

Integrated Pollution Prevention and Control (IPPC)

Secretary of State's Guidance for
A2 animal carcass incineration with
capacity of less than 1 tonne per hour

Defra would like to acknowledge the work of the Environment Agency's Local Authority Unit in the drafting of this guidance note.



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Contents

Introduction	1
Best Available Techniques (BAT)	1
Installations covered	2
Review and Upgrading Periods	3
Existing installations or activities	3
New installations or activities	4
Substantially changed installations or activities	4
Permit reviews	4
Summary of releases	4
Emission limits and other requirements	6
Emissions to air (and other provisions) associated with the use of BAT	6
Emissions to water associated with the use of BAT	7
Techniques for pollution control	8
Process description and in-process controls	8
Emissions control	14
Point source emissions to air	14
Point source emissions to surface water and sewer	16
Point source emissions to groundwater	17
Control of fugitive emissions to air	17
Fugitive emissions to surface water, sewer and groundwater	18
Odour	19
Management	20
Raw Materials	22
Raw materials selection	22
Waste minimisation (optimising the use of raw materials)	22
Water use	23
Waste handling	24
Waste re-use, recovery, recycling or disposal	24
Energy	25
Basic energy efficiency requirements	25
Additional energy efficiency requirements	25
Accidents	26
Noise and Vibration	28
Monitoring	28
Monitoring emissions to air	30
Monitoring emissions to water	30
Environmental monitoring (beyond installation)	30
Monitoring of process variables	30
References	33
Abbreviations	34

Appendix 1: Some common monitoring and sampling methods	35
Appendix 2: Ash Monitoring Protocol - BSE Suspects And OTMS cattle	37
Introduction	37
Appendix 3: Ash Monitoring Protocol - No BSE Suspects Nor OTMS Cattle	38
Introduction	38

List of Tables

Table 1: Compliance timetable	3
Table 2: Summary of releases - animal carcass incinerators A(2)	4
Table 3: Emission limits, monitoring and other provisions	6
Table 4: Emissions to water associated with the use of BAT	7
Table 5: Reagent selection – advantages and disadvantages for acid gas control	13
Table 6: Measurement methods for common substances to water	35
Table 7: Monitoring methods	36

1 Introduction

Background

- 1.1 This sector guidance note is issued by the Secretary of State and the Welsh Assembly Government (WAG), following consultation with relevant trade bodies, representatives of regulators including members of the Industrial Pollution Liaison Committee, and other interested organisations.
- 1.2 The note constitutes statutory guidance under regulation 37 of the Pollution Prevention and Control (England and Wales) Regulations 2000, SI 1973 (Ref 1) on the integrated pollution control standards appropriate for the generality of new and existing A2 installations in the following sector:

Animal carcass incineration with a capacity of less than 1 tonne per hour but with an aggregate treatment capacity of more than 10 tonnes per day of animal carcasses and animal waste.

These installations require a permit to operate in accordance with the 2000 Regulations under what is known as the Local Authority-Integrated Pollution Prevention and Control (LA-IPPC) regime. Local authority regulators are required by regulation 37 to have regard to this guidance. The Secretary of State / WAG will also treat this guidance as one of the material considerations when determining any appeals made under the Regulations against a local enforcing authority decision.
- 1.3 The guidance also (where appropriate) gives details of any mandatory requirements affecting emissions and impacts from these installations, which are in force at the time of publication. These include requirements contained in directions from the Secretary of State / WAG.
- 1.4 This is one of a series of such guidance notes aimed at providing a strong framework for consistent and transparent regulation of LA-IPPC installations.
- 1.5 General guidance explaining LA-IPPC and setting out the policy and procedures, is contained in the "General Guidance Manual on Policy and Procedures for A2 and B Installations" (Ref 2) available from www.defra.gov.uk/environment/ppc/index.htm, to be referred to in this document as the "General Guidance Manual." This is designed for operators and members of the public, as well as for local authority regulators.

Best Available Techniques (BAT)

- 1.6 BAT is the main basis for determining standards in LA-IPPC. This sector guidance note addresses what is considered by the Secretary of State/WAG to constitute BAT for

an animal carcass incineration installation with a capacity of 50kg/hr and over and less than 1 tonne per hour and with a treatment capacity exceeding 10 tonnes per day

As made clear in chapter 12 of the General Guidance Manual, BAT for each installation should be assessed by reference to the appropriate sector guidance note, and these notes should be regarded by local authorities as their primary reference document for determining BAT in drawing up permits. In general terms what is BAT for one installation is likely to be BAT for a comparable installation. However, determination of what is BAT is ultimately a matter for case-by-case decision taking into account that individual circumstances may affect BAT judgements and what are the appropriate permit conditions.

Thus, for each animal carcass incineration installation with a capacity of 50kg/hr or more and under 1 tonne per hour and with a treatment capacity exceeding 10 tonnes per day

installation, local authorities (subject to appeal to the Secretary of State / WAG) should regard this guidance note as a baseline, but ensure they take into account any relevant case-specific factors such as the individual process configuration and other characteristics, its size, location, and any other relevant features of the particular installation. Further guidance on this, including the issue of taking account of operators' individual financial position, is contained in chapter 12 of the General Guidance Manual.

1.7 If there are any applicable mandatory EU emission limits, these must be met, although BAT may go further. The same applies to UK regulations, such as, for England, The Control of Pollution (Oil Storage) (England) Regulations 2001, SI 2954¹.

Who is this guidance for?

1.8 This guidance is for:

- local authority regulators: who must have regard to the guidance when determining applications and when regulating installations which have a permit
- operators: who are best advised also to have regard to it when making applications and in the subsequent operation of their activities
- members of the public: who may be interested to know what standards are envisaged for the generality of installations in this sector.

1.9 The guidance is based on the state of knowledge and understanding of installations in this sector, their potential impact on the environment, and the available control techniques at the time of writing. The guidance may be amended from time to time in order to keep abreast with developments, including improvements or changes in techniques and new understanding of environmental impacts and risks. Any such amendments may be issued in a complete revision of this note, or in separate additional guidance notes which address specific issues. (N.B. It may not always be possible to issue amending guidance quickly enough to keep in absolute step with rapid changes, which might be another justification in particular cases for diverging from this note.) Steps will be taken to ensure that those who need to know about changes are informed of any amendments. Operators (and their advisers) are, however, strongly advised to check with the relevant local authority whether there have been any amendments before relying on this note for the purposes of applying for a permit or making any other decisions where BAT and related matters may be a consideration.

Terminology

1.10 In addition to the General Guidance Manual referred to above, explanation or clarification of certain terms used in this sector guidance note may be found in a general guidance note issued under Part I of the Environmental Protection Act 1991: 'Interpretation of terms used in process guidance notes', known as General Guidance Note 4 - GG4 - published by HMSO in 1991. Where there is any conflict between GG4 and the guidance issued in this note or in the General Guidance Manual, the latter two documents should prevail, as should any subsequent guidance issued in relation to LA-IPPC.

Installations covered

1.11 This Note covers the installations listed in Section 5.1 Part A (2) (c) of Schedule 1 of the Pollution Prevention and Control Regulations as follows:

Part A2 for animal carcass incineration

The incineration of animal carcasses or animal waste in a plant, which is not an incineration plant or a co-incineration plant, with a capacity of more than 10 tonnes per day but less than 1 tonne per hour of animal carcasses or animal waste or, in aggregate, of both.

Waste Incineration Directive - WID

1.12 For a definition of Animal Carcasses see Page 20 of Edition 2 of the Draft revised guidance on WID was issued by Defra in 2003 (Ref 11). Processed animal by-products (eg tallow, and meat and bonemeal) are not regarded as constituting animal carcasses, so incinerators which take this material will be WID compliance, irrespective of capacity.

Animal By-product Regulation - ABPR

1.13 Processes covered by this Note must satisfy the regulators of the Animal By-Products Regulations² (SI 2003/1482 in England). The regulators are the State Veterinary Service and the local regulators of LAPC/LAPPC. Compliance with the provisions of this note will satisfy the LA-IPPC part of the Animal By-Product Regulations obligations. This note does not intend to deal with biosecurity, or risks to operatives health.

Incineration covered by this Note can include;

- incineration of BSE-suspects and Over Thirty Month Scheme cattle.

1. There are no equivalent Regulations in Wales.

2. in Wales, WSI 2003 No.2756 (W.267) The Animal By-Products (Wales) Regulations 2003

- 1.14 This Note does not apply to
- processes which burn other matter as well as animal carcasses. They are subject to the Waste Incineration Directive. (eg tallow, meat and bone meal) See the Waste Incineration Directive draft guidance and Part A1 or Part A2 guidance. [Ref 11]
 - [Advice is currently still awaited from the European Commission on the precise scope of the Waste Incineration Directive and the extent to which it applies to the burning of parts of animal carcasses. It is hoped to be able to provide more guidance in the final published version of this note or, if not available by then, in separate supplementary guidance. Processed animal by-products are not regarded as coming within the meaning of "animal carcass"; the area of doubt surrounds parts of animal carcasses from slaughterhouses, knacker yards or butchery operations.] - see 1.12.
 - installations which burn animal carcasses only but with a capacity of 1 tonne per hour or more. They are Part A1 of PPC. See Part A1 guidance [Ref 12]
 - installations which burn animal carcasses only with a treatment capacity under 10 tonnes per day and a disposal rate of 50kg an hour or more and less than 1 tonne per hour. They are Part B of PPC; see process guidance note PG5/3(04)
 - installations which burn animal carcasses at a rate of less than 50 kg per hour i.e. "low capacity incinerators". (The Animal By-Product Regulations do apply and waste management licensing may apply)

Review and Upgrading Periods

Existing installations or activities

- 1.15 The previous guidance (Secretary of State's guidance - Animal carcass incineration process under 1 tonne per hour PG5/3(95)) relating to emissions to air advised that upgrading to that standard should have been completed, other than in exceptional circumstances, by 1 October 1997. Requirements still outstanding from any existing upgrading programme should be completed.
- 1.16 The new provisions of this note and the dates by which compliance with these provisions is expected, are listed in Table 1 below, together with the paragraph number where the relevant guidance is to be found. Compliance with the new provisions should normally be achieved by the dates shown. Permits should be drafted having regard to this compliance timetable.
- (1) Where this guidance note specifies provisions which are additional to, higher than or different to those in PG notes (reference PG 5/3(95)), only in exceptional circumstances should upgrading of existing installations and activities having regard to these additional/higher/different provisions be completed later than the compliance date specified in [Table 1](#) below.
- (2) Where standards or provisions in PG notes (reference PG 5/3(95)) have been deleted in this guidance note or where this guidance note specifies less stringent provisions than those in PG note (reference PG 5/3(95)), the new LA-IPPC permit should reflect this straightaway.
- 1.17 A programme for upgrading within the specified timescales, to those new / additional provisions in this guidance which involve significant improvement work, should be submitted to the relevant local authority regulator within 6 months of the date of issue of the permit.

