basic Characterisations and are mixed during treatment, we expect a Level 1 Basic Characterisation for each process batch prior to disposal to landfill.

- Where treatment separates mixed wastes, we expect a new Basic Characterisation for each separate fraction prior to disposal. If hazardous and non-hazardous components from a combination of received wastes could be mixed as part of this process, the waste producer must follow the procedures within WM2.

- We expect a Basic Characterisation prior to disposal where the treatment operator bulks up wastes segregated from mixed sources for logistical reasons (for example, trommel fines).

3.6 Landfill disposal operators

Landfill operators are responsible for ensuring that they only accept wastes that their landfill sites are permitted to accept. That includes compliance with WAC limit values for materials disposed of to the body of the landfill. Landfill operators must ensure that any other wastes they accept (for example, for engineering purposes) are fit for purpose. They may need to test these as per the requirements of their permit.

Landfill operators must carry out the following checks:

- Ensure that there is sufficient waste characterisation information available to make a decision about whether to accept the waste prior to receipt and that this information, once assessed, can be cross-referenced to the waste received.

- Visual check of each waste load to verify that it conforms to the written waste description.

- Verification sampling and testing of key, relevant characteristics (as set out in Sections 4 and 5) to ensure that the waste he accepts complies with the Basic Characterisation.

4 Sampling Requirements

4.1 Waste population and sample preparation

Laboratories require relatively small quantities of sampled materials to perform all of the WAC characterisation tests. The laboratory is unlikely to have information regarding the waste and its heterogeneity. Therefore, someone with knowledge of the objectives of the waste producer's 'sampling plan' and the nature of the waste must design and manage the initial sampling programme at the waste source site.

Waste producers and landfill operators must develop their sampling plan in accordance with BS EN 14899:2005 Characterisation of waste – Sampling of waste materials - Framework for preparation of a sampling plan, BSI 2006 and associated Technical Reports (CEN/TR 15310 series). For more information on sampling plans, see our guidance on Waste Acceptance at Landfills.

You must consider the range in particle size of the waste and any variation in its material when taking representative samples for analysis. We recommend that you contact the analysing laboratory in advance of sampling to discuss sample preparation.

Those sampling the waste should screen it at the point of sampling to remove large items and materials unsuitable for laboratory testing. We consider that this smaller particle sized fraction generally provides the most representative sample, with respect to leaching, as it is likely that most leachable contamination is associated with the sub 10mm fraction. A description of the material removed prior to testing and its likely behaviour in a landfill must be included within the Basic Characterisation.

Those sampling wastes can then take one of two approaches, either;

- From knowledge of the waste's chemical properties and justified assumption that the contamination is associated with a particular size fraction and target this fraction for sampling and analysis, then recalculate the total concentration based on the quantity of the fraction analysed. The method used including a justification that the constituents excluded are unlikely to be significant must be described in the Basic Characterisation; or

- Sort / screen the waste to remove the larger fraction that would then be disposed of via a separate EWC code and Basic Characterisation. Those sampling waste should clearly identify fractions unsuitable for testing.

The approach you select must be justified and documented within the Basic Characterisation information. If the analysed fraction is hazardous, you must assume the waste is hazardous without further processing.

You must separately identify components such as gypsum, asbestos, organic matter and other identifiable items requiring a specific, individual classification and specific disposal conditions in a mixed waste. These components must be fully described and form part of the classification, or physically separated and managed as a separate waste stream.

The test for total organic carbon in granular wastes utilises minimal sample quantities (<0.2g) such that visible organic matter is unlikely to be properly characterised. Therefore, you must separate all visible organic matter from wastes destined for disposal at cells where active gas control will not be in place (i.e. hazardous, SNRHW or inert cells) or otherwise demonstrate that the organic matter is within the TOC limits for disposal at a particular class of site.

The leaching test method requires a 2kg sample where the sample particle size is less than 10mm (e.g. soils). Larger quantities can result in additional effort to cone, homogenise and quarter the sample prior to analysis, as well as increase laboratory sample disposal costs. Each sample must be representative of the waste you are characterising.

You need only take larger samples where the sample physical variability is high and you cannot obtain smaller, representative samples (for example, stones and brick waste). You should discuss with the laboratory prior to sampling whether they can properly crush and homogenise the waste to below 10mm. You should also ensure that you supply samples to the laboratory in containers suitable for sample preservation during transit.

It is the waste producer's responsibility to ensure that any sample sent to the laboratory for analysis is representative of the source waste. Your sampling strategy must therefore consider what sampling and sub-sampling procedures you will employ to generate representative samples for laboratory analysis. WM2 provides guidance on how to sample and the sample size appropriate for the testing laboratory to ensure it is representative of the waste sub-population. We will accept the statistical approach identified in WM2 for leachable content and waste acceptance limits for all waste classifications. You must demonstrate, at the 95th percentile confidence limit, that your waste has been properly characterised to decide whether the waste population is within a particular limit (Table 5.2) and thus acceptable for disposal at the appropriate class of landfill site.

Waste producers should segregate and assess wastes that are unsuitable for laboratory testing for an appropriate treatment and / or disposal route.

4.2 Sampling density

For all wastes defined as absolute hazardous (AH) or mirror-entry hazardous (MH), the waste producer must follow the approach taken within Technical Guidance WM2 to classify a waste population. Where all test data is likely to be below a WAC limit value for acceptance at a site, you can apply the sampling densities presented in Table 4.1.

We consider the sample frequencies for laboratory testing presented in Table 4.1 (based on professional judgement) are pragmatic for the purposes of WAC limit values as we accept that such limited sampling could never fully characterise a waste. The principal purpose of the WAC limit value is to identify the appropriate class of landfill for disposal and, in broad terms, the wastes potential to cause pollution. We consider these frequencies sufficient for waste streams where there is a thorough knowledge of the waste chemistry. Where waste producers have a poor knowledge of their waste's chemistry, they will have to take more samples for analysis. Waste producers must consider historical datasets and known analytical precision when they decide the number of samples for the Basic Characterisation.

Waste producers must apply a higher sampling frequency and analytical precision (as per the methods outlined in Technical Guidance WM2) for new waste streams where they have no prior characterisation knowledge.

Waste producers can classify regularly generated wastes based on their known variability and their knowledge of the waste source and/ or the treatment process undertaken.

