

# Environmental Permitting

## Environmental Permitting Guidance The Directive on the Incineration of Waste

For the Environmental Permitting (England and Wales)  
Regulations 2007



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# 1. Introduction

## About this guidance

- 1.1 This guidance is part of a series of documents which accompany the Environmental Permitting (England and Wales) Regulations 2007 SI 2007 No. 3538 (“the Regulations”)<sup>1</sup>.
- 1.2 The series consists of the Environmental Permitting Core Guidance<sup>2</sup>, which describes the general permitting and compliance requirements, and guidance on each of the European Directives implemented through the regime<sup>3</sup>. Separate guidance is available for local authority regulation under the regime<sup>4</sup>.
- 1.3 This guidance is about the European Community (EC) Directive 2000/76/EC on the incineration of waste (“the Waste Incineration Directive”).
- 1.4 This guidance is being published to help in particular those operating and regulating incineration and co-incineration plants, but it will also be of interest to others concerned with waste incineration. The guidance describes the views of the Secretary of State for the Environment, Food and Rural Affairs (Defra) and the Welsh Assembly Government (WAG) on how the Waste Incineration Directive should be applied and how particular terms should be interpreted. However only the national or European Courts can give a definitive interpretation of the legislation.
- 1.5 Schedule 13 to the Regulations (reproduced in this document as Annex 1) sets out the relevant requirements from the Directive.
- 1.6 Chapter 2 provides guidance on the scope of the Directive. Chapter 3 sets out how the Regulations transpose the relevant parts of the Directive and describes the requirements of the Directive which will be delivered through environmental permits. Chapter 4 describes other relevant requirements.
- 1.7 A copy of the Waste Incineration Directive is provided in Annex 2.

## The Waste Incineration Directive

- 1.8 The Waste Incineration Directive (WID) was agreed by the European Parliament and the Council of the European Union on 4 December 2000 and the final text was published in the Official Journal of the European Communities on 28 December 2000 (OJ L 332/91, 28 December 2000).
- 1.9 The aim of the WID is to prevent or limit, as far as practicable, negative effects on the environment, in particular pollution by emissions into air, soil, surface and groundwater, and the resulting risks to human health, from the incineration

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<sup>1</sup> Available at [www.defra.gov.uk/environment/epp/guidance.htm](http://www.defra.gov.uk/environment/epp/guidance.htm)

<sup>2</sup> *ibid.*

<sup>3</sup> *ibid.*

<sup>4</sup> Available at [www.defra.gov.uk/environment/ppc/localauth/pubs/guidance/manuals.htm](http://www.defra.gov.uk/environment/ppc/localauth/pubs/guidance/manuals.htm)

and co-incineration of waste. The WID seeks to achieve this high level of environmental and human health protection by requiring the setting and maintaining of stringent operational conditions, technical requirements and emission limit values for plants incinerating and co-incinerating waste throughout the European Community.

- 1.10 The requirements of the WID apply to virtually all waste incineration and co-incineration plants, going beyond the requirements of the 1989 Municipal Waste Incineration (MWI) Directives (89/429/EEC and 89/369/EEC). To increase legal clarity and enforceability, the WID also incorporates the Hazardous Waste Incineration Directive (94/67/EC) forming a single text on waste incineration. These Directives were repealed by the WID from 28 December 2005. The WID requirements have been developed to reflect the ability of modern incineration plants to achieve high standards of emission control more cost effectively.
- 1.11 For those installations which are also subject to the IPPC Directive (96/61/EC)<sup>5</sup>, compliance with the WID is not necessarily sufficient to meet IPPC requirements since the latter are more broadly based and may involve more stringent emission limit values and conditions.
- 1.12 A separate glossary of terms is available<sup>6</sup>. The glossary briefly explains the meaning of many words, phrases and acronyms used in the Regulations and Directives.

#### **Review of the WID**

- 1.13 Article 14 of the WID states that the Commission should submit a report to European Parliament and Council before 31 December 2008 concerning the application of the WID.
- 1.14 During 2007 and in parallel with the review of the IPPC Directive the Commission has carried out a review of the WID. This was completed at the end of 2007. It is proposed that the WID will be included in a revised IPPC Directive, however, it should be noted it is unlikely that the revised IPPC Directive would come into effect before 2013.

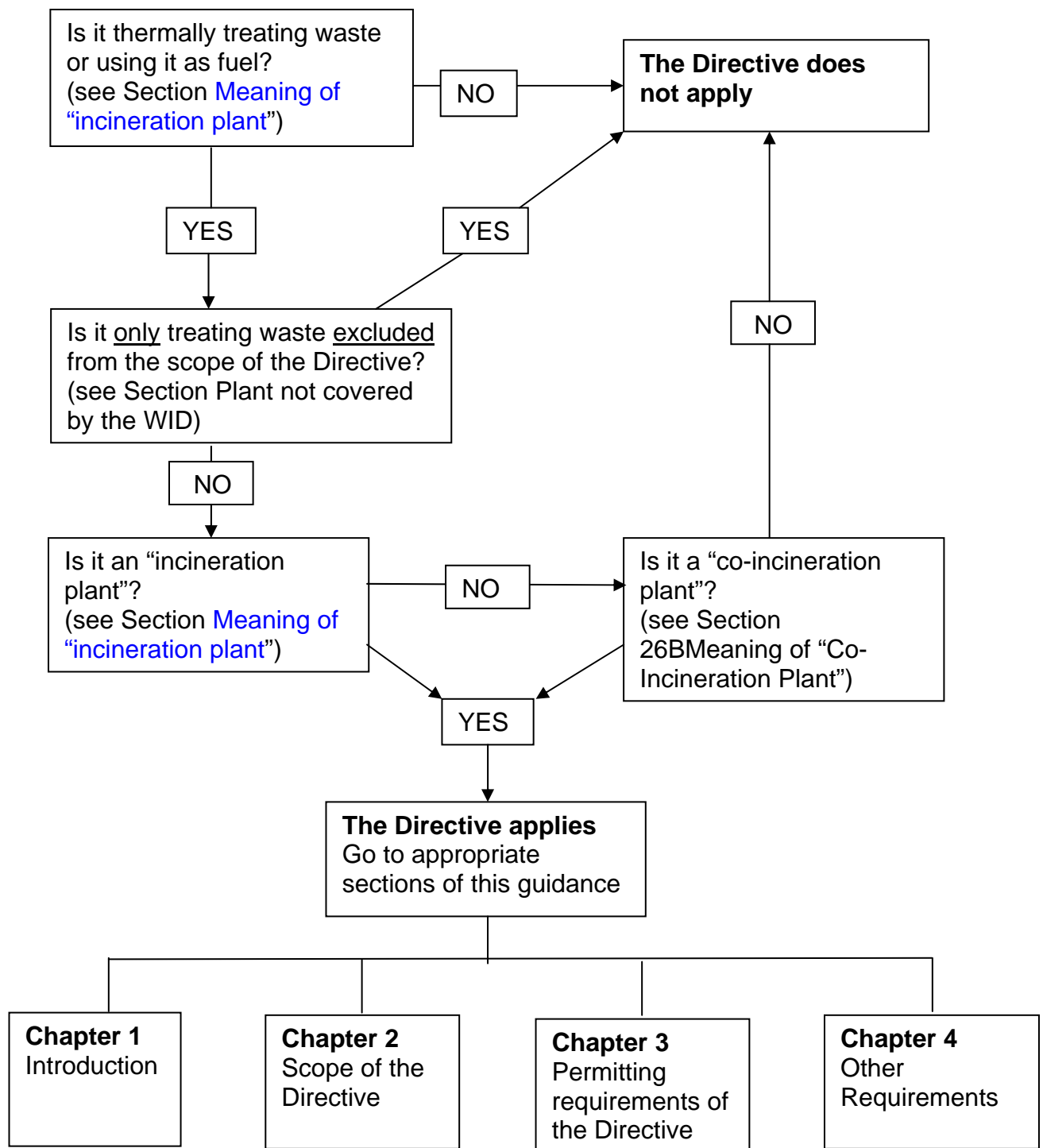
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<sup>5</sup> This guidance will be updated to take account of the codified version of the IPPC Directive 2008/1/EC

<sup>6</sup> Available at [www.defra.gov.uk/environment/epp/guidance.htm](http://www.defra.gov.uk/environment/epp/guidance.htm)

## 2. Scope of the Waste Incineration Directive

2.1 The Waste Incineration Directive applies to the incineration and co-incineration of both hazardous and non-hazardous waste. The definition of the three terms “waste”, “incineration plant” and “co-incineration plant” determine the scope of the Directive. This is discussed in detail below but the following flow chart may help to provide initial screening to determine if the WID applies to a given activity.



### **Meaning of the term “waste”**

- 2.2 For the purposes of the WID “waste” means any solid or liquid waste as defined in Article 1(a) of the Waste Framework Directive (Article 3 of the WID). Reference should be made to Guidance on the Waste Framework Directive<sup>7</sup> and see paragraph 2.20 below.

### **Meaning of “incineration plant”**

- 2.3 Article 3 of the WID defines “incineration plant” as follows:

“Incineration plant means any stationary or mobile technical unit and equipment dedicated to the thermal treatment of waste with or without recovery of the combustion heat generated. This includes the incineration by oxidation of waste as well as other thermal treatment processes such as pyrolysis, gasification or plasma processes insofar as the substances resulting from the treatment are subsequently incinerated.”

- 2.4 The WID then lists a range of related operations/equipment around the plant that will also be covered by the definition:

“This definition covers the site and the entire incineration plant including all incineration lines, waste reception, storage, on site pre-treatment facilities, waste-fuel and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack, devices and systems for controlling incineration operations, recording and monitoring incineration conditions.”

- 2.5 The definition implies that an “incineration plant” will have a degree of technical sophistication. There is a diversity of devices in which waste is burnt, and regulators must therefore consider each type of device on a case by- case basis to assess whether it may be “incineration plant” for the purposes of the WID. A device which does nothing more than provide physical containment for what would otherwise be an open bonfire lacks the necessary degree of technical sophistication. But devices providing more than that – for example, fan assisted air flow controls – may be “incineration plant” for the purposes of the WID.

### **“Thermal treatment”**

- 2.6 The key element of the definition is that the activity must involve “thermal treatment of waste”.
- 2.7 “Thermal treatment” includes both incineration/combustion and other treatments, such as gasification and pyrolysis. However, if the activity involves only thermal treatment in this broader sense (as distinct from incineration/combustion), then it will be subject to the WID only “insofar as the substances resulting from the treatment are subsequently incinerated” [emphasis added]. This ensures that the WID covers processes such as pyrolysis and gasification, unless their purpose is the manufacture of products with no resulting release of combustion gases. Therefore, if a gasification/pyrolysis plant produces a number of products, one or more of which are subsequently burnt, then the WID applies to the whole plant. In cases

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<sup>7</sup> Available at [www.defra.gov.uk/environment/epp/guidance.htm](http://www.defra.gov.uk/environment/epp/guidance.htm)

where the products are burnt away from the gasification/ pyrolysis plant (remote units), the WID will apply both to the plants initially producing, as well as subsequently using, these products.

- 2.8 Pyrolysis and gasification plants that dispose of all their products and residues without incineration (for example by landfill or use as raw materials in other processes) would not be covered by the WID. These operations are themselves closely regulated by the Regulations.

### **Meaning of “Co-Incineration Plant”**

- 2.9 Article 3 of the WID defines “co-incineration plant” as follows:

"Co-incineration plant" means any stationary or mobile plant whose main purpose is the generation of energy or production of material products and:

- which uses wastes as a regular or additional fuel, or
- in which waste is thermally treated for the purpose of disposal."

- 2.10 If co-incineration takes place in such a way that the main purpose of the plant is not the generation of energy or production of material products but rather the thermal treatment of waste, the plant shall be regarded as an incineration plant."

- 2.11 As with incineration plant, this definition also covers the site and the entire plant including all co-incineration lines, waste reception, storage, on site pre-treatment facilities, waste-, fuel- and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack devices and systems for controlling incineration operations, recording and monitoring incineration conditions. Also as with incineration plant, this definition may include devices which do anything more than provide physical containment or uncontrollable support for what in practical terms can be regarded as an open bonfire.

- 2.12 Also as with incineration plant, this definition excludes devices which do nothing more than provide physical containment for what would otherwise be an open bonfire.

### **Plant not covered by the WID**

- 2.13 Some plants will be excluded from the scope of the WID even though they may involve the thermal treatment of waste. However, many of these plants will still be subject to the Regulations.

### **Plant characteristics**

- 2.14 As indicated in the Section on the Meaning of “Co-Incineration Plant” above, regulators may determine that some devices in which waste is burnt may lack the technical sophistication which would place them with the definitions of “incineration plant” or “co-incineration plant. Burning waste in such devices is therefore not covered by the WID, but may still be subject to controls under the Waste Framework Directive, the IPPC Directive, statutory nuisance legislation or Health and Safety legislation in any combination. For example, simple appliances with no degree of technical sophistication which may burn waste oil for the provision of space heating fall into this category and are already subject to local authority regulation under the Environmental Permtting Regulations and

require a permit to operate. The Government keeps under review whether regulation of these appliances by these means is delivering proportionate and effective environmental safeguards.

### **Thermal Treatment**

- 2.15 Not all processes where waste is subjected to heat fall within the scope of the WID. There is a distinction between the “thermal treatment” that leads to a process falling within the WID (WID Thermal Treatment) and that which keeps it outside the WID (Non-WID Thermal Treatment). This distinction is summarised in the following text and the diagram “Thermal treatment of waste” on the following page.

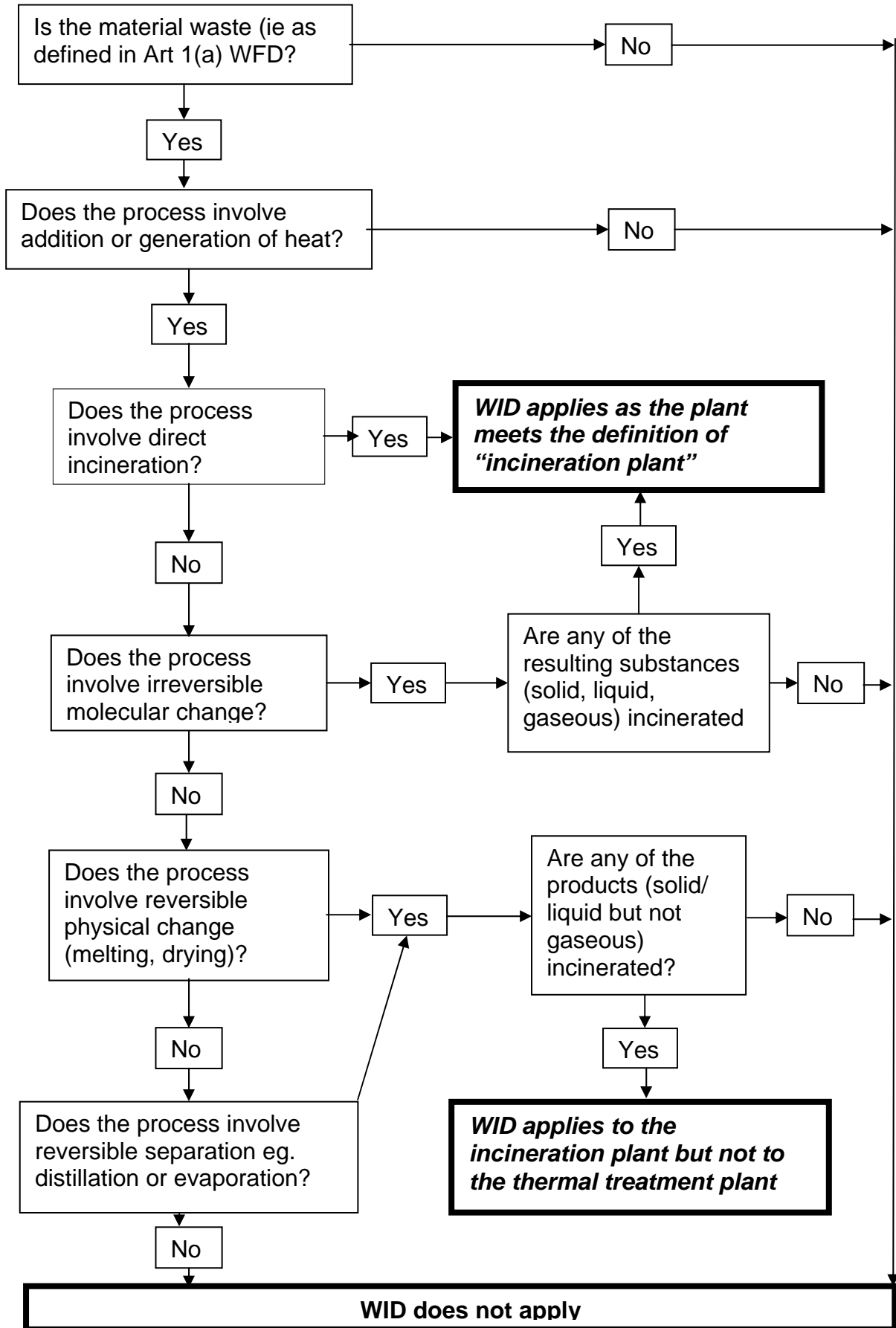
### **WID Thermal Treatment**

- 2.16 The thermal treatment results in the change to the chemical structure of the original waste, and the change is not reversible. For example, incineration is a thermal treatment in which the carbon and hydrogen present in the original waste gets changed to carbon dioxide and water respectively. Similarly, in pyrolysis and gasification, the molecular structure of the original waste is transformed resulting in substances that are physically and chemically different from the original waste.

### **Non-WID Thermal Treatment**

- 2.17 This treatment incorporates the application of heat but without a change in the chemical structure of the waste. Moreover, any physical change is reversible, e.g. drying of sewage sludge. Similarly, in the case of distillation of waste, to separate different fractions, heat is applied and different fractions are collected but there is no change in the chemical structure. Another example is heating where phase change occurs, e.g. there is a need to heat waste in storage before it can be shipped. However, there is no chemical change and the waste will go solid again when cooled.

## Thermal treatment of waste



## Purpose of the plant

- 2.18 The Government is aware of plants other than incineration or co-incineration which may involve the burning of a small quantity of waste material as part of a process which is not a waste incineration process. These plants may be excluded from the WID by virtue of their purpose rather than the definition of a “technical unit”.
- 2.19 It is not possible to provide a complete list of these plants and it may be necessary for the regulators to consider each process on an individual basis. However, some examples are:
- The cleaning of paint from jigs. Although the paint will be burnt off the purpose of the process is to clean the jig for reuse.
  - Spent granular activated carbon (for example, as used in some water treatment processes) may be regenerated by heating to remove the adsorbed contaminants. Here, burning of the vapours evolved is for abatement and the process leaves the bulk of the carbon regenerated and ready for further use.
  - The drying of swarf to make the metal waste suitable for feeding into the furnace. Small amounts of oily contaminants present will be burnt but the purpose of the plant is not the incineration of waste..
  - The injection of Recovered Fuel Oil (RFO) into a steel furnace to provide carbon for the reduction of iron ore.
  - The remediation of contaminated soil.
  - The use of an afterburner for the abatement of emissions from plant which is not an incineration plant.

### **Plants Excluded by Article 2(2) of the WID**

- 2.20 The definition of “waste” under the WID refers only to Article 1(a) of the Waste Framework Directive (WFD). As a result, not all of the Article 2 (WFD) exclusions apply to the WID. The only plants excluded from the scope of the WID are those set out in Article 2(2) of the WID. These fall into two principal categories. The first covers plants treating only specified wastes; the second covers experimental plants.

### **Plants treating only specified wastes**

- 2.21 The WID does not apply to plants provided they treat only the wastes specified below. It should be noted that a plant may burn one (or more) of these wastes, alone or in combination with conventional non-waste fuels, and still be excluded from the WID. However, if it uses any other wastes in combination with any of the specified wastes, the exclusion does not apply and the plant will be subject to the WID requirements.

**Vegetable waste from agriculture and forestry (Article 2(2)(a)(i))**

- 2.22 Plants treating vegetable waste from agriculture and forestry are excluded from the WID. This includes vegetable waste from horticulture including the container in which the plant has been grown.

**Vegetable waste from food processing industry (Article 2(2)(a)(ii))**

- 2.23 The meaning of “vegetable waste from the food processing industry “ should be taken in a strict sense. It is taken as meaning vegetable waste that is uncontaminated by any product of animal origin.

- 2.24 With respect to the use of Used Cooking Oil (UCO), the use of oil is relevant in that oil that has been used for cooking vegetables (for example, chip potatoes) remains a vegetable waste whereas oil that has been used for cooking meat or fish ceases to be a vegetable waste (and consequently is not excluded from the WID).

- 2.25 Oil which may be of animal origin, such as lard or beef dripping, obviously cannot be considered as being “vegetable waste” even if it has been used for cooking vegetables.

- 2.26 Furthermore the meaning of “food processing industry” should include any activity that “carries out food preparation of any type which changes the nature of the food in question.” This will include retail outlets, such as fish and chip shops and restaurants as well as manufacture of potato crisps in bulk. Consequently in order to fall within the terms of Article 2(2)(a)(iii) of the WID the plant must:

- be using vegetable waste (uncontaminated by any products of animal origin);
- the vegetable must be from the food processing industry;
- the energy must be recovered.

**Fibrous vegetable waste from pulp-making (Article 2(2)(a)(iii))**

- 2.27 Plants treating fibrous wastes from virgin pulp production and from production of paper from pulp, are excluded from the WID provided this happens on the site of waste generation and the heat generated is recovered. Wastes arising from the production of pulp are excluded only if the pulp production is from virgin materials. However, plants treating fibrous vegetable waste from paper production are exempted whether the pulp used is from virgin or recycled sources.

**Wood waste (Article 2(2)(a)(iv))**

- 2.28 Plants treating only wood waste, with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood-preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste, are excluded from the WID. Wood cannot be taken to include paper and card.
- 2.29 The Government recognises that some manufacturers producing, for example fibre board, do not use chemicals containing halogens or heavy metals in the manufacturing process. However, if the wood waste used for the manufacture of

the fibre board was already contaminated, then the final product may be also contaminated (note: the WID doesn't specify at what point the contamination has to take place), consequently the exclusion might not be applicable. However, this is a question of fact and the onus is on the operator of the incineration / co-incineration plant to demonstrate that the wood waste originally used did not arise from treated wood.

- 2.30 Some untreated wood products, such as wood pallets, may become unintentionally or accidentally contaminated during their normal use with organic chemicals and / or heavy metals. However, the WID exclusion would still apply because the contamination is not "as a result of treatment with wood preservatives or coating". Operators wishing to take advantage of this exclusion will have to demonstrate to the regulator that the contamination is accidental and not as a result of a treatment process.
- 2.31 The WID envisages that wood wastes arising from construction or demolition are likely to have been treated and hence covered by the WID. Wood waste recovered from Transfer Stations is equally likely to contain demolition or construction wood waste. It will be for the operator to demonstrate that such wastes do not contain treated wood waste.

#### **Radioactive Waste (Article 2(2)(a)(vi))**

- 2.32 Currently, radioactive waste is either burnt in off-site incinerators (e.g. hazardous waste incinerators or clinical waste incinerators) or in dedicated incinerators at nuclear power stations. As far as the off-site incinerators are concerned, the WID exclusion will not apply, because most of the waste burnt in these plants is non-radioactive. If the operators of incinerators at nuclear power stations wish to be excluded from the WID they will need to prove that all waste streams going to the incinerator are indeed radioactive. If the waste streams are mixed (i.e. some but not all are radioactive), then the exclusion will not apply. In any case, the plants will need an environmental permit and will be subject to BAT (Best Available Techniques) considerations (see Part A Guidance). The Regulators will apply the more stringent of the WID or BAT in imposing limits on non-radioactive emissions e.g. acid gases, dust, heavy metals and dioxins. Separate authorisations under the Radioactive Substances Act 1993 will also be required.

#### **Animal Carcasses (Article 2(2)(a)(vii))**

- 2.33 Incinerators that burn only animal carcasses are excluded from the scope of the WID. For this purpose, the Government considers as being excluded from the WID, incinerators which burn **only**:
- animal carcasses, including those carcasses which have been cut to facilitate incineration at the point of disposal; and/or
  - unprocessed parts of animal carcasses e.g. animal by-products such as SRM etc.
- 2.34 This means that incineration plants that burn only animal carcasses and or parts of carcasses (as described above) will be considered to be excluded from the WID. This will generally include incinerators on premises such as slaughterhouses, knacker yards, wholesale butchers and pet crematoria. But does not include retail premises and distribution depots.

- 2.35 However, this approach does not extend to any processed animal by-products such as tallow or meat and bone meal (MBM) or to products of animal origin such as former foodstuffs or catering waste.
- 2.36 Animal carcass incinerators that are not approved under the WID require approval under Regulation (EC) No 1774/2002 (“the Animal By-Products Regulation”). Regulation (EC) No 1774/2002 is enforced in England by the Animal By-Products Regulations 2003 (SI 2003/1482) and in Wales by the Animal By-Products (Wales) Regulations 2003. S.I.2003/2756, known as “the ABPR”.
- 2.37 The relationship between the WID and the Animal By-Products Regulations 2003 is shown in the diagram on page 17.

#### **Experimental plant (Article 2(2)(b))**

- 2.38 The WID excludes experimental plants used for research, development and testing in order to improve the incineration process and which treat less than 50 tonnes of waste per year (see the definition of excluded plant in the interpretation of section 5.1 of Part 2 of Schedule 1 to the Regulations). Therefore, the purpose of the plant has to be for research, development and testing for improving the incineration part of the process – not just the testing of the plant itself. There is also the limitation on the annual throughput of the waste (i.e. 50 tonnes). It will, therefore, more probably apply to test rigs at Universities.