Table 1: Compliance timetable

Guidance	Reference	Compliance Date
Exhaust gas cleaning	Paragraphs 3.27 to 3.46 BAT 18 to 20	28 Dec 2007
Emission limit values	Paragraph 2.1 Table 3 BAT 18	28 Dec 2007
Ash testing when not burning OTMS and BSE suspects	Paragraph 3.50	immediately

Table 1: Compliance timetable

Guidance	Reference	Compliance Date
Testing of 850°C and 2 seconds residence time	Paragraphs 3.17 and 3.21 Table 3 (BAT9)	28 Dec 2007
All other provisions		12-18 months

1.18 Replacement plant should normally be designed to meet the appropriate standards specified for new installations or activities.

New installations or activities

1.19 For new installations or activities - from the first day of operation the permit should have regard to the full standards of this guidance.

Substantially changed installations or activities

1.20 For substantially changed installations or activities - as from the first day of operation, the permit should normally have regard to the full standards of this guidance with respect to the parts of the installation that have been substantially changed and any part of the installation affected by the change.

Permit reviews



1.21 Permits should be reviewed in accordance with the guidance in chapter 26 of the General Guidance Manual. The review frequencies given in that chapter are considered appropriate for activities and installations covered by this sector guidance note.

Summary of releases

Table 2: Summary of releases - Animal carcass Incinerators A(2)

Source → Releases ↓	Unloading and storage	Loading & charging/macerating & crushing	Hardstandings and storage areas. Roadways including haulage ways	Vehicle bodies and wheels	Incineration	Support fuel	Stack emissions	Wet scrubbers	Dry scrubbers	Waste water treatment
Particulate matter / Total suspended solids	W	W	A W	A W	A	A	A	A W	A	W
Oxides of sulphur					A	A	A	A	A	
Carbon monoxide					A	A	A			
Chlorides					A		A	AW	A	W
Oxides of nitrogen					A	A	A	A	A	
VOC					A	A	A			

Table 2: Summary of releases - Animal carcass Incinerators A(2)

Source  Releases 	Unloading and storage	Loading & charging/macerating & crushing	Hardstandings and storage areas. Roadways including haulage ways	Vehicle bodies and wheels	Incineration	Support fuel	Stack emissions	Wet scrubbers	Dry scrubbers	Waste water treatment
Dioxins					A		A			
Odour	A	A			A		A			
Grate ash, fly ash & sorbents					A L				A L	
Liquid effluent/scrubber liquor/sludge residues					A L			A W		W
Noise	*	*					*	*		
KEY A - Release to Air, W - Release to Water, L - Releases to Land, * - Noise release										

2 Emission limits and other requirements

2.1 This section contains emission limits, mass release rates and other provisions that are judged for the generality of the activities within the sector to represent BAT.

Emissions to air (and other provisions) associated with the use of BAT

Table 3: Emission limits, monitoring and other provisions

Row	Determinand	Emission limits / provisions see paragraph 3.120	Monitoring	Monitoring frequency subject to paragraphs 3.113 - 3.118
1	Total particulate matter	30 mg/m ³ as 1/2 hour average - 100% compliance and 10 mg/m ³ as daily average over a 24-hour day - 100% compliance unless otherwise specified	Quantitative monitoring and recording	Continuous
2	Hydrogen Chloride (excluding particulate matter)	10 mg/m ³	Manual extractive test	Annual
3	Carbon monoxide	50 mg/m ³ as an average of half hour averages over a 24 hour day - 97% compliance over a year 100 mg/m ³ as a 1/2-hour average - 100% compliance	Quantitative monitoring and recording	Continuous
4	Sulphur dioxide	50 mg/m ³ as 1/2-hour average - 100% compliance	Quantitative monitoring and recording	Continuous
5	Oxides of nitrogen	400 mg/m ³	Manual extractive test	Annual
6	Organic compounds excluding particulate matter	10 mg/m ³ as total carbon	Manual extractive test	Annual
7	Dioxins and furans (PCDD/F)	0.1 ng/m ³	Manual extractive test	Annual
8	Oxygen	Minimum 3% and average 6% by volume	Measure at or after the end of retention zone in secondary chamber and Measure at same location as annual manual extractive tests	Continuously Concurrently throughout annual manual extractive tests
9	Secondary chamber temperature	Minimum 850°C at start and at or after the end of retention zone in secondary chamber	Measure at start and at or after the end of retention zone in secondary chamber	Continuously
	Secondary chamber retention time	Minimum 2 seconds after the last injection of combustion air	Demonstrate or calculate	On commissioning, See 3.24
10	Organic carbon in ash	1% carbon	See ash monitoring protocols	See ash monitoring protocols

Emissions to water associated with the use of BAT

- 2.2 Limit values for water discharges will be specified in individual cases taking account of the receiving environment. Wastewater treatment systems can maximise the removal of metals using precipitation, sedimentation and possibly filtration. The reagents used for precipitation may be hydroxide, sulphide or a combination of both, depending on the mix of metals present. It is also practicable in many cases to re-use treated water. The following table provides information regarding achievable levels associated with the use of wastewater treatment systems.
- 2.3 In all cases the effluent discharged from the installation must not give rise to a potential breach of an EQS or an EAL for the final receiving water, when taken with compliance with any water company permit.

Table 4: Emissions to water associated with the use of BAT

Determinand	Concentration, mg/litre
Suspended solids	45
BOD	60
pH	6-10
Ammoniacal nitrogen expressed as N	15
The appropriateness of the above release concentrations will vary depending upon the sensitivity of the receiving water and should be proportionate to the scale of the operations.	

3 Techniques for pollution control

- 3.1 This section summarises, in the outlined BAT boxes, what BAT should be in most circumstances. The boxes should not be taken as the only source of permit conditions; compliance with emission limits and other provisions contained in this guidance note together with any relevant case-specific considerations will also need to be taken into account.
- 3.2 The standards cover the techniques and measures which, in combination with those in the relevant previous (LAPC/IPC/Waste) guidance, have been identified as representing BAT in a general sense. They also cover the other requirements of the Pollution Prevention and Control (England and Wales) Regulations 2000 and requirements of other regulations, such as the Waste Management Licensing Regulations and the Groundwater Regulations insofar as they are relevant to an IPPC permit. For the sake of brevity these boxes simply use the term "BAT".

Process description and in-process controls

- 3.3 Where techniques or operating conditions are referred to in the BAT boxes below, provided that it is demonstrated to the satisfaction of the regulator that an equivalent or better level of control of environmental impacts will be achieved, then other techniques or operating conditions may be used.

Summary of activities

- 3.4 The meaning of "installation" and "directly associated activity" is addressed in chapter 2 of the General Guidance Manual.

Part A2

- 3.5 Animal carcass incineration installations that meet all these four conditions are prescribed for LA-IPPC ie Part A2
- capacity is less than 1 tonne per hour,
 - and capacity is 50 kilogrammes per hour or more
 - and the treatment capacity exceeds 10 tonnes per day
 - and only animal carcasses are burnt

Continuous Reloaders Single load

- 3.6 Animal carcass incinerators can typically be operated by:
- loading continuously, without a cool-down period for weeks or months
 - reloading before the previous load has burnt out, with a cool-down period every day of operation, or
 - single load, with a cool-down period after each load. (Unlikely to be Part A2)

Throughput

- 3.7 The calculation of throughput varies with style of operation. Although the courts determine the interpretation of the law, within this note the following ways of calculating throughput should be of use to regulators and operators of Part A2 processes and activities.
- continuous loaders - weight of average load divided by average period between load
 - reloaders - total weight loaded between cool-downs divided by time from first loading after cool-down to when waste is combusted
 - single loaders - weight loaded between cool-downs divided by time from loading to when waste is combusted
 - "when waste is combusted" one indication of this might be when the temperature in the secondary combustion zone could legally be allowed to fall below 850 degrees centigrade.
- 3.8 Within this note, the incineration rate of over 50 kg/hr and under 1 tonne per hour should be read as meaning the rate at which animal carcasses are loaded into the primary combustion chamber of the incinerator averaged over an incineration cycle. An incineration cycle means the period between the first load being charged to the primary combustion chamber and the end of the burndown time. The capacity of over 10 tonnes per day should be read as meaning the design treatment capacity of the incinerator. The design treatment capacity is the maximum quantity of material that can be incinerated in a 24 hour period, and includes any requirement to burndown and/or de-ash. Therefore, for example if an incinerator can be charged hourly for 15 hours and then requires a burndown period of 8 hours followed by cooling and de-ashing which takes about 1 hour, the daily capacity would be the quantity of material loaded to the primary combustion chamber over the first 15 hours of the incineration cycle. For each of these

definitions, reference has to be made to the secondary combustion chamber residence time and temperature, and to the emission limits. Therefore it may be physically possible to load a 500 kg carcass into a primary combustion chamber and incinerate it over 11 hours, however if the residence time or temperature in the secondary combustion chamber is not adequate or emission limit values are exceeded at any stage in the incineration cycle, this incinerator would not be rated as <50 kg/hr

3.9 Some animal carcass incinerators reload once the load volume in the combustor has diminished and may reload several times in a day before the previous load is completely combusted. At the end of the day when waste is completely combusted, the primary chamber temperature is then allowed to fall, and once cooler the ash is removed. In this note, reloading incinerators should be treated as continuous incinerators if the period from when all waste is combusted to the next loading is less than 6 hours. The 6 hours is taken as the typical duration to achieve adequate combustion.

Carcass handling and storage

3.10 Odour from the receipt, handling and storage of animal carcasses may cause offence at or beyond the process boundary. Prevention should involve:

- the careful siting of animal carcass storage,
- setting different maximum storage times for unrefrigerated, refrigerated and frozen carcasses, (up to one shift unrefrigerated may be reasonable, but if odour problems (see *paragraph 3.78 Odour*) are expected or caused then refrigeration should be provided)
- storage times for un-refrigerated, refrigerated and frozen carcasses should be kept to a minimum
- preventing spillage of solid or liquids while carcasses are being transferred eg carcasses should be carried not dragged, eg half-barrel shovel for carrying carcasses avoids dripping

3.11 Storage and handling equipment should be cleaned and disinfected at least each week.

3.12 Washdown water should usually be incinerated, though at abattoirs the water disposal facilities may be adequate. The incineration of washwater may affect incinerator efficiency and the volumes of wash water that can be injected will vary between incinerators. Assessments should be made of the optimum volumes of wash water that can be incinerated.

