Classifying and coding wastes from physico-chemical treatment facilities

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4.0	June 2008	
5.0	April 2011	Page 3 – Deleted text (paragraphs 2, 3 & 4) referring to the Hazardous Waste Directive and Waste Framework Directive and associated footnotes. Page 6 – Footnote 6 updated link to BREF. Page 10 – Under the definition section the term ‘dangerous substance’ was updated to refer to latest version of CHIP regulations. The definition of a hazardous property was amended to include H15.

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Reference number HWR06 Version 5.0 – April 2011

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Who should read this guide?

You should read this guide if you are treating hazardous waste. The guide equally applies to producers who treat their own waste as well as operators of other sites that treat waste on behalf of others.

What does this guide do?

This guide gives you advice on how to classify and code wastes from some of the methods used to treat hazardous waste. Correctly classifying and coding the outputs from treatment activities depends on the process you used and, where necessary, the composition of the waste after treatment.

The principles for classifying and coding a hazardous waste are found in the Hazardous Waste Regulations[1] (HWR) and the List of Waste Regulations[2] (LoWR). The List of Waste Regulations implement the latest version of the List of Wastes Decision. We call this 'the List' and it is also known as the European Waste Catalogue (EWC). These regulations are the legal framework for the decisions in this document.

Our main guide for classifying and coding hazardous wastes is *WM2 – Interpretation of the definition and classification of hazardous waste*. We have a short guide to defining hazardous wastes, *HWR01 - What is a Hazardous Waste?* You can find these and other hazardous waste guides on our website: www.environment-agency.gov.uk/hazwaste. You can also look at *Using the List of Wastes to code waste: for Waste Transfer Notes, PPC Permits and Waste Management Licences in England & Wales* which can be found at http://www.environment-agency.gov.uk/static/documents/Business/low_guide_v1.2_1397222.pdf

What this guide doesn't do

This guide does not identify whether a treatment process is appropriate for the waste(s) involved. A facility's permit defines the limits of the authorised processes and the wastes that can be accepted for treatment.

This guide does not cover Waste Acceptance Criteria for wastes destined for landfill. If you want to landfill the outputs from treatment activities please refer to http://www.environment-agency.gov.uk/business/topics/waste/32122.aspx

The information in this guide is based on what we know at the moment. It may change in the future if there is a change in law, guidance from the Government changes or as a result of our experience in regulating this type of waste.

[1] 'Hazardous Waste Regulations' is an abbreviation for both the Hazardous Waste (England and Wales) Regulations 2005 and the Hazardous Waste (Wales) Regulations 2005.

[2] 'List of Waste Regulations' is an abbreviation for both the List of Wastes (England) Regulations 2005 and the List of Wastes (Wales) Regulations 2005.

Overriding Principle of Classification

All wastes must be coded and classified in accordance with the Annex given in Schedule 1 to the List of Wastes Regulations. The Schedule requires that the "appropriate" six-digit code is found for a waste. The term "appropriate" means that the code that best describes a waste using the rules in the Schedule must be chosen.

Introduction

Chapter 19 of the catalogue includes some "Wastes from Waste Management Facilities". If a waste code can be found in that chapter it can be used to classify a treated waste. If Chapter 19 does not include the waste, or if the 99 code in Chapter 19 is the only choice, the rest of the catalogue must be searched to find a more appropriate code, before the 99 code can be used.

This guidance will direct you to the correct choice of code for a treated waste in the following situations:

- pre-mixed waste;
- bulked waste;
- stabilisation and solidification;
- metal precipitation sludges, cyanide treatment sludges and chromic acid treatment sludges; and
- waste from oil / water separation

It does not currently give any advice in the following circumstances:

- waste incineration;
- vitrification;
- aerobic treatment;
- anaerobic treatment;
- landfill leachate;
- waste water treatment;
- preparation of water for human or industrial use;
- shredding;
- oil regeneration;
- disinfection;
- mechanical treatment; and
- soil and groundwater remediation.

Principles for treating hazardous waste

You should use the following to help you classify and code the wastes resulting from treating hazardous waste:

MIXING
Mixing waste is the combining or blending of waste with other waste or non-waste.

Advice on mixing of hazardous waste is available from Defra at:
http://www.defra.gov.uk/environment/waste/topics/hazwaste/documents/hwrmixing-guide.pdf

Pre-mixing and bulking are forms of mixing. A chemical reaction should not usually take place during pre-mixing or bulking.