#### **Meaning of “Hazardous Waste”**

- 2.39 For the purposes of the WID, “hazardous waste” means any solid or liquid waste as defined in regulation 6 of the Hazardous Waste (England and Wales) Regulations 2005<sup>8</sup>. However, the requirements of the WID which apply to hazardous waste are disapplied by Article 3(2) to the categories of waste set out below. These requirements include those relating to the reception, sampling, analysis and combustion temperatures applying to hazardous waste:
- combustible liquid wastes including waste oils provided that they meet the following criteria:
    - the mass content of polychlorinated aromatic hydrocarbons, e.g. polychlorinated biphenyls (PCB) or pentachlorinated phenol (PCP) amounts to concentrations not higher than those set out in the relevant Community legislation;
    - these wastes are not rendered hazardous by virtue of containing other constituents listed in Schedule 2 of the Hazardous Waste (England and Wales) Regulations 2005 in quantities or in concentrations which are inconsistent with the achievement of the objectives set out in Article 4 of the Waste Framework Directive; and
    - the net calorific value amounts to at least 30 MJ per kilogram,

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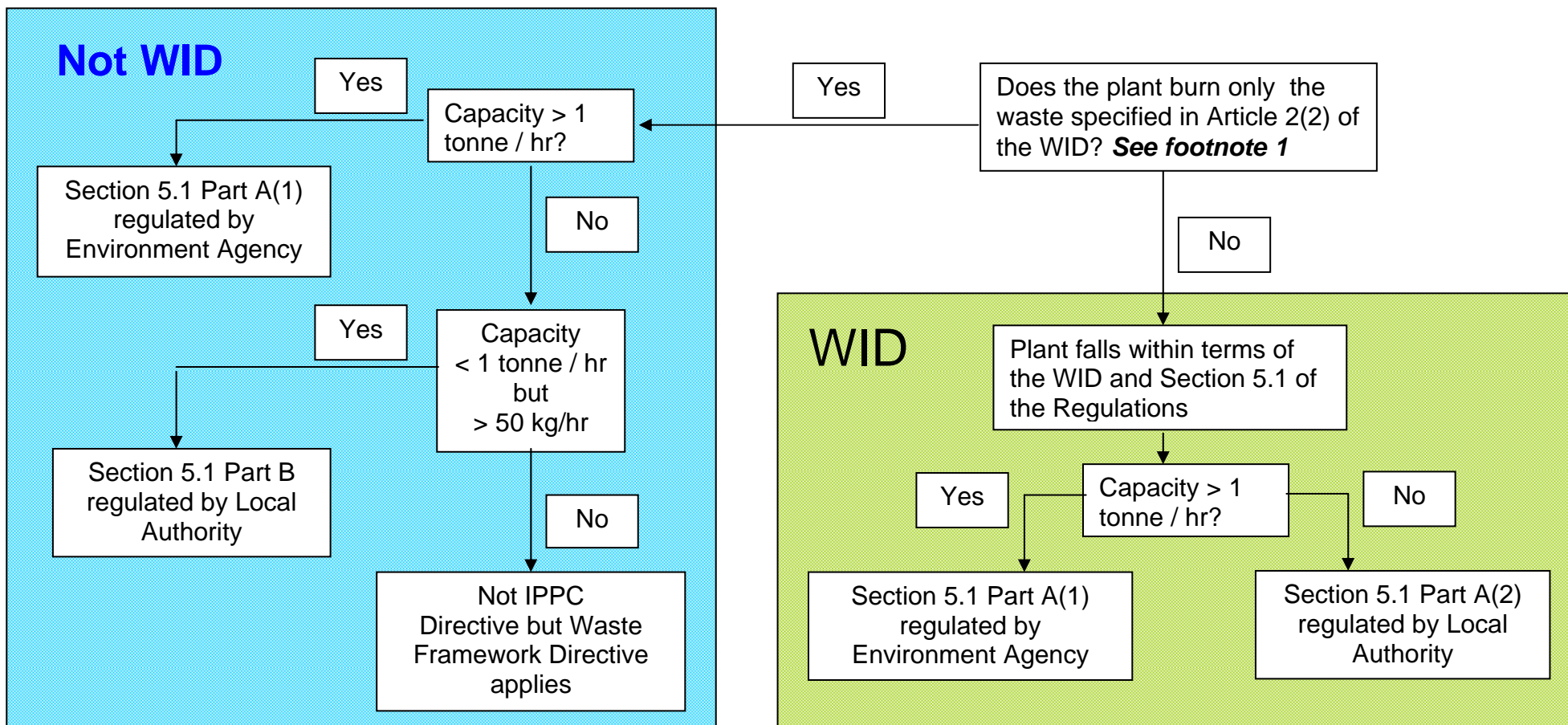
<sup>8</sup> S.I. 2005/894.

- any combustible liquid wastes which cannot cause, in the flue gas directly resulting from their combustion, emissions other than those from gasoil as defined in Article 1(1) of Directive 93/12/EEC or a higher concentration of emissions than those resulting from the combustion of gasoil as so defined.
- 2.40 Some wastes (for example, waste oils) will meet these criteria and so will not be subject to the WID requirements which apply to hazardous waste (these requirements relate to waste delivery and reception, operating temperatures and some time-limited derogations from emission limit values). It should be noted that all other requirements of the WID are to be met in full.

**Section 5.1 of Part 2 of Schedule 1 to the Environmental Permitting Regulations.**

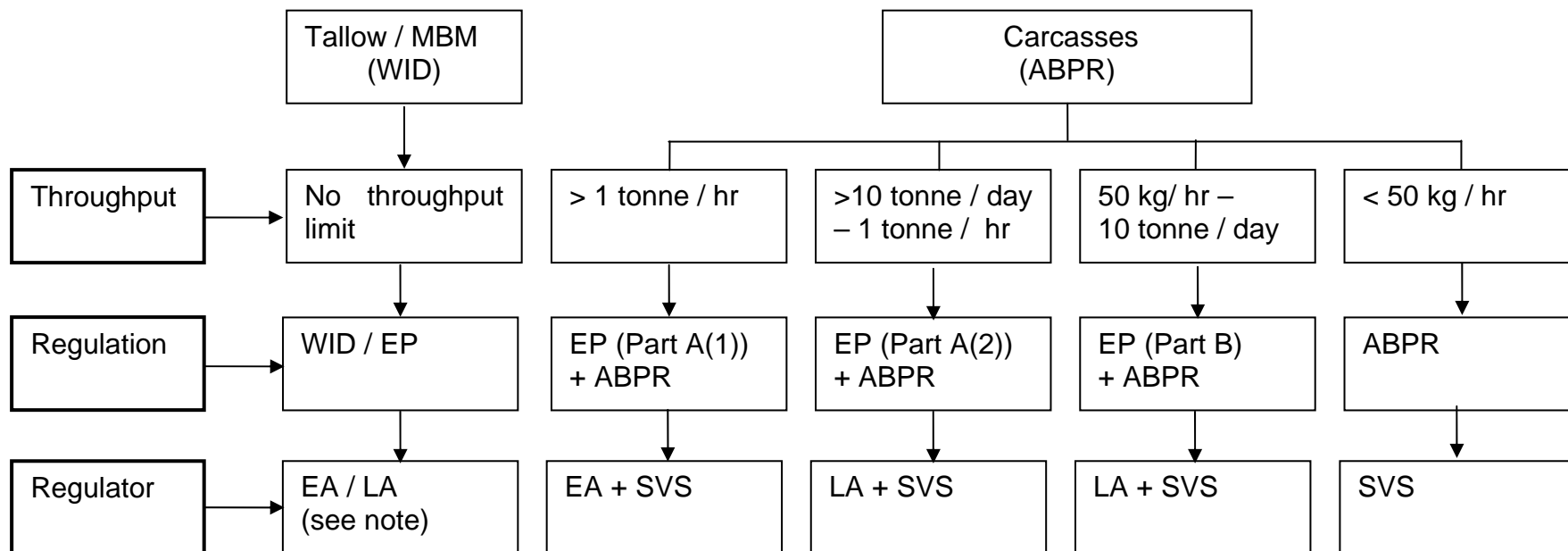
- 2.41 Operators should be aware that although plant may be excluded from the WID this does not mean that they are also excluded from Section 5.1 (Incineration and Co-incineration of Waste) of Part 2 of Schedule 1 to the Environmental Permitting Regulations (the Regulations). Reference should be made to the Guidance on Part A installations.
- 2.42 The link between Section 5.1 and the WID is summarised by the diagram on the following page “The scope of the WID and Section 5.1 of Schedule 1 to the Regulations” summarises this relationship.

The scope of the WID and Section 5.1 of Part 2 of Schedule 1 to the Environmental Permitting Regulations as applied to plants burning waste in a “technical unit”.



1. This means: any combination of wastes that may fall within Article 2(2) of the WID see section Plants Excluded by Article 2(2) of the WID
2. The incineration of any “hazardous waste” will fall under Section 5.1 Part A1 and be regulated by the Environment Agency .
3. Plants whose main purpose is the production of energy or material products may also burn waste and will be regulated as co-incinerators.

## Relationship between the Waste Incineration Directive and Animal By-Products Regulations (ABPR)



### Note:

The regulator for co-incineration plant will normally be whoever regulates the main activity on site.

For definition of “carcase” see main text.

EP: Environmental Permitting

SVS: State Veterinary Service

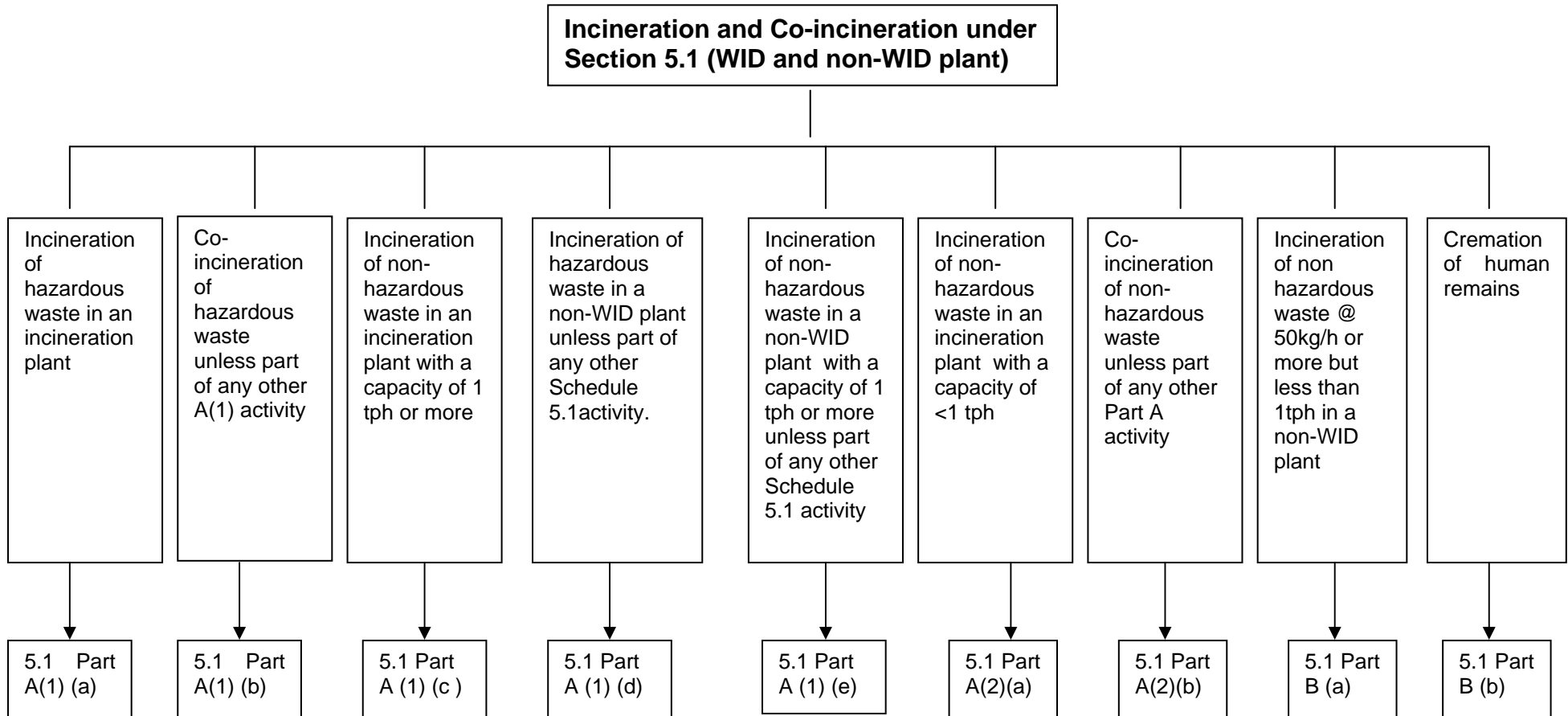
**All WID plants are “Part A installations”**

- 2.43 An important aspect of the overall approach is ensuring that all waste incineration plants and co-incineration plants which are subject to the WID are “Part A installations” under Part 2 of Schedule 1 to the Regulations.

**“Waste incineration installations”**

- 2.44 The Regulations include a key definition for the purposes of securing the WID implementation, namely “waste incineration installation” which is defined so as to include all incineration plant and co-incineration plant which are subject to the WID. These are those which fall within Section 5.1 Part A(1)(a),(b) or (c), Part A(2) or which are co-incineration plant falling within other descriptions in Part A of Schedule 2, Part 1; commonly these will fall within Part A(1) of Section 1.1 (combustion plant) or Section 3.1 (cement manufacturing).

## Section 5.1 Incineration installations



**Note:**

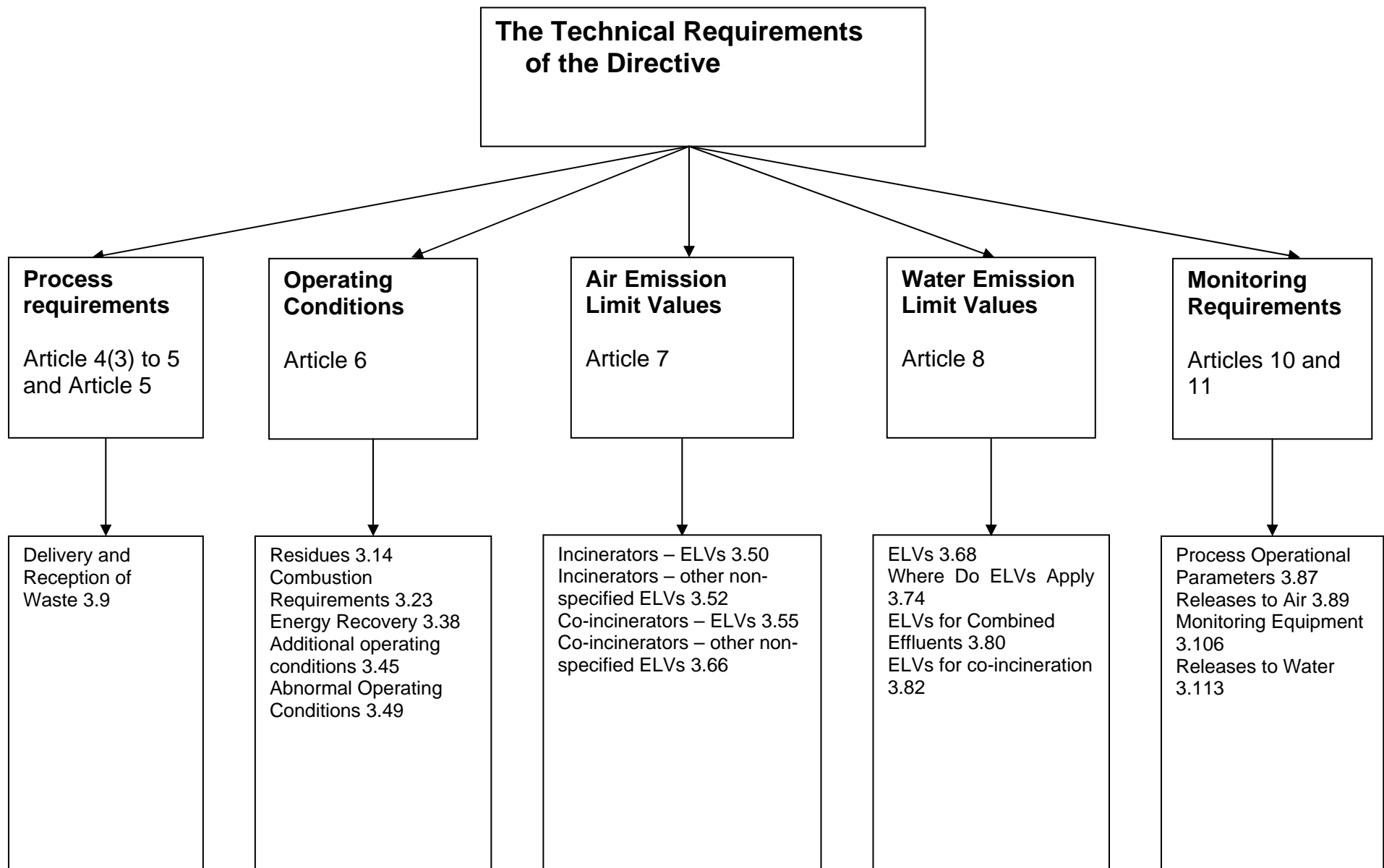
Non-WID plant means a plant which is not an incineration plant or a co-incineration plant i.e. a waste burning plant which is outside the scope of the WID

## 3. Permitting Requirements

- 3.1 This chapter describes the WID requirements that environmental permits must deliver and how the Regulations apply these requirements.
- 3.2 Paragraph 1 of Schedule 13 to the Regulations applies the requirements of the Schedule to every waste incineration installation (see [chapter 2](#) of this guidance).
- 3.3 Schedule 13 to the Regulations requires the regulator to ensure that for waste incineration installations the environmental protection standards and requirements of the WID are met through the Environmental Permitting system.
- 3.4 Paragraph 4 of the Schedule requires the regulator to exercise its “relevant functions” so as to comply with certain requirements of the WID. The term “relevant functions” is defined to include the grant and refusal of permits, setting conditions within those permits and securing compliance with those permits (regulation 9 and see chapters 5, 6 and 10 of the Environmental Permitting Core Guidance).
- 3.5 Paragraph 4 requires the regulator to deliver the following WID obligations:
  - In relation to waste incineration installation Articles 4(3) to 4(5), 5, 6 (except the last indent of 6(4)), 7(1) to 7(4), 8(1) to 8(7), 9, 10, 11 (except 11(1) and 11(13)) 12(2) and 13.
- 3.6 A waste incineration installation can be a Part A(1) installation or a Part A(2) installation (section 5.1 of Part 2 of Schedule 1 to the Regulations). The Regulator can therefore either be the Environment Agency or the Local Authority.

### The technical requirements of the WID

- 3.7 The WID imposes stringent requirements on incineration and co-incineration plants falling within its scope. These requirements cover, types of wastes permitted at the plant, their delivery and reception; combustion furnaces, abatement plant, residue handling, monitoring equipment and emission limit values. All these requirements have to be included in the permit. These requirements are discussed below.
- 3.8 The diagram on the following page summarises the technical requirements of the WID.



## Process Requirements

### **Permitted waste and their delivery and reception - Article 4(3) to (5) and Article 5**

- 3.9 A waste incineration installation must operate within its design envelope to achieve the operational and abatement standards required by the WID. The type of furnace chosen and the type/size of abatement plant will be influenced by the waste to be burnt (e.g. its calorific value, heterogeneity, moisture etc.). Article 4 requires that conditions relating to the waste quality are included in the permit.
- 3.10 Regulators should set conditions relating to waste quality in line with the following:
- An explicit list of the categories of waste permitted at the plant should be included in the permit. These categories should be based on those given in the List of Wastes Regulations<sup>9</sup>, particularly the need to use six digit codes and not simple headings or subheadings.
  - The total waste incineration / co-incineration capacity of the plant should be specified. Note that the WID defines capacity as “the sum of the incineration capacities of the furnaces of which an incineration plant is composed, as specified by the constructor and confirmed by the operator, with due account being taken, in particular, of the calorific value of the waste, expressed as the quantity of waste incinerated per hour”. The operators will, therefore, need to indicate the maximum design throughput taking into account the above factors.
  - Any sampling and measurements relevant to the permitted waste should be included in the permit.
  - Where the permitted waste is a hazardous waste, the regulators should also specify the quantities of different categories of permitted wastes, their minimum and maximum mass flows, their lowest and highest CV, and their maximum content of pollutants e.g. PCB, PCP, chlorine, fluorine, sulphur and heavy metals.
- 3.11 Article 5 of the WID requires that operators must take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable negative effects on the environment, in particular the pollution of air, soil, surface water and groundwater as well as odours and noise.
- 3.12 These requirements not only cover the design of the reception area but also the management of the waste. In addition to this general requirement, the following requirements are also to be met. These, unless stated otherwise, apply to both hazardous and non-hazardous waste:

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<sup>9</sup> The List of Wastes (England) Regulations 2005 (SI 2005 No. 895), or The List of Wastes (Wales) Regulations 2005 (SI 2005 No.1820) (W.148)

- If possible, the mass of each category of waste, should be determined according to the List of Wastes Regulations, prior to accepting the waste at the plant. Waste categories accepted at the plant should be detailed in the application. The operator should make provision to determine the mass of each category by the use of a weighbridge, loading mechanism weigh devices or through calculation. Where categories are mixed prior to delivery, the total mixed weight should be determined and the individual categories estimated and recorded.
- Operators should obtain documentary and analytical details of hazardous waste prior to its acceptance in order to comply with any specified restrictions on types that may be accepted. This does not mean that every item has to be sampled but requires an approach proportionate to the risk e.g. a need to have information necessary to evaluate suitability for the intended storage, handling and the incineration process.
- For hazardous waste, operators are also required to check statutory documents (consignment notes); take representative samples to verify the waste type and retain samples for at least one month after incineration. Sampling or analysis may be impractical (e.g. laboratory disposals) or inappropriate (e.g. infectious clinical waste). The frequency and scope of sampling/ analysis will be specified by the regulator according to the operator compliance record; taking into account the source of the waste, its variability, composition and the likely hazards that the waste may pose in relation to the process concerned e.g. halogenated organics, heavy metal content, etc.
- Exemptions from the above requirements may be granted by the regulator to industrial plants burning their own waste at the place of generation (provided other WID requirements are met). This means that in-house plants, burning their own hazardous or non-hazardous wastes do not need to go to the same lengths (in relation to document checking, sampling and analysis) as those plants accepting waste from other sites. It reflects the fact that operators incinerating their own waste have greater knowledge of the waste streams and that the risks are consequently reduced.

## **Operating Conditions - Article 6**

3.13 The WID specifies a number of requirements on the operations of incinerators and co-incinerators. These include, combustion gas temperatures, gas residence time, the TOC content of residues, conditions when waste feed should be stopped, energy recovery from the plant. It also allows some derogations from these requirements under some conditions. The above requirements are discussed in more detail in the following sections.

### **Residues - Articles 6 and 9**

3.14 Articles 6 and 9 set out the requirements of the WID in respect of incineration and co-incineration plant residues and these are detailed below.

### **TOC/LOI Content of slag and bottom ashes**

- 3.15 Article 6.1 requires that all incineration processes must be operated in such a way that Total Organic Carbon (TOC) or Loss on Ignition (LOI) content of the slag and bottom ashes will not be higher than 3% or 5% respectively. Here TOC means carbon associated with an organic molecule and would thus exclude elemental carbon. LOI is a measure of weight loss on ignition and would include both TOC and elemental carbon (it will also include weight loss due to the breaking up of inorganic compound e.g. silicates, carbonates etc). This requirement does not apply to fly ash or APC residues.
- 3.16 Article 6.4 appears to allow derogation from the above requirement and the Government sought views on this in the Consultation Document. Advice received indicates that Article 6.4 derogations only apply to operating conditions that the operator can set. The level of TOC/LOI is, in fact, a consequence of these operating conditions. It was also pointed out to the Government that allowing higher levels of TOC than specified would conflict with the requirements of Article 6.4 which states that any derogations should not result in higher content of organic pollutants. The Government has received advice that this is not an onerous condition even for new technologies like gasification and pyrolysis. In view of this, the regulators cannot give any derogations for TOC/LOI.
- 3.17 Elemental carbon does not count as total organic carbon. Regulators may set an elemental carbon limit which represents BAT for a particular technology.

### **Residues- minimise, recycle and dispose**

- 3.18 Compliance with BAT and the 3% TOC limit will generally be used as the technical criteria that demonstrate bottom ash meets the requirement of minimisation. Other factors to be considered include: a waste pre-treatment stage (e.g. shredder / sorter), ensuring that plant throughput is within specified plant rating, grate and furnace design, ash treatment, optimisation of the use of APC reagents and consideration of whether other reagents or reagent recycle could reduce the mass of residues or their harmfulness.
- 3.19 Opportunities for residue recycling should be adopted where practicable. On site schemes are preferred but not essential. The emphasis should be on recycling the residues. Regulators should require operators to keep records of such recycling and report in accordance with the standard permit conditions.
- 3.20 Any dusty wastes (including bottom ash) should be handled on-site such that they do not give rise to fugitive dust releases to the environment by using equipment that conforms to BAT. Guidance may be obtained from the relevant Technical Guidance Notes. Containers are not needed in all circumstances and damp storage may be sufficient for bottom ashes although all new plant would be expected to provide for ash storage within a building and in an area of controlled drainage. Particular attention must be paid to APC residues which should be held in bags or bulk containers. Bottom ash and APC residues should not be mixed together.
- 3.21 Although the above requirement does not extend beyond the boundary of the installation, the operators have duties beyond the point of the production of residues – for example, Duty of Care with respect to the downstream

management of these wastes. They should therefore adopt procedures so as to ensure that wastes are dispatched in a manner that considers downstream factors e.g. is the waste packaged well enough to prevent its release in transit and can it be managed when it reaches the next site?

