



BAT Guidance Note
On Best Available Techniques
for the Disposal or Recycling of
Animal Carcasses and Animal Waste
(1st Edition)

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1. INTRODUCTION

1.1 GENERAL

This Guidance Note is one of a series issued by the Environmental Protection Agency (EPA), which provides guidance on the determination of Best Available Techniques (BAT) in relation to:

- applicants seeking Integrated Pollution Prevention and Control (IPPC) licenses under Part IV of the Environmental Protection Agency Acts 1992 to 2007,
- existing Integrated Pollution Prevention and Control (IPPC) Licensees, whose licence is to be reviewed under the Environmental Protection Agency Acts 1992 to 2007,
- applicants seeking Waste Licenses under Part V of the Waste Management Acts 1996 to 2008,
- existing Waste Licensees, whose licence is to be reviewed under Waste Management Acts 1996 to 2008.

This Guidance Note shall not be construed as negating the installation/facility statutory obligations or requirements under any other enactments or regulations.

1.2 BAT GUIDANCE NOTE STRUCTURE

This Guidance Note has been structured as follows:

Section	Details
1	Introduction
2	Interpretation of BAT
3	Sector(s) Covered by this Guidance Note
4	Process Description, Risk to the Environment & Control Techniques
5	Best Available Techniques
6	BAT Associated Emission Levels
7	Compliance Monitoring

Where relevant, references are made to other detailed guidance; such as the reference documents (BREF) published by the European Commission, Agency Guidance Notes for *Noise in Relation to Scheduled Activities*, and the determination of BAT should be made giving regard to these.

The information contained in this Guidance Note is intended for use as a tool to assist in determining BAT for the specified activities.

2. INTERPRETATION OF BAT

2.1 STATUS OF THIS GUIDANCE NOTE

This Guidance Note will be periodically reviewed and updated as required to reflect any

changes in legislation and in order to incorporate technological advances as they arise.

Techniques identified in these Guidance Notes are considered to be current best practice at the time of writing. The EPA encourages the development and introduction of new and innovative technologies and techniques, which meet BAT criteria and look for continuous improvement in the overall environmental performance of the sector's activities as part of sustainable development. Operators should therefore continue to keep up to date with the best available techniques relevant to the activity and discuss appropriate innovations with the EPA.

2.2 INTERPRETATION OF BAT

The concept of BAT was introduced as a key principle in the IPPC Directive 96/61/EC. This Directive has been incorporated into Irish law by the Environmental Protection Agency Acts 1992 to 2007. To meet the requirements of this Directive, relevant Sections of the Environmental Protection Agency Act 1992 and the Waste Management Act 1996 have been amended to replace BATNEEC (Best Available Technology Not Entailing Excessive Costs) with BAT.

Best available techniques (BAT) is defined in Section 5 of the Environmental Protection Agency Acts 1992 to 2007 and Section 5(2) of the Waste Management Acts 1996 to 2008 as the "most effective and advanced stage in the development of an activity and its methods of operation, which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission values designed to prevent or eliminate or where that is not practicable, generally to reduce an emission and its impacts on the environment as a whole" where:

- B** 'best' in relation to techniques, means the most effective in achieving a high general level of protection of the environment as a whole
- A** 'available techniques' means those techniques developed on a scale which allows implementation in the relevant class of activity under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the person carrying on the activity
- T** 'techniques' includes both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned.

The range of BAT associated emission level values specified in Section 6 indicate those that are achievable through the use of a combination of the process techniques and abatement technologies specified as BAT in Section 5. The licensee must demonstrate to the satisfaction of the Agency, during the licensing process, that the installation/facility will be operated in such a way that all the appropriate preventative measures are taken against pollution through the application of BAT and justify the application of other than the most stringent ELV in the range.

At the installation/facility level, the most appropriate techniques will depend on local factors. A local assessment of the costs and benefits of the available options may be needed to establish the best option. The choice may be justified on:

- the technical characteristics of the facility;
- its geographical location;
- local environmental considerations;
- the economic and technical viability of upgrading existing installations.

The overall objective of ensuring a high level of protection for the environment as a whole will often involve making trade-off judgments between different types of environmental impact, and

these judgments will often be influenced by local considerations. On the other hand, the obligation to ensure a high level of environmental protection including the minimisation of long-distance or trans-boundary pollution implies that the most appropriate techniques cannot be set on the basis of purely local considerations.

The guidance issued in this Note in respect of the use of any technology, technique or standard does not preclude the use of any other similar technology, technique or standard that may achieve the required emission standards and is demonstrated to the Agency to satisfy the requirement of BAT.

2.3 BAT HIERARCHY

In the identification of BAT, emphasis is placed on pollution prevention techniques rather than end-of-pipe treatment.