3.13 For incineration of BSE suspects or cattle from the Over Thirty Month Scheme (OTMS), washwater must be incinerated.

Environmental impact

Water: Washdown water

Land: Not significant

Air: Dust, odour

Waste:

Energy: Not Significant

Accidents: mechanical transport

Noise:

BAT

- 1 Storage must be lockable, totally self enclosed with self closing doors, and bird insect and rodent proof.
- 2 Vehicles, containers, trailers, storage areas, loaders and all equipment must be designed for easy cleaning and disinfection, impervious and kept clean.
- 3 Storage areas where carcasses are handled must have a resistant finish and slope to a holding pit:
- 4 Washdown water should be incinerated. For incineration of BSE suspects or OTMS carcasses, washwater must be incinerated.

Carcass incineration

- 3.14 Limits should be put on visible and odorous emissions. Abnormal emissions require action as described in BAT [89](#) to [92](#).
- 3.15 Most Part A2 animal carcass incinerators are loaded through a door opened while loading. The load may be in pieces or loaded whole. Automatic feed could be via ram feeder, bin feeder, horizontal feed hopper, and sealed units do not emit fumes during loading, and control the amount of air entering the incinerator. Mechanical feed might be by forklift with modified half barrel into the feed mechanism or direct into the combustion chamber.
- 3.16 Loading doors are usually open for less than 15 seconds during loading. Loading doors left open for excessive time can lead to reduced temperature in the primary chamber that might impact on the minimum required temperature for the secondary chamber. Melted fat or other liquids should not run out of doors or other openings.
- 3.17 For new plant, loading and reloading should be by sealed unit.
- 3.18 Grates are usually fixed hearth to catch liquids (eg fat that melts, body fluids), stepped hearths are less common.
- 3.19 Continuous incinerators have automatic de-ashing arrangements.
- 3.20 The charging system must be interlocked to prevent the addition of any material to the combustion zone if the secondary chamber temperature is below 850°C. Mechanical charging should be required. Automatic feed should be required for new plant but is more applicable to rotary hearths than fixed hearth incinerators.
- 3.21 Fuels used include natural gas, LPG, gas oil, and red diesel. The use of waste or recovered oil requires compliance with the Waste Incineration Directive
- 3.22 The secondary chamber varies in shape and location, often depending on the space available on site.
- 3.23 Good combustion includes the continuous control of primary and secondary combustion including oxygen and carbon monoxide levels and achieves satisfactory burnout.
- 3.24 The residence time, as well as the minimum temperature shall be subject to appropriate verification, at least once when the incineration plant is brought into service, or within one year of permitting. Such verification shall be under the most unfavourable operating condition anticipated. At the design stage, the 2 second residence time might be calculated from manufacturer's data but during commissioning the 2 second residence time should be demonstrated, either be measured or be calculated from actual combustion data, eg measured gas flow rates and pressures together with the known volume of the secondary chamber. Good mixing of the gases in the secondary chamber should be designed in. CFD is not required, but should be acceptable. The 2 seconds is not corrected for temperature, so very high temperatures which arise from too rapid incineration can cause noncompliance due to the larger volume of gases combusted at the same time as the gases occupy a larger volume due to their higher temperature.
- 3.25 Animal carcasses and parts of animal carcasses can be reduced in size (macerated) to increase the surface area and to facilitate burning to help stabilise combustion conditions resulting in improved burnout and reduction in peak emissions.

- 3.26 Frozen carcasses will require different times and procedures to control emissions and achieve burn out eg a lower primary chamber temperature for skinned fresh meat may be needed to slow the initial rate of combustion.
- 3.27 Where loading is not sealed, the incinerator should be indoors to prevent windwhipping of ash while the door is open.
- 3.28 Good combustion and low particulate emissions minimise the emission of dioxins (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans).

Dioxins

Environmental impact

Water: Not significant

Land: Not significant

Air: Particulate matter, carbon monoxide, dioxins, hydrogen chloride, sulphur dioxide, volatile organic compounds (from methane to PAH), odour, nitrogen oxides

Waste: Bottom ash,

Energy: Significant

Accidents:

Noise:

BAT	
5	Emissions from combustion processes should in normal operation be free from visible smoke and in any case should not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742:1969.
6	All releases to air, other than condensed water vapour, should be free from persistent visible emissions.
7	All emissions to air should be free from droplets.
8	The charging system must be interlocked to prevent the addition of any material to the combustion zone if the secondary chamber temperature is below 850°C.
9	The 2 second residence time at 850°C should be verified
10	Mechanical charging should be provided at rotary hearth incinerators.
11	Automatic feed should be provided for new plant.

Gas Cleaning

- 3.29 Acid gas and particulate emissions will require gas cleaning to meet the limits. Wet, semi-dry and dry techniques are available as are several reagents.
- 3.30 Fabric filters are proven and when correctly operated and maintained provide reliable abatement of particulate matter to below 5mg/m³. They cannot be used at high temperatures (over approx. 250°C) as this may give rise to fire risk.
- 3.31 Where fabric filters are used, they should have multiple compartments, which can be individually isolated in case of individual bag failures as well as bag burst detectors on each compartment to indicate the need for maintenance when this happens. Alternatively, the operator should submit a maintenance programme for the approval of the local authority, which will ensure replacement of bags at a frequency likely to avoid any cases of bag burst. The maintenance programme should be reviewed in the event of any bag bursts occurring.
- 3.32 Where wet scrubbing is used in combination with fabric filters (e.g. HWI), the cool and wet gases may require reheat (using indirect heat exchange from an otherwise waste heat source where practicable) to prevent dew point and other problems.

- 3.33 Ceramic filters provide an alternative where high temperature filtration is required although such filters can be used in a range of temperatures. Smaller design ceramic filters (e.g. 1 metre ceramic filter elements) either with or without mineral wool elements have been successful although larger units with larger filter elements have encountered mechanical failures.
- 3.34 Wet scrubbers are not considered to be BAT for particulate abatement on their own, but may represent BAT in combination with barrier filtration. They give rise to liquid effluent, which, if not recycled into the process, requires treatment and disposal.
- 3.35 Plume visibility is likely to be increased where wet scrubbers are employed unless plume reheat is employed. The source of this heat will have implications in relation to the overall energy efficiency of the installation
- 3.36 There are three main techniques for the control of acid gases, wet scrubbing, semi-dry scrubbing and dry scrubbing. Each has advantages and disadvantages, and each may represent BAT in different circumstances depending on overall process design.
- 3.37 Generally wet scrubbing can ensure meeting air emission limit values water-soluble acid gas species. Wet scrubbing does however have disadvantages regarding the production of an effluent stream and of a wet plume which may require energy input, and is not appropriate for particulate abatement without some filtration.
- 3.38 Dry and semi-dry systems are available. The advantages and disadvantages of these are outlined in Table 5 below.
- 3.39 The most commonly used reagents for acid gas abatement are:
- sodium bicarbonate (NaHCO₃)
 - lime(Ca(OH)₂)
 - sodium hydroxide (NaOH)
- 3.40 Sodium bicarbonate systems have demonstrably good removal rates and have been successfully used at animal carcass incinerators in conjunction with ceramic filters or fabric filters.
- 3.41 Sodium hydroxide is, in practice, the most efficient for acid gas removal and lime the least. This is explained by the relative reaction rates achieved i.e. the lime / acid reaction takes longer to reach completion.
- 3.42 All of these reagents can be effectively used to secure the emission limit values outlined in Table 2, and may represent BAT in an individual situation. The advantages and disadvantages of these are outlined in Table 5. Operators should be required to justify their selected technology by referring to the factors indicated.
- 3.43 Optimisation of the alkaline reagent dosing system is considered to be BAT. This is because a well optimised reagent dosing control system will:
- control acid gas emissions within emission limit values
 - reduce consumption of reagent
 - reduce production of alkaline residues
- 3.44 Exhaust gases need to be cooled before gas cleaning. The acceptable temperature range depends on the abatement technique and reagent. The maximum temperature for filter bags depends on the material. Ceramic filters operate at considerably higher temperatures.
- 3.45 Although narrow tube coolers are compact they are prone to blockages.
- 3.46 Large bore radiative coolers do not block but need more space and waste heat recovery is difficult. Quenching with water sprays can be useful as an addition to reduce peak temperatures before ceramic filters

- 3.47 Adding carbon to the reagent can improve dioxin control, but is not BAT unless it is necessary to meet the emission limit value. Arrestment systems for particulate matter, effective cooling and other controls might, in many circumstances be sufficient as BAT to meet the emission limit value for dioxins.

Table 5: Reagent selection – advantages and disadvantages for acid gas control

Reagent	Advantages	Disadvantages	Comments
Sodium Hydroxide wet	Highest acid gas removal rates Copes well with high acid load Low solid waste production	Effluent requires treatment Corrosive material ETP sludge for disposal Poor sub-micron particulate removal Risk of non-achievement of particulate emission requirements	But acid load from ACI is consistent and not high
Lime Wet, dry and semi dry systems available	Very good removal rates Copes well with medium acid loads Temperature of reaction well suited to use with bag filters	Corrosive material Some handling / pumping difficulties May give greater residue volume if no in-plant recycle May give rise to problems of plume visibility	
Sodium Bi-carbonate dry and semi-dry	Good removal rates Easiest to handle Dry recycle systems proven	Efficient temperature range (140 °C upwards) may be at upper end for use with bag filters Leachable solid residues Bicarbonate more expensive	Used at some ACI plants with ceramic filters and bag filters

- 3.48 One solution recently chosen at Part A1 animal carcass incinerators is:
- radiative cooling, plus in-duct water spray quenching to protect abatement plant from sudden temperature peaks, and with no waste heat recovery
 - dry sodium bi-carbonate without the addition of carbon
 - ceramic filters
- 3.49 The use of enclosed handling systems without using brushes or compressed air can minimise dust emissions.

Environmental impact

Water: effluent from wet scrubbers

Land: not significant

Air: Particulate matter,

Waste: used sorbent/fly ash, sludge from scrubber effluent treatment

Energy: fan

Accidents: filter bag fires

Noise: main induced draft fan

Ash Handling

Ash monitoring - BSE/OTMS

- 3.50 Ash monitoring must be carried out for incinerators that handle any BSE suspects or cattle from the Over Thirty Month Scheme (OTMS). The determinands, frequencies and methods are detailed in [Appendix 2](#).

Ash monitoring - non BSE/OTMS

- 3.51 If the regulator has reasons to doubt the day to day efficiency of combustion, one off or periodic monitoring of ash may be required in accordance with the non BSE/OTMS protocol in [Appendix 3](#). White ash indicates good ash burnout, black ash indicates poor ash burnout

- 3.52 Continuous incinerators (ie those with a cool down period of less than 6 hours) should be fitted with automatic de-ashing.
- 3.53 During deashing air flows should be controlled to minimise ash pick-up from the bed.
- 3.54 De-ashing should be enclosed and made directly into an enclosed transport skip. Where the enclosure is not tightly sealed, there should be air extraction and a filter.