- 3.22 The WID also requires that appropriate physical and chemical testing, including the pollution potential of the residues, is carried out prior to determining their disposal or recycling routes. Analysis should be carried out to determine the total soluble fraction and the heavy metals content of this soluble fraction. CEN standards are currently under development for ash sampling but in the meantime reference should be made to the Environment Agency protocol on sampling and testing of ashes.

### **Operating conditions – Combustion Requirements**

- 3.23 Combustion requirements for incinerators are set out in Articles 6.1 and 6.3 and those for co-incinerators are set out in Articles 6.2 and 6.3. Derogation from some of these requirements are permitted in some cases by Article 6.4 and these are also discussed in this section.

### **Temperature/Time Requirements:**

- 3.24 All incinerators and co-incinerators burning waste must be designed, equipped, built and operated in such a way that the gas resulting from the process is raised to a temperature of 850°C for 2 seconds. In the case of hazardous waste with more than 1% of halogenated organic substances, expressed as chlorine, the temperature must be raised to 1100°C. Operators whose plants cannot operate at temperatures at or above 1100°C will, therefore, have to demonstrate that they will not incinerate hazardous wastes with a chlorine content of more than 1%.
- 3.25 Combustion gas temperature should be measured near the inner wall or another representative point in the combustion chamber as authorised by the regulator. The temperature measurement point should be located after the last injection of combustion air, including secondary air and re-circulated flue gases where carried out.
- 3.26 The temperature has to be raised in a controlled and homogeneous fashion. To satisfy this, operators will need to demonstrate that cold spots in the chamber or channelling in the gas flow have been avoided. Computational fluid dynamics (CFD) modelling will be acceptable as a proof of this.
- 3.27 The WID also requires that the above temperatures are achieved under the most unfavourable conditions. This is taken to mean the most unfavourable operating conditions i.e. at the edge of the operational process design envelope and requires operators to understand their waste stream and its impact upon their plant. At the design stage, operators will need to take account of waste heterogeneity (e.g. CV, moisture content ranges) and will be required to demonstrate that they have adopted a sufficiently wide process envelope. During operation, operators will need to manage the waste stream such that it does not cause the temperature to fluctuate to the extent that compliance becomes a problem. Management of the waste feedstock would need to include consideration of waste types, their segregation and the need for pre-treatment.

- 3.28 Temperatures should be maintained during shutdown until all the waste in the combustion chamber has been burnt. Most plants will be able to quote a hearth/grate residence time – this may be used as the minimum time for which temperature should be maintained after the waste feed was stopped. Where waste feeds are sufficiently homogeneous to give rise to steady state emissions it may be possible for operators to make a case for the cross-over point between raw flue gas emissions derived from waste burning and those derived from auxiliary fuel burning to be used as a trigger to commence a controlled temperature reduction.
- 3.29 At least one automatic auxiliary burner is required for each incineration line in order to maintain the required temperatures. The burners must be linked to an automatic system activated by the output from the sensors checking the 850°C /1100°C minimum temperature at the specified location. Auxiliary burners are not required for co-incineration plants and gas engines and/or gas turbines operating on syngas from gasification/ pyrolysis plants.
- 3.30 Start-up fuels used in the auxiliary burners must not cause higher emissions than those arising from the burning of gas oil (as defined in Article 1(1) of Council Directive 75/716/EEC), liquefied gas or natural gas. For practical purposes this may be determined by comparison of fuel specification with gas oil, and may usually be limited to the pollutants listed in Annex V for release to air, unless the fuel contains a particular substance of concern.
- 3.31 Waste feed interlocks are required to prevent waste from being fed to the incinerator/co-incinerator when the required temperature conditions are not reached either at start up or during operation. Waste feed must also be stopped whenever the emission limits are being exceeded owing to problems with the abatement system except under abnormal operating conditions discussed in the Section on Abnormal Operating Conditions - Articles 6 and 13. It will be necessary for low temperature output signals to be linked to the waste loading mechanism in such a way that it cannot be operated until the relevant condition returns to the permitted level.

#### **Derogation from Operational Parameters**

- 3.32 Article 6(4) allows for certain conditional derogation from operational parameters for certain categories of waste or for certain thermal processes provided other requirements of the WID are met. This means that it is not a universal derogation for all wastes and for all plants.
- 3.33 Furnace temperatures and the flue gas residence time are the two parameters that can be derogated provided the plant does not exceed the emission limits and the specific plants satisfy the following conditions. There is no derogation from TOC or the quality of start up fuels.

- 3.34 Additional conditions to be satisfied if derogation is given for temperature or residence time:

<b>Plant</b>	<b>Condition to be met</b>
Incineration plant	No higher quantities or TOC content of residues
Co-incineration plant	Annex V (WID) TOC and CO limits for air must always be met
Bark boilers	TOC for air should not be exceeded

- 3.35 It is expected that all new plants would have been designed to meet the requirements of the WID and would not need this derogation. It is likely that older plants may not achieve the required residence time. The operators will need to apply for a derogation with a full justification. It is unlikely that the regulators will derogate from both residence time and operating temperature without a robust justification. In addition to the older plants, the most likely candidates for this derogation are gas turbines and gas engines burning gas from waste gasification and waste pyrolysis.
- 3.36 All Article 6(4) derogations granted must be notified to the European Commission. Defra will agree a mechanism with the regulators to collect this information.
- 3.37 Additional conditions that must be satisfied before derogations can be given are: compliance with emission limit values; incineration plants do not produce greater quantities of residues (e.g. ashes) or residues with a higher content of organic pollutants (i.e. TOC); co-incinerators do not exceed TOC and CO; emissions set in Annex V of the WID and the bark boilers within the pulp and paper industry do not exceed TOC limits. Note that Annex V ELVs do not generally apply to co-incinerators but if a derogation is given then the TOC and CO limits of this Annex will apply.

#### **Operating conditions – Energy Recovery**

- 3.38 Article 6(6) requires that any heat generated by the incineration or the co-incineration process should be recovered as far as practicable. It will, therefore, be necessary for all operators of incineration plants to demonstrate that this condition has been met or explain why it is not possible to recover energy. Guidance on energy recovery techniques is given in technical guidance notes issued by the regulators. In summary, the hierarchy of heat recovery is given below. Under this hierarchy, the least preferred option is option e) and the best option is a combination of all other four options.
- a) use of waste heat from boiler water cooling system,
  - b) use of a boiler for steam generation or electricity generation,
  - c) use of exhaust steam for process heating or CHP schemes,
  - d) internal heat exchange for primary air heating and/or flue gas reheating,
  - e) no heat recovery.

- 3.39 Opportunities to maximise the potential for improving heat recovery through the provision of district heating or process steam should be carefully considered, and tie-ins included in the design to enable link up in the future should the opportunity arise. This should be considered at the early planning stage, when sites are being identified for such facilities, to ensure that maximising energy recovery through the use of CHP is included as a factor in the decision.
- 3.40 The high capital cost, along with operational, maintenance and logistical requirements of electricity generation may not be economical at smaller plants. Comparison with other plants within the same sector provides a good guide to the affordability.
- 3.41 For incineration plants, waste heat recovery for process heating, electrical generation or plume abatement should be a feature of all new municipal waste incinerators (MWIs), clinical waste incinerators (CWIs) and for many chemical waste incinerators (ChWIs). It is noted however, that when highly chlorinated wastes are being destroyed, for example in merchant ChWIs, the potential for boiler corrosion and the need for rapid quenching may be more important than heat recovery, and that in the smaller plant sizes heat recovery may not be economical.
- 3.42 Heat recovery is normally limited to process use in sewage sludge incinerators i.e. combustion air, sludge drying and plume reheat. Recovery of heat from drum incinerators and animal remains incinerators (e.g. those burning MBM and tallow) must be encouraged where there is a practical use for energy (e.g. in associated drum laundry or neighbouring plant).
- 3.43 Where the waste is suitable it may also be appropriate to consider pyrolysis or gasification and the use of gas turbines to increase electrical energy recovery.
- 3.44 In all cases it will be necessary to consider pollution control aspects when assessing options for increasing energy recovery. For example, boiler designs must also minimise the potential for dioxin reformation (de novo synthesis) in the 450<sup>o</sup>C to 200<sup>o</sup>C range. Maximising electrical energy recovery may not be appropriate where some of that energy might be better used to improve the dispersion of wet plumes from wet scrubbers.

#### **Additional Operating conditions**

- 3.45 The WID requires some additional conditions to be imposed on the incineration and co-incineration plants. These are summarised below.
- 3.46 Article 6(5) requires that exhaust gas stack heights are calculated in such a way that significant ground level concentrations of pollutants are avoided and that relevant Community air quality standards are met. Significance in this context refers to process contribution and has the same meaning as, for example, used in Environment Agency Guidance Note H1 for the purposes of environmental assessment. Operators should consult the regulator for the methodology of calculations and the standards to be used.
- 3.47 Article 6(6) requires that infectious clinical waste should be fed straight into the furnace without first being mixed with other categories of waste and without direct handling. Such waste should be delivered, stored and transported to the facility in appropriate containers and in such a manner that complies with

national guidance on handling and transport of infectious clinical waste. Intermediate storage of infectious clinical waste may be carried out, but only in accordance with the relevant guidance and for the minimum time period possible. Refrigerated storage should be considered.

- 3.48 The WID also requires that the management of the incineration or co-incineration plant shall be in the hands of a natural person who is competent to manage the plant. Natural person means a real person rather than a company. Competence will be demonstrated by means of compliance with permit conditions, level of personnel training, availability of written instructions and the operator's ability to deliver any actions necessary to improve compliance. A prosecution by the regulator for breaches of the authorisation does not necessarily mean that the operator is not competent.

### **Abnormal Operating Conditions - Articles 6 and 13**

- 3.49 Article 6.3 (c) of the WID requires that waste feed should be automatically stopped whenever the continuous measurements required by this Directive show that any emission limit value is exceeded due to disturbances or failures of the purification devices. However, in some cases it may be possible for the operator to undertake quick remedial action to resolve the problem without the necessity of shutting the plant down. Article 13 of the WID recognises this possibility and allows the regulators to lay down in the permit the maximum permissible periods of any technically unavoidable stoppages, disturbances, or failures of the purification devices or the measurement devices, during which the concentrations in the discharges into the air and the purified waste water of the regulated substances may exceed the prescribed ELVs. This time-limited derogation (amounting to less than 1% of average annual operating time) is conditional on the following requirements being met.
- If the plant breakdown is likely to be longer than the permitted time period, plant operations should be reduced or stopped altogether as soon as practicable. This means that if the operator knows that the fault cannot be rectified within the allowable period, he should not wait till the end of this period before initiating shutdown.
  - The maximum allowable period for any one episode of abatement or monitoring equipment failure (separately or together) must not exceed 4 hours. In addition, the total allowable period in a year must not exceed 60 hours. If, in a given year, the operator has used up his allowance of 60 hours then any further failures will require plant shut down until normal operations can be resumed.
  - In the case of incineration plants, other requirements that must be met during the abnormal operations include: compliance with the operating conditions above (see the Section on Operating conditions – Energy Recovery), compliance with ELVs for CO and TOC and that dust emissions remaining below 150 mg/m<sup>3</sup> at all times. In practice this means that the pollutants that can be exceeded during abnormal operations are HCl, SO<sub>2</sub>, NO<sub>x</sub> and dust (limited to 150 mg/m<sup>3</sup>).

## Air Emission Limit Values - Article 7

### Emission Limit Values for Incinerators

- 3.50 Article 7(1) requires all incinerators to be designed and operated, as a minimum, to meet the ELVs set out in Annex V of the WID.
- 3.51 The tables and notes below summarise the ELVs that must be achieved. Note that reference conditions in the following tables are: Temperature 273 K, pressure 101.3 kPa, 11% oxygen (3% oxygen if burning waste oils), dry gas.

#### (a) Daily Average Values

Total dust	10 mg/m <sup>3</sup>
Gaseous and vaporous organic substances, expressed as total organic carbon	10 mg/m <sup>3</sup>
Hydrogen chloride (HCl)	10 mg/m <sup>3</sup>
Hydrogen fluoride (HF)	1 mg/m <sup>3</sup>
Sulphur dioxide (SO <sub>2</sub> )	50 mg/m <sup>3</sup>
Nitrogen monoxide (NO) and nitrogen dioxide (NO <sub>2</sub> ), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	200 mg/m <sup>3</sup>
Nitric oxide (NO) and nitrogen dioxide (NO <sub>2</sub> ), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity of 6 tonnes per hour or less	400 mg/m <sup>3</sup>

#### (b) Half-hourly Average Values

	(100%) A	(97%) B
Total dust	30 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>
Gaseous and vaporous organic substances, expressed as total organic carbon	20 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>
Hydrogen chloride (HCl)	60 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>
Hydrogen fluoride (HF)	4 mg/m <sup>3</sup>	2 mg/m <sup>3</sup>
Sulphur dioxide (SO <sub>2</sub> )	200 mg/m <sup>3</sup>	50 mg/m <sup>3</sup>
Nitrogen monoxide (NO) and nitrogen dioxide (NO <sub>2</sub> ), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	400 mg/m <sup>3</sup>	200 mg/m <sup>3</sup>

#### (c) Heavy Metals

The table below shows average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours. These average values cover also gaseous and the vapour forms of the relevant heavy metal emissions as well as their compounds.

### Average values for heavy metal emissions

Cadmium and its compounds, expressed as cadmium (Cd)	total 0.05mg/m <sup>3</sup>
Thallium and its compounds, expressed as thallium (Tl)	
Mercury and its compounds, expressed as mercury (Hg)	0.05 mg/m <sup>3</sup>
Antimony and its compounds, expressed as antimony (Sb)	total 0.5 mg/m <sup>3</sup>
Arsenic and its compounds, expressed as arsenic (As)	
Lead and its compounds, expressed as lead (Pb)	
Chromium and its compounds, expressed as chromium (Cr)	
Cobalt and its compounds, expressed as cobalt (Co)	
Copper and its compounds, expressed as copper (Cu)	
Manganese and its compounds, expressed as manganese (Mn)	
Nickel and its compounds, expressed as nickel (Ni)	
Vanadium and its compounds, expressed as vanadium (V)	

#### (d) Dioxins

The WID requires dioxins to be reported using the I-TEQ reporting convention to assess compliance against an emission limit of 0.1ng I-TEQ / Nm<sup>3</sup>. The UK's independent health advisory committee, Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT), has adopted the World Health Authority (WHO) toxicity equivalence factors (TEF) for both dioxins and dioxin-like PCBs in their recent review of Tolerable Daily Intake (TDI) criteria. The Government is of the opinion that, in addition to the requirements of the WID, the WHO-TEF values for both dioxins and dioxin-like PCBs should be specified for monitoring and reporting purposes. This will enable evaluation of exposure to dioxins and dioxin-like PCBs to be made using the revised TDI recommended by COT.

Regulators will, therefore, set dioxin emission limits using on I-TEF (1990) values but with additional monitoring/reporting requirements for dioxins and dioxin-like PCBs using WHO-TEF (1997/98) factors (see table on the next page for these factors).

## Equivalence factors for dibenzo-p-dioxins, dibenzofurans and dioxin-like PCBs

For the determination of the total concentration, the mass concentrations of each congener should be multiplied by the following equivalence factors before summing:

<b>TEF schemes for dioxins, furans and dioxin-like PCBs</b>				
<b>Congener</b>	<b>I-TEF(1990)</b>	<b>WHO-TEF (1997/8)</b>		
		<b>Human/ Mammals</b>	<b>Fish</b>	<b>Birds</b>
<i>Dioxins</i>				
2,3,7,8-TCDD	1	1	1	1
1,2,3,7,8-PeCDD	0.5	1	1	1
1,2,3,4,7,8-HxCDD	0.1	0.1	0.5	0.05
1,2,3,6,7,8-HxCDD	0.1	0.1	0.01	0.01
1,2,3,7,8,9-HxCDD	0.1	0.1	0.01	0.1
1,2,3,4,6,7,8-HpCDD	0.01	0.01	0.001	<0.001
OCDD	0.001	0.0001	-	-
<i>Furans</i>				
2,3,7,8-TCDF	0.1	0.1	0.05	1
1,2,3,7,8-PeCDF	0.05	0.05	0.05	0.1
2,3,4,7,8-PeCDF	0.5	0.5	0.5	1
1,2,3,4,7,8-HxCDF	0.1	0.1	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.01	0.01
OCDF	0.001	0.0001	0.0001	0.0001
<i>Non-ortho PCBs</i>				
3,4,4',5-TCB (81)	-	0.0001	0.0005	0.1
3,3',4,4'-TCB (77)	-	0.0001	0.0001	0.05
3,3',4,4',5 - PeCB (126)	-	0.1	0.005	0.1
3,3',4,4',5,5'-HxCB(169)	-	0.01	0.00005	0.001
<i>Mono-ortho PCBs</i>				
2,3,3',4,4'-PeCB (105)	-	0.0001	<0.000005	0.0001
2,3,4,4',5-PeCB (114)	-	0.0005	<0.000005	0.0001
2,3',4,4',5-PeCB (118)	-	0.0001	<0.000005	0.00001
2',3,4,4',5-PeCB (123)	-	0.0001	<0.000005	0.00001
2,3,3',4,4',5-HxCB (156)	-	0.0005	<0.000005	0.0001
2,3,3',4,4',5'-HxCB (157)	-	0.0005	<0.000005	0.0001
2,3',4,4',5,5'-HxCB (167)	-	0.00001	<0.000005	0.00001
2,3,3',4,4',5,5'-HpCB (189)	-	0.0001	<0.000005	0.00001

**(e) Carbon Monoxide**

The following emission limit values for carbon monoxide (CO) must not be exceeded (excluding the start-up and shut-down phase):

- 50 milligrams/m<sup>3</sup> of combustion gas determined as daily average value;
- 150 milligrams/m<sup>3</sup> of combustion gas of at least 95 % of all measurements determined as 10-minute average values or 100 mg/m<sup>3</sup> of combustion gas of all measurements determined as half-hourly average values taken in any 24-hour period.

Exemptions may be authorised by the regulators for incineration plants using fluidised bed technology, provided that the permit foresees an emission limit value for carbon monoxide (CO) of not more than 100 mg/m<sup>3</sup> as a hourly average value.

**Other non-specified ELVs**

- 3.52 Article 7(5) allows Member States to set emission limits for other pollutants especially polycyclic aromatic hydrocarbons (PAHs). There is lack of monitoring data on the release of PAHs from incinerators on which to base such limits or even to decide if a limit is required. The Waste Incineration directions thus require the regulators to impose monitoring requirements in the permits but not to set a limit. Once sufficient data is available, a decision can be made on the future of this requirement.
- 3.53 The following PAHs should be monitored and results reported on the same frequency as for dioxins and dioxin-like PCBs.

**Polycyclic Aromatic Hydrocarbons (PAHs) to be monitored:**

Anthanthrene  
Benzo[a]anthracene  
Benzo[b]fluoranthene  
Benzo[k]fluoranthene  
Benzo(b)naph(2,1-d)thiophene  
Benzo(c)phenanthrene  
Benzo[ghi]perylene,  
Benzo[a]pyrene  
Cholanthrene  
Chrysene  
Cyclopenta(c,d)pyrene  
Dibenzo[ah]anthracene  
Dibenzo[a,i]pyrene  
Fluoranthene  
Indo[1,2,3-cd]pyrene  
Naphthalene

- 3.54 Most of the larger incinerators are likely to require abatement plant for meeting the NO<sub>x</sub> limits and Selective Non-catalytic Reduction (SNCR) is the technique commonly used for this purpose. SNCR has a potential to release ammonia and N<sub>2</sub>O. Regulators will therefore be asking for monitoring of these pollutants with or without specified limits.

#### **Air Emission Limit Values for co-incinerators**

- 3.55 Article 7(2) requires that co-incineration plant shall be designed, equipped, built and operated in such a way that the emission limit values determined according to or set out in Annex II of the WID are not exceeded in the exhaust gas. However, Annex V ELVs will apply to co-incineration plant where:

- the co-incineration (of non-hazardous or hazardous waste) takes place in such a way that the main purpose of the plant is not the production of material products or the generation of energy, but the thermal treatment of waste (Article 3(5)). In this case all of the WID requirements that apply to incinerators will now apply to this plant because for the purposes of the WID the plant is considered to be an “incineration plant”;
- more than 40% of the resulting heat release comes from the incineration of hazardous waste (Article 7(2)). Only the ELVs from Annex V apply. The plant does not become an incineration plant as defined in Article 3(4) and therefore continues only to have to comply with those aspects of the WID as they relate to co-incinerators; or
- when untreated mixed municipal waste is co-incinerated. "Mixed municipal waste" is defined by the WID as “waste from households as well as commercial, industrial and institutional waste, which because of its nature and composition is similar to waste from households, but excluding fractions indicated in the Annex to Decision 94/3/EC under heading 20 01 that are collected separately at source and excluding the other wastes indicated under heading 20 02 of that Annex”. Here reference to 94/3/EC should be taken to mean the List of Wastes Regulations.

- 3.56 It will be for the operator to prove that he is not using untreated municipal waste. The Government considers that, in this context, “treatment” of mixed municipal waste should be taken to mean “any physical, thermal, chemical or biological process, including sorting, that changes the characteristics of waste in order significantly to enhance its combustion qualities in the co-incineration process in which it is to be used.

#### **Determination of air emission limit values for the co-incinerators.**

- 3.57 For this, Annex II of the WID generally applies a mixing rule based on the principle that, in a mixed fuel/waste firing situation, the flue gases generated by the waste meet the ELVs given in Annex V of the WID. Further guidance on actual calculations is provided in Annex 3 of this guidance. Annex II of the WID is reproduced on the following page but some points need to be noted.

- Where a total ELV (C) has been specified in Annex II it should be taken as an ELV under the WID.

- Annex II specifies limits for some heavy metals and dioxins which apply in full to the co-incineration plants without pro rata.
- If the resulting heat release from the incineration of hazardous waste amounts to less than 10% of the total heat released in the plant,  $V_{\text{waste}}$  must be calculated from a (notional) quantity of waste that, being incinerated, would equal 10% heat release, the total heat release being fixed.
- Where Annex II does not specify a total emission limit for a pollutant, it must be calculated by using the mixing rule.  $C_{\text{proc}}$  values specified in this annex must be used for pro rata calculations.
- Where Annex II does not specify a  $C_{\text{proc}}$  value, then limits in the permit are to be used in the mixing rule formula. In the absence of these, i.e. where the permit does not specify a limit for a pollutant e.g. HCl for a combustion plant, actual measured values should be used.

3.58 Bearing in mind that the ELVs for waste and process fuels may be specified at different oxygen concentrations, the total emission limit calculated by the Annex II formula will require an equivalent oxygen concentration. This oxygen concentration is to be calculated by using the mixing rule and the partial volumes of the flue gases coming from waste and fuels.

3.59 The calculated oxygen levels, as discussed above, will vary with the proportion of waste being burnt. However, the regulators may require that actual emission monitoring data is supplied in a standard form e.g. at 11% oxygen. This can be easily done by using the formula given in Annex VI of the WID as detailed below.

$$E_S = \frac{21 - O_S}{21 - O_M} \times E_M$$

$E_S$  calculated emission concentration at the standard percentage oxygen concentration

$E_M$  measured emission concentration

$O_S$  standard oxygen concentration

$O_M$  measured oxygen concentration

## ANNEX II of the WID

The limit or guide value for each relevant pollutant and carbon monoxide in the exhaust gas resulting from the co-incineration of waste must be calculated as follows:

$$C = \frac{V_{waste} \times C_{waste} + V_{proc} \times C_{proc}}{V_{waste} + V_{proc}}$$

$V_{waste}$ : exhaust gas volume resulting from the incineration of the waste only determined from the waste with the lowest calorific value specified in the permit and standardised at the conditions given in Article 11(7).

If the resulting heat release from the incineration of hazardous waste amounts to less than 10% of the total heat released in the plant,  $V_{waste}$  must be calculated from a (notional) quantity of waste that, being incinerated, would equal 10% heat release, the total heat release being fixed.

$C_{waste}$ : emission limit values set for incineration plants in Annex V for the relevant pollutants and carbon monoxide.

$V_{proc}$ : exhaust gas volume resulting from the plant process including the combustion of the authorised fuels normally used in the plant (wastes excluded) determined on the basis of oxygen contents at which the emissions must be standardised as laid down in Community or national regulations. In the absence of these measures, the real oxygen content in the exhaust gas without being thinned by addition of air unnecessary for the process must be used. The standardisation at the other conditions is given in this Directive.

$C_{proc}$ : emission limit values as laid down in the tables in Annex II for certain industrial sectors or in case of the absence of such a table or such values, emission limit values of the relevant pollutants and carbon monoxide in the flue gas of plants which comply with the national laws, regulations and administrative provisions for such plants while burning the normally authorised fuels (wastes excluded). In the absence of these measures the emission limit values laid down in the permit are used. In the absence of such permit values the real mass concentrations are used.

$C$ : total emission limit value and oxygen content as laid down in the tables in annex II for certain industrial sectors and certain pollutants or in case of the absence of such a table or such values total emission limit values for CO and the relevant pollutants replacing the emission limit values as laid down in specific Annexes of this Directive. The total oxygen content to replace the oxygen content for the standardisation is calculated on the basis of the content above respecting partial volumes.

### Setting ELVs for cement kilns co-incinerating waste.

- 3.60 The ELVs, as given in Annex II.I for cement kilns, are summarised in the table below. There are no half-hourly limits but half hourly value will be needed to calculate daily average value. With the possible exception of TOC and SO<sub>2</sub>, there is no need to apply the Annex II mixing formula when burning non-hazardous waste or hazardous waste below 40% thermal substitution. If the heat input from hazardous waste is greater than 40%, the ELVs given in the Section on Emission Limit Values for Incinerators (incinerators) apply.