- Homogeneous solid residues from a known process and with low variability in the input stream are wastes where you can show continuity, with negligible variability, in substance concentrations over successive waste populations (that is, analytical data is within the expected concentration range

demonstrated by previous Basic Characterisations once outliers are removed from the original characterisation dataset).

- Heterogeneous or stratified solid waste residues are wastes from an unknown process and with a high level of variability in input stream, for example, transfer station fines and new wastes without source knowledge.

Table 4.1 provides laboratory testing frequencies for Level 1, 2 and 3 testing. We will accept alternative rates of testing providing they are fully justified with reference to a detailed knowledge of the wastes physical and chemical properties and descriptive Basic Characterisation (see section 5.3).

Table 4.1 Laboratory sample testing frequency for Level 1, 2 and 3 testing where the waste can be clearly classified as a single waste type.

	Population (tonnes)	**Homogeneous (number of samples)**	**Heterogeneous and new wastes (number of samples)**
Level 1 Characterisation for Descriptive, Total Concentration & Leaching Tests	<100 t < 500 t <1000 t 10,000 t plus per additional 10,000 t	2 3 5 11 +5 (pro rata)	5 8 14 22 +10 (pro rata)
Level 2 Compliance for regularly generated wastes. (Total Concentration and Leaching Tests Required)		1 per defined waste sub- population to a targeted suite per year or as defined in the Basic Characterisation	3 per defined waste sub-population to a targeted suite per year or as defined in the Basic Characterisation
Level 3 Verification Delivery document & visual check. Sample using Level 2 Testing suite or as identified from Basic Characterisation		Visual - Each load	Visual - Each load
		Chemical - 1 per year per waste stream or source / carrier >2,000T/a	Chemical - 3 per year per waste stream or source /carrier > 2,000T/a

Note: Council Decision 2003/33/EC requires a minimum of one sample to be taken annually for Level 2 testing of regularly generated wastes

All composite samples for granular wastes must be prepared from 7-sub-samples and be representative of the visual variability in the waste.

5 Testing Requirements

5.1 Introduction

The sampling and testing of wastes is a requirement of the Landfill Directive to properly characterise waste and demonstrate that the waste is acceptable for disposal at a specific class of landfill site. Waste acceptance procedures are therefore a combination of regulatory limits and site-specific, risk-based standards. This section describes the types of tests and pre-analytical processing required as well as the minimum testing standards.

Further to section 3.2 above, the Council Decision annex identifies a limited number of **waste types** which do not require testing prior to disposal in a landfill:

- Municipal wastes classified as non-hazardous in Chapter 20 of the European waste catalogue for disposal in a landfill for non-hazardous waste (See Council Decision Annex, Section 2.2.1).
- Asbestos waste for disposal in a separate cell of a landfill for non-hazardous waste (See Council Decision Annex, Section 2.3.3).
- Inert wastes listed in the Council Decision Annex table in paragraph 2.1.1 (as detailed below).

The Council Decision Annex assumes that waste fulfils the Landfill Directive definition of inert and Council Decision Annex, Section 2.1.2 reaching limit values where it is on a short list of wastes on the 'absolute' non-hazardous waste classification. Any mirror entry codes will require a non-hazardous classification as per WM2. We have summarised this in Table 5.1.

Please refer to the Council Decision Annex, Section 2.1.1 for the conditions and limitations of use of this table. You must also be able to classify the mirror entry codes (identified as MN in Table 5.1[14]) as non-hazardous in accordance with the Hazardous Waste technical guidance (WM2)

Table 5.1 Waste acceptable at landfill for inert waste without testing, derived from a single source

EWC code	Description	Restrictions
10 11 03 (AN)	Waste glass-based fibrous materials	Only without organic binders
15 01 07 (AN)	Glass packaging	
17 01 01 (AN)	Concrete	Selected C & D waste only(*)
17 01 02 (AN)	Bricks	Selected C & D waste only(*)
17 01 03 (AN)	Tiles and ceramics	Selected C & D waste only(*)
17 01 07 (MN)	Mixtures of concrete, bricks tiles and ceramics	Selected C & D waste only(*)
17 02 02 (MN)	Glass	

[14] Recent Agency investigations have demonstrated that 61% of Mirror Entry EWC coded Construction and Demolition Waste was wrongly classified as inert. You must ensure by visual inspection that your waste is not mixed and is free of contamination (including soluble organic components).

17 05 04 (MN)	Soil and stones	Excluding topsoil peat; excluding soil and stones from contaminated sites
19 12 05 (AN)	Glass	
20 01 02 (AN)	Glass	Separately collected glass only
20 02 02 (AN)	Soil and stones	Only from garden and parks waste; Excluding top soil peat

AN - 'Absolute' non-hazardous entry. MN - mirror entry non-hazardous
(*) Selected Construction and Demolition waste (C & D waste): with low contents of other types of materials (like metals, plastic, soil, organics, wood, rubber, etc). The origin of the waste must be known.
— No C & D waste from constructions, polluted with inorganic or organic dangerous substances, e.g. because of production processes in the construction, soil pollution, storage and usage of pesticides or other dangerous substances, etc., unless it is made clear that the demolished construction was not significantly polluted.
— No C & D waste from constructions, treated, covered or painted with materials, containing dangerous substances in significant amounts.

In addition to the above waste codes, testing is not required where the waste is in a physical form that prevents testing or where specific wastes have known composition and properties that would cause undue health and safety concerns when tested. By definition, these wastes contain dangerous substances and would be classified as hazardous.

In both cases a testing laboratory should be consulted for confirmation that the waste is not suitable for testing and the justification agreed with the Environment Agency at the earliest opportunity prior to completion of the Basic Characterisation.

5.2 Sample characterisation

There are four types of sample characterisation required by the Basic Characterisation, namely:

- Source information;
- Visual (descriptive);
- Total concentration;
- Leachable content.

Where a producer or landfill operator undertakes chemical testing, it must follow the procedures in the Council Decision Annex, section 3. We identify the key procedural stages in Appendix 3 to this guidance.

It is the waste producer's responsibility to provide a detailed Basic Characterisation based on:

- Substances identified from a knowledge of the process generating the waste.
- A suite based on the requirements of WM2 and Table 5.2.