Environmental impact

Water: Leaching from ash

Land: Not significant

Air: Particulate matter,

Waste: Ash, dioxins

Energy: Not significant

Accidents: Not significant

Noise: Not significant

BAT	
12	All spillages should be cleared as soon as possible; solids by vacuum cleaning, wet methods, or other appropriate techniques. Dry sweeping of dusty spillages should not be permitted.
13	A high standard of housekeeping should be maintained
14	For new plant, continuous incinerators should be fitted with automatic de-ashing

Emissions control

Point source emissions to air

- 3.55 The nature and source of the emissions to air expected from each activity are given in previous sections. In general they comprise:
 - **odour, particulate matter, hydrogen chloride, nitrogen oxides, sulphur dioxide, carbon monoxide, volatile organic compounds (from methane to PAH), and PCDD/F.**
- 3.56 The flue gases are the main source of releases and potential releases from animal carcass incinerators. **Odour, particulate matter, hydrogen chloride, nitrogen oxides, sulphur dioxide, carbon monoxide, volatile organic compounds (from methane to PAH), and PCDD/F** may be emitted.

Dispersion and dilution of stack emissions

- 3.57 The basis upon which stack heights are calculated using HMIP Technical Guidance Note D1 (D1) (Ref 4) is that pollutants are dispersed and diluted in the atmosphere to ensure that they ground at concentrations that are harmless under the theoretical conditions of the D1 model. The emission limits in this sector note should be used as the basis for stack height calculation. The stack height so obtained is adjusted to take into account local meteorological data, local topography, nearby emissions and the influence of plant structure. It is necessary that the assessment also takes into account the relevant air quality standards that apply for the emitted pollutants.

The calculation procedure of D1 is usually used to calculate the required stack height but alternative dispersion models may be used in agreement with the regulator. D1 relies upon the unimpeded vertical emission of the pollutant. A cap or other restriction over the stack impedes

the vertical emission and hinders dispersion. For this reason where dispersion is required such flow impellers should not be used. A cone may sometimes be useful to increase the efflux velocity and achieve greater dispersion.

Revised stack height calculations should not be required unless it is considered necessary because of a breach, or serious risk of breach, of an EC Directive limit value and because it is clear from the detailed review and assessment work that the Part A2 activity itself is a significant contributor to the problem.

An operator may choose to meet a tighter emission limit in order to reduce the required stack height.

Animal carcass incineration is usually a batch process and the exit velocity of the exhaust gases varies considerably during the cycle. Exhaust gases discharged through a chimney or vent should achieve a peak exit velocity greater than 15 m/sec during the firing cycle. Gas cooling prior to abatement will minimise the thermal buoyancy of the exhaust gases.

Fitting additional arrestment systems will require recalculation of stack heights due to potential changes in exhaust gas temperatures and flow rates. Increased stack heights might have planning implications and should be referred to the Local Planning Authority.

- 3.58 Liquid condensation on internal surfaces of flues and exhaust ducts might lead to corrosion and ductwork failure or to droplet emission.
- adequate insulation should be provided to minimise the cooling of waste gases and prevent liquid condensation by keeping the temperature of the exhaust gases above the dewpoint
- 3.59 Unacceptable emissions of droplets could possibly occur as a result of entrainment from wet abatement plant where the linear velocity within the associated ductwork exceeds 9 m/s. The use of mist eliminators reduces the potential for droplet emissions.
- where a linear velocity of 9 m/s is exceeded in the ductwork of existing wet abatement plant, the linear velocity should be reduced, subject to health and safety considerations, to ensure that droplet fallout does not occur
- 3.60 The dispersion from all emission points to air can be impaired by low exit velocity at the point of discharge, or deflection of the discharge.
- flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme
 - a minimum discharge velocity should be required in order to prevent the discharged plume being affected by aerodynamic down wash

BAT

All releases to air

The operator should:

- 15 Ensure that emissions from combustion processes in normal operation are free from visible smoke and in any case do not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742:1969.
- 16 Ensure that stack heights are sufficient to ensure adequate dispersion under normal conditions.
- 17 Ensure that the minimum stack height is 3 metres above roof ridge height of any building within a distance of 5 times the uncorrected stack height and in no circumstances should it be less than 8 metres above ground level.
- 18 Be able to demonstrate to the regulator that all reasonably practicable steps are taken during start-up and shut down, and changes of fuel or combustion load in order to minimise emissions.
- 19 Ensure that suitable arrestment systems are installed to meet the acid gas and particulate limits identified in [Table 3](#) as a minimum.

BAT

- 20 Justify their selected technology for acid gas and particulate arrestment as BAT in consideration of the advantages and disadvantages of each arrestment method.
- 21 Ensure that where alkaline reagents are used, the dosing system is optimised.
- 22 Ensure that exhaust gases are cooled prior to gas cleaning.
The operator should:
 - 23 Investigate the cause and nature of any persistent visible emissions and provide a report to the regulator.
 - 24 Ensure that emissions of water vapour are free from droplet fallout.
 - 25 Ensure that liquid entrainment in the duct of wet abatement, leading to droplet fallout, does not occur as a result of the linear flow rate within the duct exceeding 9 m/s.
 - 26 Ensure that flues and ductwork are cleaned to prevent accumulation of materials, as part of the routine maintenance programme.
 - 27 Ensure that exhaust gases discharged through a stack achieve an exit velocity greater than 15 m / sec during normal operating conditions to achieve adequate dispersion.
 - 28 Ensure that stacks are not fitted with any restriction at the final opening such as a plate, cap or cowl, with the exception of a cone which may be necessary to increase the exit velocity of the emissions.

Point source emissions to surface water and sewer

- 3.61 The nature and source of the emissions expected from each activity is given in previous sections. In general, wastewater can arise from storm water, from cooling water, from accidental emissions of raw materials, products or waste materials and from fire-fighting. In addition to the techniques below, guidance on cost-effective effluent treatment techniques can be found in ETBPP/Envirowise Guides (**Ref 4**).
- 3.62 The following general principles should be applied in sequence to control emissions to water:
 - water use should be optimised and wastewater re-used or recycled
 - contamination risk of process or surface water should be minimised
 - wastewater treatment systems can maximise the removal of pollutants, for example metals, using precipitation, sedimentation and filtration. The mix of pollutants will define the methods and reagents used. Concentrated effluents should be pretreated as necessary before discharge into the final effluent treatment system
 - ultimately, surplus water is likely to need treatment to meet the requirements of BAT (and statutory and non-statutory objectives). Generally, effluent streams should be kept separate as treatment will be more efficient. However, the properties of dissimilar waste streams should be used where possible to avoid adding further chemicals, e.g. neutralising waste acid and alkaline streams. Also, biological treatment can occasionally be inhibited by concentrated streams, while dilution, by mixing streams, can assist treatment
 - systems should be engineered to avoid effluent by-passing the treatment plant
- 3.63 The nature of the receiving water should be taken into account, with regard to any pollutant released to this media. Irrespective of the receiving water, the adequacy of the plant to minimise emissions must be considered. Guidance on treatment of persistent substances can be found in **Ref 4**.
- 3.64 Waste washwater from non-BSE/OTMS carcasses is typically not discharged to surface water but either incinerated, discharged to sewer, or more commonly removed from site using tankers for off-site treatment

Local Authority Regulation

- 3.65 Regulation 13 of The Pollution Prevention and Control (England and Wales) Regulations 2000 states that:
- "(1) In the case of a Part A installation or Part A mobile plant in relation to which a local authority regulator exercises functions under these Regulations, the Environment Agency may, at any time, give notice to the local authority regulator specifying the emission limit values or conditions which it considers are appropriate in relation to preventing or reducing emissions into water."
 - "(3) Where a notice under paragraph (1) specifies conditions in relation to emissions into water from an installation or mobile plant, the permit authorising the operation of that installation or mobile plant, shall include those conditions or more onerous conditions dealing with the same matters as the local authority regulator considers to be appropriate."

BAT

- 29 Waste / surplus water from the installation should be minimised.
- 30 All emissions should be controlled, as a minimum, to avoid breach of water quality standards. The Environment Agency may require monitoring, calculations and / or modelling to demonstrate this, where the discharge is to controlled waters.
- 31 Wastewater treatment systems should be used as required to meet emission benchmarks given in Table 3 and in any case, to avoid a breach of water quality standards.
- 32 Cleaning agents containing chlorine should be avoided to minimise the generation of dioxins.
- 33 Process effluent should be channelled / transported to suitable effluent treatment plant.
- 34 If scrubber liquors are generated from gas cleaning, they should be recycled taking into account the need to remove indestructible substances that would build up in the circuit if not removed. Appropriate effluent treatment may be required in this case.

Point source emissions to groundwater

Groundwater protection legislation

- 3.66 The Groundwater Regulations for the UK came into force on 1 April 1999. If List I or List II substances are discharged to groundwater or may be discharged to groundwater then the Environment Agency will provide advice as part of their statutory consultation duties. For further guidance see chapter 31 in the General Guidance Manual.

Control of fugitive emissions to air

- 3.67 Common sources of fugitive emissions are carcass handling and storage areas and de-ashing processes.

BAT

- 35 Operations should be controlled to minimise fugitive emissions.
- 36 All process buildings should be cleaned regularly, according to a written maintenance programme, to minimise fugitive emissions.
- 37 Storage areas and yard surfaces should be cleaned as appropriate and maintained free from dust

Fugitive emissions to surface water, sewer and groundwater

3.68 Operations should be controlled so as to minimise fugitive emissions. A record of fugitive emissions should be submitted on a regular basis, and normally at least once a year.