	Directive Requirement	
	Emission Limit (mg/m <sup>3</sup> ) (*)	Averaging Period
Dusts	30	daily
VOCs (as TOC)	10 <sup>Note 1</sup>	daily
HCl	10	daily
HF	1	daily
SO <sub>2</sub>	50 <sup>Note 1</sup>	daily
NO <sub>x</sub> (NO and NO <sub>2</sub> expressed as NO <sub>2</sub> ) for existing plant	800	daily
NO <sub>x</sub> (NO and NO <sub>2</sub> expressed as NO <sub>2</sub> ) for new plant	500	daily
CO	Set by the regulator <sup>Note 2</sup>	
Cd and Tl	Total 0.05	Average values over the sample period of 30 minutes to 8 hours
Hg	0.05	
Sb,As, Pb, Cr, Co, Cu, Mn, Ni and V	Total 0.5	
Dioxins	0.1 ng/m <sup>3</sup> TEQ	CEN method, sample period 6 to 8 hours

Reference conditions: 273 K, 101.3 kPa, 10% O<sub>2</sub>, dry gas. <sup>Note 3</sup>

### Notes

- Exemptions can be granted in cases where TOC and SO<sub>2</sub> do not result from the incineration of waste. It will be up to the operator to prove that these pollutants exclusively arise from raw materials. In other cases, the regulators are likely to use the mixing rule for pro rata calculations of these.
- Daily average ELV to be set based on a site-specific assessment.
- Note the different standard oxygen content specified in the standard reference conditions, 10% O<sub>2</sub> rather than 11% O<sub>2</sub> specified for incineration plant. This means that the limits for heavy metals and dioxins are tighter than incinerators.

### Annex II.2 Special provisions for combustion plant co-incinerating waste

- 3.61 This section specifies the process emission limit values that are to be used in the mixing rule formula. Note that the limits are to be based on daily averages - half-hourly values are only needed to calculate the daily average values.

#### Process emission limits ( $C_{proc}$ )

- 3.62 Annex II specifies  $C_{proc}$  values for SO<sub>2</sub>, NO<sub>x</sub>, and dust as listed below. These should be used to calculate the total ELV for these pollutants. For other pollutants (such as VOCs, HCl, HF and CO) use process limits ( $C_{proc}$ ) specified in the permit/national guidance or in the absence of these, the actual measured values.

#### $C_{proc}$ for solid fuels expressed in mg/Nm<sup>3</sup> (O<sub>2</sub> content 6%):

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO <sub>2</sub> General case		850	850 to 200 (linear decrease from 100 to 300 MWth)	200
Indigenous fuels		or rate of desulphurisation > 90%	or rate of desulphurisation > 92%	or rate of desulphurisation > 95%
NO <sub>x</sub>		400	300	200
Dust	50	50	30	30

#### $C_{proc}$ for biomass expressed in mg/Nm<sup>3</sup> (O<sub>2</sub> content 6%):

- 3.63 Biomass means products consisting of any whole or part of a vegetable matter from agriculture or forestry, which can be used for the purpose of recovering its energy content as well as wastes listed in Article 2(2)(a)(i) to (v) of the WID.

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO <sub>2</sub>		200	200	200
NO <sub>x</sub>		350	300	300
Dust	50	50	30	30

$C_{proc}$  for liquid fuels expressed in  $mg/Nm^3$  ( $O_2$  content 3%):

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO <sub>2</sub>		850	850 to 200 (linear decrease from 100 to 300 MWth)	200
NOx		400	300	200
Dust	50	50	30	30

**Total emission limit values for heavy metals and dioxins for combustion plants burning waste**

3.64 The WID sets the following emission limit values for certain pollutants which are to be imposed without pro rata. Note that these limits are at 6% oxygen even for liquid fuels.

Pollutant	Directive Requirement	
	Emission Limit ( $mg/Nm^3$ )	Averaging Period
Cd and Tl	total 0.05	All average values over the sample period 30 minutes to 8 hours
Hg	0.05	
Sb,As, Pb, Cr, Co, Cu, Mn, Ni and V	total 0.5	
Dioxins	0.1 $ng/m^3$ TEQ	CEN method, sample period 6 to 8 hours

**Special provisions for industrial sectors not covered under II.1 or II.2 co-incinerating waste**

3.65 Use Annex II mixing formula to calculate ELVs for SO<sub>2</sub>, NOx, dust, VOCs, HCl, and HF, CO, and total Sb +As + Pb + Cr + Co + Cu + Mn + Ni + V (relevant pollutants listed in Annex V). In addition the following limits apply in full. The WID does not specify reference conditions but it will be reasonable to assume that the limits will apply at 11% oxygen.

Pollutant	Directive Requirement	
	Emission Limit, $mg/Nm^3$	Averaging Period
Cd and Tl	total 0.05	All average values over the sample period 30 minutes to 8 hours
Hg	0.05	
Dioxins	0.1 $ng/m^3$ TEQ	CEN method, sample period 6 to 8 hours

**Other non-specified ELVs:**

3.66 Article 7(5) allows Member States to set emission limits for other pollutants especially polycyclic aromatic hydrocarbons (PAHs). There is lack of monitoring

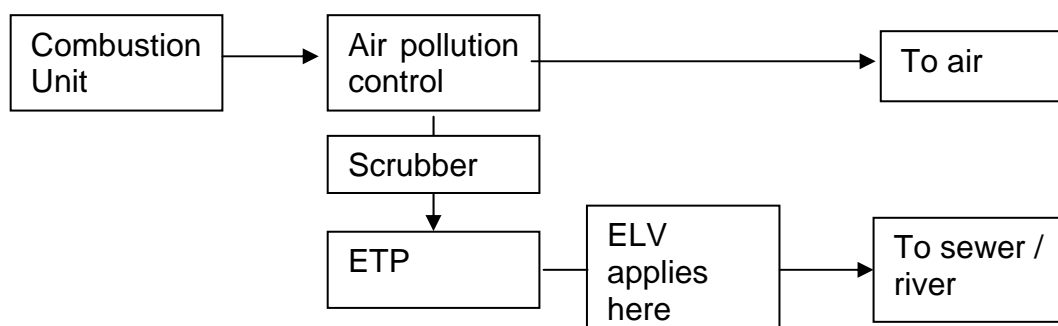
data on the release of PAHs from the co-incineration sector on which to base such limits or even to decide if a limit is required. The Regulations thus require the regulators to impose monitoring requirements in the permits but not set a limit. Once sufficient data is available, a decision can be made on the future of this requirement. The list of PAHs to be monitored and reported is given in the Section on Other non-specified ELVs.

- 3.67 Some co-incinerators are likely to require abatement plant for meeting the NO<sub>x</sub> limits and SNCR is the technique commonly used for this purpose. SNCR has a potential to release ammonia and N<sub>2</sub>O. Regulators will therefore be asking for monitoring of these pollutants with or without specified limits.

### **Water Emission Limit Values - Article 8**

- 3.68 The WID requires that the waste water from the cleaning of exhaust gases discharged from an incineration or co-incineration plant shall be subject to a permit granted by the regulators. It further requires that discharges to the aquatic environment of waste water resulting from the cleaning of exhaust gases shall be limited as far as practicable, at least in accordance with the emission limit values set in Annex IV. There is also a requirement to set operational control parameters at least for pH, temperature and flow.
- 3.69 There are also some more general requirements in respect of the design and operation of the plant to prevent unauthorised and accidental release of polluting substances into soil, surface water or ground water. This applies to all potential sources of pollution on the site, not just to the releases from air pollution control equipment. If BAT is used this will normally fulfil the WID requirements.
- 3.70 The WID specifically states that storage capacity shall be provided for contaminated rainwater run-off from the site or for contaminated water arising from "spillage or fire fighting operations."
- 3.71 In the context of this requirement, "contaminated rainwater" should also be taken to include all areas where there is reasonable risk of contamination by the installation. This would normally exclude roof water, access road drainage and office or other ancillary operations. Contamination of rainwater and spillages caused by the storage of feedstock wastes, chemicals, fuels and all residues should be avoided by storage under cover, on suitably impermeable surfaces with contained or controlled drainage.
- 3.72 A risk assessment process should be used to determine the volume of storage that is required to contain fire water. At new sites it is likely that it will be possible for site drainage to be engineered such that complete containment is provided. This may include, for example, the use of bunding, or the routing of drainage to a holding tank or an on-site effluent treatment plant using an emergency valve.
- 3.73 Annex IV of the WID lists the emission limit values for discharge of water from air pollution control devices. Where such effluents are discharged (to sewer or controlled water) these limits, and the monitoring and compliance requirements must be included in permits. It is important to note that the operational control parameters of pH, temperature and flow apply to all effluents (including

scrubber discharges), whereas the ELVs for suspended solids, metals and dioxins only need to be applied where air pollution control liquors are discharged (alone or in combination with other effluents).



### Emission Limit Values for discharges of waste water from the cleaning of exhaust gases

Polluting substances	Emission limit values expressed in mass concentrations for unfiltered samples	
	1. Total suspended solids as defined by Directive 91/271/EEC	95% 30 mg/l
2. Mercury and its compounds, expressed as mercury (Hg)	0.03 mg/l	
3. Cadmium and its compounds, expressed as cadmium (Cd)	0.05 mg/l	
4. Thallium and its compounds, expressed as thallium (Tl)	0.05 mg/l	
5. Arsenic and its compounds, expressed as arsenic (As)	0.15 mg/l	
6. Lead and its compounds, expressed as lead (Pb)	0.2 mg/l	
7. Chromium and its compounds, expressed as chromium (Cr)	0.5 mg/l	
8. Copper and its compounds, expressed as copper (Cu)	0.5 mg/l	
9. Nickel and its compounds, expressed as nickel (Ni)	0.5 mg/l	
10. Zinc and its compounds, expressed as Zinc (Zn)	1.5 mg/l	
11. Dioxins and furans, defined as the sum of the individual dioxins and furans I-TEQ	0.3 ng/l	

### Where do the ELVs apply?

- 3.74 The emission limits apply at the point where waste-waters from the cleaning of exhaust gases are discharged from the plant and allow on-site or off-site effluent treatment to be used to achieve the ELVs. Where there is an ETP the ELVs apply at the discharge point from the ETP. Where the ETP receives other

inputs ELVs must be prorata by volume (see section below on **combined effluents**).

**Off-site ETP:**

- 3.75 BAT is likely to require an on-site effluent treatment plant for the treatment of liquors from air pollution control equipment prior to release from the site (whether to sewer or controlled water). Off-site ETPs dedicated to the treatment of wastewater from incineration or co-incineration are in practice unlikely to be found.
- 3.76 It is more likely that other effluents will also be received at an off-site ETP (e.g. a sewerage treatment plant). Here ELVs must be pro rata by volume (see section below on **combined effluents**) and compliance determined by means of up-stream and downstream measurements of concentration and flow. Access arrangements are again likely to be an issue.
- 3.77 Wherever off-site treatment is proposed, the regulator will need to carefully consider the fate of the pollutants discharged from the incineration process. Treatment of a more concentrated effluent stream in a dedicated ETP is more likely to meet BAT requirements than downstream treatment in a plant provided primarily for other purposes (e.g. sewerage treatment plant). For example, heavy metals and dioxins may accumulate in sludge, which may be subsequently re-used for agricultural purposes. Up-stream dedicated treatment would avoid such pollutant transfer.

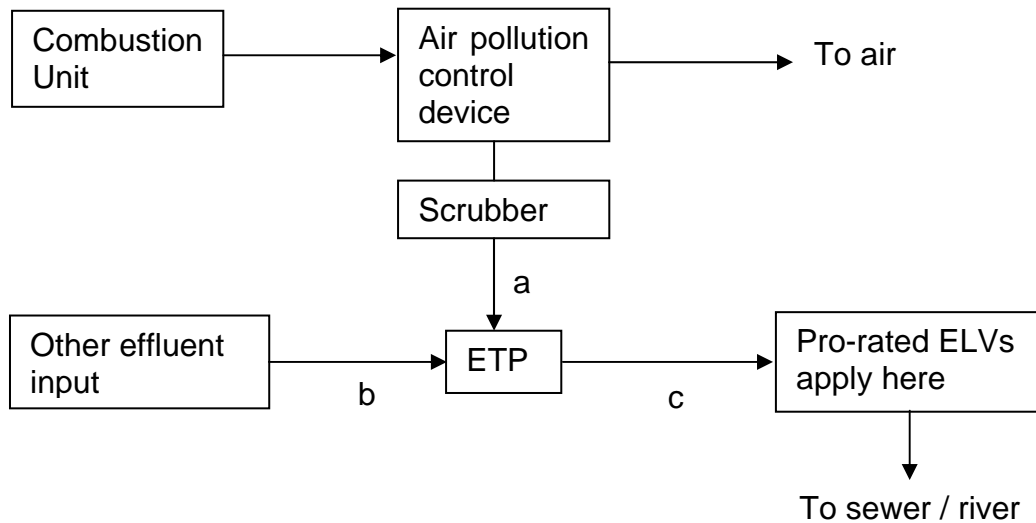
**Common Examples where ELVs do not apply:**

- 3.78 Hard-standing drainage is discharged separately from scrubber liquors (i.e. it only combines after the scrubber liquors have been treated in the ETP) – ELVs will not apply. BAT will.
- 3.79 Boiler blow-down is treated and the effluent re-circulated to an ash quench pit where it is absorbed onto the ash – there is no effluent discharge and there is no requirement for internal ELVs.

**Calculating ELVs for Combined Effluents:**

- 3.80 The WID does not allow dilution to be used for the purposes of compliance with the water ELVs. Where effluents are combined it will be necessary to account for any dilution in assessing compliance. This is the case whether the additional diluting effluents are derived from the incineration plant itself or from other sources and applies to on-site or off-site ETP.
- 3.81 The aim is to assess the concentration of the pollutants listed in Annex IV that are discharged from the site, that are attributable to the cleaning of the exhaust gases.

### Combined Effluent Treatment:



#### Notes:

1. Points a, b and c relate to sampling points required to assess compliance with ELVs.
2. The same procedure applies to on-site and off-site ETP.

In such situations the ELVs still apply after the scrubber effluent has been treated by the ETP, but it is necessary to account for any dilution afforded by the addition of the other effluents.

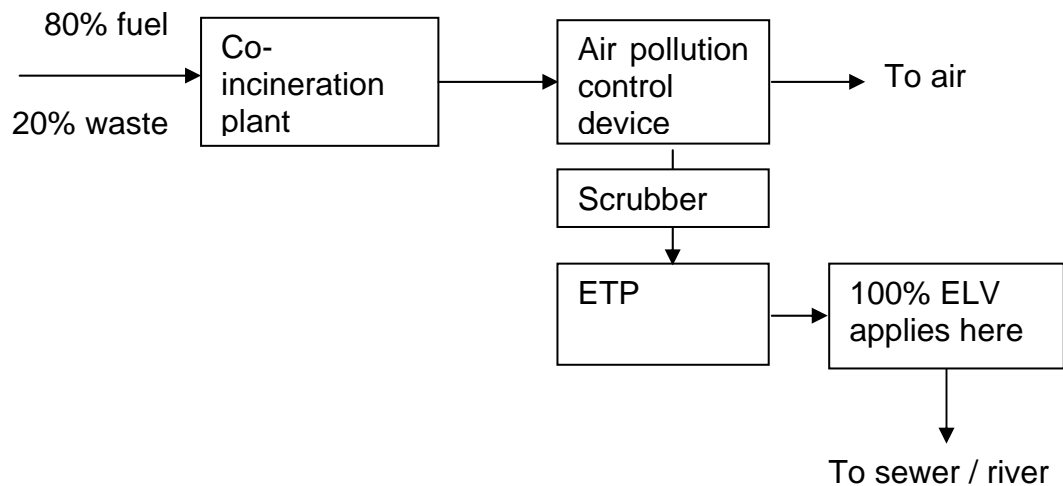
This must be achieved by taking the required measurements at locations a, b and c.

Appropriate mass balance calculations should then be used to determine the emission levels in the final wastewater discharge (i.e. from the ETP) that can be attributed to the wastewater arising from the cleaning of exhaust gases.

#### Water Discharge ELVs for co-incinerators

- 3.82 Note that the WID does not specify that only those pollutants that arise from the combustion of waste are subject to the ELVs. Where waste is co-incinerated with non-waste fuels this therefore means that the ELVs will apply to all of the waste water arising from the flue gas treatment system, and not just to that part which is attributable to waste combustion.

### Co-incineration:



#### Note:

1. the ELV applies to all of the scrubber liquors, not just the 20% arising from the combustion of waste.
2. Again the pollutant concentrations should be compared with the ELVs after the ETP. Also, were the ETP to take other effluents, it will be necessary for compliance with the WID ELVs to be assessed as described in the section above on combined effluents.

### Monitoring Requirements for Incinerators and Co- Incinerators - Articles 10 and 11

3.83 The aim of the WID is to prevent or to limit negative effects on the environment and the risks to human health. It achieves this by setting stringent operational conditions and technical requirements and through setting emission limit values for waste incineration and co-incineration plants.

3.84 The WID requires that:

- the permit can only be granted if the applicant shows that the proposed measurement techniques for emissions to air will comply with the requirements of the WID;
- the permit specifies the sampling and measurement procedures to satisfy the obligations imposed;
- measurement requirements are laid down in the permit or in the conditions attached to the permit issued by the regulators;
- measurement equipment should be installed meaning thereby that temporary equipment is not acceptable (on long term basis);
- the location of the sampling or measurement points must be laid down by the regulator, and
- the calibration of continuous monitoring equipment and the periodic measurements of the emissions into the air and water must be carried

out representatively and according to CEN standards. If CEN standards are not available, ISO standards, national/international standards which can provide data of equivalent scientific quality must be used.

3.85 Monitoring requirements are taken to include the substances to be measured, the frequency at which they should be measured and reported, the methods to be used, compliance criteria, calibration methods and the standards to be used.

3.86 In addition to the generic requirements listed above and the calibration of monitors discussed later, the main parameters that are to be monitored include: process operational parameters, releases to air and releases to water.

### **Monitoring of Process / Operational Parameters**

3.87 Some of the process/operational parameters, e.g. TOC/LOI, that should be monitored was discussed earlier. The WID also requires continuous measurements of the following process operation parameters:

- temperature near the inner wall or at another representative point of the combustion chamber as authorised by the regulator,
- concentration of oxygen,
- pressure,
- temperature, and
- water vapour content of the exhaust gas. The continuous measurement of water vapour is not required if the sampled flue gas is dried before the emissions are analysed.

3.88 These requirements can be summarised as below.

<b>Parameter</b>	<b>Monitoring/Measurement Requirement</b>
Mass of each category of waste accepted	According to List of Waste Regulations where possible. Use actual weight where possible
Hazardous waste accepted	Composition, CV, taking samples
TOC/LOI content of slag / bottom ashes	Sampling and analysis as specified in the permit
Flue gases	Continuous measurement of oxygen content, temperature, pressure and water vapour (except where the gas is dried before analysis).
Soluble fraction of Residues	Total soluble fraction and the heavy metal content of this fraction
Residence time and temperatures	Verification of residence time, location of temperature measurement points

### **Monitoring of Releases to Air**

3.89 NO<sub>x</sub>, total dust, TOC, HCl, HF and SO<sub>2</sub> should be monitored continuously. Regulators may also set frequencies for the monitoring of NH<sub>3</sub> and N<sub>2</sub>O.

- 3.90 Operators should take at least two measurements per year of heavy metals, dioxins and furans, dioxin-like PCBs and PAHs but there should be one measurement at least every three months for the first 12 months of operation. These are the minimum frequencies for periodic measurements. However, the regulators may ask for more frequent sampling and analysis.

### **Exemptions**

- 3.91 The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded. This means that two conditions have to be satisfied simultaneously i.e. there has to be an abatement stage for HCl removal and the abated flue gas has to meet HCl emission limits. The assumption here is that any technology that removes HCl from the flue gas will also remove HF. In this case the emissions of HF can be subject to periodic measurements as noted above for dioxins and heavy metals.
- 3.92 Periodic measurements of HCl, HF and SO<sub>2</sub> instead of continuous measuring may be authorised for incineration or co-incineration plants, if the operator can prove that the emissions of those pollutants can under no circumstances be higher than the prescribed emission limit values. Since these pollutants arise from the constituents of the waste, the operator will have to prove that the concentrations of chlorine, sulphur and fluorine in the waste will under all circumstances be below a certain level. Regulators will have to ensure that this remains the case and are, therefore, likely to impose frequent sampling and analysis requirements on the waste streams.

## **Standardisation and Compliance**

### **Standardisation**

- 3.93 The results of the measurements made to verify compliance with the emission limit values are to be standardised at the following conditions and for oxygen according to the formula in Annex VI (see the Section on [Air Emission Limit Values for co-incinerators](#)):
- Temperature 273 K, pressure 101,3 kPa, 11% oxygen, dry gas, in exhaust gas of incineration plants;
  - Temperature 273 K, pressure 101,3 kPa, 3% oxygen, dry gas, in exhaust gas of incineration of waste oil as defined in Directive 75/439/EEC. Note that this reference condition only applies to waste oils and not to all liquid wastes;
  - When the wastes are incinerated or co-incinerated in an oxygen-enriched atmosphere, the results of the measurements can be standardised at an oxygen content laid down by the regulator reflecting the special circumstances of the individual case, and
  - In the case of co-incineration, the results of the measurements should be standardised at a total oxygen content as described in the Section on [Air Emission Limit Values for co-incinerators](#) above.

3.94 When the emissions of pollutants are reduced by exhaust gas treatment in an incineration or co-incineration plant treating hazardous waste, the standardisation with respect to the oxygen contents can only be done if the measured oxygen level exceeds the relevant standard oxygen content. For example, if the emission limit is set at 10% oxygen (e.g. for cement plants), standardisation to this value is only allowed if the oxygen level during emission monitoring is higher than 10%. Note that this requirement does not apply to non-hazardous waste.

### **Compliance**

3.95 It is essential that all results are recorded, processed and presented in a fashion that allows a transparent verification of compliance with the operating conditions and emission limit values specified in the permit. Regulators would have developed their own procedures to achieve this and, where these are included in the permit, the operators will need to comply with these.

3.96 The WID requires that if the measurements taken show that the emission limit values for air or water have been exceeded, the regulator should be informed without delay.

3.97 To show that the operator has complied with the emission limit values for air, the following criteria would apply:

- none of the daily average values exceeds any of the emission limit values set out in the Sections on Emission Limit Values for Incinerators and Air Emission Limit Values for co-incinerators above,
- 97% of the daily average values over the year does not exceed the emission limit value of 50 mg/m<sup>3</sup> CO,
- either none of the half-hourly average values exceeds any of the emission limit values set out in column A or, where relevant, 97% of the half-hourly average values over the year do not exceed any of the emission limit values set out in column B (see table for half hourly limits in the Section on [Emission Limit Values for Incinerators](#)). The regulators may be more inclined to apply the limit values in Column A as this gives a better short term picture,
- none of the average values over the sample period set out for heavy metals and dioxins and furans exceed the emission limit values set out in tables in the Sections on [Emission Limit Values for Incinerators](#) (incinerators) and [Air Emission Limit Values for co-incinerators](#) (co-incinerators), and
- CO emission limit values of 150 mg/m<sup>3</sup> of combustion gas of at least 95 % of all measurements determined as 10-minute average values or 100 mg/m<sup>3</sup> of combustion gas of all measurements determined as half-hourly average values taken in any 24-hour period are complied with.

3.98 The above compliance requirements apply at all times when waste is being burnt except under abnormal operating conditions as discussed in the Section on Abnormal Operating Conditions - Articles 6 and 13. This raises the question whether these requirements also apply during the commissioning of a new

plant. The WID does not seem to cover this situation as it always relates to normal plant operations. The Government believes that a strict compliance is not achievable during this period. As such, regulators should require the operator to submit a commissioning plan with an estimate of:

- number of operating hours outside the emission limits;
- anticipated emission levels; and
- environmental impact

3.99 Any breaches should be reported as normal for review by the regulator. Given the breaches are anticipated and that commissioning of the plant is not normal operation there is sufficient mitigation that no enforcement action is required, providing the regulator considers the operator has not been negligent and that the management controls for commissioning are sufficient.

### **Averages**

3.100 The WID specifies limit values averaged over a defined period, e.g. daily, half hourly etc. It also details how these averages are to be calculated.

3.101 The half-hourly and the 10-minute averages should be determined within the effective operating time from the measured values after having subtracted the value of the confidence interval specified in the Section on Uncertainty budgets later. Effective period here does not include start-up or shut-down provided no waste is being burnt. The daily average values are then determined from those validated average values.

3.102 To obtain a valid daily average value no more than five half-hourly average values in any day may be discarded due to malfunction or maintenance of the continuous measurement system. Where more than 10 daily averages during operating time are invalid, this will be a breach of a permit condition and the regulators will consider what enforcement action is appropriate. Note that values can only be discarded if the operator can confirm that the CEM(s) were under maintenance or malfunctioning. In other words, operators cannot simply discard five highest averages in a day.

### **Monitoring standards**

3.103 The table below summarises monitoring requirements in respect of releases to air. Monitoring standards apply to continuous monitoring, for monitoring systems permanently fixed onto stacks, and to periodic methods, which are used for check monitoring and for calibrating permanent monitoring systems.

3.104 CEN standards should be used in the first instance, but if there are no CEN standards available, then the ISO standards should be used next, followed by national and any other international standards which produce data of an equivalent quality.

3.105 The Environment Agency's Technical Guidance Note (TGN), M2, Monitoring of stack emissions to air, contains up-to-date lists of monitoring standards. This TGN is available from the Environment Agency's website at [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk), or directly through [www.mcerts.net](http://www.mcerts.net).