The IPPC Directive 96/61/EC and the Environmental Protection Agency Acts 1992 to 2007 require the determination of BAT to consider in particular the following, giving regard to the likely costs and advantages of measures and to the principles of precaution and prevention:

- (i) the use of low-waste technology,
- (ii) the use of less hazardous substances,
- (iii) the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate,
- (iv) comparable processes, facilities or methods of operation, which have been tried with success on an industrial scale,
- (v) technological advances and changes in scientific knowledge and understanding,
- (vi) the nature, effects and volume of the emissions concerned,
- (vii) the commissioning dates for new or existing activities,
- (viii) the length of time needed to introduce the best available techniques,
- (ix) the consumption and nature of raw materials (including water) used in the process and their energy efficiency,
- (x) the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it,
- (xi) the need to prevent accidents and to minimise the consequences for the environment, and
- (xii) the information published by the Commission of the European Communities pursuant to any exchange of information between Member States and the industries concerned on best available techniques, associated monitoring, and developments in them, or by international organisations, and such other matters as may be prescribed.

3. SECTOR COVERED BY THIS GUIDANCE NOTE

This Guidance Note covers the following activities under the First Schedule of the Environmental Protection Agency Acts 1992 to 2007:

- 7.1 The manufacture of vegetable and animal oils and fats where the capacity for processing raw materials exceeds 40 tonnes per day, not included in paragraph 7.8.
- 7.7.1 The disposal or recycling of animal carcasses and animal waste with a treatment capacity exceeding 10 tonnes per day.
- 7.7.2 The processing (including rendering) of animal carcasses and by-products, not included in paragraph 7.7.1.
- 8.6.1 The tanning of hides and skins where the treatment capacity exceeds 12 tonnes of finished products per day.
- 8.6.2 The fell-mongering of hides and tanning of leather in installations where the capacity exceeds 100 skins per day, not included in paragraph 8.6.1.

“Animal By-product” means any carcass or part of any animal or fish or any product of animal origin not intended for direct human consumption with the exception of animal excreta and catering waste (S.I. No. 257 of 1994).

This Guidance Note covers the following animal by-product sectors:

- a) Rendering of Animal by-products
- b) Fat Melting
- c) Bone Processing
- d) Blood Processing
- e) Gelatine Manufacture
- f) Land Spreading/Injection
- g) Biogas Production
- h) Composting

It should be noted that the slaughtering of animals is outside the scope of this Guidance Note.

4. PROCESS DESCRIPTION RISK TO THE ENVIRONMENT & CONTROL TECHNIQUES

4.1 DESCRIPTION OF PROCESS

(Note: Any reference to BREF in this document means the reference document on *Best Available Techniques in the Slaughterhouses and Animal By-products Industries*, published by the European Commission, November 2003).

4.1.1 Rendering

The rendering process uses animal by-products from meat production. The process comprises a number of processing stages, as follows, although the order may vary between installations. The raw material is received at the installation and stored. Preparing the raw material for rendering generally involves size reduction, to meet the requirements of ABP Regulation 1774/2002/EC. The material is then heated under pressure to kill micro-organisms and to remove moisture. The liquefied fat and the solid protein are separated by centrifugation and/or pressing. The solid product may then be ground into a powder to make animal protein meal, such as MBM or feather meal. The final products are transferred to storage and dispatch.

Some examples of rendering systems include:

- Batch dry rendering (see BREF Section 2.2.2.1)
- Continuous drying in added fat (see BREF Section 2.2.2.1)
- Pressing, evaporation, drying in fat and pressing (see BREF Section 2.2.2.1)
- Separation, evaporation and drying in natural fat (see BREF Section 2.2.2.1)
- Cooking and multiple-effect evaporation in added fat, pressing (see BREF Section 2.2.2.1)
- Pressing, separation, vacuum evaporation, drying without fat (see BREF Section 2.2.2.1).

4.1.1.1 Potential emissions

a) Air

Reported emissions of CO₂, SO₂, NO_x and Dust are shown in Table 4.1

Substances emitted	Range of emission per tonne of unspecified animal by-product treated (kg).
CO ₂	10.2-14.6
SO ₂	1.2-1.6
NO _x	0.51-0.59
Dust	0.19-0.21

[Source: BREF, 2003]

b) Water

The water consumption from unspecified rendering processes has been reported to be 500-1,000l/t of raw materials. Consumption is divided as follows: condensers consume 200-500l/t, boilers 150-200l/t, and cleaning 200-300l/t. (see BREF, 2003).

For every tonne of raw material used 1,000-1,500 litres of wastewater is produced, including approximately 600 litres from condensate, i.e. water evaporated from the raw materials. On average, one tonne of raw material is reported to produce 5kg of COD, 600g of nitrogen and 1.65kg of solids (see BREF, 2003) before wastewater treatment. Vapour condensate accounts for 50-90% of the wastewater contamination.

The waste water from the process exhaust air treatment can be highly loaded with organic components, up to 25g/l COD, mercaptans \leq 2g/l, hydrogen sulphide \leq 800mg/l, ammonium nitrogen \leq 400mg/l, volatile oils, phenols, aldehydes and others.

The wastewater from lorry cleaning may contain mineral oil, solids and possibly cleaning agents.