Pre-mixing
If a hazardous waste is mixed with:

- a hazardous waste with a different EWC code;
- a hazardous waste with the same EWC but different hazardous properties or chemical composition;
- a non-hazardous waste; or
- a non-waste

and a reaction does not take place, then this is considered pre-mixing. This waste is coded **19 02 04*** ***premixed wastes composed of at least one hazardous waste***. This is an absolute hazardous waste; threshold criteria do not apply to absolute hazardous wastes.

If the pre-mixed waste is not subject to further treatment, this code will apply for onward movement of this waste[3]..

Bulking
Bulking of hazardous wastes is the mixing of hazardous wastes with the wastes of the same EWC code, same hazardous properties, and similar constituents. It is not considered pre-mixing. For example, bulking two similar loads of **08 03 12*** ***waste ink containing dangerous substances*** together gives a bulk load of **08 03 12*** waste.

[3] If you assess a 19 02 04* waste in accordance with the rules set out in WM2 and the waste does not have a hazardous property, the waste is still hazardous. You can put "none", in the hazardous properties section, on any consignment notes you use to move this hazardous waste. A consignee that receives this waste must include it in their quarterly consignee return to the Environment Agency. The computer system devised to accept these returns requires the consignee to include a hazardous waste property for every waste included on the return. "None" is not a valid choice on the return at the moment – whilst we are adapting our systems to allow a consignee to put N/A on the return, can you please record H5 as the hazard in the meantime.

STABILISATION AND SOLIDIFICATION (IMMOBILISATION)

Stabilisation and solidification are very similar processes and the terms are often used interchangeably. They are techniques that reduce the mobility and toxicity of dangerous substances. Terms such as immobilisation, fixation and encapsulation are also used for these treatment options.

Stabilisation

From the List of Waste Regulations:
"Stabilisation processes change the dangerousness of the constituents in the waste and thus transform hazardous waste into non-hazardous waste."
"A waste is considered partly stabilised if, after the stabilisation process, dangerous constituents which have not been changed completely into non-dangerous constituents could be released into the environment in the short, middle or long term."

From the BREF[4];
"[Stabilisation] is a process by which contaminants (e.g. heavy metals) are fully or partially bound by the addition of supporting media, binders, or other modifiers. Stabilisation is accomplished by mixing the waste with a reagent (depending on the type of waste and reaction planned, this can be, for example, clay particles; humic organic substances, such as peat; activated carbon; oxidisers; reductors; precipitating reagents) to minimise the rate of contamination migration from the waste, thereby reducing the toxicity of the waste and improving the handling properties of the waste at the landfill. To achieve this, a process should include a physico-chemical interaction between the reagent and waste, rather than just a dilution.
These stabilisation methods make use of both the precipitation of metals in new minerals as well as the binding of metals to minerals by sorption. The process includes some sort of solubilisation of the heavy metals in the material and a subsequent precipitation in or sorption to new minerals.
The physical mechanisms used in stabilisation are: macro-encapsulation, micro-encapsulation, absorption, adsorption, precipitation and detoxification. There is an extensive range of sorbents and binders available for such purposes. Some of the most commonly used are: cement, pozzolans (alumino-silicious material that reacts with lime and water), lime, soluble silicates, organically modified clays or lime, thermosetting organic epolymers, thermoplastic materials and vitrification (in-situ or in-plant).
In many cases, both types of reagents (chemical reagents as mentioned three paragraphs above) and sorbents and binders (as mentioned in the above paragraph) are used simultaneously."

From the Standard Handbook of Hazardous Waste Treatment and Disposal[5]
"Stabilisation refers to a process by which waste is converted to a more chemically stable form. Chemical reactions take place between the additives and the waste to reduce the contaminants of concern to their least soluble, mobile, and/or toxic state. Stabilisation does not necessarily produce a solid. Biological processes are not considered."

Solidification

From the List of Waste Regulations:
"Solidification processes only change the physical state of the waste (e.g. liquid into solid) by using additives without changing the chemical properties of the waste."

[4] The BREF can be found at http://eippcb.jrc.ec.europa.eu/reference/wt.html
[5] Second Edition, Harry M. Freeman, ISBN 0-07-022044-1

From the BREF:
"[Solidification] uses additives to change the physical properties of the waste (as measured by its engineering properties such as strength, compressibility, and/or permeability). The term 'solidification' (and encapsulation or fixation) relate to the mixing of wastes with a reagent (pulverised fuel ash; cement, lime; blast furnace slag; cement kiln dust; organic binders such as bitumen/asphalt or paraffin; and polyethylene) to produce a solid waste form (with low porosity and low permeability matrix) for landfill disposal. Substances are either adsorbed to the reagent or trapped within the waste form. The output should possess a high resistance to chemical and biological degradation processes that could lead to the release of contaminants.
The addition of cement, for example, generally decreases the hydraulic conductivity and porosity of the material, and in addition increases tortuosity, durability, strength and volume. However, it usually increases the pH and alkaline capacity of the mixture, therefore improving the leaching behaviour of the product (e.g. amphoteric metals, some organic compounds). In some cases, depending on the binder, solidification may result in chemical changes of the material matrix.
In summary, the fixation and insolubilisation of the pollutants is realised by means of four mechanisms: precipitation, complexation, encapsulation and adsorption."