Parameter	Frequency	Method/Specification	WID Ref.
NO <sub>x</sub> (NO and NO <sub>2</sub> as NO <sub>2</sub> )	Continuous (provided emission limits are set)	ISO 10849 <sup>1</sup>	11.2(a) Annex V
	Periodic: extractive, wet chemical method - 2 per year but every 3 months in first year of operation	BS EN 14792	Annex III
CO	Continuous	ISO 12039 <sup>1</sup>	11.2(a) Annex V
	Periodic	BS EN 15058	Annex III
Total dust	Continuous	BS ISO 13284-2 and prEN 15267-3 <sup>1</sup>	11.2(a) Annex V
	Periodic - 2 per year but every 3 months in first year of operation	BS EN 13284-1:	Annex III
VOC (expressed as TOC)	Continuous	BS EN 12619 (low concentrations) <sup>2</sup>	11.2(a) Annex V
	Periodic - 2 per year but every 3 months in first year of operation	BS EN 12619	Annex III
HCl	Continuous or,	MCERTS Performance Standards for CEMs <sup>1</sup>	11.2(a) Annex V
	Periodic - 2 per year but every 3 months in first year of operation (only where raw flue gas cannot exceed ELV)	BS EN1911, parts 1-3	Annex III 11.6
HF	Continuous	MCERTS performance standards for CEMs <sup>1</sup>	11.2(a) Annex V
	Periodic - 2 per year but every 3 months in first year of operation (providing treatment stages for HCl ensure ELV for HCl is complied with or where raw flue gas cannot exceed ELV)	ISO 15713	Annex III 11.4 11.6
SO <sub>2</sub>	Continuous	BS 6069-4.4 (ISO 7935) <sup>1</sup>	11.2(a) Annex V
	Periodic	BS EN 14791	Annex III Annex III

Parameter	Frequency	Method/Specification	WID Ref.
Hg	Periodic – 2 per year but every 3 months in first year of operation. Average value over sample period of between 30 minutes and 8 hours.	BS EN 13211	11.2(c) 11.7 Annex V Annex III
Cd, Tl, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	Periodic – 2 per year but every 3 months in first year of operation. Average value over sample period of between 30 minutes and 8 hours.	BS EN 14385	11.2(c) 11.7 Annex V Annex III
Dioxins and Furans (TEQ as per Annex I of the Directive)	Periodic – 2 per year but one every 3 months in first 12 months of operation. Average value over sample period of between 6 and 8 hours. Determination in accordance with CEN standard.	BS EN 1948 parts 1-3	11.2(c) 11.7 Annex V Annex III Annex II
PAHs and other pollutants	Frequency to be specified at the discretion of the regulator.	ISO 11338, parts 1 and 2	11.2(c)
Combustion chamber gas temperature	Continuous (Temperature measured near the inner wall or agreed representative point)	MCERTS Performance Standards for CEMs	11.2(b)
Exhaust gas oxygen concentration	Continuous Note: Verification of oxygen content required under “most unfavourable conditions” (Article 11(3))	ISO 12039 <sup>1</sup>	11.2(b) 11.3
	Periodic – whenever other periodic measurements are performed	Using equipment which complies with ISO 12039 within an accredited method <sup>1</sup>	11.2(b)
Exhaust gas pressure	Continuous	MCERTS Performance Standards for CEMs	11.2(b)
Exhaust gas velocity	Continuous	BS ISO 14164 <sup>1</sup>	
	Periodic – whenever other forms of periodic monitoring are carried out.	ISO 10780 <sup>3</sup>	
Exhaust gas water content	Continuous (not required if sampled exhaust gas is dried prior to analysis)	MCERTS Performance Standards for CEMs <sup>1</sup>	11.2(b)
	Extractive	BS EN 14790	11.5

## Notes:

- 1: CEN standards are currently being developed and these should be used when published. These standard are in the prEN 15267 series and CEN will publish these no later than 2008.
- 2: BS EN 12619 is primarily a reference method although it can also be used for permanent CEMs subject to certain operational requirements. These requirements have been clarified in a new CEN standard, prEN 15267-3. Until this is published, BS EN 12619 applies.
- 3: ISO 10780 is recommended, unless there is a sound reason to justify the use of BS 1042-2.1

## Monitoring Equipment

3.106 The following requirements relate to the monitoring equipment and the relevant standards to be used.

- measurement equipment should be installed and techniques used in order to monitor the parameters, conditions and mass concentrations relevant to the incineration or co-incineration process;
- CEMs should meet the requirements of applicable international standards and demonstrate that they meet such requirements, i.e be MCERTS certified;
- CEMs should also be proven over a suitable range for the process;
- the appropriate installation and the functioning of the automated monitoring equipment for emissions into air and water must be subject to at least an annual surveillance test. Calibration has to be carried out using parallel measurements with reference methods at least every three years;
- the location of the sampling or measurement points should be specified by the regulator. Operators should refer to the Environment Agency's TGN M1, Sampling and safety requirements for monitoring stack releases to air, available from the Environment Agency's website at [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk);
- measurements for the determination of concentrations of air and water polluting substances must be carried out representatively;
- sampling and analysis of all pollutants including dioxins and furans as well as reference measurement methods to calibrate automated measurement systems shall be carried out as given by CEN-standards. If CEN standards are not available, ISO standards, national or international standards, which will ensure the provision of data of an equivalent scientific quality, should be used; and
- CEMs shall meet the requirements for uncertainty budgets specified in Annex III of the WID. These requirements are explained in the following section.

### Uncertainty budgets

- 3.107 The WID expresses uncertainty budgets and 95% confidence intervals at the ELV. The uncertainty budget can be viewed as an allowable margin of error in the measurement, as a combination of the systematic and random errors. The systematic error is a measure of the accuracy whilst the random error can be seen as a measure of the precision of the measurements.
- 3.108 The 95% confidence interval encompasses approximately two standard deviations of the measurement either side of the mean average value. This is known as the expanded uncertainty, whereas the standard uncertainty is one standard deviation.
- 3.109 For CEMs and at the daily ELV, the values of the 95% confidence intervals of a single measured result must not exceed the following percentages of the emission limit values:

Carbon monoxide	10%
Sulphur dioxide	20%
Nitrogen dioxide	20%
Total dust	30%
Total organic carbon	30%
Hydrogen chloride	40%
Hydrogen fluoride	40%

In simple terms, the allowable uncertainty budgets are performance specifications for the monitoring systems and they can be converted to absolute values from the specifications in Annex III of the WID. For example, the table below shows the daily average ELVs for some determinands, and the concomitant allowable uncertainty expressed in as concentrations.

### Uncertainty budgets for specific determinands

Determinand	ELV	Uncertainty budget (%)	Uncertainty budget in mg/m <sup>3</sup>
HCl	10	40	4
SO <sub>2</sub>	50	20	10
TOC	10	30	3
NO <sub>2</sub>	200	20	40
Dust	10	30	3

- 3.110 Several performance characteristics contribute to the overall uncertainty of the monitoring results, such as the drift, linearity, sensitivity to environmental conditions and cross-sensitivity to other determinands. The operator must demonstrate that the monitoring performed at the installation – for both continuous and periodic measurements – at least meets the uncertainty budgets specified in the WID.
- 3.111 BS EN ISO 14956, Air quality —Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty, describes a procedure for determining uncertainty of monitoring, whilst EN14181, Quality assurance of automated measuring systems, describes a procedure for

ensuring that monitoring systems are suitable at the outset and perform sufficiently to continue meeting the uncertainty requirements of the WID. The Environment Agency for England and Wales applies BS EN ISO 14956, and the related QAL1 requirements of BS EN ISO 14181, through MCERTS for CEMs<sup>10</sup>.

3.112 To assess compliance of monitoring data against an emission limit value, the monitoring data needs to be “corrected” for uncertainty errors. This is achieved by subtracting the above confidence interval from the measured value. The appropriate percentage value needs to be applied to the measured value to correct the data. The required steps to be taken are set out below:

**Step 1.**

$$\text{Measured value} \times \frac{\% \text{ Confidence Interval}}{100} = \text{measured uncertainty error}$$

**Step 2.**

Correct the measured result by subtracting the measurement uncertainty error

$$\text{Measured value} - \text{measurement uncertainty error} = \text{“corrected” data}$$

**Step 3.**

Compare the corrected data versus the appropriate emission limit value to assess compliance

**Example calculation**

Assume:

Measured value for particulates is 13 mg/m<sup>3</sup> hourly average

Confidence interval for particulates is 30%.

ELV for particulates is 10mg/m<sup>3</sup>

Following the steps set out above:

1.  $13 \times \frac{30}{100} = 3.9 \text{ mg/m}^3$  measurement uncertainty error

2.  $13 - 3.9 = 9.1 \text{ mg/m}^3$  “corrected” data

3. “corrected data” < ELV therefore the measured value is compliant with the ELV taking into account measurement uncertainty

**Monitoring Releases to Water**

3.113 Water release limits are discussed in the Section on [Water Emission Limit Values - Article 8](#). The WID imposes the following monitoring requirements for these releases.

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<sup>10</sup> Available at: [www.environment-agency.gov.uk/business/1745440/444671/466158/monitoring/](http://www.environment-agency.gov.uk/business/1745440/444671/466158/monitoring/)

- pH, temperature and flow of the discharge water should be measured continuously,
- daily spot sample for measurements of total suspended solids,
- regulators may alternatively require measurements of a flow proportional representative sample over a period of 24 hours;
- at least monthly measurements of a flow proportional representative sample of the discharge over a period of 24 hours of the heavy metals listed in the ELV table in the Section on Water Emission Limit Values - Article 8, and
- dioxins and furas should be measured at least every six months; however one measurement at least every three months should be carried out for the first 12 months of operation. Regulators may fix measurement periods for polycyclic aromatic hydrocarbons or other pollutants.

The following table summarises these requirements.

Parameter	Frequency of sampling	Standard/Method
pH	Continuous	BS 1647-2:1984
Temperature	Continuous	Traceable to national standards
Flow	Continuous	BS 3680 series
Total suspended solids (as defined by 91/271/EEC)	Daily spot sample <b>or</b> flow proportional sample over 24-hours	BS EN 872:1996
Hg and its compounds, expressed as Hg.	Monthly flow proportional sample over 24-hours	BS EN 13506:2002
Cd and its compounds, expressed as Cd.	Monthly flow proportional sample over 24-hours	BS ISO/DIS 17294-1, 2
Tl and its compounds, expressed as Tl.	Monthly flow proportional sample over 24-hours	BS ISO/DIS 17294-1, 2
As and its compounds, expressed as As.	Monthly flow proportional sample over 24-hours	BS EN ISO 11969:1996
Pb and its compounds, expressed as Pb.	Monthly flow proportional sample over 24-hours	BS EN ISO 11885:1997
Cr and its compounds, expressed as Cr	Monthly flow proportional sample over 24-hours	BS EN ISO 11885:1997
Cu and its compounds, expressed as Cu.	Monthly flow proportional sample over 24-hours	BS EN ISO 11885:1997
Ni and its compounds, expressed as Ni.	Monthly flow proportional sample over 24-hours	BS EN ISO 11885:1997
Zn and its compounds, expressed as Zn.	Monthly flow proportional sample over 24-hours	BS EN ISO 11885:1997
Dioxins and Furans (TEQ)	Every 6 months, but every 3 months during the first year of operation.	USEPA Method 1613
Other pollutants - PAH	As appropriate based on site specific assessment.	USEPA Method 0610
Other pollutants – Dioxin-like PCBs	As appropriate based on site specific assessment.	USEPA Methods 0680, 1668

### Compliance

3.114 The emission limit values (see the Section on [Water Emission Limit Values - Article 8](#)) for water will be regarded as being complied with if:

- 95% and 100% of the measured values do not exceed the respective emission limit values for suspended solids,
- no more than one measurement per year exceeds the emission limit values for heavy metals or, if the regulator requires more than 20 samples per year, no more than 5% of these samples exceed these emission limit values, and
- the twice-yearly measurements do not exceed the emission limit value for dioxins and furans.

### **Disposal of Ash**

- 3.115 Although the WID does not specifically state how ash from incineration plant should be treated other EU legislation is relevant. Ash which is disposed of to landfill will be required to comply with the Landfill Directive. Further guidance on the Landfill Directive can be found in Guidance on the Landfill Directive.

### **Further guidance on the requirements of waste destined for landfill**

- 3.116 Further guidance is available from the Environment Agency in the form of the following documents.

### **Summary Guides**

1. Requirements for waste destined for disposal in landfill – a guide for waste producers and waste managers.
2. Requirements for the sampling and testing of wastes destined for landfill – a guide for waste producers and waste managers.

### **Technical guidance**

1. Guidance for waste destined for disposal in landfills
2. Guidance on the sampling and testing of wastes to meet landfill waste acceptance procedures.

## 4. Other Directive Requirements

### Application forms - Article 4(2)

- 4.1 Regulators must ensure that the application form for an environmental permit for a waste incineration installation requires the applicant to provide the information specified in Article 4(2) of the WID (paragraph 3 of Schedule 13 to the Regulations).
- 4.2 Applicants for WID-compliant permits must ensure that their applications contain this information. Applications which do not include this information may be regarded by the regulator as not duly made (see chapter 5 of the Environmental Permitting Core Guidance).
- 4.3 The information that must be included in a standard application for a Part A installation is described in the guidance on Part A installations. However, the WID requires additional information, which is summarised below. Applicants for WID-compliant authorisations and permits must ensure that their applications contain this information.
- 4.4 Applicants should provide the following information as a minimum.
  - (a) Demonstration that the plant is designed, equipped and operated to meet the requirements of the WID taking account of the categories of waste to be incinerated.
  - (b) Plant capacity, categories of waste (according to the List of Wastes Regulations) to be treated in the plant including their quantities, systems for receiving, storing and handling of waste on site (see the Section on [Permitted waste and their delivery and reception - Article 4\(3\) to \(5\) and Article 5](#) for further details).
  - (c) The quality (total organic carbon content and/or loss on ignition) and quantity of residues produced, handling and storage of these residues, proposals for minimising/recycling and disposal, and information on the chemical constituents of the residues (for details see the Section on [Residues - Articles 6 and 9](#)).
  - (d) Information on temperatures and residence time (including measurement and validation methods), waste feed interlock to stop waste feed when the temperatures are below the permitted levels, provision of auxiliary burners including the description of proposed auxiliary fuel (see the Section on [Operating conditions – Combustion Requirements](#) for further details).
  - (e) In the case of a request for derogation from the temperature or residence time requirements, justification for the proposal and its effect on the quality and quantity of residues produced and the emissions into air of TOC and CO (see the Section on [Operating conditions – Combustion Requirements](#) for further details).

- (f) Information of the use of heat generated from the process – for example through combined heat and power, generation of process steam or district heating including proposals for future improvements in heat utilisation. (see the Section on [Operating conditions – Energy Recovery](#) for further details).
- (g) In the case of abnormal operating condition, how will the dust emissions be controlled to below 150 mg/m<sup>3</sup> (see the Section on [Abnormal Operating Conditions - Articles 6 and 13](#)).
- (h) Information on the predicted emissions to air and water and show how the WID emission limits will be complied with at all times (e.g. by showing that there are enough operating margins between the predicted emissions and the ELVs) (see the Section on [Air Emission Limit Values - Article 7](#) for details of the emission limit requirements).
- (i) Applications will need to include details of stack height calculations, dispersion calculations and the environmental impact of the emissions from the plant to demonstrate that human health and the environment will be protected.
- (j) The applicants for co-incinerator plants will need to provide the information on the process and their conventional fuels and calculations of the *pro rata* emission limits by using the methods discussed in the Section on Air Emission Limit Values for co-incinerators and Annex 3 of this Guidance.
- (k) Information on methods and handling of waste waters on the site should be provided to show particularly that storage areas have been designed in a way that will prevent the unauthorised and accidental releases of any polluting substances into air, soil, surface water and ground water (see the Section on [Water Emission Limit Values - Article 8](#)).
- (l) Applicants will need to provide the details of the monitoring techniques they will employ to meet the requirements of the WID. In particular, they will need to confirm that they will apply the CEN standards where available and, when such standards are not available, they will use ISO or national or international standards (subject to the agreement of the regulator) (see the Section on [Monitoring Requirements for Incinerators and Co- Incinerators - Articles 10 and 11](#)).
- (m) Details of the monitoring points and the monitoring equipment to be used, especially the continuous emission monitors (CEMs) should be provided.
- (n) The regulators may require more information than summarised above either through development of template application forms, during pre-application discussions or through written notices after the receipt of the application.

## **Public Information About Waste Incineration Installations - Article 12 (2)**

- 4.5 The WID requirement for the operators of plants with a nominal capacity of over 2 tonnes to provide annual reports (Article 12 (2)) is one which regulators are directed to include in the WID permits. The other WID requirement, for a list of plant with a nominal capacity of less than 2 tonnes to be made available to the public, is reflected in Schedule 19 to the Regulations, which includes this list in the public register information. Regulation 46 of the Regulations places this duty on each regulator for the installations it regulates and, as such, this list will have to be maintained by the Environment Agency and Local Authorities for their respective plants.
- 4.6 The list will need to be kept up to date by the regulator.
- 4.7 The WID's addition to the definition of "substantial change " is reflected in the Regulations (paragraph 5(5) of Schedule 5)- "(b) any change in operation of an incineration or co-incineration plant for non-hazardous waste which would involve the incineration or co-incineration of hazardous waste". Such a "substantial change" will trigger the relevant consultation requirements (see guidance on Part A installations).
- 4.8 Operators should be aware of the requirements of the amendments made to the IPPC Directive by Public Participation Directive (the "PPD") which came into force on 25 June 2005. These amendments apply to all new and substantially changed IPPC (i.e. Regulations "Part A" installations) and also in cases where the regulator is prompted by significant pollution to propose revision of ELVs in an existing permit.

# Annex 1 – Schedule 13 to the Environmental Permitting Regulations

## SCHEDULE 13

Regulation 35(g)

### Provision in relation to waste incineration

#### Application

1. This Schedule applies in relation to every waste incineration installation.

#### Interpretation

2.—(1) In this Schedule, “waste incineration installation” means that part of an installation or mobile plant in which any of the following activities is carried out—

(a) the incineration of waste falling within the following provisions of Section 5.1 of Part 2 of Schedule 1—

(i) sub-paragraphs (a) to (c) of Part A(1), or

(ii) sub-paragraphs (a) or (b) of Part A(2); or

(b) any other activity falling within Part 2 of Schedule 1 which is carried out in a co-incineration plant (as that term is defined in Section 5.1 of Part 2 of Schedule 1).

(2) When interpreting the Waste Incineration Directive for the purposes of this Schedule—

(a) an expression defined in Section 5.1 of Part 2 of Schedule 1 has the meaning given in that Section;

(b) except where also defined in Section 5.1 of Part 2 of Schedule 1, an expression defined in Part 1 of these Regulations has the meaning given that part;

(c) “permit” means environmental permit;

(d) the competent authority is the regulator.

#### Applications for an environmental permit

3. The regulator must require that every application for an environmental permit includes the information specified in Article 4(2) of the Waste Incineration Directive.

#### Exercise of relevant functions

4.—(1) The regulator must exercise its relevant functions so as to ensure compliance with the following provisions of the Waste Incineration Directive—

(a) Article 4(3) to 4(5);

(b) Article 5;

(c) Article 6, except the last indent of 6(4);

(d) Article 7(1) to 7(4);

(e) Article 8(1) to 8(7);

(f) Article 9;

(g) Article 10;

(h) Article 11, except for 11(1) and 11(13);

(i) Article 12(2), to the extent that it relates to the provision of annual reports by the operator;

(j) Article 13.

- (2) But when interpreting the Directive for the purposes of this paragraph—
- (a) in Article 6(4), ignore the words “Member States may lay down rules governing these authorisations” in both places they occur;
  - (b) in Article 11(1), ignore the words “either” and “or by general binding rules”;
  - (c) Article 11(2)(c) must be read as if the words “and dioxin-like polychlorinated biphenyls and polycyclic aromatic hydrocarbons” appeared after the word “furans”; and
  - (d) Annex V must be read as if every reference to an exemption which “may” be authorised by the competent authority was to an exemption which “must” be authorised by the competent authority.

# **Annex 2 – The Waste Incineration Directive**

**DIRECTIVE 2000/76/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL**  
**of 4 December 2000**  
**on the incineration of waste**

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission <sup>(1)</sup>,

Having regard to the Opinion of the Economic and Social Committee <sup>(2)</sup>,

Having regard to the Opinion of the Committee of the Regions <sup>(3)</sup>,

Acting in accordance with the procedure laid down in Article 251 of the Treaty <sup>(4)</sup>, and in the light of the joint text approved by the Conciliation Committee on 11 October 2000,

Whereas:

- (1) The fifth Environment Action Programme: Towards sustainability — A European Community programme of policy and action in relation to the environment and sustainable development, supplemented by Decision No 2179/98/EC on its review <sup>(5)</sup>, sets as an objective that critical loads and levels of certain pollutants such as nitrogen oxides (NO<sub>x</sub>), sulphur dioxide (SO<sub>2</sub>), heavy metals and dioxins should not be exceeded, while in terms of air quality the objective is that all people should be effectively protected against recognised health risks from air pollution. That Programme further sets as an objective a 90 % reduction of dioxin emissions of identified sources by 2005 (1985 level) and at least 70 % reduction from all pathways of cadmium (Cd), mercury (Hg) and lead (Pb) emissions in 1995.
- (2) The Protocol on persistent organic pollutants signed by the Community within the framework of the United Nations Economic Commission for Europe (UN-ECE) Convention on long-range transboundary air pollution sets legally binding limit values for the emission of dioxins and furans of 0,1 ng/m; TE (Toxicity Equivalents) for installations burning more than 3 tonnes per hour of municipal solid waste, 0,5 ng/m; TE for installations burning more than 1 tonne per hour of medical

waste, and 0,2 ng/m; TE for installations burning more than 1 tonne per hour of hazardous waste.

- (3) The Protocol on Heavy Metals signed by the Community within the framework of the UN-ECE Convention on long-range transboundary air pollution sets legally binding limit values for the emission of particulate of 10 mg/m<sup>3</sup> for hazardous and medical waste incineration and for the emission of mercury of 0,05 mg/m<sup>3</sup> for hazardous waste incineration and 0,08 mg/m<sup>3</sup> for municipal waste incineration.
- (4) The International Agency for Research on Cancer and the World Health Organisation indicate that some polycyclic aromatic hydrocarbons (PAHs) are carcinogenic. Therefore, Member States may set emission limit values for PAHs among other pollutants.
- (5) In accordance with the principles of subsidiarity and proportionality as set out in Article 5 of the Treaty, there is a need to take action at the level of the Community. The precautionary principle provides the basis for further measures. This Directive confines itself to minimum requirements for incineration and co-incineration plants.
- (6) Further, Article 174 provides that Community policy on the environment is to contribute to protecting human health.
- (7) Therefore, a high level of environmental protection and human health protection requires the setting and maintaining of stringent operational conditions, technical requirements and emission limit values for plants incinerating or co-incinerating waste within the Community. The limit values set should prevent or limit as far as practicable negative effects on the environment and the resulting risks to human health.
- (8) The Communication from the Commission on the review of the Community Strategy for waste management assigns prevention of waste the first priority, followed by reuse and recovery and finally by safe disposal of waste; in its Resolution of 24 February 1997 on a Community Strategy for waste management <sup>(6)</sup>, the Council reiterated its conviction that waste prevention should be the first priority of any rational waste policy in relation to minimising waste production and the hazardous properties of waste.

<sup>(1)</sup> OJ C 13, 17.1.1998, p. 6 and OJ C 372, 2.12.1998, p. 11.

<sup>(2)</sup> OJ C 116, 28.4.1999, p. 40.

<sup>(3)</sup> OJ C 198, 14.7.1999, p. 37.

<sup>(4)</sup> Opinion of the European Parliament of 14 April 1999 (OJ C 219, 30.7.1999, p. 249), Council Common Position of 25 November 1999 (OJ C 25, 28.1.2000, p. 17) and Decision of the European Parliament of 15 March 2000 (not yet published in the Official Journal). Decision of the European Parliament of 16 November 2000 and Decision of the Council of 20 November 2000.

<sup>(5)</sup> OJ C 138, 17.5.1993, p. 1 and OJ L 275, 10.10.1998, p. 1.

<sup>(6)</sup> OJ C 76, 11.3.1997, p. 1.

- (9) In its Resolution of 24 February 1997 the Council also underlines the importance of Community criteria concerning the use of waste, the need for appropriate emission standards to apply to incineration facilities, the need for monitoring measures to be envisaged for existing incineration plants, and the need for the Commission to consider amending Community legislation in relation to the incineration of waste with energy recovery in order to avoid large-scale movements of waste for incineration or co-incineration in the Community.
- (10) It is necessary to set strict rules for all plants incinerating or co-incinerating waste in order to avoid transboundary movements to plants operating at lower costs due to less stringent environmental standards.
- (11) The Communication from the Commission/energy for the future: renewable sources of energy/White paper for a Community strategy and action plan takes into consideration in particular the use of biomass for energy purposes.
- (12) Council Directive 96/61/EC<sup>(1)</sup> sets out an integrated approach to pollution prevention and control in which all the aspects of an installations environmental performance are considered in an integrated manner. Installations for the incineration of municipal waste with a capacity exceeding 3 tonnes per hour and installations for the disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day are included within the scope of the said Directive.
- (13) Compliance with the emission limit values laid down by this Directive should be regarded as a necessary but not sufficient condition for compliance with the requirements of Directive 96/61/EC. Such compliance may involve more stringent emissions limit values for the pollutants envisaged by this Directive, emission limit values for other substances and other media, and other appropriate conditions.
- (14) Industrial experience in the implementation of techniques for the reduction of polluting emissions from incineration plants has been acquired over a period of ten years.
- (15) Council Directives 89/369/EEC<sup>(2)</sup> and 89/429/EEC<sup>(3)</sup> on the prevention and reduction of air pollution from municipal waste incineration plants have contributed to the reduction and control of atmospheric emissions from incineration plants. More stringent rules should now be adopted and those Directives should accordingly be repealed.
- (16) The distinction between hazardous and non-hazardous waste is based principally on the properties of waste prior to incineration or co-incineration but not on differences in emissions. The same emission limit values should apply to the incineration or co-incineration of hazardous and non-hazardous waste but different techniques and conditions of incineration or co-incineration and different monitoring measures upon reception of waste should be retained.
- (17) Member States should take into account Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air<sup>(4)</sup> when implementing this Directive.
- (18) The incineration of hazardous waste with a content of more than 1 % of halogenated organic substances, expressed as chlorine, has to comply with certain operational conditions in order to destroy as many organic pollutants such as dioxins as possible.
- (19) The incineration of waste which contains chlorine generates flue gas residues. Such residues should be managed in a way that minimises their amount and harmfulness.
- (20) There may be grounds to provide for specified exemptions to the emission limit values for some pollutants during a specified time limit and subject to specific conditions.
- (21) Criteria for certain sorted combustible fraction of non-hazardous waste not suitable for recycling, should be developed in order to allow the authorisation of the reduction of the frequency of periodical measurements.
- (22) A single text on the incineration of waste will improve legal clarity and enforceability. There should be a single directive for the incineration and co-incineration of hazardous and non-hazardous waste taking fully into account the substance and structure of Council Directive 94/67/EC of 16 December 1994 on the incineration of hazardous waste<sup>(5)</sup>. Therefore Directive 94/67/EC should also be repealed.
- (23) Article 4 of Council Directive 75/442/EEC of 15 July 1975 on waste<sup>(6)</sup> requires Member States to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without harming the environment. To this end, Articles 9 and 10 of that Directive provide that any plant or undertaking treating waste must obtain a permit from the competent authorities relating, *inter alia*, to the precautions to be taken.