De-sludging wastewater from the evaporators has little organic load, but may contain phosphorous compounds from any conditioning agents used. It can also have high pH-values, which need to be neutralised. There is also wastewater from the de-sludging of the cooling water recirculation. See BREF Sections 1.3.2 and 3.2.2 for useful data on overall and individual unit operation water consumption per tonne of product.

c) Land

Leakage from drainage pipes and tanks could cause emissions to soil. The bulk storage of fuels and other chemicals if not properly managed may pose a risk of accidental spillages and leaks, which could potentially result in contamination of the soil and groundwater (see BREF Section 3.2.2).

d) Energy

The energy and heat consumption from this sector has been reported as shown in table 4.2

Electricity Consumption	Approximately 75 kWh per tonne of raw material
Heat Consumption	Approximately 775 kWh per tonne of raw material
Excluding odour abatement and waste water treatment (approximately an additional 20kWh)	
Feedstock unspecified.	

Table 4.2: Energy consumption for dry rendering process (see BREF, 2003)

Drying consumes about 2/3 of the energy demand of a rendering plant. Emissions will vary between the wet and dry processes, also, depending on whether sterilisation is undertaken as a separate step or incorporated in the cooking/drying process, and on whether presses or centrifuges or a combination of both are used to separate the tallow, meal and residual water (see BREF Sections 3.2.2).

e) Odour

Decomposition commences as soon as the animal is slaughtered. Undue delays before rendering in conjunction with inadequate temperature control have a direct effect on the state of decomposition and on the consequent severity of any odours. The biological and/or thermal decomposition of raw materials leads to the formation of odour-intensive substances, such as ammonia and amines, sulphur compounds, such as hydrogen sulphide, mercaptans, and other sulphide; saturated and unsaturated low-boiling fatty acids; aldehydes; ketones and other organic

compounds. Measurements have shown that average odour concentration can be 80-800kOU/kg raw material.

The malodorous emissions arise from gaseous emissions. These include highly concentrated process gases and vapours from the cooking operation and associated ductwork transferring the gases to the odour abatement plant. Odour emissions also arise from discharges from cookers, presses and/or centrifuges receiving hot rendered material for separation and hot separated material en route to storage. Other sources include the displacement of malodorous air from the tallow storage tanks; the cleaning of process equipment; fugitive emissions from process buildings and the operation of an odour abatement plant beyond its design specification. They also arise from liquid effluents, including the following: accumulated liquid at the base of the raw material transport containment and on-site storage hoppers; material spillages and floor washings; cooler condensate, the by-products of abatement techniques and treatment/effluent holding tanks. The storage and handling of animal meal and tallow can also cause odour problems.

The non-condensable gases and the condensate liquor have a particularly strong and offensive odour. If the odour is not destroyed at source, it can cause problems from within the installation and, for liquor, at the WWTP (see BREF Section 3.2.2).

f) Noise and vibration

The main areas of concern exist where plants are located in or near residential areas. In these locations significant noise pollution can arise from the operation of fans, scrubbing towers, filtration equipment and conveyors. See BREF Section 3.2.2 for further information on noise and vibration.

Table 4.1: Summary of direct releases to the environment

Source →											
Release ↓	Delivery of materials	Unloading of material	Crushing and transporting of material	Processing of material	Treatment of extracted gases	Effluent treatment	Cleaning of vehicles	Storage of processed material	Cleaning of surfaces	Drainage systems	Tallow storage
Odour	A	A	A	A	A	A	A	A	A	A	A
Oxides of sulphur					A						
Oxides of nitrogen					A						
Carbon Dioxide					A						
Carbon Monoxide					A						
Particulate/ Total suspended solids	A/W	A/W	W	A/W	A/W	L/W		A/W	A/L/W		
Ammonia	W	W	W			W	W		W		
COD	W	W	W	W	W	W	W	W	W	W	W
BOD	W	W	W	W	W	W	W	W	W	W	W
Solid waste or sludge	L/W	L/W	L/W	L/W	L/W	L/W	L/W	L/W	L/W	L/W	
Oils and greases	L/W	L/W	L/W	L/W			L/W	L/W	L/W	L/W	L/W
Noise	*	**	**	**	*		*		*		
Key											
A- Release To Air, W- Release to Water, L- Release to Land, ***-High potential for noise, **- Medium potential for noise, * - Low potential for noise											
Substances include their compounds, except where separate reference to the compound is made.											
Releases to air may also be released to land or water, depending on the abatement technology employed, e.g. via collected dusts, sludges or liquors.											
N.B. It should be noted that this is not necessarily an exhaustive list. Equally not all installations will necessarily have these releases.											
*Source – UKDEFRA Sector Guidance Note IPPC SG 8(2004)											

4.1.2 Fat Melting

The fat melting process is similar in many ways to rendering. The end product of fat melting is generally for food use, so feedstocks are required to be fresh and consequently cause less odour problems during storage and processing. The process comprises a number of stages, as follows, although the order may vary between installations. The raw material is received at the installation and stored. Preparing the raw material for melting may involve size reduction, the material is then

heated either through the use of direct or indirect heating, water is removed from the raw material either mechanically or through evaporation. After a period the free fat liberated is drained to an intermediate tank. The solid fraction (greaves) are either pressed or centrifuged and again the free fat is drained to a holding vessel. The remaining greaves may be reprocessed or milled. The final products are transferred to storage and dispatch.