The total concentration elements of the Basic Characterisation comprise a wider suite of substances than those identified for leaching limits (Table 5.2). Where a testing suite has been carried out under the requirements of WM2, the waste producer can use this data to demonstrate whether a waste is hazardous or non-hazardous and for the receiving landfill operator to understand the nature of the waste they will be receiving.

Examples of specific total chemical testing over and above the requirements of Table 5.2 will include solvents, petroleum products, pesticides and herbicides, inorganic

nitrogen forms (e.g. ammonium, cyanide, nitrate, nitrite), carbides, metal oxides, native metals, phosphates and phosphides, oxidising agents, etc.

In some circumstances and for some waste types, different tests may be of value to assist in the characterisation of leaching behaviour. For most wastes destined for disposal in landfill sites government[15] consider that a single step leaching test at a Liquid to Solid (L:S) ratio of 10:1 l/kg is adequate for establishing and monitoring the cumulative mass leached and general leaching behaviour.

The limits in Table 5.3 are set at a level where a single waste stream should not have a discernible impact or unacceptable impact[16] on leachate quality (unless landfilled in a specifically designated mono-cell). However, the L:S 10:1 ratio leaching test has limited use in determining the initial leachate concentration expected from the presence of a highly leachable constituent (for example, chloride).

It may be that the cumulative mass leached does not provide sufficient information to fully characterise the waste for operational controls and risk assessment purposes. A **landfill** operator may request evidence from a leaching test at a lower liquid to solid ratio (For example, at L:S of 2:1, or L:S of 0.1:1, by batch or column test) to determine if the waste is acceptable for disposal without further treatment.

The leaching test is sensitive to the exact method of extraction and filtration. We outline further information on the required techniques in Appendix 3 to this guidance.

5.3 Characterisation information

The waste producer's characterisation should include as a minimum, the following background information on the source and origin of the waste and specific chemical test data, unless there is a specific reason why testing is unnecessary. These details should be readily available to the waste producer.

- Waste source and origin.
- The code applicable to the waste under the European Waste Catalogue (EWC)[17] .
- Determination if the waste has any hazardous properties as per WM2;
- In the case of hazardous waste, the properties which render it hazardous.
- The process producing the waste (including a description of the process, its SIC code for receipt at the landfill, the characteristics of its raw materials and products which may affect its behaviour under landfill conditions).
- The waste treatment applied, or a statement of why treatment is not considered necessary.

[15] Environmental Permitting (England and Wales) Regulations 2010, schedule 10, paragraph 7(e)

[16] i.e. the impact is within the parameters assessed in the site's hydrogeological risk assessment

[17] In England, the EWC is transposed into domestic legislation by The List of Wastes (England) Regulations 2005 SI 2005/895. We refer to the EWC here to reflect the requirements of the Council Decisions annex, paragraph 1.1.2(f). Hereafter we will refer to the list of wastes.

- The appearance of the waste (including smell, colour, consistency and physical form).
- Confirmation that the waste is not prohibited from disposal to landfill (for example liquid waste and whole used tyres).
- The class of landfill the waste can be disposed at.
- Confirmation of whether the waste requires testing. If the producer decides that he cannot[18] or should not[19] test, he must agree why with the Environment Agency.

We expect the following for wastes that require sampling and testing:

- The full composition of the waste including hazardous constituents / properties based on the known composition of the waste and likely contaminants. The suite analysed should be informed by the requirements of WM2.
- The likely behaviour of the waste in a landfill and any additional precautions the landfill operator must take. This may include short term leaching effects if highly leachable components are present.
- An assessment against any relevant limit values and its other characteristic properties.
- Identification of key variables for compliance testing for regularly generated wastes.

The specific suite requirements should be based on:

- WM2.
- Source material knowledge.
- Whether additional testing is required.
- The proposed disposal route WAC requirements and any additional substances not identified below.

Where a waste producer does not test his waste, references should be provided to the WM2 classification information or commentary made why a test is unnecessary. The waste producer must agree the testing suite with the landfill operator.

This includes reference to the justification of why leaching tests are not carried out for landfill classes where limits are not set at the EU level, that is, non-hazardous waste. Notwithstanding this, the waste must conform to the risk based framework used to permit the site; hence a knowledge of the likely leaching behaviour under landfill conditions is required.

[18] *i.e.* a physical form that makes testing impractical. A testing laboratory should be consulted for confirmation and justification agreed with the Environment Agency

[19] *i.e.* specific wastes which have known detailed composition and properties that would cause undue health and safety concerns when tested. By definition, these wastes contain dangerous substances and would be classified as hazardous. A testing laboratory should be consulted for confirmation and justification agreed with the Environment Agency

Table 5.2: Basic Characterisation

Tests to consider	Parameter	Commentary required to discuss data (where necessary), justify why a specific test was not carried out or supply descriptive information
Source & originating process		Description
Appearance	Visual description	Include artificial constituents and soil type (e.g. silty clay), as well as material size variability with particular attention paid to oversized material and non-crushable material
Population Size		Quantity to be disposed of
Sub-population Size		See attached glossary and Technical Guidance WM2
Nature	Homogeneous Heterogeneous	Delete as applicable Comment on whether heterogeneous nature is visible
EWC Code and Waste Classification	6-digit code AH/MH/MN/AN* Inert	*AH - Absolute Hazardous, MH - Mirror Hazardous entry (to be confirmed by testing and/or source material knowledge), MN - Mirror Non-hazardous (to be confirmed following Hazardous Waste Guidance WM2). AN - Absolute non-hazardous entry (testing and/or source knowledge required to demonstrate inert status)
Disposal Route	For Treatment Hazardous SNRHW Non-hazardous Inert	Site Type - Delete as applicable
Total concentration for Basic Characterisation		
Refined Petroleum Hydrocarbons	C6- C40	Speciated to include PAH (US EPA 16 and B(a)P, BTEX, and aliphatic hydrocarbons
PCBs (for disposal to inert waste sites only)	7 congeners	PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180 * (BS EN 15308:2008, the Barbour index)
Organic screens	VOC SVOC pesticide / herbicide	To be considered and extended if appropriate based on a knowledge of the source material
Inorganic Screen	e.g. cyanide ammonia	To be considered and extended if appropriate based on a knowledge of the source material
Acid Neutralisation Capacity / pH		Determination of whether a waste is corrosive or caustic to include leachable pH
Asbestos	Presence or absence/ trace	Include commentary if test is not required or discussion where trace quantities are below quantifiable amounts
Matrix constituents - anions - cations	Mineral CO_3 Ca, Mg, Na, K	Identify the type and nature of the unanalysed components (with justification) where composition does not equate to 100% (e.g. unanalysed silicates)
Total and leachable concentration for Basic Characterisation		
Matrix Constituents	Cl, SO_4, F	
Inorganic Contaminants of Concern	Cd, Hg, Pb, Ni, Cr, Cu, Zn, Sn As, Se, Mo, Sb Fe, Mn, Ba	Speciate for Cr(VI) based on knowledge of source material
Total Organic Content (TOC) and Loss on Ignition (LOI)	TOC* & DOC	Comment if possible between active / degradable content and natural stabilised soil organic matter for process control. Distinguish inorganic carbon (i.e. elemental & carbonate) from organic carbon *LOI can be substituted for TOC.
Phenol Index	(leachable only)	(For inert classification only)