<sup>(1)</sup> OJ L 257, 10.10.1996, p. 26.

<sup>(2)</sup> OJ L 163, 14.6.1989, p. 32. Directive as last amended by the Accession Act of 1994.

<sup>(3)</sup> OJ L 203, 15.7.1989, p. 50. Directive as last amended by the Accession Act of 1994.

<sup>(4)</sup> OJ L 163, 29.6.1999, p. 41.

<sup>(5)</sup> OJ L 365, 31.12.1994, p. 34.

<sup>(6)</sup> OJ L 194, 25.7.1975, p. 39. Directive as last amended by Commission Decision 350/96/EC (OJ L 135, 6.6.1996, p. 32).

- (24) The requirements for recovering the heat generated by the incineration or co-incineration process and for minimising and recycling residues resulting from the operation of incineration or co-incineration plants will assist in meeting the objectives of Article 3 on the waste hierarchy of Directive 75/442/EEC.
- (25) Incineration and co-incineration plants treating only animal waste regulated by Directive 90/667/EEC <sup>(1)</sup> are excluded from the scope of this Directive. The Commission intends to propose a revision to the requirements of Directive 90/667 with a view to providing for high environmental standards for the incineration and co-incineration of animal waste.
- (26) The permit for an incineration or co-incineration plant shall also comply with any applicable requirements laid down in Directives 91/271/EEC <sup>(2)</sup>, 96/61/EC, 96/62/EC <sup>(3)</sup>, 76/464/EEC <sup>(4)</sup>, and 1999/31/EC <sup>(5)</sup>.
- (27) The co-incineration of waste in plants not primarily intended to incinerate waste should not be allowed to cause higher emissions of polluting substances in that part of the exhaust gas volume resulting from such co-incineration than those permitted for dedicated incineration plants and should therefore be subject to appropriate limitations.
- (28) High-standard measurement techniques are required to monitor emissions to ensure compliance with the emission limit values for the pollutants.
- (29) The introduction of emission limit values for the discharge of waste water from the cleaning of exhaust gases from incineration and co-incineration plants will limit a transfer of pollutants from the air into water.
- (30) Provisions should be laid down for cases where the emission limit values are exceeded as well as for technically unavoidable stoppages, disturbances or failures of the purification devices or the measurement devices.
- (31) In order to ensure transparency of the permitting process throughout the Community the public should have access to information with a view to allowing it to be involved in decisions to be taken following applications for new permits and their subsequent updates. The

<sup>(1)</sup> Council Directive 90/667/EEC of 27 November 1990, laying down the veterinary rules for the disposal and processing of animal waste, for its placing on the market and for the prevention of pathogens in feedstuffs of animal or fish origin and amending Directive 90/425/EEC (OJ L 363, 27.12.1990, p. 51). Directive as last amended by the Accession Act of 1994.

<sup>(2)</sup> Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (OJ L 135, 30.5.1991, p. 40). Directive as amended by Directive 98/15/EC (OJ L 67, 7.3.1998, p. 29).

<sup>(3)</sup> Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management (OJ L 296, 21.11.1996, p. 55).

<sup>(4)</sup> Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (OJ L 129, 18.5.1976, p. 23). Directive as last amended by the Accession Act of 1994.

<sup>(5)</sup> Directive 1999/31/EC of 26 April 1999 on the landfill of waste (OJ L 182, 16.7.1999, p. 1).

public should have access to reports on the functioning and monitoring of the plants burning more than three tonnes per hour in order to be informed of their potential effects on the environment and human health.

- (32) The Commission should present a report both to the European Parliament and the Council based on the experience of applying this Directive, the new scientific knowledge gained, the development of the state of technology, the progress achieved in emission control techniques, and on the experience made in waste management and operation of the plants and on the development of environmental requirements, with a view to proposing, as appropriate, to adapt the related provisions of this Directive.
- (33) The measures necessary for the implementation of this Directive are to be adopted in accordance with Council Decision 1999/468/EC of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission <sup>(6)</sup>.
- (34) Member States should lay down rules on penalties applicable to infringements of the provisions of this Directive and ensure that they are implemented; those penalties should be effective, proportionate and dissuasive,

HAVE ADOPTED THIS DIRECTIVE:

#### Article 1

#### Objectives

The aim of this Directive is to prevent or to limit as far as practicable negative effects on the environment, in particular pollution by emissions into air, soil, surface water and groundwater, and the resulting risks to human health, from the incineration and co-incineration of waste.

This aim shall be met by means of stringent operational conditions and technical requirements, through setting emission limit values for waste incineration and co-incineration plants within the Community and also through meeting the requirements of Directive 75/442/EEC.

#### Article 2

#### Scope

1. This Directive covers incineration and co-incineration plants.

<sup>(6)</sup> OJ L 184, 17.7.1999, p. 23.

2. The following plants shall however be excluded from the scope of this Directive:

- (a) Plants treating only the following wastes:
- (i) vegetable waste from agriculture and forestry,
  - (ii) vegetable waste from the food processing industry, if the heat generated is recovered,
  - (iii) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered,
  - (iv) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood-preserved or coating, and which includes in particular such wood waste originating from construction and demolition waste,
  - (v) cork waste,
  - (vi) radioactive waste,
  - (vii) animal carcasses as regulated by Directive 90/667/EEC without prejudice to its future amendments,
  - (viii) waste resulting from the exploration for, and the exploitation of, oil and gas resources from off-shore installations and incinerated on board the installation;
- (b) Experimental plants used for research, development and testing in order to improve the incineration process and which treat less than 50 tonnes of waste per year.

(i) the mass content of polychlorinated aromatic hydrocarbons, e.g. polychlorinated biphenyls (PCB) or pentachlorinated phenol (PCP) amounts to concentrations not higher than those set out in the relevant Community legislation;

(ii) these wastes are not rendered hazardous by virtue of containing other constituents listed in Annex II to Directive 91/689/EEC in quantities or in concentrations which are inconsistent with the achievement of the objectives set out in Article 4 of Directive 75/442/EEC; and

(iii) the net calorific value amounts to at least 30 MJ per kilogramme,

(b) any combustible liquid wastes which cannot cause, in the flue gas directly resulting from their combustion, emissions other than those from gasoil as defined in Article 1(1) of Directive 93/12/EEC<sup>(3)</sup> or a higher concentration of emissions than those resulting from the combustion of gasoil as so defined;

3. 'mixed municipal waste' means waste from households as well as commercial, industrial and institutional waste, which because of its nature and composition is similar to waste from households, but excluding fractions indicated in the Annex to Decision 94/3/EC<sup>(4)</sup> under heading 20 01 that are collected separately at source and excluding the other wastes indicated under heading 20 02 of that Annex;

4. 'incineration plant' means any stationary or mobile technical unit and equipment dedicated to the thermal treatment of wastes with or without recovery of the combustion heat generated. This includes the incineration by oxidation of waste as well as other thermal treatment processes such as pyrolysis, gasification or plasma processes in so far as the substances resulting from the treatment are subsequently incinerated.

This definition covers the site and the entire incineration plant including all incineration lines, waste reception, storage, on site pretreatment facilities, waste-fuel and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack, devices and systems for controlling incineration operations, recording and monitoring incineration conditions;

5. 'co-incineration plant' means any stationary or mobile plant whose main purpose is the generation of energy or production of material products and:

- which uses wastes as a regular or additional fuel; or
- in which waste is thermally treated for the purpose of disposal.

### Article 3

#### Definitions

For the purposes of this Directive:

1. 'waste' means any solid or liquid waste as defined in Article 1(a) of Directive 75/442/EEC;
2. 'hazardous waste' means any solid or liquid waste as defined in Article 1(4) of Council Directive 91/689/EEC of 12 December 1991 on hazardous waste<sup>(1)</sup>.

For the following hazardous wastes, the specific requirements for hazardous waste in this Directive shall not apply:

- (a) combustible liquid wastes including waste oils as defined in Article 1 of Council Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils<sup>(2)</sup> provided that they meet the following criteria:

<sup>(1)</sup> OJ L 377, 31.12.1991, p. 20. Directive as amended by Directive 94/31/EC. (OJ L 168, 2.7.1994, p. 28).

<sup>(2)</sup> OJ L 194, 25.7.1975, p. 23. Directive as last amended by the Accession Act of 1994.

<sup>(3)</sup> Council Directive 93/12/EEC of 23 March 1993 relating to the sulphur content of certain liquid fuels (OJ L 74, 27.3.1993, p. 81). Directive as last amended by Directive 1999/32/EC (OJ L 121, 11.5.1999, p. 13).

<sup>(4)</sup> Commission Decision 94/3/EC of 20 December 1993 establishing a list of wastes pursuant to Article 1a of Council Directive 75/442/EEC on waste (OJ L 5, 7.1.1994, p. 15).

If co-incineration takes place in such a way that the main purpose of the plant is not the generation of energy or production of material products but rather the thermal treatment of waste, the plant shall be regarded as an incineration plant within the meaning of point 4.

This definition covers the site and the entire plant including all co-incineration lines, waste reception, storage, on site pretreatment facilities, waste-, fuel- and air-supply systems, boiler, facilities for the treatment of exhaust gases, on-site facilities for treatment or storage of residues and waste water, stack devices and systems for controlling incineration operations, recording and monitoring incineration conditions;

6. 'existing co-incineration or co-incineration plant' means an incineration or co-incineration plant:
- (a) which is in operation and has a permit in accordance with existing Community legislation before 28 December 2002, or,
  - (b) which is authorised or registered for incineration or co-incineration and has a permit issued before 28 December 2002 in accordance with existing Community legislation, provided that the plant is put into operation not later than 28 December 2003, or
  - (c) which, in the view of the competent authority, is the subject of a full request for a permit, before 28 December 2002, provided that the plant is put into operation not later than 28 December 2004;
7. 'nominal capacity' means the sum of the incineration capacities of the furnaces of which an incineration plant is composed, as specified by the constructor and confirmed by the operator, with due account being taken, in particular, of the calorific value of the waste, expressed as the quantity of waste incinerated per hour;
8. 'emission' means the direct or indirect release of substances, vibrations, heat or noise from individual or diffuse sources in the plant into the air, water or soil;
9. 'emission limit values' means the mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during one or more periods of time;
10. 'dioxins and furans' means all polychlorinated dibenzo-p-dioxins and dibenzofurans listed in Annex I;
11. 'operator' means any natural or legal person who operates or controls the plant or, where this is provided for in national legislation, to whom decisive economic power over the technical functioning of the plant has been delegated;
12. 'permit' means a written decision (or several such decisions) delivered by the competent authority granting authorisation to operate a plant, subject to certain conditions which guarantee that the plant complies with all the

requirements of this Directive. A permit may cover one or more plants or parts of a plant on the same site operated by the same operator;

13. 'residue' means any liquid or solid material (including bottom ash and slag, fly ash and boiler dust, solid reaction products from gas treatment, sewage sludge from the treatment of waste waters, spent catalysts and spent activated carbon) defined as waste in Article 1(a) of Directive 75/442/EEC, which is generated by the incineration or co-incineration process, the exhaust gas or waste water treatment or other processes within the incineration or co-incineration plant.

#### Article 4

#### Application and permit

1. Without prejudice to Article 11 of Directive 75/442/EEC or to Article 3 of Directive 91/689/EEC, no incineration or co-incineration plant shall operate without a permit to carry out these activities.
2. Without prejudice to Directive 96/61/EC, the application for a permit for an incineration or co-incineration plant to the competent authority shall include a description of the measures which are envisaged to guarantee that:
  - (a) the plant is designed, equipped and will be operated in such a manner that the requirements of this Directive are taking into account the categories of waste to be incinerated;
  - (b) the heat generated during the incineration and co-incineration process is recovered as far as practicable e.g. through combined heat and power, the generating of process steam or district heating;
  - (c) the residues will be minimised in their amount and harmfulness and recycled where appropriate;
  - (d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Community legislation.
3. The permit shall be granted only if the application shows that the proposed measurement techniques for emissions into the air comply with Annex III and, as regards water, comply with Annex III paragraphs 1 and 2.
4. The permit granted by the competent authority for an incineration or co-incineration plant shall, in addition to complying with any applicable requirement laid down in Directives 91/271/EEC, 96/61/EC, 96/62/EC, 76/464/EEC and 1999/31/EC:
  - (a) list explicitly the categories of waste which may be treated. The list shall use at least the categories of waste set up in the European Waste Catalogue (EWC), if possible, and contain information on the quantity of waste, where appropriate;

(b) include the total waste incinerating or co-incinerating capacity of the plant;

(c) specify the sampling and measurement procedures used to satisfy the obligations imposed for periodic measurements of each air and water pollutants.

5. The permit granted by the competent authority to an incineration or co-incineration plant using hazardous waste shall in addition to paragraph 4:

(a) list the quantities of the different categories of hazardous waste which may be treated;

(b) specify the minimum and maximum mass flows of those hazardous wastes, their lowest and maximum calorific values and their maximum contents of pollutants, e.g. PCB, PCP, chlorine, fluorine, sulphur, heavy metals.

6. Without prejudice to the provisions of the Treaty, Member States may list the categories of waste to be mentioned in the permit which can be co-incinerated in defined categories of co-incineration plants.

7. Without prejudice to Directive 96/61/EC, the competent authority shall periodically reconsider and, where necessary, update permit conditions.

8. Where the operator of an incineration or co-incineration plant for non-hazardous waste is envisaging a change of operation which would involve the incineration or co-incineration of hazardous waste, this shall be regarded as a substantial change within the meaning of Article 2(10)(b) of Directive 96/61/EC and Article 12(2) of that Directive shall apply.

9. If an incineration or co-incineration plant does not comply with the conditions of the permit, in particular with the emission limit values for air and water, the competent authority shall take action to enforce compliance.

#### Article 5

##### Delivery and reception of waste

1. The operator of the incineration or co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or to limit as far as practicable negative effects on the environment, in particular the pollution of air, soil, surface water and groundwater as well as odours and noise, and direct risks to human health. These

measures shall meet at least the requirements set out in paragraphs 3 and 4.

2. The operator shall determine the mass of each category of waste, if possible according to the EWC, prior to accepting the waste at the incineration or co-incineration plant.

3. Prior to accepting hazardous waste at the incineration or co-incineration plant, the operator shall have available information about the waste for the purpose of verifying, *inter alia*, compliance with the permit requirements specified in Article 4(5). This information shall cover:

(a) all the administrative information on the generating process contained in the documents mentioned in paragraph 4(a);

(b) the physical, and as far as practicable, chemical composition of the waste and all other information necessary to evaluate its suitability for the intended incineration process;

(c) the hazardous characteristics of the waste, the substances with which it cannot be mixed, and the precautions to be taken in handling the waste.

4. Prior to accepting hazardous waste at the incineration or co-incineration plant, at least the following reception procedures shall be carried out by the operator:

(a) the checking of those documents required by Directive 91/689/EEC and, where applicable, those required by Council Regulation (EEC) No 259/93 of 1 February 1993 on the supervision, and control of shipments of waste within, into and out of the European Community <sup>(1)</sup> and by dangerous-goods transport regulations;

(b) the taking of representative samples, unless inappropriate, e.g. for infectious clinical waste, as far as possible before unloading, to verify conformity with the information provided for in paragraph 3 by carrying out controls and to enable the competent authorities to identify the nature of the wastes treated. These samples shall be kept for at least one month after the incineration.

5. The competent authorities may grant exemptions from paragraphs 2, 3 and 4 for industrial plants and undertakings incinerating or co-incinerating only their own waste at the place of generation of the waste provided that the requirements of this Directive are met.

#### Article 6

##### Operating conditions

1. Incineration plants shall be operated in order to achieve a level of incineration such that the slag and bottom ashes Total Organic Carbon (TOC) content is less than 3 % or their loss on ignition is less than 5 % of the dry weight of the material. If necessary appropriate techniques of waste pretreatment shall be used.

<sup>(1)</sup> OJ L 30, 6.2.1993, p. 1. Regulation as last amended by Commission Regulation (EC) No 2408/98 (OJ L 298, 7.11.1998, p. 19).

Incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the process is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of 850 °C, as measured near the inner wall or at another representative point of the combustion chamber as authorised by the competent authority, for two seconds. If hazardous wastes with a content of more than 1 % of halogenated organic substances, expressed as chlorine, are incinerated, the temperature has to be raised to 1 100 °C for at least two seconds.

Each line of the incineration plant shall be equipped with at least one auxiliary burner. This burner must be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below 850 °C or 1 100 °C as the case may be. It shall also be used during plant start-up and shut-down operations in order to ensure that the temperature of 850 °C or 1 100 °C as the case may be is maintained at all times during these operations and as long as unburned waste is in the combustion chamber.

During start-up and shut-down or when the temperature of the combustion gas falls below 850 °C or 1 100 °C as the case may be, the auxiliary burner shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gasoil as defined in Article 1(1) of Council Directive 75/716/EEC, liquefied gas or natural gas.

2. Co-incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the co-incineration of waste is raised in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of 850 °C for two seconds. If hazardous wastes with a content of more than 1 % of halogenated organic substances, expressed as chlorine, are co-incinerated, the temperature has to be raised to 1 100 °C.

3. Incineration and co-incineration plants shall have and operate an automatic system to prevent waste feed:

- (a) at start-up, until the temperature of 850 °C or 1 100 °C as the case may be or the temperature specified according to paragraph 4 has been reached;
- (b) whenever the temperature of 850 °C or 1 100 °C as the case may be or the temperature specified according to paragraph 4 is not maintained;
- (c) whenever the continuous measurements required by this Directive show that any emission limit value is exceeded due to disturbances or failures of the purification devices.

4. Conditions different from those laid down in paragraph 1 and, as regards the temperature, paragraph 3 and specified in the permit for certain categories of waste or for certain thermal processes may be authorised by the competent authority,

provided the requirements of this Directive are met. Member States may lay down rules governing these authorisations. The change of the operational conditions shall not cause more residues or residues with a higher content of organic pollutants compared to those residues which could be expected under the conditions laid down in paragraph 1.

Conditions different from those laid down in paragraph 2 and, as regards the temperature, paragraph 3 and specified in the permit for certain categories of waste or for certain thermal processes may be authorised by the competent authority, provided the requirements of this Directive are met. Member States may lay down rules governing these authorisations. Such authorisation shall be conditional upon at least the provisions for emission limit values set out in Annex V for total organic carbon and CO being complied with.

In the case of co-incineration of their own waste at the place of its production in existing bark boilers within the pulp and paper industry, such authorisation shall be conditional upon at least the provisions for emission limit values set out in Annex V for total organic carbon being complied with.

All operating conditions determined under this paragraph and the results of verifications made shall be communicated by the Member State to the Commission as part of the information provided in accordance with the reporting requirements.

5. Incineration and co-incineration plants shall be designed, equipped, built and operated in such a way as to prevent emissions into the air giving rise to significant ground-level air pollution; in particular, exhaust gases shall be discharged in a controlled fashion and in conformity with relevant Community air quality standards by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.

6. Any heat generated by the incineration or the co-incineration process shall be recovered as far as practicable.

7. Infectious clinical waste should be placed straight in the furnace, without first being mixed with other categories of waste and without direct handling.

8. The management of the incineration or the co-incineration plant shall be in the hands of a natural person who is competent to manage the plant.

#### Article 7

#### Air emission limit values

1. Incineration plants shall be designed, equipped, built and operated in such a way that the emission limit values set out in Annex V are not exceeded in the exhaust gas.

2. Co-incineration plants shall be designed, equipped, built and operated in such a way that the emission limit values determined according to or set out in Annex II are not exceeded in the exhaust gas.

If in a co-incineration plant more than 40 % of the resulting heat release comes from hazardous waste, the emission limit values set out in Annex V shall apply.

3. The results of the measurements made to verify compliance with the emission limit values shall be standardised with respect to the conditions laid down in Article 11.

4. In the case of co-incineration of untreated mixed municipal waste, the limit values will be determined according to Annex V, and Annex II will not apply.

5. Without prejudice to the provisions of the Treaty, Member States may set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

#### Article 8

##### Water discharges from the cleaning of exhaust gases

1. Waste water from the cleaning of exhaust gases discharged from an incineration or co-incineration plant shall be subject to a permit granted by the competent authorities.

2. Discharges to the aquatic environment of waste water resulting from the cleaning of exhaust gases shall be limited as far as practicable, at least in accordance with the emission limit values set in Annex IV.

3. Subject to a specific provision in the permit, the waste water from the cleaning of exhaust gases may be discharged to the aquatic environment after separate treatment on condition that:

- (a) the requirements of relevant Community, national and local provisions are complied with in the form of emission limit values; and
- (b) the mass concentrations of the polluting substances referred to in Annex IV do not exceed the emission limit values laid down therein.

4. The emission limit values shall apply at the point where waste waters from the cleaning of exhaust gases containing the polluting substances referred to in Annex IV are discharged from the incineration or co-incineration plant.

Where the waste water from the cleaning of exhaust gases is treated on site collectively with other on-site sources of waste water, the operator shall take the measurements referred to in Article 11:

- (a) on the waste water stream from the exhaust gas cleaning processes prior to its input into the collective waste water treatment plant;

- (b) on the other waste water stream or streams prior to its or their input into the collective waste water treatment plant;

- (c) at the point of final waste water discharge, after the treatment, from the incineration plant or co-incineration plant.

The operator shall take appropriate mass balance calculations in order to determine the emission levels in the final waste water discharge that can be attributed to the waste water arising from the cleaning of exhaust gases in order to check compliance with the emission limit values set out in Annex IV for the waste water stream from the exhaust gas cleaning process.

Under no circumstances shall dilution of waste water take place for the purpose of complying with the emission limit values set in Annex IV.

5. When waste waters from the cleaning of exhaust gases containing the polluting substances referred to in Annex IV are treated outside the incineration or co-incineration plant at a treatment plant intended only for the treatment of this sort of waste water, the emission limit values of Annex IV are to be applied at the point where the waste waters leave the treatment plant. If this off-site treatment plant is not only dedicated to treat waste water from incineration, the operator shall take the appropriate mass balance calculations, as provided for under paragraph 4(a), (b) and (c), in order to determine the emission levels in the final waste water discharge that can be attributed to the waste water arising from the cleaning of exhaust gases in order to check compliance with the emission limit values set out in Annex IV for the waste water stream from the exhaust gas cleaning process.

Under no circumstances shall dilution of waste water take place for the purpose of complying with the emission limit values set in Annex IV.

6. The permit shall:

- (a) establish emission limit values for the polluting substances referred to in Annex IV, in accordance with paragraph 2 and in order to meet the requirements referred to in paragraph 3(a);
- (b) set operational control parameters for waste water at least for pH, temperature and flow.

7. Incineration and co-incineration plant sites, including associated storage areas for wastes, shall be designed and in such a way as to prevent the unauthorised and accidental release of any polluting substances into soil, surface water and groundwater in accordance with the provisions provided for in relevant Community legislation. Moreover, storage capacity shall be provided for contaminated rainwater run-off from the incineration or co-incineration plant site or for contaminated water arising from spillage or fire-fighting operations.

The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.

8. Without prejudice to the provisions of the Treaty, Member States may set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

#### Article 9

##### Residues

Residues resulting from the operation of the incineration or co-incineration plant shall be minimised in their amount and harmfulness. Residues shall be recycled, where appropriate, directly in the plant or outside in accordance with relevant Community legislation.

Transport and intermediate storage of dry residues in the form of dust, such as boiler dust and dry residues from the treatment of combustion gases, shall take place in such a way as to prevent dispersal in the environment e.g. in closed containers.

Prior to determining the routes for the disposal or recycling of the residues from incineration and co-incineration plants, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the different incineration residues. The analysis shall concern the total soluble fraction and heavy metals soluble fraction.

#### Article 10

##### Control and monitoring

1. Measurement equipment shall be installed and techniques used in order to monitor the parameters, conditions and mass concentrations relevant to the incineration or co-incineration process.

2. The measurement requirements shall be laid down in the permit or in the conditions attached to the permit issued by the competent authority.

3. The appropriate installation and the functioning of the automated monitoring equipment for emissions into air and water shall be subject to control and to an annual surveillance test. Calibration has to be done by means of parallel measurements with the reference methods at least every three years.

4. The location of the sampling or measurement points shall be laid down by the competent authority.

5. Periodic measurements of the emissions into the air and water shall be carried out in accordance with Annex III, points 1 and 2.

