BAT Guidance Note on
Best Available Techniques for the
Manufacturing of Fish Meal & Fish Oil

(1st Edition)

ENVIRONMENTAL PROTECTION AGENCY

An Ghníomhaireacht um Chaomhnú Comhshaoil

PO Box 3000, Johnstown Castle Estate, Co. Wexford, Ireland

Telephone: +353 53 916 0600; Fax: +353 53 916 0699

E-Mail: info@epa.ie Website: www.epa.ie

Lo Call: 1890 33 55 99

Acknowledgements

The Environmental Protection Agency would like to acknowledge the assistance provided by Project Management in preparing the consultation draft document. A public consultation process was carried out as part of the preparation of this document. The comments/constructive criticism on the consultation draft guidance note offered by individuals and organisations particularly IBEC staff and representatives of the relevant sectoral groups, Office of Environmental Enforcement and Office of Climate, Licensing & Resource Use staff are gratefully acknowledged.

The Environmental Protection Agency would also like to acknowledge the assistance provided by Mr John Doheny, Office of Environmental Enforcement, for the use of the cover photograph from his personal portfolio.

ISBN: 1-84095-282-2 08/08/50

Price: Free

Contents

1. INTRODUCTION

1.1 GENERAL

The guidance note is one of a series issued by the Environmental Protection Agency (EPA) which provide 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 Covered by this Guidance Note
4	Process Description, Risk to the Environment and 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

BAT was introduced as a key principle in the IPPC Directive, 96/61/EC. This Directive has been incorporated into Irish law by the Protection of the Environment Act 2003. 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 the 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 out 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 installation/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 impacts, 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 transboundary 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.

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 (section 5(3)) 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 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 organisation, 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 to the Environmental Protection Agency Acts 1992 to 2007:

7.5 The manufacture of fish meal and fish oil, not included in paragraph 7.8.

4. PROCESS DESCRIPTION, RISK TO THE ENVIRONMENT AND CONTROL TECHNIQUES

Note: any reference to BREF in this document means the reference document on *Best Available Techniques in the Slaughterhouse and Animal By-Products Industries*, published by the European Commission, May 2005.

Additional references have also been taken from the reference document on *Best Available Techniques in the Food, Drink and Milk Industries*, published by the European Commission January 2006.

4.1 DESCRIPTION OF PROCESS

The primary steps involved in the manufacture of fish meal & fish oil industry are (see BREF Section 2.2.3):

- Fish reception and storage
- Cooking
- Pressing of cooked fish
- Decanting of press water
- Centrifugation of decanted water to produce fish oil and stickwater (see Food & Drink BREF Section 2.1.3.4)
- Evaporation of stickwater (see Food & Drink BREF Section 2.1.6.1)
- Meal cooling
- Grinding (see Food & Drink BREF Section 2.1.2.3)
- Storage & packaging of fish meal & fish oil.

4.1.1 Cleaning

In addition to the above processing steps, cleaning of process equipment, containers, floors, etc. is carried out on a daily basis (see BREF Section 4.1.42).

4.2 RISK TO THE ENVIRONMENT

The key environmental issues associated with the manufacture of fish meal and fish oil are high water consumption, wastewater emissions and odour. Noise can also be an issue during offloading and conveying of raw materials to storage silos (see BREF Section 3.2.3).

4.2.1 Water Consumption

High seawater consumption is associated mainly with use as cooling water and cleaning (see BREF Section 3.2.3).

4.2.2 Energy Use

High energy consumption is associated with the offloading of fish to the plant, separating, evaporation and drying. See description in BREF Section 3.2.3 for details and energy consumption per tonne of fish treated and per unit process.

4.2.3 Emissions to Air

Emissions to air include SOx, NOx, CO and particulates from boilers. Odour can also be a significant local issue and can arise from incoming raw material, the process itself and from on site wastewater treatment. See description in BREF Sections 1.3.2.4 and 3.2.3 for details on emissions to air.