BAT (Sheet 1 of 2)

- 38 With regard to **subsurface structure**, the operator should:
- establish and record the routing of all installation drains and subsurface pipework
 - identify all subsurface sumps and storage vessels
 - engineer systems to minimise leakages from pipes and ensure swift detection if they do occur, particularly where hazardous (i.e. listed) substances are involved
 - provide, in particular, secondary containment and/or leakage detection for such subsurface pipework, sumps and storage vessels
 - establish an inspection and maintenance programme for all subsurface structures, e.g. pressure tests, leak tests, material thickness checks or CCTV
- 39 For **surfacing**, the operator should:
- ensure that all operational areas are equipped with an impervious surface, spill containment kerbs, sealed construction joints, and connection to a sealed drainage system unless the operator justifies that this is not necessary to the satisfaction of the regulator.
 - keep records of the design and condition of the surfacing of all operational areas - relevant information may include, as appropriate, capacities, thicknesses, falls, material, permeability, strength/reinforcement, and resistance to chemical attack
 - have an inspection and maintenance programme of impervious surfaces and containment kerbs
 - justify where operational areas have not been equipped with:
 - an impervious surface
 - spill containment kerbs
 - sealed construction joints
 - connection to a sealed drainage system
- 40 The operator should ensure that all tanks containing liquids whose spillage could be harmful to the environment are contained. The operator should ensure that all bunds:
- are impermeable and resistant to the stored materials
 - have no outlet (that is, no drains or taps) and drain to a blind collection point
 - have pipework routed within bunded areas with no penetration of contained surfaces
 - are designed to catch leaks from tanks or fittings
 - have a capacity of at least 110% of the largest tank *
 - are visually inspected weekly and any contents pumped out or otherwise removed under manual control after checking for contamination
 - where not frequently inspected, are fitted with a high-level probe and an alarm as appropriate
 - have an annual maintenance inspection (normally visual but extending to water testing where structural integrity is in doubt)
- 41 All sumps should:
- be impermeable and resistant to stored materials
 - be subject to regular visual inspection agreed with the regulator and any contents pumped out or otherwise removed after checking for contamination

* A Code of Practice on the use and storage of solvents is currently being drawn up and will be published on the Defra website. www.defra.gov.uk/environment/water/ground/solvents/index Where the Code, when published, contains anything more stringent as regards bunding, account should be taken of it.

BAT (Sheet 2 of 2)

- 42 All storage tanks should:
- be fitted with high-level alarms or volume indicators to warn of overfilling. Where practicable the filling system should be interlocked to the alarm system to prevent overfilling
 - have delivery connections located within a bunded area, fixed and locked when not in use
 - have their integrity inspected, recorded and documented, particularly where corrosive substances are involved. These inspections should be included in the maintenance schedule
- 43 Storage areas and containers should be designed and operated to minimise the risk of fugitive releases to surface water, sewer and groundwater, in particular:
- storage areas should be located away from watercourses and should be protected against vandalism
 - the maximum storage capacity of storage areas should be stated and not exceeded
 - the maximum storage period for containers should be specified
 - storage areas and silos should be inspected at least once a week to check for signs of leakage or potential leakage

Odour

- 3.69 Chapter 17 of the General Guidance Manual provides guidance on controlling odour from installations and the information required in an application.
- 3.70 Implementation of the best available techniques and the emission limit values and provisions of this note should ensure that offensive odours are not perceived beyond the site boundary, other than where unavoidable plume grounding occurs. It may be necessary to include additional controls to avoid offensive odours, for example where local meteorological conditions frequently lead to poor dispersion conditions.
- 3.71 The locality will influence the assessment of the potential for odour impact, for example, where the site has a low odour impact due to its remoteness from sensitive receptors, the escape of offensive odour beyond the installation would be unlikely to cause harm. In these circumstances it is expected that the operations should be optimised to minimise odour emissions and also that effective process management is applied. Assessment of the potential for offensive odour beyond the site boundary should take account of all predicted wind directions and weather conditions, which are typical of the location in question.
- 3.72 Odour from the receipt, handling and storage of animal carcasses may cause offence at or beyond the process boundary. Prevention should involve
- the careful siting of animal carcass storage
 - setting different maximum storage times for unrefrigerated, refrigerated and frozen carcasses, (up to one shift unrefrigerated may be reasonable, but if odour problems are expected or caused then refrigeration should be provided)
 - preventing spillage of solid or liquids while carcasses are being transferred eg carcasses should be carried not dragged, eg half-barrel shovel for carrying carcasses avoids dripping
 - vehicles, containers, trailers storage areas, loaders and all equipment must be designed for easy cleaning and disinfection, impervious and kept clean
 - vehicles, containers, trailers storage areas, loaders and all equipment must be designed for easy cleaning and disinfection, impervious and kept clean
 - storage areas where carcasses are handled must have a resistant finish and slope to a holding pit

- 3.73 Areas used for storage, handling and possibly size reduction equipment can be sealed or maintained under negative pressure and the air extracted can then be used to provide oxygen for the incineration process. The amount of air which can be fed to the combustion chamber will be limited to the optimum oxygen requirements for the incineration process.

Odour control

Best Available Techniques

- 44 There should be no offensive odour beyond the site boundary site.
- 45 Animal carcass storage areas should be sited to minimise odour at the site boundary.
- 46 Different maximum storage times should be set for un-refrigerated, refrigerated and frozen carcasses.
- 47 Spillages of solids or liquids should be prevented while carcasses are being transferred.
- 48 Vehicles, containers, trailers storage areas, loaders and all equipment should be designed for easy cleaning and disinfection, impervious and kept clean.
- 49 Storage areas where carcasses are handled should have sealed drainage to a holding pit.
- 50 Air from storage, handling and any size reduction equipment should be extracted and used in the incineration process.
- 51 Where necessary to prevent odour emissions, extracted air should be abated through charcoal filters if necessary to minimise high intensity odour emissions.
- 52 The handling and treatment of liquid effluent should be carried out so as to minimise the emission of offensive odour.

Management

- 3.74 Within IPPC, an effective system of management is a key technique for ensuring that all appropriate pollution prevention and control techniques are delivered reliably and on an integrated basis.

- 3.75 An effective and proportionate Environmental Management System (EMS) will help the operator to maintain compliance with regulatory requirements and to manage other significant environmental impacts.

Operations and maintenance

- 3.76 **Maintenance** - It is good practice to ensure:
- effective preventative maintenance on all aspects of the process the failure of which could impact on the environment
 - clear written maintenance instructions for all relevant items are developed and maintained
 - a method of reviewing maintenance needs, with demonstrable evidence that this process takes place
- 3.77 **Responding to problems** - The regulator needs to be notified about certain events and expects the operator to respond to problems which may have an effect on emissions to the environment. Such problems may arise within the process itself or, for example, with the abatement plant. "... (see BAT 89 to 91).
- 3.78 **Contractors on site** - It is important to be aware that in complying with their permit, operators will be responsible for work undertaken by contractors. Operators are advised to provide instructions to contractors regarding protecting the environment whilst working on site.

Operations and maintenance

- 53 Effective operational and maintenance systems should be employed on all aspects of the installation whose failure could impact on the environment, in particular there should be:
- documented operational control procedures
 - a documented preventative maintenance schedule, covering all plant whose failure could lead to impact on the environment, including major 'non productive' items such as tanks, pipework, retaining walls, bunds, ducts and filters; this should be reviewed and updated annually
 - documented procedures for monitoring emissions
- 54 The regulator should be provided with a list of key process equipment and abatement equipment. Such equipment should be provided with alarms or other warning systems which indicate equipment malfunction or breakdown. Such warning systems should be maintained and checked to ensure continued correct operation, in accordance with the manufacturer's recommendations.
- 55 Essential spares and consumables should be held on site or be available at short notice from suppliers, so that plant breakdown can be rectified rapidly.
- 56 Records of breakdowns should be kept and analysed by the operator in order to eliminate common failure modes.
- 57 A competent person should be appointed to liaise with the regulator and the public with regard to complaints. The regulator should be informed of the designated individual.

Audits

- 58 All audit records of raw materials usage, water usage, energy usage and waste production should be referenced to annual production.

Competence and training

- 59 Training systems, covering the following items, should be in place for all relevant staff:
- awareness of the regulatory implications of the permit
 - awareness of all potential environmental impacts under normal and abnormal circumstances
 - awareness of the procedures for dealing with a breach of the permit conditions
 - prevention of accidental emissions and action to be taken when accidental emissions occur
 - awareness of all operating procedures
- 60 The skills and competencies necessary for key posts (which may include contractors and those purchasing equipment and materials) should be documented and records of training needs and training received for these posts maintained.
- 61 The potential environmental risks posed by the work of contractors should be assessed and instructions provided to contractors about protecting the environment while working on site.

Accidents/incidents/non conformance

- 62 There should be written procedures for investigating incidents, (and near misses) including identifying suitable corrective action and following up.

Raw Materials

- 3.79 This section covers the use of raw materials and water and the techniques for both optimising their use and minimising their impact by selection (Energy and fuels are covered under **Energy**).
- 3.80 As a general principal, the operator will need to demonstrate the measures taken to:
- **reduce** the use of chemicals and other materials (**Waste minimisation (optimising the use of raw materials)**)
 - **substitute** with materials presenting lower risks to the environment
 - **understand** the fate of by-products and contaminants and their environmental impact

Raw materials selection

- 3.81 Raw materials used in animal carcass incinerators consist of:
- Animal carcasses including those carcasses which have been cut to facilitate incineration at point of disposal
 - Parts of animal carcasses e.g. animal by-products such as SRM etc.
 - Gas treatment reagents such as lime - calcium, sodium bicarbonate, sodium hydroxide
 - Water- make up for washing, cooling and any wet scrubbing (see paragraphs **3.89 - 3.91**)
 - Potentially activated carbon reagents for dioxin / heavy metal absorption
 - Water and effluent treatment chemicals
 - Fuels - either gas or fuel oil for start up and temperature stabilising
 - Biocides - to reduce fouling in direct cooling systems and for biological safety in cooling water.
 - MgSi - additive to reduce corrosion
 - Polythene (packaging)
 - Others"
 - (see page 20 of the draft Defra Guidance on: Directive 2000/76/EC on the Incineration of Waste, Edition 2 ([Ref 11]).

BAT

- 63 The operator should:
- maintain an inventory covering the principal types of raw materials used
 - annually review alternatives for the principal types of raw materials used with regard to their environmental impact
 - have quality procedures to control the specification of raw materials used, in order to minimise any potential environmental impact
 - complete any long term studies needed into the less polluting options and make any material substitutions identified within the review period
- 64 PVC packaging should not be accepted. No packaging other than that required to contain infectivity should be burnt

Waste minimisation (optimising the use of raw materials)

- 3.82 Wastes as defined in this section does **not** refer to animal carcasses and parts of carcasses destined for incineration.

- 3.83 The most important wastes are:
- incinerator ash
 - air pollution control residues
 - scrubber liquors and sludges
 - output from the effluent treatment plant
 - fuel containers
- 3.84 Waste minimisation can be defined simply as: *“a systematic approach to the reduction of waste at source, by understanding and changing processes and activities to prevent and reduce waste”*.
- 3.85 A variety of techniques can be classified under the term waste minimisation and they range from basic housekeeping techniques through statistical measurement techniques, to the application of clean technologies.
- 3.86 Key operational features of waste minimisation will be:
- the ongoing identification and implementation of waste prevention opportunities
 - the active participation and commitment of staff at all levels including, for example, staff suggestion schemes
 - monitoring of materials' usage and reporting against key performance measures
- 3.87 Using this information, opportunities for waste reduction, changes in process and improved efficiency should be generated and assessed, and an action plan prepared for the implementation of improvements.
- 3.88 The use and fate of all materials should be mapped onto a process flow diagram using data from the raw materials inventory and other company data as appropriate. Data should be incorporated for each principal stage of the operation in order to construct a mass balance for the installation. The mass balance can then be used to identify opportunities for improvements.