From the Standard Handbook of Hazardous Waste Treatment and Disposal:
"A process in which materials are added to the waste to produce a solid is referred to as solidification. It may or may not involve a chemical reaction or chemical bonding with the waste contaminants and the additive, but it reacts with free water in the waste. Absorption of the water with absorbents such as sawdust is not generally considered solidification. Microencapsulation of the finer particles is the main mechanism that may reduce the mobility of the contaminants."
"Solidification may produce a monolithic waste form, a granular material, a claylike material, or some form considered a solid."

Coding and classification of solidified / stabilised waste
The terms solidification and stabilisation are used to appropriately describe the immobilisation / fixation / encapsulation of wastes into binder materials. The materials used most often in these processes are fly ashes and cement. When, for example fly ash or cement, is used to encapsulate hazardous waste materials the output is going to be either

19 03 04* ***wastes marked as hazardous, partly stabilised***[6]; or

19 03 06* ***wastes marked as hazardous, solidified***

The use of the solidified / stabilised codes is irrespective of **any** chemical reactions that may occur during the treatment – chemical reactions are not uncommon during stabilisation and solidification treatments.

It is for the treatment plant operator to decide whether the classification is **19 03 04*** or **19 03 06*** based on their understanding of their process in relation to the definitions provided above.

If hazardous waste is solidified, the waste is appropriately coded as **19 03 06***. If hazardous waste is stabilised, the waste is appropriately coded **19 03 04***. Both **19 03 04***

[6] The definition of partly stabilised is given on page 5 of this document. A "dangerous constituent" means the presence of a dangerous substance at any level.

and **19 03 06*** are absolute hazardous waste entries and the concentration of dangerous substances within them is not considered in the assessment of these materials as hazardous wastes.[7]

If the stabilisation / solidification process is not considered effective in fixing / immobilising / encapsulating the dangerous substances, the waste should be appropriately classified as **19 02 04* *pre-mixed waste***. The minimum requirement for stabilisation is adsorption of the waste – absorption of waste is considered pre-mixing.

A partly stabilised waste (**19 03 04***) that undergoes further treatment to remove all of the untreated dangerous substances or convert them to non-dangerous substances, and does not introduce other hazardous properties, may be coded 19 03 05 *stabilised wastes other than those mentioned in 19 03 04*, which is a non-hazardous waste code. If another EWC code is considered to be more accurate in coding the waste that code may be used.

METAL PRECIPITATION SLUDGES, CYANIDE TREATMENT SLUDGES AND CHROMIC ACID TREATMENT SLUDGES

From the BREF:

Treatment	Type of waste or examples of type of waste	Additional information
Precipitation using acids and alkalis to adjust the pH to achieve minimum solubilities	Metals, for example, Zn, Ni, Cr, Pb, Cu	The pH value for minimum solubility depends on the metal, and then in the case of a mixture of metals, an optimum value needs to be found. For such an optimum pH, it may be that some metals do not precipitate at all. This is the reason why, in some cases, more than one pH step is used to maximise the removal of metals.
Chromic acid treatment	Chromium oxide (CrO3) is acidic, toxic, water soluble and an oxidising agent	Conversion of Cr6+ to less hazardous Cr3+, by the addition of a reducing agent, such as sodium metabisulphite followed by precipitation
Cyanide treatment	Cyanide salts, e.g. sodium cyanide from metal surface treatments	Conversion of cyanide to less hazardous cyanate maintaining pH >10 using on oxidising agent

Where the primary process is one of metal precipitation, chromic acid treatment or cyanide treatment, as described in the BREF, the output sludge can be coded and classified:

19 02 05* *sludges from physico/chemical treatment containing dangerous substances*; or
19 02 06 *sludges from physico/chemical treatment other than those mentioned in 19 02 05*.

[7] If you assess a 19 03 04* or 19 03 06* waste in accordance with the rules set out in WM2 and the waste does not have a hazardous property, the waste is still hazardous. You can put "None", in the hazardous properties section, on any consignment notes you use to move this hazardous waste. A consignee that receives this waste must include it in their quarterly consignee return to the Environment Agency. The computer system devised to accept these returns requires the consignee to include a hazardous waste property for every waste included on the return. "None" is not a valid choice on the return at the moment – whilst we are adapting our systems to allow a consignee to put N/A on the return, can you please record H5 as the hazard in the meantime.