Note: additional substances may be required based on source knowledge

Table 5.3: Criteria for granular waste acceptable at landfills (Transposed from Council Decision annex 2003/33/EC)

Parameter	Inert waste landfill	Stable non-reactive hazardous waste and non-hazardous waste co-disposed with SNRHW	Hazardous waste landfill
Parameters determined on the waste – total concentration			
Total organic carbon (%w/w)	3%	5%	6%*
Loss on ignition (%w/w)			10%*
BTEX (mg/kg)	6		
PCBs (7 congeners) (mg/kg)	1		
Mineral oil C10-C40 (mg/kg)	500		
PAHs (mg/kg)	100		
pH		>6	
Acid neutralisation capacity		To be evaluated	To be evaluated
Limit values (mg/kg) for compliance leaching testusing BS EN 12457 at L/S 10 l/kg			
As (arsenic)	0.5	2	25
Ba (barium)	20	100	300
Cd (cadmium)	0.04	1	5
Cr (chromium (total))	0.5	10	70
Cu (copper)	2	50	100
Hg (mercury)	0.01	0.2	2
Mo (molybdenum)	0.5	10	30
Ni (nickel)	0.4	10	40
Pb (lead)	0.5	10	50
Sb (antimony)	0.06	0.7	5
Se (selenium)	0.1	0.5	7
Zn (zinc)	4	50	200
Cl (chloride) +	800	15,000	25,000
F (fluoride)	10	150	500
SO_4 (sulphate)	#1,000	20,000	50,000
Total dissolved solids (TDS)+	4,000	60,000	10,0000
Phenol index	1		
Dissolved organic carbon at own pH or pH7.5-8.0@	⊕500	800	1,000

* Either TOC or LOI must be used for hazardous wastes

If an inert waste does not meet the SO_4 L/S10 limit, alternative limit values of 1500 mg/l SO_4 at C_0 (initial eluate from the percolation test (prCEN/TS 14405:2003)) AND 6000 mg/kg SO_4 at L/S10 (either from the percolation test or batch test BS EN 12457), can be used to demonstrate compliance with the acceptance criteria for inert wastes.

+ The values for TDS can be used instead of the values for Cl and SO_4.

@ DOC at pH 7.5-8.0 and L/S10 can be determined on eluate derived from a modified version of the pH dependence test, prCEN/TS 14429:2003, if the limit value at own pH (BS EN 12457 eluate) is not met.

⊕ In the case of soils, a higher TOC limit value may be permitted by the Environment Agency at an inert waste landfill, provided the DOC value of 500mg/kg is achieved at L/S 10 l/kg, either at the soil's own pH or at a pH value between 7.5 and 8.0.

6 Information Interpretation

6.1 Introduction

Waste producers must consider information from the visual assessment, knowledge of the source material and sampling and analysis to determine whether a waste is hazardous or non-hazardous waste[20]. The test data should also show whether the waste could comply with the WAC limit values for the proposed class of landfill.

For the purposes of this guidance, we have assumed that waste producers can separate their waste populations so that they can classify each waste under a single EWC code. Wherever possible you must separate mixed wastes that you cannot classify under a single EWC code and classify them individually. Where separation is not possible, you must classify the waste under the most appropriate hazardous classification.

A key factor in a sampling and analysis programme is to properly classify and characterise a waste population to decide whether it is above or below a WAC limit value for acceptance at a given class of landfill site. However, given the variability in waste, we accept it is possible that individual samples analysed are not representative of the waste as a whole. In these cases, at the landfill operator's discretion, we will accept the use of statistical techniques using all available data as part of the decision making process for waste acceptance. Further information on statistical methods that you can use is in our Hazardous Waste Technical Guidance WM2.

For statistical interpretation purposes we will accept all 'less than' concentrations to be at the limit of detection providing they are below the leaching limit value.

This is a significant change from the current practice, which does not allow any statistical interpretation of WAC limit data. Whenever a statistical interpretation is included as part of a Level 1 or Level 2 test interpretation, you must clearly identify it and discuss it with the landfill operator. They will notify us as part of routine information submissions.

Applying this approach is not mandatory. Landfill operators can insist that a waste is below all WAC limit values for any waste sent to them.

We intend to apply this statistical approach to assessing compliance to help us understand the proportion of samples failing and thus build evidence about the effectiveness of the statutory analytical methods. We will continually review the approach and may remove it on advice from government or regulatory experience.

6.2 Basic characterisation (Level 1 Testing)

The waste producer is responsible for the Basic Characterisation and must firstly decide if the waste is hazardous or non-hazardous, by referring to the EWC code and/ or following the approach in WM2 to classify a waste population. compliance with the waste acceptance criteria must then be established for both total concentration and leachable content.

Where the characterisation data suggests that certain substance concentrations exceed the WAC limit values for a specific class of landfill due to statistical outliers,

[20] Recent Agency investigations have demonstrated that over 61% of construction and Demolition waste tested was not inert.

then the waste producer must take more samples to achieve greater certainty to develop a more representative characterisation. The producer can use the data from the additional sampling to show whether a large or minor proportion of the original data was unrepresentative of the waste originally sampled and whether the overall concentration (that is, if the entire waste mass could be sampled) is within the WAC limits set for the proposed class of landfill.

The waste producer can use any of the statistical methods to demonstrate that their waste has been properly classified as hazardous or not.