Three methods of fat melting have been reported:

- Batch wet fat melting
- Batch dry fat melting, and
- Continuous wet fat melting

(see BREF Sections 2.2.1 and 3.2.1).

4.1.3 Bone Processing

Bone processing uses bone as its raw material, the bones are cut using mechanical equipment. From here the bone is dried and the fat is mechanically removed from the bone. The bone is sterilised and ground and passed on to where it is incorporated in the meat and bone meal process (see BREF Section 3.2.5).

4.1.4 Blood Processing

Blood processing uses blood from animals which have been passed fit for human consumption. The blood is collected from multiple animals and stored in a holding vessel where, to prevent clotting, it is mixed with a solution of sodium citrate and/or sodium phosphate.

The blood is filtered at the slaughterhouse and at the processing plant to remove gross particles. Following filtration it is centrifuged to separate plasma from the blood cells. The plasma yield is collected in a refrigerated stainless steel storage tank and refrigerated at 4°C. The plasma is then machine homogenised and pressurised, in preparation for spray drying. Alternatively, the plasma may be concentrated by vacuum evaporation, i.e. the removal of water under vacuum at <40°C.

Once the plasma has undergone the drying procedure it is then bagged and stored.

The red blood cell fraction is pumped under high pressure, spray dried, bagged and stored in a similar manner to that for plasma, except that as the red cell fraction already comprises 30% solids, it is not necessary to concentrate it prior to drying (see BREF Sections 2.2.5 & 3.2.4).

4.1.5 Gelatine Manufacture

Gelatine is a natural, soluble protein, gelling or non-gelling, obtained by the partial hydrolysis of collagen produced from bones, fresh or frozen hides, pig skins or fish skins. The use of hides and skins submitted to tanning processes is prohibited for the production of gelatine intended for human consumption [BREF, 2003]. The main gelatine manufacturing processes are listed as follows:

- a) Degreasing – removal of soft tissue and fat from bones
- b) Demineralisation – removal of the inorganic component
- c) Liming
- d) Neutralisation
- e) Extraction
- f) Filtration

- g) Ion Exchange
- h) Concentration
- i) Sterilisation
- j) Drying
- k) Acid Treatment
- l) Alkali Pre-treatment
- m) Preheating
- n) Autoclaving and extraction
- o) Cutting
- p) Lime treatment
- q) Washing and acid treatment
- r) Alkali treatment
- s) Washing
- t) Acid treatment and rinsing
- u) Neutralisation and rinsing
- v) Second filtration

Gelatine is used in a diverse selection of industries and products. The majority of gelatine produced is edible and pharmaceutical gelatine. It is used in the photographic industry, in both films and paper. Technical gelatine is used for example in cosmetics and micro-encapsulation (carbon paper) (see BREF Section 3.2.6).

4.1.6 Glue Manufacture

The manufacturing process for hide glue is the same as that for food gelatine, as listed above (see BREF Section 2.2.7).

4.1.7 Land Spreading/Injection

ABP Regulation 1774/2002/EC bans the application to pasture land of organic fertilisers and soil improvers, other than manure and consequently limits the opportunities for the land spreading of animal by-products (see BREF Section 2.2.10). Animal by-products, which are landfilled, include animal meal, feathers, gelatine shavings and WWTP solid residues. The requirements of the Landfill Directive must be met.

4.1.8 Biogas Production

Animal waste and material like digestive tract content is easily digested anaerobically and it gives a high yield of biogas. The carbon containing material is degraded by micro-organisms, thereby releasing biogas, comprising about 65% CH₄ and 35% CO₂, with small amounts of other gases. The process can be either wet or dry. The biogas is energy rich and the digestion residues can often be used as organic fertilisers and soil improvers. Animal waste is mixed with the organic matter to reduce the nitrogen content and therefore aid in a slower digestion process. Animal by-products, manure and the sewage sludge from slaughterhouses can all be treated (see BREF Sections 2.2.11 & 3.2.9).

4.1.9 Composting

Composting has been defined as the controlled biological decomposition and stabilisation of organic substrates, under conditions that are predominately aerobic and that allow the development of thermophilic temperatures as a result of biologically produced heat. It results in a final product that has been sanitised and stabilised, is high in humic substances and can be beneficially applied to land (see BREF, 2003). The composting of animal by-products and their application to land is controlled by ABP Regulation 1774/2002/EC and by Commission Regulation (EC) No 808/2003 of 12 May 2003 amending Regulation (EC) No 1774/2002 of the European Parliament and of the Council laying down health rules concerning animal by-products not intended for human consumption (see BREF Sections 2.2.11 & 3.2.10).