#### Article 11

##### Measurement requirements

1. Member States shall, either by specification in the conditions of the permit or by general binding rules, ensure that paragraphs 2 to 12 and 17, as regards air, and paragraphs 9 and 14 to 17, as regards water, are complied with.

2. The following measurements of air pollutants shall be carried out in accordance with Annex III at the incineration and co-incineration plant:

(a) continuous measurements of the following substances:  $\text{NO}_x$ , provided that emission limit values are set, CO, total dust, TOC, HCl, HF,  $\text{SO}_2$ ;

(b) continuous measurements of the following process operation parameters: temperature near the inner wall or at another representative point of the combustion chamber as authorised by the competent authority, concentration of oxygen, pressure, temperature and water vapour content of the exhaust gas;

(c) at least two measurements per year of heavy metals, dioxins and furans; one measurement at least every three months shall however be carried out for the first 12 months of operation. Member States may fix measurement periods where they have set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

3. The residence time as well as the minimum temperature and the oxygen content of the exhaust gases shall be subject to appropriate verification, at least once when the incineration or co-incineration plant is brought into service and under the most unfavourable operating conditions anticipated.

4. The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded. In this case the emissions of HF shall be subject to periodic measurements as laid down in paragraph 2(c).

5. The continuous measurement of the water vapour content shall not be required if the sampled exhaust gas is dried before the emissions are analysed.

6. Periodic measurements as laid down in paragraph 2(c) of HCl, HF and  $\text{SO}_2$  instead of continuous measuring may be authorised in the permit by the competent authority in incineration or co-incineration plants, if the operator can prove that the emissions of those pollutants can under no circumstances be higher than the prescribed emission limit values.

7. The reduction of the frequency of the periodic measurements for heavy metals from twice a year to once every two years and for dioxins and furans from twice a year to once every year may be authorised in the permit by the competent authority provided that the emissions resulting from co-incineration or incineration are below 50 % of the emission limit values determined according to Annex II or Annex V respectively and provided that criteria for the requirements to be met, developed in accordance with the procedure laid down in Article 17, are available. These criteria shall at least be based on the provisions of the second subparagraph, points (a) and (d).

Until 1 January 2005 the reduction of the frequency may be authorised even if no such criteria are available provided that:

- (a) the waste to be co-incinerated or incinerated consists only of certain sorted combustible fractions of non-hazardous waste not suitable for recycling and presenting certain characteristics, and which is further specified on the basis of the assessment referred to in subparagraph (d);
- (b) national quality criteria, which have been reported to the Commission, are available for these wastes;
- (c) co-incineration and incineration of these wastes is in line with the relevant waste management plans referred to in Article 7 of Directive 75/442/EEC;
- (d) the operator can prove to the competent authority that the emissions are under all circumstances significantly below the emission limit values set out in Annex II or Annex V for heavy metals, dioxins and furans; this assessment shall be based on information on the quality of the waste concerned and measurements of the emissions of the said pollutants;
- (e) the quality criteria and the new period for the periodic measurements are specified in the permit; and
- (f) all decisions on the frequency of measurements referred to in this paragraph, supplemented with information on the amount and quality of the waste concerned, shall be communicated on a yearly basis to the Commission.

8. The results of the measurements made to verify compliance with the emission limit values shall be standardised at the following conditions and for oxygen according to the formula as referred to in Annex VI:

- (a) Temperature 273 K, pressure 101,3 kPa, 11 % oxygen, dry gas, in exhaust gas of incineration plants;
- (b) Temperature 273 K, pressure 101,3 kPa, 3 % oxygen, dry gas, in exhaust gas of incineration of waste oil as defined in Directive 75/439/EEC;
- (c) when the wastes are incinerated or co-incinerated in an oxygen-enriched atmosphere, the results of the measurements can be standardised at an oxygen content laid down by the competent authority reflecting the special circumstances of the individual case;
- (d) in the case of co-incineration, the results of the measurements shall be standardised at a total oxygen content as calculated in Annex II.

When the emissions of pollutants are reduced by exhaust gas treatment in an incineration or co-incineration plant treating hazardous waste, the standardisation with respect to the oxygen contents provided for in the first subparagraph shall be done only if the oxygen content measured over the same period as for the pollutant concerned exceeds the relevant standard oxygen content.

9. All measurement results shall be recorded, processed and presented in an appropriate fashion in order to enable the competent authorities to verify compliance with the permitted operating conditions and emission limit values laid down in this Directive in accordance with procedures to be decided upon by those authorities.

10. The emission limit values for air shall be regarded as being complied with if:

- (a) — none of the daily average values exceeds any of the emission limit values set out in Annex V(a) or Annex II;  
— 97 % of the daily average value over the year does not exceed the emission limit value set out in Annex V(e) first indent;
- (b) either none of the half-hourly average values exceeds any of the emission limit values set out in Annex V(b), column A or, where relevant, 97 % of the half-hourly average values over the year do not exceed any of the emission limit values set out in Annex V(b), column B;
- (c) none of the average values over the sample period set out for heavy metals and dioxins and furans exceeds the emission limit values set out in Annex V(c) and (d) or Annex II;
- (d) the provisions of Annex V(e), second indent or Annex II, are met.

11. The half-hourly average values and the 10-minute averages shall be determined within the effective operating time (excluding the start-up and shut-off periods if no waste is being incinerated) from the measured values after having subtracted the value of the confidence interval specified in point 3 of Annex III. The daily average values shall be determined from those validated average values.

To obtain a valid daily average value no more than five half-hourly average values in any day shall be discarded due to malfunction or maintenance of the continuous measurement system. No more than ten daily average values per year shall be discarded due to malfunction or maintenance of the continuous measurement system.

12. The average values over the sample period and the average values in the case of periodical measurements of HF, HCl and SO<sub>2</sub> shall be determined in accordance with the requirements of Article 10(2) and (4) and Annex III.

13. The Commission, acting in accordance with the procedure laid down in Article 17, shall decide, as soon as appropriate measurement techniques are available within the Community, the date from which continuous measurements of the air emission limit values for heavy metals, dioxins and furans shall be carried out in accordance with Annex III.

14. The following measurements shall be carried out at the point of waste water discharge:

- (a) continuous measurements of the parameters referred to in Article 8(6)(b);
- (b) spot sample daily measurements of total suspended solids; Member States may alternatively provide for measurements of a flow proportional representative sample over a period of 24 hours;
- (c) at least monthly measurements of a flow proportional representative sample of the discharge over a period of 24 hours of the polluting substances referred to in Article 8(3) with respect to items 2 to 10 in Annex IV;

(d) at least every six months measurements of dioxins and furans; however one measurement at least every three months shall be carried out for the first 12 months of operation. Member States may fix measurement periods where they have set emission limit values for polycyclic aromatic hydrocarbons or other pollutants.

15. The monitoring of the mass of pollutants in the treated waste water shall be done in conformity with Community legislation and laid down in the permit as well as the frequency of the measurements.

16. The emission limit values for water shall be regarded as being complied with if:

- (a) for total suspended solids (polluting substance number 1), 95 % and 100 % of the measured values do not exceed the respective emission limit values as set out in Annex IV;
- (b) for heavy metals (polluting substances number 2 to 10) no more than one measurement per year exceeds the emission limit values set out in Annex IV; or, if the Member State provides for more than 20 samples per year, no more than 5 % of these samples exceed the emission limit values set out in Annex IV;
- (c) for dioxins and furans (polluting substance 11), the twice-yearly measurements do not exceed the emission limit value set out in Annex IV.

17. Should the measurements taken show that the emission limit values for air or water laid down in this Directive have been exceeded, the competent authorities shall be informed without delay.

#### Article 12

##### Access to information and public participation

1. Without prejudice to Council Directive 90/313/EEC<sup>(1)</sup> and Directive 96/61/EC, applications for new permits for incineration and co-incineration plants shall be made available at one or more locations accessible to the public, such as local authority offices, for an appropriate period to enable it to comment on them before the competent authority reaches a decision. That decision, including at least a copy of the permit, and any subsequent updates, shall also be made available to the public.

2. For incineration or co-incineration plants with a nominal capacity of two tonnes or more per hour and notwithstanding Article 15(2) of Directive 96/61/EC, an annual report to be provided by the operator to the competent authority on the functioning and monitoring of the plant shall be made available to the public. This report shall, as a minimum requirement, give an account of the running of the process and the emissions into air and water compared with the emission standards in this Directive. A list of incineration or co-incineration plants with a nominal capacity of less than two tonnes per

hour shall be drawn up by the competent authority and shall be made available to the public.

#### Article 13

##### Abnormal operating conditions

1. The competent authority shall lay down in the permit the maximum permissible period of any technically unavoidable stoppages, disturbances, or failures of the purification devices or the measurement devices, during which the concentrations in the discharges into the air and the purified waste water of the regulated substances may exceed the prescribed emission limit values.

2. In the case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.

3. Without prejudice to Article 6(3)(c), the incineration plant or co-incineration plant or incineration line shall under no circumstances continue to incinerate waste for a period of more than four hours uninterrupted where emission limit values are exceeded; moreover, the cumulative duration of operation in such conditions over one year shall be less than 60 hours. The 60-hour duration applies to those lines of the entire plant which are linked to one single flue gas cleaning device.

4. The total dust content of the emissions into the air of an incineration plant shall under no circumstances exceed 150 mg/m<sup>3</sup> expressed as a half-hourly average; moreover the air emission limit values for CO and TOC shall not be exceeded. All other conditions referred to in Article 6 shall be complied with.

#### Article 14

##### Review clause

Without prejudice to Directive 96/61/EC, the Commission shall submit a report to the European Parliament and the Council before 31 December 2008 based on experience of the application of this Directive, in particular for new plants, and on the progress achieved in emission control techniques and experience in waste management. Furthermore, the report shall be based on the development of the state of technology, of experience in the operation of the plants, of environmental requirements. This report will include a specific section on the application of Annex II.1.1. and in particular on the economic and technical feasibility for existing cement kilns as referred to in the footnote to Annex II.1.1. of respecting the NO<sub>x</sub> emission limit value for new cement kilns set out in that Annex. The report shall, as appropriate, be accompanied by proposals for revision of the related provisions of this Directive. However, the Commission shall, if appropriate, propose an amendment for Annex II.3 before the said report, if major waste streams are directed to types of co-incineration plants other than those dealt with in Annex II.1 and II.2.

<sup>(1)</sup> Council Directive 90/313/EEC of 7 June 1990 on the freedom of access to information on the environment (OJ L 158, 23.6.1990, p. 56). Directive as last amended by the Accession Act of 1994.

*Article 15***Reporting**

The reports on the implementation of this Directive shall be established in accordance with the procedure laid down in Article 5 of Council Directive 91/692/EEC. The first report shall cover at least the first full three-year period after 28 December 2002 and comply with the periods referred to in Article 17 of Directive 94/67/EC and in Article 16(3) of Directive 96/61/EC. To this effect, the Commission shall elaborate the appropriate questionnaire in due time.

*Article 16***Future adaptation of the directive**

The Commission shall, in accordance with the procedure laid down in Article 17(2), amend Articles 10, 11 and 13 and Annexes I and III in order to adapt them to technical progress or new findings concerning the health benefits of emission reductions.

*Article 17***Regulatory committee**

1. The Commission shall be assisted by a regulatory committee.

2. Where reference is made to this paragraph, Articles 5 and 7 of Decision 1999/468/EC shall apply, having regard to the provisions of Article 8 thereof.

The period laid down in Article 5(6) of Decision 1999/468/EC shall be set at three months.

3. The committee shall adopt its own rules of procedure.

*Article 18***Repeal**

The following shall be repealed as from 28 December 2005:

- (a) Article 8(1) and the Annex to Directive 75/439/EEC;
- (b) Directive 89/369/EEC;
- (c) Directive 89/429/EEC;
- (d) Directive 94/67/EC.

*Article 19***Penalties**

The Member States shall determine penalties applicable to breaches of the national provisions adopted pursuant to this Directive. The penalties thus provided for shall be effective, proportionate and dissuasive. The Member States shall notify those provisions to the Commission by 28 December 2002 at the latest and shall notify it without delay of any subsequent amendment affecting them.

*Article 20***Transitional provisions**

1. Without prejudice to the specific transitional provisions provided for in the Annexes to this Directive, the provisions of this Directive shall apply to existing plants as from 28 December 2005.

2. For new plants, i.e. plants not falling under the definition of 'existing incineration or co-incineration plant' in Article 3(6) or paragraph 3 of this Article, this Directive, instead of the Directives mentioned in Article 18, shall apply as from 28 December 2002.

3. Stationary or mobile plants whose purpose is the generation of energy or production of material products and which are in operation and have a permit in accordance with existing Community legislation where required and which start co-incinerating waste not later than 28 December 2004 are to be regarded as existing co-incineration plants.

*Article 21***Implementation**

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 28 December 2002. They shall forthwith inform the Commission thereof.

When Member States adopt those measures, they shall contain a reference to this Directive or be accompanied by such reference on the occasion of their official publication. The methods of making such reference shall be laid down by the Member States.

2. Member States shall communicate to the Commission the text of the provisions of domestic law which they adopt in the field governed by this Directive.

*Article 22***Entry into force**

This Directive shall enter into force on the day of its publication in the *Official Journal of the European Communities*.

*Article 23***Addressees**

This Directive is addressed to the Member States.

Done at Brussels, 4 December 2000.

*For the European Parliament*

*The President*

N. FONTAINE

*For the Council*

*The President*

F. VÉDRINE

## ANNEX I

**Equivalence factors for dibenzo-p-dioxins and dibenzofurans**

For the determination of the total concentration (TE) of dioxins and furans, the mass concentrations of the following dibenzo-p-dioxins and dibenzofurans shall be multiplied by the following equivalence factors before summing:

		Toxic equivalence factor
2,3,7,8	— Tetrachlorodibenzodioxin (TCDD)	1
1,2,3,7,8	— Pentachlorodibenzodioxin (PeCDD)	0,5
1,2,3,4,7,8	— Hexachlorodibenzodioxin (HxCDD)	0,1
1,2,3,6,7,8	— Hexachlorodibenzodioxin (HxCDD)	0,1
1,2,3,7,8,9	— Hexachlorodibenzodioxin (HxCDD)	0,1
1,2,3,4,6,7,8	— Heptachlorodibenzodioxin (HpCDD)	0,01
	— Octachlorodibenzodioxin (OCDD)	0,001
2,3,7,8	— Tetrachlorodibenzofuran (TCDF)	0,1
2,3,4,7,8	— Pentachlorodibenzofuran (PeCDF)	0,5
1,2,3,7,8	— Pentachlorodibenzofuran (PeCDF)	0,05
1,2,3,4,7,8	— Hexachlorodibenzofuran (HxCDF)	0,1
1,2,3,6,7,8	— Hexachlorodibenzofuran (HxCDF)	0,1
1,2,3,7,8,9	— Hexachlorodibenzofuran (HxCDF)	0,1
2,3,4,6,7,8	— Hexachlorodibenzofuran (HxCDF)	0,1
1,2,3,4,6,7,8	— Heptachlorodibenzofuran (HpCDF)	0,01
1,2,3,4,7,8,9	— Heptachlorodibenzofuran (HpCDF)	0,01
	— Octachlorodibenzofuran (OCDF)	0,001

## ANNEX II

## DETERMINATION OF AIR EMISSION LIMIT VALUES FOR THE CO-INCINERATION OF WASTE

The following formula (mixing rule) is to be applied whenever a specific total emission limit value 'C' has not been set out in a table in this Annex.

The limit value for each relevant pollutant and carbon monoxide in the exhaust gas resulting from the co-incineration of waste shall be calculated as follows:

$$\frac{V_{\text{waste}} \times C_{\text{waste}} + V_{\text{proc}} \times C_{\text{proc}}}{V_{\text{waste}} + V_{\text{proc}}} = C$$

$V_{\text{waste}}$ : exhaust gas volume resulting from the incineration of waste only determined from the waste with the lowest calorific value specified in the permit and standardised at the conditions given by this Directive.

If the resulting heat release from the incineration of hazardous waste amounts to less than 10 % of the total heat released in the plant,  $V_{\text{waste}}$  must be calculated from a (notional) quantity of waste that, being incinerated, would equal 10 % heat release, the total heat release being fixed.

$C_{\text{waste}}$ : emission limit values set for incineration plants in Annex V for the relevant pollutants and carbon monoxide.

$V_{\text{proc}}$ : exhaust gas volume resulting from the plant process including the combustion of the authorised fuels normally used in the plant (wastes excluded) determined on the basis of oxygen contents at which the emissions must be standardised as laid down in Community or national regulations. In the absence of regulations for this kind of plant, the real oxygen content in the exhaust gas without being thinned by addition of air unnecessary for the process must be used. The standardisation at the other conditions is given in this Directive.

$C_{\text{proc}}$ : emission limit values as laid down in the tables of this annex for certain industrial sectors or in case of the absence of such a table or such values, emission limit values of the relevant pollutants and carbon monoxide in the flue gas of plants which comply with the national laws, regulations and administrative provisions for such plants while burning the normally authorised fuels (wastes excluded). In the absence of these measures the emission limit values laid down in the permit are used. In the absence of such permit values the real mass concentrations are used.

C: total emission limit values and oxygen content as laid down in the tables of this annex for certain industrial sectors and certain pollutants or in case of the absence of such a table or such values total emission limit values for CO and the relevant pollutants replacing the emission limit values as laid down in specific Annexes of this Directive. The total oxygen content to replace the oxygen content for the standardisation is calculated on the basis of the content above respecting the partial volumes.

Member States may lay down rules governing the exemptions provided for in this Annex.

### II.1. Special provisions for cement kilns co-incinerating waste

Daily average values (for continuous measurements) Sample periods and other measurement requirements as in Article 7. All values in mg/m<sup>3</sup> (Dioxins and furans ng/m<sup>3</sup>). Half-hourly average values shall only be needed in view of calculating the daily average values.

The results of the measurements made to verify compliance with the emission limit values shall be standardised at the following conditions: Temperature 273 K, pressure 101,3 kPa, 10 % oxygen, dry gas.

#### II.1.1. C — total emission limit values

Pollutant	C
Total dust	30
HCl	10
HF	1
NO <sub>x</sub> for existing plants	800
NO <sub>x</sub> for new plants	500 (1)

Pollutant	C
Cd + Tl	0,05
Hg	0,05
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0,5
Dioxins and furans	0,1

(<sup>1</sup>) For the implementation of the NO<sub>x</sub> emission limit values, cement kilns which are in operation and have a permit in accordance with existing Community legislation and which start co-incinerating waste after the date mentioned in Article 20(3) are not to be regarded as new plants.

Until 1 January 2008, exemptions for NO<sub>x</sub> may be authorised by the competent authorities for existing wet process cement kilns or cement kilns which burn less than three tonnes of waste per hour, provided that the permit foresees a total emission limit value for NO<sub>x</sub> of not more than 1200 mg/m<sup>3</sup>.

Until 1 January 2008, exemptions for dust may be authorised by the competent authority for cement kilns which burn less than three tonnes of waste per hour, provided that the permit foresees a total emission limit value of not more than 50 mg/m<sup>3</sup>.

#### II.1.2. C — total emission limit values for SO<sub>2</sub> and TOC

Pollutant	C
SO <sub>2</sub>	50
TOC	10

Exemptions may be authorised by the competent authority in cases where TOC and SO<sub>2</sub> do not result from the incineration of waste.

#### II.1.3. Emission limit value for CO

Emission limit values for CO can be set by the competent authority.

### II.2. Special provisions for combustion plants co-incinerating waste

#### II.2.1. Daily average values

Without prejudice to Directive 88/609/EEC and in the case where, for large combustion plants, more stringent emission limit values are set according to future Community legislation, the latter shall replace, for the plants and pollutants concerned, the emission limit values as laid down in the following tables (C<sub>proc</sub>). In that case, the following tables shall be adapted to these more stringent emission limit values in accordance with the procedure laid down in Article 17 without delay.

Half-hourly average values shall only be needed in view of calculating the daily average values.

C<sub>proc</sub>:

C<sub>proc</sub> for solid fuels expressed in mg/Nm<sup>3</sup> (O<sub>2</sub> content 6 %):

Pollutants	< 50 MWth	50-100 MWth	100 to 300 MWth	> 300 MWth
SO <sub>2</sub> general case		850	850 to 200 (linear decrease from 100 to 300 MWth)	200
indigenous fuels		or rate of desulphurisation ≥90 %	or rate of desulphurisation ≥92 %	or rate of desulphurisation ≥95 %
NO <sub>x</sub>		400	300	200
Dust	50	50	30	30

Until 1 January 2007 and without prejudice to relevant Community legislation, the emission limit value for NO<sub>x</sub> does not apply to plants only co-incinerating hazardous waste.

Until 1 January 2008, exemptions for  $\text{NO}_x$  and  $\text{SO}_2$  may be authorised by the competent authorities for existing co-incineration plants between 100 and 300 MWth using fluidised bed technology and burning solid fuels provided that the permit foresees a  $C_{\text{proc}}$  value of not more than 350 mg/Nm<sup>3</sup> for  $\text{NO}_x$  and not more than 850 to 400 mg/Nm<sup>3</sup> (linear decrease from 100 to 300 MWth) for  $\text{SO}_2$ .

$C_{\text{proc}}$  for biomass expressed in mg/Nm<sup>3</sup> ( $\text{O}_2$  content 6 %):

'Biomass' means: products consisting of any whole or part of a vegetable matter from agriculture or forestry, which can be used for the purpose of recovering its energy content as well as wastes listed in Article 2(2)(a)(i) to (v).

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
$\text{SO}_2$		200	200	200
$\text{NO}_x$		350	300	300
Dust	50	50	30	30

Until 1 January 2008, exemptions for  $\text{NO}_x$  may be authorised by the competent authorities for existing co-incineration plants between 100 and 300 MWth using fluidised bed technology and burning biomass provided that the permit foresees a  $C_{\text{proc}}$  value of not more than 350 mg/Nm<sup>3</sup>.

$C_{\text{proc}}$  for liquid fuels expressed in mg/Nm<sup>3</sup> ( $\text{O}_2$  content 3 %):

Pollutants	< 50 MWth	50 to 100 MWth	100 to 300 MWth	> 300 MWth
$\text{SO}_2$		850	850 to 200 (linear decrease from 100 to 300 MWth)	200
$\text{NO}_x$		400	300	200
Dust	50	50	30	30

#### II.2.2. C — total emission limit values

C expressed in mg/Nm<sup>3</sup> ( $\text{O}_2$  content 6 %). All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours:

Pollutant	C
Cd + Tl	0,05
Hg	0,05
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0,5

C expressed in ng/Nm<sup>3</sup> ( $\text{O}_2$  content 6 %). All average values measured over the sample period of a minimum of 6 hours and a maximum of 8 hours:

Pollutant	C
Dioxins and furans	0,1

#### II.3. Special provisions for industrial sectors not covered under II.1 or II.2 co-incinerating waste

##### II.3.1. C — total emission limit values:

C expressed in ng/Nm<sup>3</sup>. All average values measured over the sample period of a minimum of 6 hours and a maximum of 8 hours:

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Pollutant	C
Dioxins and furans	0,1

---

C expressed in mg/Nm<sup>3</sup>. All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours:

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Pollutant	C
Cd + Tl	0,05
Hg	0,05

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ANNEX III

**Measurement techniques**

1. Measurements for the determination of concentrations of air and water polluting substances have to be carried out representatively.
2. Sampling and analysis of all pollutants including dioxins and furans as well as reference measurement methods to calibrate automated measurement systems shall be carried out as given by CEN-standards. If CEN standards are not available, ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall apply.
3. At the daily emission limit value level, the values of the 95 % confidence intervals of a single measured result shall not exceed the following percentages of the emission limit values:

Carbon monoxide:	10 %
Sulphur dioxide:	20 %
Nitrogen dioxide:	20 %
Total dust:	30 %
Total organic carbon:	30 %
Hydrogen chloride:	40 %
Hydrogen fluoride:	40 %

## ANNEX IV

**Emission limit values for discharges of waste water from the cleaning of exhaust gases**

Polluting substances	Emission limit values expressed in mass concentrations for unfiltered samples	
	95 % 30 mg/l	100 % 45 mg/l
1. Total suspended solids as defined by Directive 91/271/EEC		
2. Mercury and its compounds, expressed as mercury (Hg)	0,03 mg/l	
3. Cadmium and its compounds, expressed as cadmium (Cd)	0,05 mg/l	
4. Thallium and its compounds, expressed as thallium (Tl)	0,05 mg/l	
5. Arsenic and its compounds, expressed as arsenic (As)	0,15 mg/l	
6. Lead and its compounds, expressed as lead (Pb)	0,2 mg/l	
7. Chromium and its compounds, expressed as chromium (Cr)	0,5 mg/l	
8. Copper and its compounds, expressed as copper (Cu)	0,5 mg/l	
9. Nickel and its compounds, expressed as nickel (Ni)	0,5 mg/l	
10. Zinc and its compounds, expressed as zinc (Zn)	1,5 mg/l	
11. Dioxins and furans, defined as the sum of the individual dioxins and furans evaluated in accordance with Annex I	0,3 mg/l	

Until 1 January 2008, exemptions for total suspended solids may be authorised by the competent authority for existing incineration plants provided the permit foresees that 80 % of the measured values do not exceed 30 mg/l and none of them exceed 45 mg/l.

## ANNEX V

## AIR EMISSION LIMIT VALUES

## (a) Daily average values

Total dust	10 mg/m <sup>3</sup>
Gaseous and vaporous organic substances, expressed as total organic carbon	10 mg/m <sup>3</sup>
Hydrogen chloride (HCl)	10 mg/m <sup>3</sup>
Hydrogen fluoride (HF)	1 mg/m <sup>3</sup>
Sulphur dioxide (SO <sub>2</sub> )	50 mg/m <sup>3</sup>
Nitrogen monoxide (NO) and nitrogen dioxide (NO <sub>2</sub> ) expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	200 mg/m <sup>3</sup> (*)
Nitrogen monoxide (NO) and nitrogen dioxide (NO <sub>2</sub> ), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity of 6 tonnes per hour or less	400 mg/m <sup>3</sup> (*)

(\*) Until 1 January 2007 and without prejudice to relevant (Community) legislation the emission limit value for NO<sub>x</sub> does not apply to plants only incinerating hazardous waste.