There are a number of methods for establishing that the waste is below an appropriate WAC limit value which can be transposed from the approach taken for classifying a waste as hazardous or non-hazardous as set out in WM2. Table 6.1 illustrates the minimum number of samples required to reach the 95th percentile confidence level (the level we will accept for compliance purposes):

- A minimum of 2 samples (Section 4) will be required to demonstrate WAC limits for wastes landfilled under a single EWC code.
- For mirror-entry wastes, the total concentration elements of the Basic Characterisation should follow WM2.
- Where there has been a failure of a specific WAC limit a minimum of 5 samples (Table 6.1) will be required to demonstrate that a waste can be accepted at a particular class of landfill.
- Where the waste producer cannot demonstrate that their waste is homogeneous (from prior knowledge of the waste type) or the average concentration approaches a WAC limit, we expect the waste producer to take additional samples to conclusively show that a limit has not been exceeded.

Table 6.1 Number of Samples Required to Pass the Statistical Test Limit (using Non-parametric Method)

Number of samples analysed	Number of failures that can occur and allow the average concentration to be estimated as below the leaching limit with sufficient confidence (95th percentile	Number of samples that must be below the test limit
<5	0	all
5	1	4
6	1	5
8	2	6
10	2	8

We present worked examples of the non-parametric method for a soil and filter cake in Appendix 2 of this guidance document.

You may also apply the other statistical techniques presented in WM2, including those based on a mean and standard deviation.

6.3 Compliance (Level 2 testing)

Waste producers may undertake Level 2 Compliance testing for regularly generated wastes to demonstrate consistency with the Basic Characterisation. They must maintain an ongoing statistical record for each sub-population of regularly generated waste tested (to the schedule identified in the Basic Characterisation) to demonstrate that:

- The average concentration between successive sub-populations does not change so much from the Basic Characterisation that the waste would have to be sent to a different class of landfill.
- There is no significant increase in average concentration in successive sub-populations.

All Level 2 Test data must be supplied to the receiving landfill operator for each Level 2 test undertaken to the schedule required by the Basic Characterisation. The waste producer should also identify the cumulative quantity of waste disposed of under each Basic Characterisation and the frequency of testing.

If a sample exceeds a total concentration or leaching limit, this may be limited to the specific sub-population tested or may reflect a real change in the waste population. The producer must confirm the result by taking additional samples so that he understands the reasons for that variability. This should include analysis of each individual batch that makes up the sub-population.

The waste producer should undertake statistical analysis and the application of the limits in Table 5.2 to demonstrate that there is no significant change to the average concentration or classification. Where there is a significant change, the waste producer must repeat the Basic Characterisation.

6.4 Verification (Level 3 testing)

Landfill operators can identify non-conforming wastes by visual inspection at the site entrance and/ or point of disposal and by comparing this with the written description of the waste that accompanies the load.

The waste may only be accepted at the landfill, if it is the same as that which has been subjected to basic characterisation and/ or compliance testing and which is described in the accompanying documents. If this is not the case, the waste must not be accepted.

Landfill operators must either reject the waste load or quarantine any such waste until the waste producer demonstrates that it is acceptable for disposal. We suggest a waste producer - operator 'Partnership Approach' with full disclosure of data for verification testing for regularly generated wastes.

Where there is reasonable doubt that the waste is not as described, the landfill operator must refuse to accept the waste. All rechecked loads must be documented and recorded.

The Council Decision requires that Member States shall determine the testing requirements for on-site verification (i.e. Table 4.1), including where appropriate rapid test methods. Where there has been the failure of a limit the landfill operator must:

- Cross-check the test data provided with the waste to the site's risk assessment for both leachable and total concentration (for example, organic

carbon), so that he can decide whether the objectives of Section 1.2, bullet points 2 and 3 are met (that is, a risk-based demonstration[21] that the waste would not cause pollution from leachate seepage or uncontrolled landfill gas emissions).

- Assess the landfill site's test data with the data supplied prior to receipt to assess whether the total waste population received is acceptable at the site.

Where Basic Characterisation or Compliance testing results exceeds leaching limit values, but statistical analysis shows that the waste population is acceptable, then in order to continue accepting the waste, landfill operators must be supplied with:

- Additional testing of the waste (i.e. increase the Level 1 and 2 testing frequency to a re-evaluated suite, informed by the test data).
- Increase the verification sampling density for that waste stream.
- Comment in the following year's annual report whether that waste has had any impact on the site's leachate chemistry and/ or surface emissions.

Where landfill operators cannot confirm the classification and / or the waste exceeds WAC limits, they should not continue to accept the waste population at the site until the waste producer has provided adequate characterisation information.

We consider it good practice for landfill operators to routinely test all the waste they accept at the sampling density suggested in Table 4.1.

[21] this assessment can be a demonstration that the waste accepted is compatible with an existing hydrogeological or landfill gas risk assessment

References

The Waste Hierarchy: EC Council Decision 2008/98/EC of 19 November 2008. http://www.defra.gov.uk/environment/waste/legislation/waste-hierarchy/

The Landfill Directive: EC Council Directive 1999/31/EC of 26th April 1999 as applied under the Environmental Permitting (England and Wales) Regulations 2010. http://www.environment-agency.gov.uk/business/regulation/31867.aspx

Waste Acceptance Procedures EC Council Decision 2003/33/EC of 19th December 2002 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:011:0027:0049:EN:PDF

The Environmental Protection (Duty of Care) Regulations 1991 (as amended)

The List of Wastes (England) Regulations 2005 SI 2005/895 http://www.legislation.gov.uk/uksi/2005/895/contents/made

Environment Agency, 2011 Hazardous Waste: Interpretation of the definition of hazardous waste. Technical Guidance WM2 http://publications.environment-agency.gov.uk/PDF/GEHO0411BTRD-E-E.pdf

Environment Agency, 2011. Classifying and coding wastes from physico-chemical treatment facilities (HWR06) http://www.environment-agency.gov.uk/business/topics/waste/104765.aspx

Environment Agency, 2011. Treatment of waste for landfill http://publications.environment-agency.gov.uk/PDF/GEHO1111BVDF-E-E.pdf

Environment Agency, 2010. Waste acceptance at landfill http://www.environment-agency.gov.uk/business/sectors/108918.aspx

Environment Agency, 2011. Guidance on hazardous waste http://www.environment-agency.gov.uk/business/topics/waste/32200.aspx

Environment Agency, 2011 Guidelines for Ash Sampling and Analysis http://publications.environment-agency.gov.uk/PDF/GEHO0311BTPZ-E-E.pdf

List of abbreviations

ANC	Acid neutralising capacity
BTEX	Volatile aromatic hydrocarbons benzene, toluene, ethylbenzene and xylenes
DOC	Dissolved organic carbon
EWC	European waste catalogue
LOI	Loss on ignition
LoW	List of Wastes
MFSU	Manufacture, formulation, supply and use
PAH	Polycyclic aromatic hydrocarbons
SIC	Standard Industrial Classification
SVOC	Semi-volatile organic compound
TOC	Total organic carbon
VOC	Volatile organic compound
WAC	Waste acceptance criteria

Glossary

Mirror-entry
A European Waste Catalogue term for waste types which could be classified as either hazardous or non-hazardous dependent on the presence of dangerous substances. Classification as hazardous or non-hazardous must be confirmed by testing for wastes capable of being tested.