5. BEST AVAILABLE TECHNIQUES FOR THE DISPOSAL OR RECYCLING OF ANIMAL CARCASSES AND ANIMAL WASTE

5.1 INTRODUCTION

As explained in Section 2, this Guidance Note identifies BAT but obviously does so in the absence of site-specific information. Accordingly, it represents the requirements expected of any new activity covered by the Guidance Note and ultimately, the requirements expected of existing facilities, but exclude additional requirements, which may form part of the granting of a licence for a specific site.

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly, or in combination, the measures represent BAT solutions when implemented in the appropriate circumstances. These circumstances depend on plant scale, fuels used, nature of process, etc.

5.2 TECHNIQUES FOR PREVENTION AND MINIMISATION OF RESOURCE CONSUMPTION

5.2.1 General Process and Operations

5.2.1.1 *BAT for Animal by-Product Installations*

For all animal by-product installations, BAT is to do all of the following:

- use an environmental management system (see BREF Sections 4.1.1 & 5.1.1.1)
- provide employee training (see BREF Section 4.1.2)
- use a planned maintenance programme (see BREF Section 4.1.3)
- apply dedicated metering of water consumption (see BREF Section 4.1.4)
- separate process and non-process waste water (see BREF Section 4.1.5)
- remove all running water hoses and repair dripping taps and toilets (see BREF Section 4.1.7)
- fit and use drains with screens and/or traps to prevent solid material from entering the wastewater (see BREF Section 4.1.11)
- dry clean installations and transport by-products dry (see BREF Section 4.1.12), followed by pressure cleaning (see BREF Section 4.1.10) using hoses fitted with hand operated triggers (see BREF Section 4.1.9) and where necessary hot water supplied from thermostatically controlled steam and water valves (see BREF Section 4.1.23)
- operate continuous, dry and segregated collection of animal by-products throughout processing (see BREF Section 4.3.1.1)
- use sealed storage, handling and charging facilities for animal by-products, e.g. storage areas working under negative pressure (see BREF Section 4.3.1.3)
- where it is not possible to treat animal by-products before their decomposition starts to cause odour problems and/or quality problems, refrigerate them as quickly as possible and for as short a time as possible (see BREF Section 4.3.1.4)

- where inherently malodorous substances are used or are produced during the treatment of animal by-products, pass the low intensity/ high volume gases through a biofilter (see BREF Section 4.1.33)
- apply overfilling protection on bulk storage tanks (see BREF Section 4.1.13)
- provide and use bunds for bulk storage tanks (see BREF Section 4.1.14)
- implement energy management systems (see BREF Sections 4.1.16 & 4.1.17)
- implement refrigeration management systems (see BREF Section 4.1.18)
- operate controls over refrigeration plant running times (see BREF Section 4.1.19)
- use thermostatically controlled steam and water blending valves (see BREF Section 4.1.23)
- rationalise and insulate steam and water pipework (see BREF Section 4.1.24)
- isolate steam and water services (see BREF Section 4.1.25)
- implement light management systems (see BREF Section 4.1.26)
- store animal by-products for short periods and possibly refrigerate them (see BREF Section 4.1.27)
- audit odour (see BREF Section 4.1.28)
- design and construct vehicles, equipment and premises to ensure that they are easy to clean (see BREF Section 4.1.30)
- clean material storage areas frequently (see BREF Section 4.1.31)
- implement a noise management system (see BREF Section 4.1.36)
- reduce noise at, e.g. roof extract fans, balance lagoon blowers and refrigeration plants (see BREF Sections 4.1.3. & 4.1.36)
- replace the use of oil with natural gas, where a natural gas supply is available (see BREF Sections 4.1.37. & 4.1.38)
- enclose animal by-products during transport, loading/unloading and storage (see BREF Sections 4.1.40. & 4.1.39)
- where it is not possible to treat blood before its decomposition starts to cause odour problems and/or quality problems, refrigerate it as quickly as possible and for as short a time as possible, to minimise decomposition (see BREF Section 4.2.1.8)
- export any heat and/or power produced which cannot be used on site.

5.2.1.2 BAT for Environmental Management

BAT is to implement and adhere to an Environmental Management System (EMS) that incorporates the standard features associated with a management system.

Three further features, which can complement the EMS, are considered supporting measures. These three additional steps are;

- having the management system and audit procedure examined and validated by an accredited certification body or an external EMS verifier
- preparation and publication (and possibly external validation) of a regular environmental statement describing all the significant environmental aspects of the installation, allowing for year-by-year comparison against environmental objectives and targets as well as with sector benchmarks as appropriate
- implementation and adherence to an internationally accepted voluntary system such as EMAS and EN ISO 14001:1996.

Specifically for animal by-product installations it is also important to consider the following potential features of the EMS:

- Giving consideration to the environmental impact from the eventual decommissioning of the unit at the stage of designing the new plant
- Giving consideration to the development of cleaner technologies
- Where practicable, sectoral benchmarking on a regular basis, including energy efficiency and energy conservation activities, choice of input materials, emissions to air, discharges to water, consumption of water and generation of waste.

See Section 5.1.1.1 of BREF for further information on Environmental Management Systems.