BAT

- 65 The operator should carry out a waste minimisation audit at least as frequently as the review period of the permit. The methodology used and an action plan for optimising the use of raw materials should be submitted to the regulator within 2 months of completion of the audit.
- 66 If an audit has not been carried out in the 2 years prior to submission of the application then the first audit should take place within 18 months of the issue of the permit.
- 67 Specific improvements resulting from the recommendations of audits should be carried out within a timescale approved by the regulator.

Water use

- 3.89 Water use should be minimised within the BAT criteria for the prevention or reduction of emissions and be commensurate with the prudent use of water as a natural resource.
- 3.90 Reducing water use may be a valid environmental and/or economic aim in itself, perhaps because of local supply constraints. Also, from the point of view of reducing polluting emissions, any water passing through an industrial process is degraded by the addition of pollutants, and there are distinct benefits to be gained from reducing the water used. These include:
- reducing the size of (a new) treatment plant, thereby supporting the cost benefit BAT justification of better treatment
 - cost savings where water is purchased or disposed of to another party
 - associated benefits within the process such as reduced energy requirements for heating and pumping, and reduced dissolution of pollutants into the water leading to reduced sludge generation in the effluent treatment plant

The use of a simple mass balance for water use may help to reveal where reductions can be made.

Advice on cost-effective measures for minimising water use can be found in **Ref 4**.

- 3.91 The following general principals should be applied in sequence to reduce emissions to water:
- water-efficient techniques should be used where possible
 - water should be recycled within the process from which it issues, treating it first if necessary. Where this is not practicable, it should be recycled to another part of the process which has a lower water quality requirement

Water use

BAT

- 68 The operator should carry out a regular review of water use (water efficiency audit). Where one has not been carried out recently, an initial comprehensive audit should be carried out at the earliest opportunity. Audits should be at least as frequent as the IPPC permit reviews.
- 69 Using this information, opportunities for reduction in water use should be assessed and, where appropriate, should be carried out in accordance with a timescale approved by the regulator.
- 70 The volume of mains and abstracted water used in the activities should be directly measured normally once a day for a fortnight each year and monthly outside that fortnight, or at a frequency agreed with the regulator, when the installation is operating. All measurements should be recorded and the records held on site.

Waste handling

- 3.92 Wastes as defined in this section and the next, does not refer to animal carcasses and parts of carcasses destined for incineration.
- 3.93 Good segregation of materials is essential to facilitate opportunities for recovery, recycling and re-use.

BAT

- 71 The operator should:
- record the quantity, nature, origin and where relevant, the destination, frequency of collection, mode of transport and treatment method of any waste which is disposed of or recovered
 - ensure that waste storage areas are clearly marked and signed, and that containers are clearly labelled
 - ensure that appropriate storage facilities are provided for substances that are flammable, sensitive to heat or light etc, and that incompatible waste types are kept separate
 - ensure that containers are stored with lids, caps and valves secured and in place (this also applies to emptied containers)
 - ensure that procedures are in place to deal with damaged or leaking containers.
 - segregate waste wherever practicable
 - identify the disposal route for all waste, which should be as close to the point of production as possible

Waste re-use, recovery, recycling or disposal

- 3.94 Wastes other than animal carcasses and parts of carcasses destined for incineration should be re-used, recovered or recycled unless the regulator has accepted a satisfactory BAT justification.

BAT

- 72 The operator should carry out an annual review to demonstrate that the best environmental options are being used for dealing with all waste from the installation.

Energy

3.95 BAT for energy efficiency under the PPC Regulations will be satisfied provided the operator meets the following conditions:

either

- the operator meets the basic energy efficiency requirements below and is a participant to a Climate Change Agreement (CCA) or a Direct Participation Agreement (DPA) with the Government.

or

- the operator meets the basic energy efficiency requirements below and the additional energy efficiency requirements.

Basic energy efficiency requirements

3.96 **The requirements of this section are basic, low cost, energy standards that apply whether or not a CCA or DPA is in force for the installation.**

BAT

- 73 The operator should produce a report annually on the energy consumption of the installation.
- 74 The operator should monitor energy flows and target areas for reduction which should be updated annually. ("Sankey" diagrams and energy balances would be useful as aids.)
- 75 In order to optimise combustion, the operator should continuously monitor carbon monoxide and oxygen in waste gases.
- 76 The operator should ensure that all plant is operated and maintained to optimise the use and minimise the loss of energy.
- 77 For new plant and for plant with a significant on-site demand, waste heat boilers should be considered

Additional energy efficiency requirements

3.97 Within IPPC it is valid to consider both the emission of direct (heat and emissions from on-site generation) and indirect (emissions from a remote power station) pollution when considering options for energy efficiency.

BAT

Energy efficiency techniques

78 The following techniques should be considered:

- heat recovery from different parts of the processes
- minimisation of water use and closed circulating water systems
- good insulation
- plant layout to reduce pumping distances
- phase optimisation of electronic control motors
- optimised efficiency measures for combustion plant e.g. air/feedwater preheating, excess air etc.

Energy supply techniques

79 The following techniques should be considered:

- use of Combined Heat and Power (CHP)
- generation of energy from waste
- use of less polluting fuels

Accidents

3.98 For accident management, there are three particular components:

- **identification of the hazards** to the environment posed by the installation/activity
- **assessment of the risks** (hazard x probability) of accidents and their possible consequences
- implementation of **measures to reduce the risks** of accidents, and contingency plans for any accidents that occur

3.99 Further guidance can be found in chapter 20 of the General Guidance Manual.

BAT

Accidents/incidents/non conformance

80 There should be written procedures for investigating incidents and near misses, including identifying suitable corrective action and following up.

81 The operator should maintain an accident management plan that identifies the hazards, assesses the risks and identifies the measures required to reduce the risk of potential events or failures that might lead to an environmental impact. The plan should identify:

- the actions to be taken to minimise these potential occurrences; and
- the actions to deal with such occurrences so as to limit their consequences

82 In the case of abnormal emissions arising from an accident, such as a spillage for example, the operator should:

- investigate immediately and undertake remedial action as soon as practicable
- promptly record the events and actions taken
- ensure the regulator is made aware, as soon as practicable

Identification of the hazards

3.100 In identifying the hazards particular areas to consider may include, but should not be limited to, the following:

- transfer of substances (e.g. loading or unloading from or to containers/silos or storage tanks)
- overfilling of containers/silos or tanks
- failure of plant and/or equipment (e.g. extraction fans or pumps, over-pressure of storage silos and pipework, blocked drains)

- failure of containment (e.g. bund and/or overfilling of drainage sumps)
- fires and problems arising from fighting fires such as failure to contain firewaters
- making the wrong connections in drains or other systems
- preventing incompatible substances coming into contact
- unwanted reactions and/or runaway reactions
- emission of an effluent before adequate checking of its composition has taken place
- steam main issues
- vandalism
- vehicle movements

Measures to reduce the risks (identified by risk assessment)

3.101 Risk reduction can be achieved by process management controls and preventative measures. The following techniques will be relevant to most installations, although this is not an exhaustive list.

Process management controls

- process design, alarms, trips and other failsafe control techniques to ensure the safe operation of the plant
- security systems to prevent unauthorised access
- records of all incidents, near-misses, changes to procedures, abnormal events and findings of maintenance inspections and procedures to learn from such incidents
- personnel suitably trained in accident management
- guidance for specific accident scenarios
- procedures to ensure good communication among operations staff during shift changes and maintenance or other engineering work
- safe shutdown procedures
- established communication routes with relevant authorities and emergency services

3.102 **Preventative measures**

- procedures to ensure that the composition of the contents of a bund /sump is checked before treatment or disposal
- drainage sumps equipped with a high-level alarm with automatic pump to storage (not to discharge)
- high-level alarms etc. (which should not be routinely used as the primary method of level control)
- adequate redundancy or standby plant with maintenance and testing to the same standards as the main plant
- sufficient storage to contain process waters, site drainage waters, emergency firewater, chemically contaminated waters and spillages of chemicals, which should be routed where necessary, having regard to a site-specific assessment of risks, to the effluent system
- provision to contain surges and storm-water flows, which should be treated where necessary, having regard to a site-specific assessment of risks, before emission to controlled waters or sewer
- spill contingency procedures to minimise the risk of accidental emission of raw materials, products and waste materials and to prevent their entry into water
- suitable barriers to prevent damage to equipment from the movement of vehicles, as appropriate, having regard to a site-specific assessment of risks
- where indicated by the site-specific assessment of risks, containment or abatement for accidental emissions from vents and safety relief valves/bursting discs should be provided. Where this may be inadvisable on safety grounds, attention should be focused on reducing the probability of the emission

Noise and Vibration

- 3.103 Within this section, “noise” should be taken to refer to noise and/or vibration as appropriate, detectable beyond the site boundary.
- 3.104 Principal sources of noise on incineration plant are:
- incinerator charging
 - fans including any harmonics between fans and chimneys
 - primary and secondary air fans
 - vehicle noise
 - general mechanical handling such as dragging rather than lifting containers
- 3.105 Further guidance can be found in chapter 16 of the General Guidance Manual.
- 3.106 Noise surveys, measurement, investigation (which can involve detailed assessment of sound power levels for individual items of plant) or modelling may be necessary for either new or existing installations depending upon the potential for noise problems. Operators may have a noise management plan as part of their management system. Where an installation poses no risk of noise related environmental impact because the activities undertaken are inherently quiet or remote from receptors, these measures would not normally be required.

BAT

- 83 The operator should employ basic good practice measures for the control of noise, in particular:
- identification of key plant and equipment with the potential to give rise to noise nuisance
 - documented maintenance systems for the identified key plant and equipment

Monitoring

- 3.107 This section describes general monitoring and reporting requirements for emissions to all environmental media. Guidance is provided for the selection of the appropriate monitoring methodologies, frequency of monitoring, compliance assessment criteria and environmental monitoring. The specific monitoring requirements with respect to emissions to air are described in **Table 3**

Standards for monitoring equipment and procedures

- 3.108 The Environment Agency has introduced its Monitoring Certification Scheme (MCERTS) to improve the quality of monitoring data and to ensure that the instrumentation and methodologies employed for monitoring are fit for purpose.
- operators should ensure their monitoring arrangements comply with the requirements of MCERTS where available, e.g. using certified instruments and equipment, and using a registered stack testing organisation etc.