Waste population
The 'population' is the total amount of waste that you want to obtain information on by sampling. Examples might include:

- A single container of waste.
- A batch of waste from a process (including an excavated soil stock(pile); or
- A continuous stream of waste produced by a production process in a specific period of time (e.g. a day, a week, a month).

The population must always be defined explicitly with reference to spatial or temporal factors otherwise it is impossible to determine if sampling of that population is representative or not. The choice of population relies on experience and judgement, rather than statistics.

Key point: If the waste producer defines a population as the waste from a process produced over a period of one month, then the testing programme will not be complete until that one month of production has been sampled. The waste producer cannot assess, classify and dispose of the waste before then. Once the population has been characterised properly for WAC, then a further testing programme will be required if the process continues under Level 2 sampling and testing frequencies.

Waste sub-populations
It is sometimes necessary to divide a population into sub-populations; that is, a portion of the population that the waste producer needs to sample and consider the results separately. For example, a process might generate 24 batches of waste (the population), however each batch is a sub-population that is sampled and assessed separately.

The division into sub-populations is required where the samples from one portion of the population generate a different classification when considered separately from another portion. If the waste producer wishes to consider all the wastes to be part of a single population, with no sub-populations, the testing programme would need to demonstrate that this is a reasonable assumption and that no sub-populations exist.

The nature of the waste production process is the principal factor that determines the need for sub-populations. The more consistent, controlled and characterised the process, its outputs and its raw materials/feedstock, the fewer sub-populations are likely to be generated.

Sub-populations may also be generated:

- Where access restrictions inhibit or prevent access to the population as a whole; or
- by characteristics such as non-conforming or deviating parts in the waste.

Due consideration needs to be given to 'scale' when defining the subpopulation.

You can only consider the samples taken from a sub-population to be representative of that sub-population. The relevance of these results to the population is entirely dependent on the validity of the assumptions made in generating the sampling plan.

One-off production waste

The simplest form of waste production is a one-off production of a single waste stored in a single container, stockpile, lorry or other container. The waste producer can easily define the 'population' as the material in the specific container or location. There is no need to divide this into sub-populations.

The next level of complexity is where a one-off production of a waste is stored in more than one container. Although sampling would normally include multiple containers, the need to divide this into sub-populations would be dependent on whether other factors differentiate the containers (for example different storage conditions or methods).

Continuous production of a homogenous stream of waste

Where a continuous process produces a stream of waste that is homogenous, the waste producer can define the population in time. For example, all the waste produced in one month or one year.

The waste producer can use his sampling plan for that entire period to classify and assess his waste. However, the Sampling Plan would have to demonstrate that the material is homogenous. We would look for two key factors to underpin this:

- A process with demonstrably consistent, well characterised, and controlled inputs/ raw materials that do not vary in composition or quantity.
- The results from the sampling demonstrate that no statistical difference exists between samples taken over the time period (i.e. one batch is the same as any other).

This is more likely to be applicable to manufacturing processes using quality raw materials, than the waste disposal or recovery processes where the waste producer cannot achieve that level of input control.

Continuous production of a heterogeneous stream of waste

Continuous production processes can often result in a stream of heterogeneous (variable quality) waste. This is particularly true of waste disposal or recovery processes where the nature, composition, consistency and quantity of input materials is more variable than the higher quality raw materials used in production processes.

(a) Wastes regularly generated in the same process

These are individual and consistent wastes regularly generated in the same process, where:

- The installation and the process generating the waste are well known and the input materials to the process and the process itself are well defined.
- The operator of the installation provides all necessary information and informs the operator of the landfill of changes to the process (especially changes to the input material).

The process will often be at a single installation. The waste can also be from different installations, if it can be identified as single stream with common characteristics within known boundaries (e.g. bottom ash from the incineration of municipal waste).
For these wastes the basic characterisation will comprise the fundamental requirements listed in section 1.1.2 and especially the following:

- Compositional range for the individual wastes.
- Range and variability of characteristic properties.
- If required, the leachability of the wastes determined by a batch leaching test and/or a percolation test and/or a pH dependence test.
- Key variables to be tested on a regular basis.

If the waste is produced in the same process in different installations, information must be given on the scope of the evaluation. Consequently, a sufficient number of measurements must be taken to show the range and variability of the characteristic properties of the waste. The waste can then be considered characterised and shall subsequently be subject to compliance testing only, unless significant change in the generation processes occur.

For wastes from the same process in the same installation, the results of the measurements may show only minor variations of the properties of the waste in comparison with the appropriate limit values. The waste can then be considered characterised, and shall subsequently be subject to compliance testing only, unless significant changes in the generation process occur.

Waste from facilities for the bulking or mixing of waste, from waste transfer stations or mixed waste streams from waste collectors, can vary considerably in their properties. This must be taken into consideration in the basic characterisation. Such wastes are more likely to fall under case (b).

(b) Wastes that are not regularly generated

These wastes are not regularly generated in the same process in the same installation and are not part of a well-characterised waste stream. Each batch produced of such waste will need to be characterised. The basic characterisation shall include the fundamental requirements for basic characterisation. As each batch produced has to be characterised, compliance testing is not appropriate.

Appendix 1

Consultations

Views on drafts of this document were sought from all of the national landfill operators, hazardous waste treatment operators and testing laboratories as well as two industry bodies; the Landfill Regulatory Group Compliance sub-group and Mineral Products Association. The consultations have been focused on the companies who have to date taken responsibility for ensuring classification and testing before disposal.