5.2.2 Integration of Same Site Activities

For animal by-product installations, operating on the same site, BAT is to do the following:

- re-use heat and/or power produced in one activity in other activities (see BREF Sections 4.4.1, 4.4.2 & 4.4.3), and
- share abatement techniques, where these are required, e.g. WWTPs.

For rendering and incineration on the same site, BAT is to do the following:

- burn non-condensable gases produced during rendering (see BREF Sections 4.4.2 & 4.4.3).

5.2.3 Installation and Equipment Cleaning

For the cleaning of animal by-product installations BAT is to do the following:

- Manage and minimise the quantities of water and detergents used (see BREF Section 4.1.42.1)
- Select those detergents which cause minimum impact on the environment, without compromising the efficacy of cleaning (see BREF Section 4.1.42.2)
- Avoid, where possible, the use of cleaning and infection agents containing active chlorine (see BREF Section 4.1.42.3), and
- Where the equipment is suitable, operate a cleaning-in-place system (see BREF Section 4.2.4.3).

5.2.4 Treatment of Wastewater

For all animal by-product installations BAT is to minimise the quantity and load of wastewater generated using the measures outlined in this document, then to treat the wastewater as follows:

- prevent wastewater stagnation (see BREF Section 4.1.43.3)
- apply an initial screening of solids using sieves at the animal by-product installation (see BREF Section 4.1.43.4)
- remove fat from wastewater, using a fat trap (see BREF Section 4.1.43.9)
- use a flotation plant, possibly combined with the use of flocculants, to remove additional solids (see BREF Section 4.1.43.10)
- use a wastewater equalisation tank (see BREF Section 4.1.43.11)
- provide wastewater holding capacity in excess of routine requirements (see BREF Section 4.1.43.1)
- prevent liquid seepage and odour emissions from wastewater treatment tanks, by sealing their sides and bases and either covering them or aerating them (see BREF Sections 4.1.43.12 & 4.1.43.13)

- subject the effluent to a biological treatment process. These may include the following:
 - anaerobic pre-treatment using down-flow or up-flow reactors
 - aerobic digestion combined with intermittent or alternating denitrification under anoxic conditions. Biological wastewater treatment, or,
 - biological wastewater treatment using overpressure in conjunction with ultrafiltration(see BREF Sections 2.3.1.2, 2.3.2.1.3, 4.1.43.14, 4.1.43.15, 4.2.6.2, 4.2.6.3 & 4.3.3.15 for further information on treatment processes)
- remove nitrogen and phosphorous through the use of a single step process combining carbon oxidation, nitrification and denitrification (see BREF Section 2.3.1.2)
- remove the sludges produced and subject them to further animal by-product uses. These routes and their conditions of application are regulated by ABP Regulation 1774/2002/EC
- use methane gas produced during the anaerobic treatment for the production of heat and/or power
- subject the resulting effluent to tertiary treatment, and
- regularly conduct laboratory analyses of the effluent composition and maintain records (see BREF Section 4.1.43.2).

5.3 BAT – PREVENTATIVE MEASURES FOR SPECIFIC UNIT OPERATIONS

5.3.1 Additional BAT For Fat Melting

For fat melting no additional BAT have been identified in addition to those listed in 5.2 above.

5.3.2 Additional BAT For Rendering

In addition to those listed in Section 5.2 above, for rendering installations, BAT is to do the following:

- totally enclose the rendering line (see BREF Section 4.3.3.1)
- reduce the size of carcasses and parts of animal carcasses before rendering, as per ABP Regulation 1774/2002/EC (see BREF Section 4.3.3.2)
- remove water from blood, by steam coagulation, prior to rendering (see BREF Section 4.3.3.4)
- for raw material throughputs less than 50,000 t/yr, to use a single-effect evaporator to remove water from liquid mixtures (see BREF Section 4.3.3.5), and
- for raw material throughputs greater than, or equal to 50,000 t/yr, to use a multiple-effect evaporator to remove water from liquid mixtures (see BREF Section 4.3.1.5).

When it is impossible to use fresh materials and thereby to minimise the production of malodorous substances, BAT is to do either of the following:

- burn the non-condensable gases in an existing boiler (see BREF Section 4.3.3.11) and to pass the low intensity/high volume odours through a biofilter (see BREF Section 4.1.33), or
- to burn the whole vapour gases in a thermal oxidiser (see BREF Section 4.3.3.10) and to pass the low intensity/high volume odours through a biofilter (see BREF Section 4.1.33).

5.3.3 Additional BAT For Blood Manufacture

In addition to those listed in Section 5.2 above, for blood processing installations, BAT is to do one of the following:

- concentrate plasma, prior to spray drying, using reverse osmosis (see BREF Section 4.3.5.1)
- concentrate plasma, prior to spray drying, using vacuum evaporation, (see BREF Section 4.3.5.2), or
- remove water from blood, by steam coagulation, prior to spray drying (see BREF Section 4.3.4.4).

5.3.4 Additional BAT For Bone Manufacture

For bone processing, no additional BAT has been identified in addition to those in Section 5.2.