As mirror entry codes, the code that applies to the waste relies on the dangerous substances in the sludge being assessed in accordance with technical guidance WM2.

Addition of other hazardous waste materials to the reaction vessel (e.g. aqueous oily waste from oil/water separation), using the precipitated sludge as a binding (fixing) material, renders the waste a hazardous 19 03 waste – see under the stabilised / solidified section above to decide on the correct code for the waste.

SEPARATION

Oil/Water separation

A hazardous waste may be treated by separation, for example oil/water separation.

Aqueous oily wastes may be separated by gravity or centrifuge. There may be two or three wastes from the process:

- an oil fraction;
- an oily sludge; and
- an aqueous fraction.

In some instances, the oily sludge and aqueous fractions may be not be separated in the process.

The oily fraction is classified under **19 02 07*** ***oil and concentrates from separation***.

The sludge (on its own) is
19 02 05* ***sludges from physico/chemical treatment containing dangerous substances***; or
19 02 06 *sludges from physico/chemical treatment other than those mentioned in 19 02 06*.
The classification should be made in accordance with the guide "How to find out if waste oil and wastes that contain oil are hazardous"[8].

The aqueous fraction or the mixed sludge / aqueous fraction is **19 02 11*** ***other wastes containing dangerous substances*** or 16 10 02 *aqueous liquid wastes other than those mentioned in 16 10 01*. Again use of the oily waste guide is required in the assessment.

If the aqueous fraction is lawfully sent to sewer, it is a waste water and is not classified under the Hazardous Waste Regulations.

If oily sludge (**19 02 05***) or an oily aqueous fraction (**19 02 11***) is put into a neutralisation process or is mixed with a binder such as fly ash the waste will be classified under 19 03.

PROCESS FAILURE WASTES

If waste comes out of a stabilisation / solidification process and it is not wholly stabilised or solidified in the process, nor considered pre-mixed, that waste should be coded as it went into the process.

For example, laboratory smalls in containers are shredded into a stabilised / solidification treatment process. An immobilised residue is usually produced as a result of the treatment

[8] http://publications.environment-agency.gov.uk/pdf/GEHO0607BMTW-e-e.pdf

but some of the containers' contents remain untreated (because the containers remain intact). The waste should be coded with two codes – the immobilised residue as per the principles in the stabilised / solidified section of this guide, and the untreated laboratory smalls as **16 05 06*** ***laboratory chemicals consisting of or containing dangerous substances, including mixtures of laboratory chemicals***.

The output of the treatment is effectively two wastes – the immobilised waste and the non-treated material. This is comparable to a lead-acid battery in a skip of general waste.

Definition of terms

"Appropriate code" means the code from the List of Wastes Regulations chosen according to the rules in Schedule 1 to those regulations. When one or more code appears to be applicable to a waste, the appropriate code is the one that best supports the precautionary principle and provides the highest level of environmental protection.

A "dangerous substance" is a substance that is classified by the Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 as dangerous. For example, the substance sodium hydroxide is a dangerous substance whose classification is C: R35 (corrosive: causes severe burns).

"Dangerous constituent" means the presence of a dangerous substance at any level.

A "hazard" or "hazardous property" is a property that renders a waste hazardous. The properties which are numbered H1 to H15 are listed in Schedule 3 to the Hazardous Waste Regulations 2005.

"Absolute hazardous waste" is a waste listed in the List of Wastes Regulations with an asterisk which does not require any assessment to decide that it is hazardous. Examples include **19 03 04* waste marked as hazardous, partly stabilised** which is hazardous regardless of any dangerous substance thresholds.

"Mirror hazardous waste" and "Mirror non-hazardous waste" are joint terms. The European Commission has decided that some wastes cannot be absolutely assessed as hazardous and further work is required to make a judgment whether they are hazardous or not. The List of Wastes Regulations show these waste as "mirror" entries one of which will have a general or specific reference to a dangerous substance and is hazardous (and marked with an asterisk) and the other entry will be marked as being the opposite of that entry. Examples include **19 02 05*** ***sludges from physico-chemical treatment containing dangerous substances*** and 19 02 06 *sludges from physico-chemical treatment other than those mentioned in 19 02 06*.

Other guidance

IPPC S5.06: Guidance for the recovery and disposal of hazardous and non-hazardous waste
http://www.environment-agency.gov.uk/static/documents/Business/sgn_issue_4_968872.pdf
Regulatory position: Managing hazardous waste
http://www.environment-agency.gov.uk/research/library/position/41221.aspx

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