We received comments from 80% of the national landfill operators, testing laboratories and hazardous waste treatment operators. We also received comments from representatives of environmental consultants, waste producers and regional waste treatment companies. The following companies and bodies are thanked for their consultation comments throughout the development of this guidance:

AMEC Environment & Infrastructure

Alcontrol Laboratories

Augean PLC

Bone Environmental Consultancy Ltd.

Castle Environmental

Chemtest Ltd

Churngold Group Ltd

Cory Environmental Ltd

Derwentside Environmental testing Services

Environmental Scientifics Group

FCC Environmental (formerly WRG)

Hanson

Hills Waste Solutions

Lafarge

LRG compliance sub-group

Minerals Products Association

MJCA

Outo Kumpu

Red Industries

Scientific Analysis Laboratories

Severn Trent Services

Shotley Holdings Ltd

Tata Steel

Veolia Environmental Services

Viridor

Appendix 2

Data interpretation

We have produced two worked examples using data from a recent inter-laboratory trial under the CONTEST scheme for a soil and for a filter cake produced at a waste treatment plant.

The soil would fail the inert WAC limits for at least 9 parameters and would be classified as non-hazardous. The filter cake fails the SNRHW limit for 11 parameters and the hazardous waste limits for 5 parameters and hence could not be accepted at a landfill without further treatment. However, an inspection of the data demonstrates that the majority of limit failures were not representative of the majority of the results and under most circumstances would be considered as statistical outliers. For demonstration purposes of a proposed methodology to interpret these results an illustrative proportion of the data has been considered in more detail below.

Statistical interpretation

Section 6 of this guidance, identifies a method for assessing analytical data which should be carried out on a substance by substance basis. For samples where the nature of the statistical distribution is uncertain, this is the non-parametric method presented in WM2. This method is based on a sample median (50th percentile) and a probabilistic demonstration that:

- at least 95% of samples are within the WAC limit; and that
- when the analytical variation is taken into account average concentrations are within the limit for each substance.

For waste acceptance purposes where statistical techniques are being used, the primary objective is to demonstrate that the waste population being considered is below the WAC limit (to a pre-defined level of confidence), primarily by demonstrating that any limit exceedances are not representative of the whole population. This test, based on the cumulative binomial distribution of the test data, is shown below using the following steps:

Step 1.

Average (mean and median) concentrations can be used to support a case and establish the whole waste composition. Mean concentrations are determined by dividing the cumulative concentration by the number of samples.

For the median concentration, sample results are ranked, with the lowest concentration assigned the rank (r) of 1, the second lowest rank of 2.

The median concentration is the middle sample number and can be identified from the following equation:

X_{50} = (No Samples +1)/2.

for 22 samples X_{50} = (22+1)/2 = 11.5

X_{50} is therefore estimated by the sample with rank 11.5, which can be rounded up to the sample with rank 12.

Step 2.

The 95th% confidence interval that the estimate of X_{50} for 'n' samples is below the WAC limit can be defined by the following cumulative binomial expression to identify the lowest ranked sample (r) that satisfies the expression

- CumB(r; n, 0.5) ≥ 0.95

This can be calculated using the expression "Binomdist(r-1, n, 0.5, True)" in readily available spreadsheet software.

Where the average waste concentration and the 95th percentile ranked samples concentration is below the WAC limit, a case could be made that the waste population being considered is acceptable for disposal by landfilling. For less than five samples, the 95th percentile test would automatically be failed if one sample fails a WAC limit test.

Two worked examples are presented below

Example - soil sample

Twenty two samples were taken of a soil for leaching tests to determine if it is acceptable for disposal within a landfill for inert waste.

The data indicates that up to 6 samples failed the inert leaching test criteria.

Each sample was then ranked from the lowest concentration to the highest concentration for each substance and given the ranks r1 to r22 as a series of columns within a spreadsheet.

The binomial distribution for each sample rank was then calculated within the spreadsheet using the function "Binomdist(r-1, 22, 0.5, True)" and the percentile confidence level calculated for each sample rank.

From the distribution of the upper confidence limit is represented by the 16th Sample.

All substance concentrations for the 16th ranked sample were within the inert waste leaching test limits and therefore the soil would be considered as acceptable for disposal at a landfill for inert waste if the average mercury concentration was below the threshold limit.

Although mercury median concentrations are within the test limit, the average (mean) concentration is double the test limit. However, the mean is significantly skewed by two samples. In such cases we recommended that the waste is either disposed of via an alternative route or further samples taken to comprehensively demonstrate that the highest concentrations reported are likely to be analytical irregularities.

Table A1 Estimate of confidence level that a soil is acceptable for disposal at a landfill for Inert waste using the binomial statistical test

r (Sample No)	r -1	Binomial Dist	Antimony	Selenium	Cadmium	Mercury
(Column A)	(Column B)	Cum B	mg/kg	mg/kg	mg/kg	mg/kg
1	0	0.0000	0.000	0.000	0.000	0.000
2	1	0.0000	0.005	0.001	0.000	0.000
3	2	0.0001	0.009	0.001	0.000	0.000
4	3	0.0004	0.010	0.002	0.001	0.000
5	4	0.0022	0.010	0.002	0.001	0.000
6	5	0.0085	0.010	0.002	0.001	0.000
7	6	0.0262	0.010	0.003	0.001	0.000
8	7	0.0669	0.011	0.004	0.001	0.001
9	8	0.1431	0.013	0.010	0.001	0.001
10	9	0.2617	0.016	0.010	0.002	0.001
11	10	0.4159	0.016	0.010	0.002	0.002
12	11	0.5841	0.017	0.010	0.003	0.002
13	12	0.7383	0.020	0.014	0.004	0.003
14	13	0.8569	0.020	0.020	0.005	0.005
15	14	0.9331	0.020	0.030	0.005	0.005
Minimum No samples which must pass the test limit AND average concentration be within limit						
16	**15**	**0.9738**	**0.021**	**0.040**	**0.005**	**0.005**
17	16	0.9915	0.021	0.050	0.007	0.011
18	17	0.9978	0.028	0.050	0.008	0.012
19	18	0.9996	0.040	0.080	0.010	0.030
20	19	0.9999	0.100	0.120	0.020	0.050
21	20	1.0000	0.120	0.320	0.050	0.140
22	21	1.0000	0.300	0.320	0.060	0.210
Average (mean) concentration			0.04 (pass)	0.05 (pass)	0.01 (pass)	0.02 (fail)
Inert Leaching Limit			**0.06**	**0.1**	**0.04**	**0.01**
Number analyses			22	22	22	22
Max number of failures allowed from 22 tests			7	7	7	7
Samples above Inert Limit			3 (pass)	3 (pass)	2 (pass)	6 (pass)

Shaded cells – Concentration exceeds the leaching test limit for inert waste

Example - treatment plant filter cake

Twenty six samples were taken of a plant filter cake for leaching tests to determine if it is acceptable for disposal within a SNRHW cell or a landfill for hazardous waste.