5.3.5 Additional BAT For Gelatine Manufacture

In addition to those listed in Section 5.2 above, for gelatine manufacturing installations, BAT is to do the following:

- insulate bone de-fatting equipment (see BREF Section 4.3.7.1).

5.3.6 Additional BAT For Gas Production

In addition to the general measures listed in Section 5.2 for biogas production, BAT is to do the following:

- re-use heat during biogas production, through the use of heat exchangers (see BREF Section 4.3.10.3).

5.3.7 Additional BAT For Composting

In addition to the general measures listed in Section 5.2 for composting animal by-products, BAT is to do the following:

- provide sufficient drainage capacity for a windrow on a hard standing (see BREF Section 4.3.11.1) constructed from concrete (see BREF Section 4.3.11.2).

Further information on a number of waste gas and wastewater treatment techniques can be found in the BREF document on *Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector*, EIPPCB, February 2003.

6. BAT ASSOCIATED EMISSION LEVELS

6.1 EMISSION LEVELS FOR DISCHARGES TO AIR

The BAT emission levels for emissions to air are as follows:

Table 6.1 – BAT-Associated Emission Levels for Emissions to Air

Emission	Emission Level	Mass Emission Level ^{Note 1}
Ammonia	50 ppm v/v	150,000 mg/h
Amines	5 ppm v/v	-
Hydrogen Sulphide and Mercaptans	5 ppm v/v	15,000 mg/h
Total Particulate Matter (including emissions from material handling)	5 - 50 150	At mass flow >0.2kg/hr At mass flow up to 0.2kg/hr
Total Organic Carbon (as C)	50mg/m ³	500

Note 1: The Mass Flow Threshold is calculated in g/hr or kg/hr and is determined to be the maximum emission, which can occur over any one-hour period of plant operation. Where the Mass Flow in the raw gas exceeds the mass flow threshold given in the Table, abatement will be required to reduce the emission to below the appropriate emission level or mass flow threshold.

EMISSION LEVELS FOR ODOUR

The ELV for odour measured at the nearest odour sensitive receptor beyond the facilities boundary will be set at $\leq 1.5 \text{ OU}_E/\text{m}^3$ – 98- percentile of 1 – hourly average concentration³, above that of recorded background concentrations.

For existing facilities the ELV for odour measured at the nearest odour sensitive receptors is set at $\leq 5.0 \text{ OU}_E/\text{m}^3$ - 98-percentile of 1 - hourly average concentration, above that of recorded background concentrations.

prEN13725 Air Quality – Determination of Odour Concentration by Dynamic Olfactometry.

EPA (2001) Odour Impacts and Odour Emission Control Measures for Intensive Agriculture.

6.2 EMISSION LEVELS FOR DISCHARGES TO WATER

The following table sets out emission levels that are achievable using BAT for wastewater treatment. However establishing emission limit values within a licence for direct discharges to surface water from wastewater treatment plant and stormwater discharges must ensure that the quality of the receiving water is not impaired or that the current Environmental Quality Standards (EQS) are not exceeded.

All discharges to sewer are subject to approval from the Water Services Authority.

Compliance with the Water Framework Directive (2000/60/EC) is required where relevant, in particular Article 16.

Table 6.2: BAT-Associated Emission Levels for Discharges to Water*

Parameter	Emission Level	Notes
pH	6 - 9	
Number of Toxicity Units (TU)	5	1
Total Nitrogen (mg/l as N)	>80% removal ³ , or 5 - 40mg/l	2, 4
Total Phosphorus (mg/l as P)	>80% removal ³ , or 0.5 - 2mg/l	4
Total Ammonia (mg/l as N)	10 - 25	
Oils, Fats & Grease (mg/l)	10 - 15	
BOD ₅	>90% removal ³ , or 20 - 40mg/l	
COD	>75% removal ³ , or 125 - 250mg/l	
Mineral Oil (mg/l)	1.0 - 20	
Total Suspended Solids	50	

* All values refer to daily averages based on a 24-hour flow proportional composite sample, except where stated to the contrary and for pH, which refers to continuous values. Levels apply to effluent prior to dilution by uncontaminated streams, e.g. storm water, cooling water, etc.

* Temperature measured downstream of a point of thermal discharge must not exceed the unaffected temperature by more than 1.5°C in salmonid waters and 3°C in cyprinid waters (Freshwater Fish Directive 79/659/EEC)

Note 1: The toxicity of the effluent shall be determined on an appropriate aquatic species. The number of toxic units (TU) = 100/x hour EC/LC₅₀ in percentage vol/vol so that higher TU values reflect greater levels of toxicity. For test regimes where species death is not easily detected, immobilisation is considered equivalent to death.

Note 2: Total Nitrogen means the sum of Kjeldahl Nitrogen (organic and ammoniacal nitrogen), Nitrate N and Nitrite N.

Note 3: Reduction in relation to influent load.

Note 4: Limits will depend on the sensitivity of the receiving waterbody.