See <http://www.environment-agency.gov.uk> for listing of MCERTS equipment.

Sampling and analysis standards

- 3.109 The analytical methods given in Table 3 and Appendix 1 should normally be used. In the event of other substances needing to be monitored, standards should normally be used in the following order of priority:
- Comité Européen de Normalisation (CEN)
 - International Standardisation Organisation (ISO)
 - British Standards Institution (BSI)
 - United States Environmental Protection Agency (US EPA)
 - American Society for Testing and Materials (ASTM)

- Deutsches Institut für Normung (DIN)
- Verein Deutscher Ingenieure (VDI)
- Association Française de Normalisation (AFNOR)

3.110 Further guidance on standards for monitoring gaseous releases relevant to IPPC is given in the Technical Guidance Note M4 (Monitoring) (see **Ref 9**). A series of updated Guidance Notes covering this subject is currently in preparation. This guidance specifies manual methods of sampling and analysis, which will also be suitable for calibration of continuous emission monitoring instruments. Further guidance relevant to water and waste is available from the publications of the Standing Committee of Analysts. See <http://dwi.gov.uk/regs/pdf/scabb202.pdf>

3.111 If in doubt the operator should consult the regulator.

Monitoring and sampling protocols

3.112 Where monitoring is needed the operator should address the following:

- determinands to be monitored
- monitoring strategy and selection of monitoring points
- monitoring methods and procedures (selection of Standard Reference Methods)
- reference conditions and averaging periods
- measurement uncertainty of the proposed methods and the resultant overall uncertainty
- drift correction
- quality assurance (QA) and quality control (QC) protocols, equipment calibration and maintenance, sample storage and chain of custody/audit trail
- reporting procedures, data storage, interpretation and review of results, reporting format for the provision of information to the Regulator
- the accreditation held by samplers and laboratories or details of the people used and the training/competencies

Monitoring frequency

3.113 The frequency of testing should be increased, for example, as part of the commissioning of new or substantially changed activities, or where the emission levels are near to or approach the emission limit.

3.114 Emission flow rates must be consistent with good operating practice and meeting the requirements of the legislation relating to workplace safety.

3.115 Where non-continuous quantitative monitoring is required, the frequency may be varied. Where there is consistent compliance with emission limits, regulators may consider reducing the frequency. When determining 'consistent compliance' factors to consider include:

- the variability of monitoring results, for example, results which range from 15 - 45 mg/m³, against an emission limit of 50 mg/m³ might not qualify for a reduction in monitoring
- the margin between the results and the emission limit, for example, results which range from 45 - 50 mg/m³ when the limit is 50 mg/m³ might not qualify for a reduction in monitoring

3.116 Consistent compliance should be demonstrated using the results from at least three or more monitoring exercises within two years, or two or more monitoring exercises in one year supported by continuous monitoring. Any significant process changes which might have affected the results should be taken into account.

3.117 Where effective surrogates are available they may be used to minimise monitoring costs.

3.118 Where monitoring shows that substances are not emitted in significant quantities, consideration can be given to a reduced monitoring frequency.

Monitoring emissions to air

3.119 The reference conditions of substances in releases to air from point sources are: temperature 273.15 K (0°C), pressure 101.3 kPa (1 atmosphere), 11% oxygen, dry gas. To convert measured values to reference conditions, see Technical Guidance Note M2 (**Ref 9**) for more information.

3.120 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
- no more than ten daily average values per year shall be discarded due to malfunction or maintenance of the continuous measurement system

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 emissions to water

3.121 The appropriateness of the emission benchmarks in Section 2 will vary depending upon the sensitivity of the receiving water and should be proportionate to the scale of the operations, nature of the discharge and receiving water. For each release point the following information is required:

- the specific volume flow from the process to sewer/controlled water
- the quality of the receiving water
- the volume of discharge compared to the percentage dry river flow of the receiving water

Environmental monitoring (beyond installation)

3.122 Environmental monitoring may be required, for example, when:

- there are vulnerable receptors
- the emissions are a significant contributor to an Environmental Quality Standard (EQS) which may be at risk
- the operator is looking for departures from standards based on lack of effect on the environment
- the operator is required to validate modelling work

3.123 Further guidance is given in chapter 15 of the General Guidance Manual.

Monitoring of process variables

3.124 Some process variables will have potential environmental impact and these should be identified and monitored where they have an environmental relevance. For animal carcass incinerators, examples of monitoring these variables include:

- keeping inventories of materials used and disposed of.
- monitoring temperatures and oxygen in the secondary chamber
- indicative control parameters for plant abatement
- gas cleaning reagent feed rates
- ash sampling

Monitoring and reporting

- 84 The need for and scope of testing and the frequency and time of sampling depend on local circumstances, operational practice, and the scale of operation. As part of proper supervision the operator should monitor emissions, make tests and inspections of the process and keep records, in particular the operator should keep records of audits, inspections, tests and monitoring, including all non-continuous monitoring, inspections and visual assessments. Monitoring may include process variables and operating conditions where relevant to emissions. In such cases:
- current records should be kept on site and be made available for the regulator to examine
 - records should be kept by the operator for at least two years
- 85 The regulator needs to be informed of monitoring to be carried out and the results. The results should include process conditions at the time of monitoring.
- 86 The operator should notify the regulator at least 7 days before any periodic monitoring exercise to determine compliance with emission limit values. The operator should state the provisional time and date of monitoring, pollutants to be tested and the methods to be used.
- 87 Annual manual tests should be undertaken when the incinerator is operated at the typical maximum rated throughput.
- 88 The results of non-continuous emission testing should be forwarded to the regulator within 8 weeks of the completion of the sampling.
- 89 Adverse results from **any** monitoring activity (both continuous and non-continuous) should be investigated immediately. The operator should ensure that:
- the cause has been identified and corrective action taken
 - as much detail as possible is recorded regarding the cause and extent of the problem and the action taken to rectify the situation
 - re-testing to demonstrate compliance is carried out as soon as possible, and
 - the regulator is notified
- 90 The regulator needs to be notified about certain events and expects the operator to respond to problems which may have an effect on emissions to air. Such problems may arise within the process itself or with the abatement plant, for example.
- 91 In the case of abnormal emissions, malfunction or breakdown leading to abnormal emissions:
- investigation and remedial action should be undertaken immediately
 - the process or activity should be adjusted to minimise those emissions; and
 - the events and actions taken should be promptly recorded
 - In the case of non-compliance causing immediate danger to human health, operation of the activity should be suspended
- 92 The regulator should be informed without delay:
- if there is an emission that is likely to have an effect on the local community; or
 - in the event of the failure of key abatement plant, for example, bag filtration plant or scrubber units
 - if continuous monitoring shows an emission concentration exceeding the limit value taking into account the specified averaging period

- 93 Care is needed in the design and location of sampling systems in order to obtain representative samples for all release points.
- sampling points on new plant should be designed to comply with the CEN or equivalent standards. e.g. BS EN 13284-1 for sampling particulate matter in stacks
 - the operator should ensure that adequate facilities for sampling are provided on stacks or ducts
 - where monitoring is not in accordance with the main procedural requirements of the relevant standard, deviations should be reported as well as an estimation of any error invoked
- 94 Continuous monitoring is normally expected for the main abated releases, as identified in [Table 3](#). Where continuous monitoring is required by the permit it should be carried out as follows:
- all continuous monitoring readings should be on display to appropriately trained operating staff
 - instruments should be fitted with audible and visual alarms, situated appropriately to warn the operator of arrestment plant failure or malfunction
 - the activation of alarms should be automatically recorded
 - all continuous monitors should be operated, maintained and calibrated (or referenced) in accordance with the manufacturers' instructions, which should be made available for inspection by the regulator. The relevant maintenance and calibration (or referencing) should be recorded
 - all new continuous monitoring equipment should be designed for less than 5% downtime over any 3-month period

Monitoring and reporting of emissions to air

- 95 Exhaust flow rates of waste gases should be consistent with the efficient capture of emissions, good operating practice and meeting the requirements of the legislation relating to the workplace environment.
- 96 The introduction of dilution air to achieve emission concentration limits should not be permitted.
- 97 Dilution air may be added for waste gas cooling or improved dispersion where justified, but this should not be considered when determining the mass or concentration of the pollutant in the waste gases.
- 98 Periodic visual assessment of releases should be undertaken as required by the regulator to ensure that all final releases are colourless, free from persistent visible emissions and free from droplets.
- 99 Calibration and compliance monitoring should meet the minimum requirements as given in the relevant CEN or equivalent standard
- 100 A summary of continuous emission monitoring results should be forwarded to the local regulator at least once every six months. The summary should be presented in a format that enables the local regulator to determine compliance with the continuous provisions for carbon monoxide, oxygen and secondary chamber temperature in [Table 3](#). The information should include:
- minimum daily oxygen concentration
 - time referenced list of 1/2 hour average values in comparison with the particulate matter, sulphur dioxide and carbon monoxide emission limits in Table 2
 - the daily average 1/2-hour average carbon monoxide and particulate matter emission concentration values

BAT

101 To relate measurements to reference conditions, the following will need to be determined and recorded:

- temperature and pressure
- oxygen
- water vapour measurement is required to allow correction back to dry basis unless techniques are used which directly monitor the dry concentration

Monitoring and reporting emissions to water and sewer

102 The appropriateness of the monitoring requirements will vary depending upon the sensitivity of the receiving water and should be proportionate to the scale of the operations, nature of the discharge and receiving water. For each release point the following information is required:

- the specific volume flow from the process to sewer/controlled water
- the quality of the receiving water
- the volume of discharge compared to the percentage dry river flow of the receiving water

103 Increased monitoring should be carried out where substances to which the local environment may be susceptible could be released from the installation, e.g. where releases of common pesticides or heavy metals may occur.

104 A full analysis, to include the substances listed in Schedule 5 of the Regulations, should be carried out annually on a representative sample from each release point, unless it is agreed with the regulator that this is inappropriate.

Monitoring and reporting of waste

105 Ash monitoring must be carried out for incinerators that handle any BSE suspects or cattle from the Over Thirty Month Scheme (OTMS). The determinands, frequencies and methods are detailed in [Table 3](#) and [Appendix 2](#).

