

Waste classification

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The UK, along with other industrialised nations, has a legacy of large scale waste generation from domestic, commercial and industrial sectors. Over the past century, most of this waste has been disposed of in landfill. Waste requires appropriate storage and robust disposal, recycling and recovery options, because poor practices can result in air, soil and groundwater pollution, with potential risks to human health and the environment. This Environmental Brief outlines the broad requirements of waste classification in the UK.

The classification of whether a waste is hazardous or non-hazardous involves the skills and knowledge of chemists who understand the behaviour and toxicity of chemicals. They must evaluate the results of chemical testing, based on an understanding of the analytical methods used and the information they provide, to assess potential hazardous properties.

Careful and robust classification of waste materials is important given the strict controls required for storage, treatment and disposal of hazardous waste, in addition to the higher costs involved compared with other waste types. It is also important to ensure that wastes are disposed of in the correct landfill sites. Non-hazardous waste should not be disposed of in hazardous waste landfill sites because limited disposal volume is available in the UK. On the other hand, disposal of hazardous waste in landfills not designed to accept it can result in potential risks to the environment.

Legislation and regulations

The EU Waste Framework Directive (WFD), implemented in the UK via domestic legislation, sets out what waste is and how it should be managed. Within the directive, the List of Wastes (LoW) provides more detail on the types of wastes. The assessment and classification of waste is derived from Annex III of the Waste

Framework Directive and applies to wastes within the scope of this directive and domestic UK legislation (1).

During 2015, there were several significant legislative changes that affect the classification of waste, including: amendments to the List of Wastes; criteria for persistent organic pollutants; major revision of hazardous properties in the WFD; and the adoption of the Classification, Labelling and Packaging Regulation (CLP) for chemicals. Chemists will likely be familiar with the CLP Regulation which applies the United Nations' Globally Harmonised System on the classification and labelling of chemicals across all EU countries. This is a key resource in identifying substances with hazardous properties in waste materials. To take account of these changes, the Environment Agency and other agencies have revised technical guidance in the UK, which is presented in *WM3, Guidance on the classification and assessment of waste* (1st edition 2015) (2, 3).

Waste types

The List of Wastes is divided into twenty chapters based on separate sectors that produce the waste. Each individual waste entry is provided with a six-digit waste code. The initial classification of a waste involves identifying how it is classified in the List of Wastes and assigning a code. Wastes that fall into mirror entry codes require further assessment as discussed below.

There are three key types:

1. "absolute" hazardous entries — wastes that are always hazardous. For example, **07 01 03*** refers to organic halogenated solvents, washing liquids and mother liquors;
2. "absolute" non-hazardous entries — wastes that are always non-hazardous. For example, **05 01 16** refers to sulphur-containing wastes from petroleum desulphurisation; and
3. "mirror" entries — wastes that may be hazardous or non-hazardous depending on further assessment. Examples include **19 01 11*** (bottom ash and slag containing hazardous substances) and **19 01 12** (bottom ash and slag other than those mentioned in **19 01 11**).

A hazardous waste is defined as a waste that has one or more of the fifteen specified hazardous properties listed

in Annex III of the WFD or contains persistent organic pollutants above specified concentration limits.

Mirror entry

To determine whether a mirror entry waste is hazardous or not, its chemical composition needs to be known. There are three main ways to determine the composition of the waste: manufacturer's information; using knowledge of the process chemistry involved to elucidate the composition; or sampling and testing of the waste to determine its composition. For wastes of unknown chemical composition, such as soils and stones from contaminated sites (see below), sampling and testing of the waste and subsequent data interpretation is the primary means of determining the waste classification.

For soil from potentially contaminated sites, the chemical composition of the soil is often available from intrusive site investigation work carried out as part of redevelopment works. The redevelopment works may generate soils requiring off-site disposal or re-use and waste classification of this material could be as either **17 05 03*** (soil and stones containing hazardous substances) or **17 05 04** (soil and stones other than those mentioned in **17 05 03**).

Example

Fly ash is a waste generated from the combustion of coal at power stations and other combustion plants. From the List of Wastes, the entry can be considered to be **10 01 16*** (fly ash from co-incineration containing hazardous substances) or **10 01 17** (fly ash from co-incineration other than those mentioned in **10 01 16**).

Heavy metals such as zinc are a typical component of combustion ash. Given the combustion process, zinc oxide is a potential form of zinc in the waste. Zinc oxide is a hazardous substance possessing Hazard Statement Codes which are appropriate to Ecotoxicity (Hazardous Property 14 or HP14).

Periodic sampling and testing of batches of ash would yield the total zinc concentration, but this represents the cation and does not identify the exact hazardous substance. For example, a total zinc concentration of 3,000 ppm in the waste would represent ca. 3,750 ppm of equivalent zinc oxide. These concentrations are above the thresholds for HP14; through further assessment using the appropriate ecotoxicity equations, an assessor would classify the waste as hazardous (4).

Landfill waste acceptance criteria

Once waste has been classified as hazardous or non-

hazardous, it may be destined for disposal at a landfill site. The Landfill Directive requires that waste is properly characterised and meets specific Waste Acceptance Criteria (WAC) prior to disposal at a landfill site. WAC includes a combination of concentration limits for total composition and leachable content to ensure that waste is properly characterised. Landfills are classified according to whether they can accept hazardous, non-hazardous or inert wastes (5). The EU has not, so far, set limit values for non-hazardous wastes received at a non-hazardous landfill site (6).

A common cause of confusion is the use of Waste Acceptance Criteria to classify the waste as hazardous or non-hazardous. WAC analysis is only used for disposal of material to landfill and does not allow classification or meaningful assessment as to whether a waste may be hazardous or non-hazardous.

This brief outlines a general approach to waste classification. It is for information purposes only, is not to be relied upon and is the opinion of the author. Waste classification must be carried out by an appropriately competent and qualified person and in accordance with UK legislation and Regulatory and Technical Guidance.

References and notes

1. See www.gov.uk/waste-legislation-and-regulations
2. See www.gov.uk/how-to-classify-different-types-of-waste
3. See www.gov.uk/government/publications/waste-classification-technical-guidance
4. A single substance is unlikely to be representative of a waste, particularly combustion ash, which may contain numerous hazardous substances including heavy metals and polycyclic aromatic hydrocarbons. Their inclusion would result in a more complex waste assessment.
5. Inert waste "means waste that does not undergo any significant physical, chemical or biological transformations ... Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater." Definition from www.gov.uk/government/publications/waste-acceptance-at-landfills, page 16.
6. See www.gov.uk/government/publications/waste-sampling-and-testing-for-disposal-to-landfill