Each sample was then ranked from the lowest concentration to the highest concentration for each substance and given the ranks r1 to r26 as a series of columns within a spreadsheet.

The binomial distribution for each sample rank was then calculated within the spreadsheet using the function "Binomdist(r-1, 26, 0.5, True)" and the percentile confidence level calculated for each sample rank.

From the distribution of the upper confidence limit is represented by the 17th ranked sample.

Table A2 Estimate of confidence level that a filtercake is acceptable for disposal at a hazardous waste site using the binomial statistical test

r	r-1	Binomial Dist	Ba	Cr	Ni	SO_4	Cl
(Column A)	(Column B)	Cum B	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1	0	0.0000	0.31	0.47	2.88	3,813	5,280
2	1	0.0000	1.2	0.69	4.5	4,700	29,020
3	2	0.0000	1.6	0.7	4.7	8,000	45,360
4	3	0.0000	1.8	0.94	5.54	8,060	53,870
5	4	0.0003	1.9	0.95	5.92	8,157	56,302
6	5	0.0012	2	0.96	7.63	8,189	57,342
7	6	0.0047	2	0.98	7.76	8,304	57,460
8	7	0.0145	2	0.99	7.85	8,430	57,550
9	8	0.0378	2.02	1.01	7.9	9,020	58,550
10	9	0.0843	2.1	1.07	7.97	9,165	60,034
11	10	0.1635	2.2	1.1	9.1	9,290	61,200
12	11	0.2786	2.2	1.1	9.2	9,290	61,800
13	12	0.4225	2.3	1.1	9.29	9,454	62,028
14	13	0.5775	2.3	1.12	9.36	9,530	62,934
15	14	0.7214	2.4	1.16	9.4	9,670	63,469
16	15	0.8365	2.4	1.17	10	9,987	64,000
17	16	0.9157	2.5	1.22	10.11	9,999	64,330
Minimum No samples which must pass the test limit AND average concentration be within limit							
18	17	0.9622	2.5	1.23	10.15	10,000	64,408
19	18	0.9855	2.5	1.24	10.65	10,000	64,500
20	19	0.9953	2.5	1.32	10.86	10,000	64,900
21	20	0.9988	2.6	1.4	10.95	10,217	65,652
22	21	0.9997	2.6	1.41	11	10,725	66,500
23	22	1.0000	2.7	1.47	11.1	11,005	67,540
24	23	1.0000	2.9	1.49	11.43	12,590	71,056
25	24	1.0000	3.1	1.49	11.81	13,472	83,945
26	25	1.0000	45	4.4	12	28,240	84,000
Average (mean) concentration			4	1.2	9	9,973	59,732
SNRHW Leaching Limit			**10**	**0.2**	**10**	**20,000**	**15,000**
Haz Waste Leaching Limit			**30**	**2**	**40**	**50,000**	**25,000**
No Analyse			26	26	26	26	26
Max No failures from 26 tests			9	9	9	9	9
Samples above SNRHW limit			1	26	10	1	25
Samples above Hazardous waste limit			1	1	0	0	25

Brown shaded cells between SNRHW and hazardous waste limit.

Red shaded cells above hazardous waste limit

The data indicates that for chromium all samples failed the SNRHW limit. One sample also failed the hazardous waste limit for chromium and barium which is otherwise below the WAC limit for a SNRHW site. A single exceedence of the hazardous waste limit for chromium is within tolerance as indicated by the maximum number of failures.

However, chloride failed the hazardous waste limit for 25 out of the 26 samples.

Therefore, disposal could not be considered to a landfill for hazardous waste and further treatment would be required prior to disposal.

Appendix 3

Sample preparation and analysis

Analysis of the waste should be carried out to industry standard methods capable of meeting the limits of detection required. Samples must be taken into appropriate containers (including consideration of glass and no headspace where organic and volatile parameter analysis is also being undertaken). Additionally, where compounds have short stability times, efforts should be made to minimise sample degradation by correct storage/ transportation conditions and carrying out analysis as soon as possible after sampling to avoid the sample being classed as unrepresentative.

The person sampling the waste should seek advice from their testing laboratory.

Recommended leaching test

Legislation requires that leaching test report to the L:S 10 l/kg test Method BS EN 12457:2002. We recommend that the test is performed to BS EN 12457-2:2002

"Characterisation of waste – Leaching – Compliance test for leaching of granular waste materials and sludges – Part 2 One stage batch test at a liquid to solid ratio of 10 l/kg for materials with high solid content and with particle size below 4mm (without or with size reduction)."

However, where a size reduction to 4mm is not possible we will accept the method BS EN 12457-4:2002 for a particle size below10mm.

The main points to note of this method are:

- Moisture content of the waste is required to determine the amount of water to add in the leaching process.
- 95% of the sample used should have particle size of <4mm. If necessary samples should be ground to achieve this (under no circumstances should the sample be ground finer).
- An end over end or roller bed shaker is the preferred option. A flatbed shaker is unsuitable.
- After leaching the total eluate should be filtered through a 0.45µm membrane filter.

Alternative leaching tests and analytical methods

Laboratories must undertake all leach testing to EN12457-2 or EN12457-4 and results assessed against the L:S 10 l/kg limits. We do not consider it necessary in most circumstances to apply the L:S 2 l/kg batch test (approved methods EN12457-1 and 12457-3) or percolation testing (approved method prEn 14405). While limits are set for these tests in the Council Decision annex, the Environmental Permitting Regulations, schedule 10 state that the L:S 10 l/kg test must be used.

We will amend the above list as CEN standards become available. For tests and analyses for which CEN methods are not yet available, British Standard methods are acceptable or other tests approved by the Environment Agency.

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