Exemptions for NO<sub>x</sub> may be authorised by the competent authority for existing incineration plants:

- with a nominal capacity of 6 tonnes per hour, provided that the permit foresees the daily average values do not exceed 500 mg/m<sup>3</sup> and this until 1 January 2008,
- with a nominal capacity of >6 tonnes per hour but equal or less than 16 tonnes per hour, provided the permit foresees the daily average values do not exceed 400 mg/m<sup>3</sup> and this until 1 January 2010,
- with a nominal capacity of >16 tonnes per hour but <25 tonnes per hour and which do not produce water discharges, provided that the permit foresees the daily average values do not exceed 400 mg/m<sup>3</sup> and this until 1 January 2008.

Until 1 January 2008, exemptions for dust may be authorised by the competent authority for existing incinerating plants, provided that the permit foresees the daily average values do not exceed 20 mg/m<sup>3</sup>.

## (b) Half-hourly average values

	(100 %) A	(97 %) B
Total dust	30 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>
Gaseous and vaporous organic substances, expressed as total organic carbon	20 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>
Hydrogen chloride (HCl)	60 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>
Hydrogen fluoride (HF)	4 mg/m <sup>3</sup>	2 mg/m <sup>3</sup>
Sulphur dioxide (SO <sub>2</sub> )	200 mg/m <sup>3</sup>	50 mg/m <sup>3</sup>
Nitrogen monoxide (NO) and nitrogen dioxide (NO <sub>2</sub> ), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	400 mg/m <sup>3</sup> (*)	200 mg/m <sup>3</sup> (*)

(\*) Until 1 January 2007 and without prejudice to relevant Community legislation the emission limit value for NO<sub>x</sub> does not apply to plants only incinerating hazardous waste.

Until 1 January 2010, exemptions for  $\text{NO}_x$  may be authorised by the competent authority for existing incineration plants with a nominal capacity between 6 and 16 tonnes per hour, provided the half-hourly average value does not exceed  $600 \text{ mg/m}^3$  for column A or  $400 \text{ mg/m}^3$  for column B.

(c) **All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours**

Cadmium and its compounds, expressed as cadmium (Cd)	total $0,05 \text{ mg/m}^3$	total $0,1 \text{ mg/m}^3$ (*)
Thallium and its compounds, expressed as thallium (Tl)		
Mercury and its compounds, expressed as mercury (Hg)	$0,05 \text{ mg/m}^3$	$0,1 \text{ mg/m}^3$ (*)
Antimony and its compounds, expressed as antimony (Sb)	total $0,5 \text{ mg/m}^3$	total $1 \text{ mg/m}^3$ (*)
Arsenic and its compounds, expressed as arsenic (As)		
Lead and its compounds, expressed as lead (Pb)		
Chromium and its compounds, expressed as chromium (Cr)		
Cobalt and its compounds, expressed as cobalt (Co)		
Copper and its compounds, expressed as copper (Cu)		
Manganese and its compounds, expressed as manganese (Mn)		
Nickel and its compounds, expressed as nickel (Ni)		
Vanadium and its compounds, expressed as vanadium (V)		

(\*) Until 1 January 2007 average values for existing plants for which the permit to operate has been granted before 31 December 1996, and which incinerate hazardous waste only.

These average values cover also gaseous and the vapour forms of the relevant heavy metal emissions as well as their compounds.

(d) **Average values shall be measured over a sample period of a minimum of 6 hours and a maximum of 8 hours. The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence in accordance with Annex I.**

Dioxins and furans	$0,1 \text{ ng/m}^3$
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(e) **The following emission limit values of carbon monoxide (CO) concentrations shall not be exceeded in the combustion gases (excluding the start-up and shut-down phase):**

- $50 \text{ milligrams/m}^3$  of combustion gas determined as daily average value;
- $150 \text{ milligrams/m}^3$  of combustion gas of at least 95 % of all measurements determined as 10-minute average values or  $100 \text{ mg/m}^3$  of combustion gas of all measurements determined as half-hourly average values taken in any 24-hour period.

Exemptions may be authorised by the competent authority for incineration plants using fluidised bed technology, provided that the permit foresees an emission limit value for carbon monoxide (CO) of not more than  $100 \text{ mg/m}^3$  as an hourly average value.

(f) **Member States may lay down rules governing the exemptions provided for in this Annex.**

## ANNEX VI

**Formula to calculate the emission concentration at the standard percentage oxygen concentration**

$$E_s = \frac{21 - O_s}{21 - O_M} \times E_M$$

$E_s$  = calculated emission concentration at the standard percentage oxygen concentration

$E_M$  = measured emission concentration

$O_s$  = standard oxygen concentration

$O_M$  = measured oxygen concentration

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**CORRIGENDA****Corrigendum to Commission Regulation (EC) No 1008/2001 of 22 May 2001 establishing unit values for the determination of the customs value of certain perishable goods**

*(Official Journal of the European Communities L 140 of 24 May 2001)*

In the Annex on page 26 against code 2.70.2 'Monreales and satsumas, ex 0805 20 30', in the fourth column, under a):  
*for:* '100,308',  
*read:* '100,08'.

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**Corrigendum to Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste**

*(Official Journal of the European Communities L 332 of 28 December 2000)*

On page 95 in Article 3(6):  
*for:* '6. "existing co-incineration or co-incineration plant" means ...',  
*read:* '6. "existing incineration or co-incineration plant" means ...';  
and on page 108 in Annex IV in the second column relating to point 11. 'Dioxins and furans, ...':  
*for:* '0.3 mg/l',  
*read:* '0,3 ng/l'.

---

# Annex 3 – Worked examples for determining co-incineration limits

## A3.1 General

This Annex shows how the mixing rule formula of Annex II of the Waste Incineration Directive is to be used. The emission limit values set in the Directive are discussed in Sections 4.3.3 and 4.3.4 of the main Guidance which should be read in conjunction with the following sections. These calculations are for illustrative purpose only as it is for the operator to provide the data and the calculations.

The WID requires that the emission limit values, “C” for co-incinerators should be either those set out in Annex II or, where no values are set, these should be calculated using the following mixing rule formula.

$$C = \frac{V_{waste} \times C_{waste} + V_{proc} \times C_{proc}}{V_{waste} + V_{proc}}$$

In other words:

- C as set in Annex II, if no set value, then calculate
- C<sub>proc</sub> as set in Annex II but where no C<sub>proc</sub> values are set, permit values or, in the absence of those, actual measured values should be used.
- C<sub>waste</sub> Use Annex V values

The following table shows where these values are set or need to be calculated.

Pollutant	Cement Plants		Combustion Plants		Biomass Plants		Other Plants	
	C	C <sub>proc</sub>	C	C <sub>proc</sub>	C	C <sub>proc</sub>	C	C <sub>proc</sub>
Dust	✓		calculate	✓	calculate	✓	calculate	
TOC	calculate**							
HCl	✓		calculate		calculate		calculate	
HF	✓		calculate		calculate		calculate	
NO <sub>x</sub>	✓		calculate	✓	calculate	✓	calculate	
SO <sub>2</sub>	calculate**		calculate	✓	calculate	✓	calculate	
Cd + Tl	✓		✓		✓		✓	
Hg	✓		✓		✓		✓	
Other metals *	✓		✓		✓		calculate	
Dioxins	✓		✓		✓		✓	
CO	calculate**		calculate		calculate		calculate	

\* Sb + As + Pb + Cr + Co + Cu + Mn + Ni +V

\*\* Exemptions may be authorised where these do not result from the incineration of waste

✓ Indicates that the respective value is given in Annex II

Please note that the “C” and  $C_{proc}$  values in Annex II are at different oxygen concentrations and you will need to use the above mixing rule formula to calculate the oxygen concentration for the calculated “C” value.

### A3.2 Variables to be Calculated

Two variables that need to be determined before the C value can be calculated are  $V_{proc}$  and  $V_{waste}$ . To do this, you need to have the compositional analysis of waste and fuel for the parameters listed in the following table. Note that the values in this table are for illustrative purpose only and you should use actual analysis of your waste and fossil fuel for calculations.

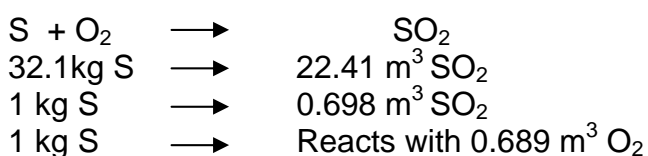
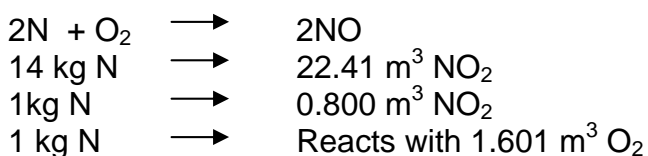
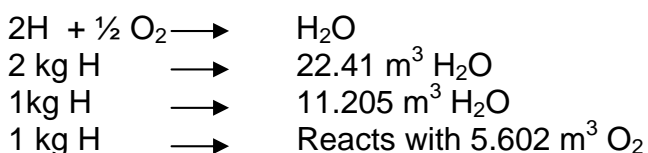
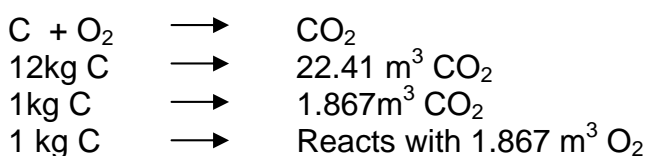
#### Typical fuel analysis (dry ash-free basis)

% Component	Coal (NCB Ref 802)	Tyres	SLF	HFO/RFO
Carbon	82	88.21	66.7	85.4
Hydrogen	5.3	7.73	8	11.4
Nitrogen	1.7	0.62	5.3	0.1
Sulphur	1.0	1.95	1.3	2.8
Oxygen	10	1.49	18.7	0.3
CV (Gross), MJ/kg	33.75	32.44	21	42.9

There are three steps for calculating flue gas volume generated by waste and fuel:

1. calculate the stoichiometric volume of oxygen (and hence air) needed for combustion
2. calculate the flue gas produced (air from 1 above plus flue gases as per the combustion reactions given below)
3. Convert the flue gas volume from 2 above (which is at stoichiometric conditions) to desired excess oxygen levels.

#### Combustion reactions



Atomic/Molecular Weights	
C	= 12
H	= 1
N	= 14
S	= 32.1
O	= 16
CO <sub>2</sub>	= 44
H <sub>2</sub> O	= 18
NO <sub>2</sub>	= 46
SO <sub>2</sub>	= 64.1
O <sub>2</sub>	= 32

**Assumptions:** The above assumes that: (a) all fuel components are oxidised as above reactions; (b) volume of ideal gas is 22.41 m<sup>3</sup>/kg mole at 273.15 K and 101.3kPa (e.g 1 kg oxygen has a volume of 0.7 m<sup>3</sup>); (c) air is 79% nitrogen and 21% oxygen.

### A3.3 Useful Conversion Factors

#### Converting flue gas volume at zero oxygen to a given oxygen Concentration

Stoichiometric calculations give flue gas volume at zero percent oxygen. However, the emission limits are set at different oxygen percentages and you will need to convert the flue gas volume to the required oxygen level. The following formula, developed from first principles, can be used for this. It is based on the fact that the oxygen comes from excess air (21% oxygen).

$$V @ x\% \text{ oxygen} = \left[ 1 + \frac{x}{21-x} \right] \times V @ \text{ zero oxygen}$$

#### Formula to calculate emission concentrations at the standard oxygen concentration

The following formula can be used for the conversion of emission limits to a standard condition (e.g. 6 or 11% oxygen)..

$$E_s = \frac{21 - O_s}{21 - O_M} \times E_M$$

$E_s$  = calculated emission concentration at the standard percentage oxygen concentration

$E_M$  = measured or calculated emission concentration

$O_s$  = standard oxygen concentration

$O_M$  = measured or calculated oxygen concentration

#### Calculating C<sub>proc</sub> for SO<sub>2</sub> for Combustion Plants in the Range 100-300 MWth

The WID specifies a sulphur dioxide limit which linearly decreases between 100 and 300 MWth input. To calculate the limit at any other thermal input (MWth) in this range, the following formula can be used.

$$C_{\text{proc}} = -3.25 \times \text{MWth} + 1175$$

## Worked Example : Combustion Plant Burning Coal and RFO

### Assumptions

- $V_{\text{waste}}$  is to be calculated (flue gas from waste burning)
- $V_{\text{proc}}$  is to be calculated (flue gas from conventional fuel)
- $C_{\text{waste}}$  for  $\text{SO}_2$  is  $50\text{mg/Nm}^3$  at 11% oxygen
- Conventional fuel is coal
- Waste to be burnt is RFO @ 5% thermal substitution.
- Fuel analysis of RFO and coal is as given A.1
- Total thermal input is 150 MWth

### Calculations

#### Step 1

Calculate  $C_{\text{proc}}$  value for  $\text{SO}_2$  using the following formula: (see section A.3)

$$C_{\text{proc}} = -3.25 \times MW_{\text{TH}} + 1175$$

$$= -3.25 \times 150 + 1175 = 687$$

$$C_{\text{proc}} = \underline{\underline{687 \text{ mg/Nm}^3 \text{ @ 6\% oxygen}}}$$

#### Step 2

Calculate stoichiometric air and flue gas volume for Coal as below.

For 1 kg of coal fuel the stoichiometric combustion air volume (A) can be calculated as follows (Note that the numerical values in brackets are the volume of oxygen needed for the reactant eg C or H etc as discussed under combustion reactions earlier):

$$A = \frac{(1.867 \times C) + (5.602 \times H) + (0.689 \times S) + (0.8 \times N) - (0.7 \times O)}{0.21}$$

$$A = (8.89 \times 0.82) + (26.68 \times 0.053) + (3.32 \times 0.01) + (3.81 \times 0.017) - (3.34 \times 0.10)$$

$$A = 7.29 + 1.414 + 0.0332 + 0.065 - 0.334$$

$$\underline{\underline{A = 8.46 \text{ Nm}^3/\text{kg of coal}}}$$

The volume of flue gas ( $V$ ) produced, assuming no significant moisture content in the air, can be calculated as below. (Note that the numerical values in brackets are the volume of combustion gases eg  $\text{CO}_2$ ,  $\text{NO}$  etc from the reactants C or N as discussed under combustion reactions earlier:

$$V = (A \times 0.79) + (1.867 \times C) + (11.205 \times H) + (0.689 \times S) + (0.8 \times N)$$

$$V = (8.52 \times 0.79) + (1.867 \times 0.82) + (11.205 \times 0.053) + (0.689 \times 0.01) + (0.8 \times 0.017)$$

$$V_{wet} = 6.731 + 1.531 + 0.594 + 0.007 + 0.013$$

$$V_{dry} = 6.731 + 1.531 + 0.007 + 0.013$$

$$\underline{\underline{V(\text{Wet}) = 8.88 \text{ Nm}^3 / \text{kg of coal}}}$$

$$\underline{\underline{V(\text{Dry}) = 8.28 \text{ Nm}^3 / \text{kg of coal}}}$$

### Step 3

Repeat step 2 above to calculate the theoretical Air and Combustion Gas for RFO

For 1 kg of RFO the theoretical combustion gas volume can be calculated as follows:

$$A = \frac{(1.867 \times C) + (5.602 \times H) + (0.689 \times S) + (0.8 \times N) - (0.7 \times O)}{0.21}$$

$$A = (8.89 \times 0.854) + (26.68 \times 0.114) + (3.32 \times 0.028) + (3.81 \times 0.001) - (3.34 \times 0.003)$$

$$A = 7.592 + 3.041 + 0.093 + 0.004 - 0.01$$

$$\underline{\underline{A = 10.72 \text{ Nm}^3 / \text{kg of RFO}}}$$

The volume of flue gas produced, assuming no significant moisture content in the air, is given by:

$$V = (A \times 0.79) + (1.867 \times C) + (11.205 \times H) + (0.689 \times S) + (0.8 \times N)$$

$$V = (10.72 \times 0.79) + (1.867 \times 0.854) + (11.205 \times 0.114) + (0.689 \times 0.028) + (0.8 \times 0.001)$$

$$V_{wet} = 8.469 + 1.594 + 1.277 + 0.019 + 0.002$$

$$V_{dry} = 8.469 + 1.594 + 1.277 + 0.019 + 0.002$$

$$\underline{\underline{V(\text{Wet}) = 11.36 \text{ Nm}^3 / \text{kg of RFO}}}$$

**V (Dry) = 10.08 Nm<sup>3</sup> /kg of RFO**

#### Step 4

Using the values derived in step 2 and 3 above, calculate the volume of combustion gas produced by coal (95% thermal input) and RFO (5% thermal input).

Fuel	Calorific value MJ/kg	Coal equivalent	Waste gas volume dry per 33.75 MJ	Thermal Input %	Waste gas volume of fuel mix m <sup>3</sup> (dry)	Waste gas volume (dry) %
Coal	33.75	1	8.29	95	7.87	95.2
RFO	42.9	0.79	7.96	5	0.4	4.8

#### Step 5

Convert the respective flue gas volumes to appropriate oxygen e.g. coal to 6% and RFO to 3% oxygen by using the formula in section A.3.

$$V_{coal} = 7.87 \times \left(1 + \frac{6}{15}\right) = 11.0$$

$$V_{RFO} = 0.4 \times \left(1 + \frac{3}{18}\right) = 0.47$$

Calculate SO<sub>2</sub> emission limit using the formula:

$$C = \frac{V_{waste} \times C_{waste} + V_{proc} \times C_{proc}}{V_{waste} + V_{proc}}$$

$$= \frac{0.47 \times 50 + 11 \times 687}{0.47 + 11} = 661 \text{ mgNm}^{-3}$$

Note that in the above calculation we have used volumes and emission limit values that are at 3% oxygen for RFO and 6% oxygen for coal. We now need to calculate the oxygen concentration of the mixture. This is done by using the partial volumes as below.

$$\frac{0.47 \times 3\% + 11 \times 6\%}{0.47 + 11} = 5.87\%$$

**C = 661 mg/Nm<sup>3</sup> at 5.87% oxygen**

Convert the above C value to mg/Nm<sup>3</sup> at 6% oxygen using formula in A5.6

$$C_{6\%} = \frac{21 - 6}{21 - 5.87} \times 661 = 655$$

**C = 655 mg/Nm<sup>3</sup> at 6% oxygen**

## Annex 4 – Summary of Directives quoted in the Waste Incineration Directive

Directive Reference	Description	Purpose
75/439/EEC	Directive on the disposal of waste oils	To determine the arrangements to be made for the collection and harmless disposal of waste oils. To require that priority is given to the regeneration of waste oils. To require a system of authorisations for plant either regenerating or burning waste oil. To prevent oils being mixed with toxic and dangerous wastes, in particular PCBs.
75/442/EEC	Directive on waste, also known as Waste Framework Directive. Amended by 91/156/EEC	To encourage the prevention and recycling of waste. To determine the arrangements to be made for the harmless disposal of waste. To provide administrative provisions for management and control. To provide a system of authorisations for firms responsible for collection, recycling or disposal.
75/716/EEC	Sulphur content of certain liquid fuels 1991	Set limits for sulphur levels in fuel oils
76/464/EEC	Framework directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community	To provide a system of authorisations for the discharge of dangerous substances into water. To provide limit values or quality objectives and monitoring procedures for List I substances. To provide quality objectives for List II substances. To adopt anti-pollution programmes for both types of substances and communicate them to the Commission. To draw up a list of discharges involving List I substances.
84/360/EC	Directive on the combating of air pollution from industrial plants	Requires the prior authorisation of plants for the disposal of toxic and dangerous waste by incineration and of plants for the treatment by incineration of other solid and liquid waste
88/609/EEC	Directive limiting emissions of certain pollutants into air from large combustion plants	Sets emission standards SO <sub>2</sub> , NO <sub>x</sub> and dust for existing and new plant; reduction targets are to be met progressively by 1993, 1998, 2003 using 1980 as a base. Amended Will be replaced by 2001/80/EC on 27/11/2002
89/369/EEC	Directive on air pollution from new municipal waste incinerators	To set emission limit values and operating requirements for new waste incinerators

<b>Directive Reference</b>	<b>Description</b>	<b>Purpose</b>
89/429/EEC	Directive on air pollution from existing municipal waste incinerators	To set emission limit values and operating requirements for existing waste incinerators and time table for achieving limits in 89/369/EEC
90/313/EEC	Directive on freedom of access to information on the environment	To oblige public authorities to provide access to environmental information, subject to certain restrictions.
90/667/EEC	Animal Waste Directive.	Lays down the veterinary rules for the disposal and processing of animal waste, for its placing on the market and for the prevention of pathogens in foodstuffs of animal and fish origin.
91/271/EEC	Directive on urban waste water treatment. Amended by 98/15/EC	To lay down minimum standards for the treatment of municipal waste water and the disposal of sludge
91/689/EEC	Directive on hazardous waste	Updates 1978 Directive on hazardous waste management, defines various types of, and constituencies of hazardous waste.
93/12/EEC	Directive relating to sulphur content of certain liquid fuels	Reduces S content of gas oils to 0.2% by weight by 01.10.94 and to 0.05% from 01.10.96
94/3/EC	Commission decision to establish establishing a list of wastes	Established a list of wastes in accordance with Article 1(a) of 75/442/EEC
94/67/EC	Directive on the incineration of hazardous waste.	To reduce or prevent adverse environmental effects.
2008/1/EC	Council Directive concerning integrated pollution prevention and control	To introduce a system of permitting for certain industrial installations
96/62/EC	Directive on air quality assessment and management	Framework Directive outlining system of monitoring and assessing air quality
1999/30/EC	Council Directive relating to limit values for SO <sub>2</sub> , NO <sub>2</sub> , oxides of nitrogen, particulate matter and lead	"Daughter" Directive under 96/62
1999/31/EC	Council Directive on Landfill of Waste	To reduce the amount of biodegradable waste sent to landfill

## Annex 5 - Glossary

In this glossary to the WID guidance, the information given is general and abbreviated in nature. In considering the precise meaning of any of the entries, therefore, the definitive source should be consulted. A glossary entry appended with reference to a Directive, applies to that Directive rather than more widely.

A further glossary of Environmental Permitting terms is available at [www.defra.gov.uk/environment/epp/guidance](http://www.defra.gov.uk/environment/epp/guidance)

APC	Air Pollution Control abatement plant used to clean up flue gases eg lime scrubbing.
CEN	Committee European de Normalisation (European standards committee)
CEM	Continuous emission monitoring equipment
CHP	Combined heat and power ie a plant where the energy generated is used to generate power and waste heat is used for process/space heating
cv	Calorific value – refers to the property of fuel/waste which determines how much heat will be generated if the material was burnt.
CWI	Clinical waste incinerator
Day	Period between 00.00 hours to 24.00 hours
Dioxins	A series of polychlorinated aromatic hydrocarbons numbering over 200. Only 17 of these are considered to be relevant to environmental control
ELV	Emission Limit Value – the mass, concentration or level of an Emission which may not be exceeded over a given period
Emission	The direct or indirect release of substances, vibrations heat or noise from individual or diffuse sources in an installation into the air, water and land
ETP	Effluent Treatment Plant
EWC	European Waste Catalogue
HWI	Hazardous waste incinerator, sometimes also called chemical waste incinerator
LCPD	Directive 2001/80/EC on the limitation of emissions from certain pollutants from Large Combustion Plants – the

“Large Combustion Plants Directive”.

LOI	Loss on ignition. A simple technique used to determine the combustible material by heating the ash residue to high temperature.
MBM	Meat and bone meal produced by rendering plants
MBT	Mechanical Biological Treatment
MWI	Municipal waste incinerator
MWID	Refers to the 1989 Municipal waste incineration Directives
NO <sub>x</sub>	Sum of oxides of nitrogen, NO and NO <sub>2</sub> , expressed as NO <sub>2</sub>
PAHs	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PCP	Pentachlorophenol
PM <sub>10</sub>	Airborne particulate matter passing a sampling inlet with a 50% efficiency cut –off at 10µm aerodynamic diameter and which transmits particles of below this size.
RFO	Recovered fuel oil
SCR	Selective catalytic reduction
SLF	Substitute Liquid Fuel
SNCR	Selective non-catalytic reduction. A technique used to abate oxides of nitrogen by injection ammonia or urea into the combustion chamber
TOC	Total organic carbon
WFD	Waste Framework Directive (2006/12/EC)

## Annex 6 - Bibliography

Environmental Permitting Core Guidance

Part A(1) Installations and Part A(1) Mobile Plant Guidance

The Animal By-Products (England) Regulations 2003. S.I.2003/1482

The Animal By-Products (Wales) Regulations 2003. S.I.2003/2756

General Guidance Manual on Policy Procedures for A2 and B installations.

*Other information relating to PPC A2 installations can be found on the Defra website at: [www.defra.gov.uk/environment/ppc/localauth/pubs/guidance/manuals.htm](http://www.defra.gov.uk/environment/ppc/localauth/pubs/guidance/manuals.htm)*

Reference document on Best Available Techniques for Waste Incineration (BREF Notes). European Commission

<http://ejppcb.jrc.es>

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Available from: Environment Agency website: [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk).

TGN M1, Sampling and safety requirements for monitoring stack releases to air, Environment Agency

Technical Guidance Note (TGN), M2, Monitoring of stack emissions to air).

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Waste Incineration (Scotland) Regulations Practical Guidance, September 2003.

Available from Scottish Executive website: <http://www.scotland.gov.uk>

Waste Incineration Regulations (Northern Ireland) 2003 S.R. 2003 No. 390

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[www.ehs.gov.uk](http://www.ehs.gov.uk)