106 The following should be monitored and recorded:

- the physical and chemical composition of the waste
- its hazard characteristics
- handling precautions and substances with which it cannot be mixed

References

Environment Agency documents referred to below are available from the Environment Agency website <http://www.environment-agency.gov.uk>. Many of the references below are being made available free of charge for viewing or download on the website. The same information can also be accessed via the SEPA website <http://www.sepa.org.uk>, or the NIEHS website www.ehsni.gov.uk

- Ref 1 *The Pollution Prevention and Control Act (1999)* (www.legislation.hmso.gov.uk)
- Ref 2 *The Pollution Prevention and Control (England and Wales) Regulations (SI 1973 2000) as amended* (www.legislation.hmso.gov.uk) or the Scottish equivalent SSI 323 2000
- Ref 3 Water efficiency references:
- ETBPP, Simple measures restrict water costs, GC22
 - ETBPP, Effluent costs eliminated by water treatment, GC24
 - ETBPP, Saving money through waste minimisation: Reducing water use, GG26
 - ETBPP (is now Envirowise) Helpline 0800 585794
- Ref 4 Environment Agency (1998) Optimum use of water for industry and agriculture dependent on direct abstraction: Best practice manual. R&D technical report W157, WRc Dissemination Centre, Swindon (tel 01793 865012)
- Ref 5 *HMIP Technical Guidance Note (Dispersion) D1*, 1993 The Stationery Office ISBN 0 11 752794 7

- Ref 6 *BS 5908: Code of Practice for Fire Precautions in the Chemical and Allied Industries*
- Ref 7 *Environment Agency, Pollution Prevention Guidance Note - Pollution prevention measures for the control of spillages and fire-fighting run-off, PPG 18, gives information on sizing firewater containment systems (EA website)*
- Ref 8 *Monitoring Guidance (EA website)*
- *M1 Sampling requirements for monitoring stack emissions to air from industrial installations, Environment Agency July 2002*
 - *M2 Monitoring of stack emissions to air. Environment Agency October 2004*
 - *M3 Standards for IPC Monitoring Part 1: Standards, organisations and the measurement infrastructure, HMIP, August 1995, ISBN 0-11-753133-2*
 - *M4 Standards for IPC Monitoring Part 2 : Standards in support of IPC Monitoring, HMIP Revised 1998*
 - *MCERTS approved equipment link via <http://www.environment-agency.gov.uk/epns> "Guidance for Business and Industry"*
 - *Direct Toxicity Assessment for Effluent Control: Technical Guidance (2000), UKWIR 00/TX/02/07*
- Ref 9 *"Policy and Practice for the Protection of Groundwater" (PPPG)(EA website)*
- Ref 10 *Secretary of State's Guidance (England and Wales): General Guidance Manual on Policy and Procedures for A2 and B Installations , March 2003- available from the Defra website and, in hard copy, from the Defra Publications line 08459 556000 www.defra.gov.uk/environment/ppc/index.htm*
- Ref 11 *"Guidance on Directive 2000/76/EC on the Incineration of Waste", 2nd edition, Defra and Welsh Assembly Government www.defra.gov.uk/environment/ppc/wasteincin/*
- Ref 12 *Sector Guidance Note IPPC S5.01 Guidance for the Incineration of Waste and Fuel Manufactured from or Including Waste, Environment Agency, Scottish Environment Protection Agency and Northern Ireland Environment and Heritage Service http://www.environment-agency.gov.uk/commondata/acrobat/incin_bat_guidance_854788.pdf*

Abbreviations

BAT	Best Available Techniques – see IPPC General Guidance Manual or the Regulations for further definition
BOD	Biochemical Oxygen Demand
BREF	BAT Reference Document
CEM	Continuous Emissions Monitoring
CHP	Combined Heat and Power plant
COD	Chemical Oxygen Demand
EA	Environment Agency
ELV	Emission Limit Value
EMS	Environmental Management System
ETP	Effluent Treatment Plant
EU	European Union
EQS	Environmental Quality Standard
ITEQ	International Toxicity Equivalents
MCERTS	Monitoring Certification Scheme
NIEHS	Northern Ireland Environment and Heritage Service
SAC	Special Areas of Conservation
SECp	Specific Energy Consumption
SEPA	Scottish Environment Protection Agency
SPA	Special Protection Area
TSS	Total Suspended Solids
TOC	Total Organic Carbon
VOC	Volatile Organic Compounds

Appendix 1: Some common monitoring and sampling methods

Table 6: Measurement methods for common substances to water

Determinand	Method	Detection limit Uncertainty	Valid for range mg/l	Standard
Suspended solids	Filtration through glass fibre filters	1 mg/l 20%	10-40	ISO 11929:1997, EN872 - Determination of suspended solids
COD	Oxidation with di-chromate	12 mg/l 20%	50-400	ISO 6060: 1989, Water Quality - Determination of chemical oxygen demand
BOD5	Seeding with micro-organisms and measurement of oxygen content	2 mg/l 20%	5-30	ISO 5815: 1989, Water Quality Determination of BOD after 5 days, dilution and seeding method EN 1899 (BOD 2 Parts)
AOX	Adsorption on activated carbon and combustion	-- 20%	0.4 - 1.0	ISO 9562: 1998, EN1485 - Determination of adsorbable organically bound halogens
Tot P				BS 6068: Section 2.28 1997, Determination of phosphorus – ammonium molybdate spectrometric method
Tot N				BS 6068: Section 2.62 1998, Determination of nitrogen Part 1 Method using oxidative digestion with peroxydisulphate, BS EN ISO 11905
pH				SCA The measurement of electric conductivity and the determination of pH, ISBN 0117514284
Turbidity				SCA Colour and turbidity of waters 1981, ISBN 0117519553 EN 27027:1999
Flow rate	Mechanical ultrasonic or electromagnetic gauges			SCA Estimation of Flow and Load, ISBN 011752364X
Temperature				SCA temperature measurement for Natural, Waste and Potable Waters and other items of interest in the Water and Sewage Disposal Industry ISBN 0117520179
TOC				SCA The Instrumental Determination of Total Organic Carbon and Related Determinants 1995, ISBN 0117529796 EN 1484:1997
Fatty acids				Determination of Volatile Fatty Acids in Sewage Sludge 1979, ISBN 0117514624
Metals				BS 6068: Section 2.60 1998, Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy
Chlorine				BS6068: Section 2.27 1990, Method for the determination of total chlorine: iodometric titration method

Table 6: Measurement methods for common substances to water

Determinand	Method	Detection limit Uncertainty	Valid for range mg/l	Standard
Trichloromethane (Chloroform) Bromoform				BS6068: Section 2.58, Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods
Dispersants Surfactants Anionic Cationic Non-ionic				SCA Analysis of Surfactants in Waters, Wastewaters and Sludges, ISBN 0117516058 EN 903:1993 (Used for anionic surfactants)
Pentachlorophenol				BS5666 Part 6 1983, Wood preservative and treated timber quantitative analysis of wood preservatives containing pentachlorophenol EN 12673:1997 (used for chlorophenol and polychlorinated phenols)
Formaldehyde				SCA The determination of formaldehyde, other volatile aldehydes, ketones and alcohols in water
Phosphates and nitrates				BS 6068: Section 2.53 1997, Determination of dissolved ions by liquid chromatography
Sulphites and sulphates				BS 6068: Section 2.53 1997, Determination of dissolved ions by liquid chromatography
Ammonia				BS 6068: Section 2.11 1987, Method for the determination of ammonium: automated spectrometric method
Grease and oils	IR absorption	0.06 mg/kg		SCA The determination of hydrocarbon oils in waters by solvent extraction IR absorption and gravimetry, ISBN 011751 7283

Table 7: Monitoring methods

Determinand	Preferred test method
Particulate matter	BS EN 13284-1 for particulate below 20mg/m ³ BS ISO 9096 for particulate above 20mg/m ³
Hydrogen chloride	BS EN 1911
Organic compounds excluding particulate matter.	BS EN 12619
Oxygen	ISO 12039
Carbon monoxide	ISO 12039

Appendix 2: Ash Monitoring Protocol - BSE Suspects And OTMS cattle

Guidance on ash testing protocol for BSE suspects / OTMS cattle was issued to local regulators by Government on 17 July 1997, and is currently being revised.

The 17 July 1997 guidance informed Part B regulators

- that they should use the Environment Agency guidance on Ash testing in the appendix to “Amplification Note No 1” regarding animal carcass incineration
- that they should modify the protocol in particular regarding frequency of testing, the letter dated 17 July 1997 gave the details

The Environment Agency “Guidelines for Ash Sampling and Testing” was re-issued on 14 May 2001.

The latest consultation draft for the revision of the Part B protocol was issued on 12 September 2003 by Defra.

The scope of the protocol is indicated below, along with a brief description of its contents.

Copies are available from Defra; enquiries can be made to:

- imalka.oyewole@defra.gsi.gov.uk Tel: 020 7082 8389 or
- carl.woodward@defra.gsi.gov.uk Tel: 020 7082 8388

The draft revision of the protocol starts as follows.

1 Introduction

1.1 This protocol provides guidance on testing methods and frequency of testing for protein and total organic carbon where incinerators are burning BSE-suspects or cattle from the Over Thirty Month Scheme (OTMS). The testing is necessary to ensure that plant are operating to acceptable standards in relation to any possible risks from BSE.

1.2 The protocol is applicable to all new plant and any existing installations, that will burn BSE suspects or cattle from the Over Thirty-Month Scheme (OTMS).

1.3 It includes:

- monitoring requirements for Part A2 incinerators - this sets out action levels and the frequency of sampling for existing plant, plant burning BSE/OTMS material for the first time, and plant that fail to meet the action levels
- guidance on selection and preparation of samples
- guidelines for preparing a Sample Plan
- a recommended tracking system for independent analysis for the local authority regulators

The protocol continues.....

Appendix 3: Ash Monitoring Protocol - No BSE Suspects Nor OTMS Cattle

This protocol is technically similar to the Ash monitoring protocol for BSE suspects/OTMS cattle for local regulators (for which see Section 9). Sampling is the same. The differences are that:

- this protocol applies to plant where no BSE and no OTMS cattle are incinerated
- testing is “if required by the regulator because of doubts about the day to day efficiency of combustion”, and may be a one-off test or periodic eg six monthly,
- protein testing is not required
- the action level is 1% organic carbon
- as Part B incinerators do not usually have gas cleaning, fly ash testing is not required
- the results are **not** sent to the Environment Agency national database for incineration of animal remains and MBM

The scope of the ash testing protocol for no BSE suspects / nor OTMS cattle starts as follows.

1 Introduction

1.1 This protocol provides guidance on testing methods and frequency of testing for total organic carbon where animal carcass incinerators are NOT burning BSE-suspects NOR cattle from the Over Thirty Month Scheme (OTMS)

It includes:

- monitoring requirements for Part B incinerators - this sets out action levels and the frequency of sampling for new and existing plant, and plant that fail to meet the action levels
- guidance on selection and preparation of samples
- guidelines for preparing a Sample Plan
- a recommended tracking system for independent analysis for the local regulatory units