6.3 EMISSIONS TO LAND

In the assessment of the impact of landspreading of organic waste, reference shall be made to the relevant Environmental Protection Agency's guidance and any guidance from the Department of Agriculture and Teagasc.

7. COMPLIANCE MONITORING

The methods proposed for monitoring the emissions from these sectors are set out below. Licence requirements may vary from those stated below due to site location considerations, sensitivity of receiving waters, and scale of the operation.

7.1 MONITORING OF EMISSIONS TO AIR

- Annual monitoring of boiler stack emission for particulates, NO_x, SO₂, and CO taking account of the nature, magnitude and variability of the emission and the reliability of the controls.
- Monitoring of boiler combustion efficiency in accordance with the manufacturer's instructions at a frequency determined by the Agency.
- Quarterly monitoring of air emissions from odour abatement equipment for ammonia, total amines and hydrogen sulphide and mercaptans, or as determined by the Agency.
- Odour monitoring should be conducted at the nearest odour sensitive receptor locations at a frequency determined by the agency.
- Olfactory (sniff) assessment for odours should be carried out daily or as directed by the Agency at a minimum at four boundary locations and at the nearest odour sensitive locations.
- Periodic monitoring of other emissions as determined by the Agency.

7.2 MONITORING OF AQUEOUS EMISSIONS

- For uncontaminated cooling waters, continuous monitoring of temperature and flow.
- Continuous monitoring of flow discharge from wastewater treatment plant and any other parameters deemed necessary by the Agency.
- Daily monitoring of flow, volume, pH, temperature and any other relevant parameters deemed necessary by the Agency, taking account of the nature, magnitude and variability of the emissions and the reliability of the control technique.
- Establish existing conditions prior to start-up of key emission constituents and salient flora and fauna.
- Monitoring of influent and effluent for the waste water treatment plant to establish % BOD reduction and early warning of any difficulties in waste water treatment, or unusual loads.
- The potential for the treated effluent to have tainting and toxic effects should be assessed and if necessary measured by established laboratory techniques.
- Periodic biodegradability checks where appropriate on effluents to municipal waste treatment plants, both prior to start-up and thereafter.

7.3 MONITORING OF EMISSIONS TO GROUNDWATER

There should be no direct process emissions to groundwater, including during the extraction and treatment of groundwater.

7.4 MONITORING OF SOLID WASTE

- The recording in a register of the types, quantities, date and manner of disposal/recovery of all wastes.
- Leachate testing of sludges and other material as appropriate being sent for landfilling.
- Annual waste minimisation report showing efforts made to reduce specific consumption together with material balance and fate of all waste materials.

Appendix 1

PRINCIPAL REFERENCES

1. E.C.

- 1.1. Reference Document on Best Available Techniques in the Slaughterhouses and Animal By-Product Industries (November 2003).
- 1.2. Council Directive 96/61/EC of 24 September 1996 concerning Integrated Pollution Prevention and Control.
- 1.3. Regulation (EC) No 1774/2002 of 3 October 2002 laying down health rules concerning animal by-products not intended for human consumption.
- 1.4. S.I. No. 257/1994: European Communities (Disposal, Processing and Placing on the Market of Animal by-products) Regulations, 1994.

2. IRELAND

- 2.1. Integrated Pollution Control Licensing BATNEEC Guidance Note For The Rendering of Animal By-products (EPA No. LC 12 (2/96)).
- 2.2. Integrated Pollution Control Licensing BATNEEC Guidance Note For Noise in Relation to Scheduled Activities (EPA No. LC 8 (1995)).
- 2.3. Environmental Protection Agency Guidance Note For Noise in Relation to Scheduled Activities - 2ND Edition (2006).

Appendix 2

GLOSSARY OF TERMS AND ABBREVIATIONS

ABP	Animal By-Products
BAT	Best Available Techniques
°C	Degree Celsius
BOD	Biochemical Oxygen Demand
CH ₄	Methane
CO	Carbon monoxide
CO ₂	Carbon dioxide
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
ELVs	Emission Limit Values
EWC	European Waste Catalogue
f:m	Food to Mass ratio
HCl	Hydrochloric acid
IPPC	Integrated Pollution Prevention and Control
K	Degree Kelvin (0 °C = 273.15 K)
kg	Kilogramme
kPa	Kilopascal
kWh	Kilowatt hours
m/sec	Meter per second
m ³	Cubic metre
mg	Milligram
mg/l	Milligram/litre
MJ	Megajoule (1 MJ = 1000 kJ = 106 joule)
N ₂	Nitrogen
NH ₃	Ammonia
NH ₄	Ammonium
Nm ³	Normal cubic metre (101.3 kPa, 273 K)
NO	Nitrogen monoxide
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides
O ₂	Oxygen
OU	Odour Units
SO ₂	Sulphur dioxide

SO _x	Sulphur oxides
SVI	Sludge Volume Index
t	Tonne (metric)
TSE	Transmissible Spongiform Encephalopathies
TSS	Total Suspended Solids
WWTP	Waste Water Treatment Plant