4.2.4 Emissions to Water

Emissions to water from the manufacture of fish meal and fish oil consist of organic material contributing BOD and inorganic material, primarily ammonia (see BREF Sections 1.3.2.4 and 3.2.3).

4.2.5 Waste

Solid waste and by-products from the manufacture of fish meal and fish oil are screenings and wastewater sludges from the effluent treatment process (see BREF Section 3.2.3).

4.2.6 Noise

The key sources of noise associated with the manufacture of fish meal and fish oil are associated mainly with the use of pumps as used during offloading of fish from fishing vessels and conveyors for the offloading of fish to on site storage silos (see BREF Section 3.2.3).

4.3 CONTROL TECHNIQUES

The existing or possible measures for eliminating, reducing and controlling emissions in fish meal and fish oil processing plants are described in this Section. References to more details and descriptions in the BREF document are given.

4.3.1 General Preventative Techniques

The following general techniques can be applied to all fish meal and fish oil manufacturing plants:

- Environmental Management (see BREF Section 4.1.1)
- Monitoring and targeting of energy, water consumption and wastewater emissions (see BREF Sections 4.1.6, 4.1.26, 4.1.18, 4.1.42.1)
- Training provision (see BREF Section 4.1.2)
- Use a planned maintenance programme (see BREF Section 4.1.3).

4.3.1.1 Minimisation of Water Consumption

The following techniques can minimise water use in fish meal and fish oil manufacturing plants:

- Dedicated metering of water consumption at the level of unit operations (see BREF Section 4.1.4)
- Ensure the regular maintenance of utility systems to reduce water consumption and wastewater production
- Reuse cooling water and water from vacuum pumps (see BREF Section 4.1.6)
- Removal of running water hoses and the repair of dripping taps, etc. (see BREF Section 4.1.7)
- Use of pressure cleaning and pressure controlled water via nozzles throughout the installation (see BREF Sections 4.1.8 and 4.1.10)
- Fit cleaning hoses with hand operated triggers (see BREF Section 4.1.9)

- Isolation of steam and water services (see BREF Section 4.1.25)
- Washing of condensate air with condensate instead of with seawater (see BREF Section 4.3.4.4).

4.3.1.2 Minimisation of Energy Consumption

The following techniques can minimise energy use in all fish meal and fish oil manufacturing facilities:

- Implement an energy management system (see BREF Section 4.1.16)
- Implement a lighting management system (see BREF Section 4.1.26)
- Employ good housekeeping and process optimisation (see BREF Section 4.1.30 and 4.1.18)
- Optimise process utilities such as compressed air, steam and electricity supply (see Food & Drink BREF Section 5.1.4.10 & 5.1(19))
- Employ energy efficiency techniques (see BREF Section 4.1.1(j)):
    - Employ heat recovery to concentrate stickwater (for example see BREF Section 4.3.4.2)
    - Frequency converters on motors (see Food & Drink BREF Section 4.2.11.1)
    - Minimise heat/energy losses through proper insulation of steam and water pipework (see BREF Section 4.1.24)
    - Use an energy monitoring system
- Isolation of steam and water services (see BREF Section 4.1.25)
- Use multiple effect evaporators (see BREF Section 4.3.1.5).

4.3.1.3 Minimisation of Emissions to Air

The following techniques can prevent or minimise the formation of air emissions and odour in the fish meal and fish oil manufacturing industry:

- Use natural gas in boilers where a natural gas supply is available (see BREF Section 4.1.40). Otherwise use low sulphur fuel oil (Sulphur content <1%)
- Collaboration with upstream and downstream activities (see BREF Section 5.1.3)
- Use appropriate storage and handling techniques to contain emissions, e.g. dust (see BREF Sections 4.3.1.2 & 4.3.1.3 and Food & Drink BREF Sections 4.2.1 & 3.2.1)
- Apply a control strategy to identify, quantify and select appropriate abatement options for emissions to air (see Food & Drink BREF Section 4.4.1)
- Audit odour to identify and characterise sources and determine any action required (see BREF Section 4.1.28)
- Reduce odour through frequent cleaning of materials storage silos (see BREF Section 4.1.31)
- Short term and possibly cold storage of raw materials before processing (see BREF Section 4.1.27)
- Use a “Check System” for avoidance of improper materials acceptance during reception of raw materials
- Enclose raw materials during transport, loading / unloading and storage to reduce odour and enclose all odour generating activities using negative pressure extraction units such as in storage, handling and processing areas
- Use fresh low total volatile nitrogen feedstock (see BREF Section 4.3.4.1)

- Aerate and cover wastewater treatment plants to prevent odour (see BREF Sections 4.1.43.12 & 4.1.43.13).

4.3.1.4 Minimisation of Wastewater

The following techniques can prevent or minimise the volume and contamination level of emissions to water from fish meal and fish oil manufacturing plants:

- Overfill protection and bunding or double skin tank protection for bulk storage tanks (see BREF Sections 4.1.13, 4.1.14 and 4.1.15)
- Fit and use floor drains with screens and/or traps at appropriate strategic points to prevent solid material from entering the wastewater stream (see BREF Section 4.1.11)
- Separation of process water from non process water, and segregation of process water into individual process streams with dedicated pre-treatment, e.g. solids removal (see BREF Section 4.1.5)
- Washing of condensate air with condensate instead of with seawater (see BREF Section 4.3.4.4)
- Use of fresh raw materials will reduce the organic / inorganic load to the wastewater stream (see BREF Section 4.3.1.4)
- Selection of materials/chemicals used in cleaning for minimal impact on the environment (see BREF Section 4.1.42.2).

4.3.1.5 Minimisation of Noise

The following techniques can be employed to minimise noise emissions from fish meal and fish oil plants:

- Implement a noise management system incorporating design and monitoring (see BREF Section 4.1.36)
- Modify external fans to produce higher frequency noise (see BREF Section 4.1.37)
- Insulate pipework or use pipework with better insulating properties for the transport of materials (see Food & Drink BREF Section 4.1.3.4)
- Enclose noisy equipment in insulated buildings where possible (see Food & Drink BREF Section 4.1.4).

4.3.2 Preventative Techniques of Specific Unit Operations

The following preventative techniques can be applied to the stated specific unit operations in fish meal and fish oil manufacturing plants.

4.3.2.1 Raw Materials Reception and Preparation

- Enclose raw materials during transport, loading / unloading and storage to reduce odour and enclose all odour generating activities using negative pressure extraction units such as in storage, handling and processing areas
- Use fresh low total volatile nitrogen feedstock to reduce the potential for malodorous emissions to air. Employ a “check” system to ensure quality of materials accepted is to standard (see BREF Sections 4.3.1.4 and 4.3.4.1)
- Overfill protection and bunding or double skin tank protection for bulk storage tanks (see BREF Sections 4.1.13, 4.1.14 and 4.1.15). Reduce odour through frequent cleaning of materials storage areas (see BREF Section 4.1.31)
- Short term and possibly cold storage of raw materials before processing (see BREF Section 4.1.27).

4.3.2.2 Size Reduction, Mixing, Forming

- Particulate matter (dust) is often generated and should be recovered in extracted air and reused in the process where practicable
- Noise can be an issue with size reduction techniques such as grinding. Insulate and enclose noisy equipment in insulated buildings where possible.

4.3.2.3 Separation

- Use high efficiency separation techniques to maximise recovery of fish meal cake.

4.3.2.4 Heat Processing

- Remove the organic odour components by condensing the vapour from boiling vessels combined with energy recovery
- Reuse condensate where practicable
- Use appropriate abatement technology to reduce malodorous emissions from the cooking and drying processes (see Section 4.3.3.1 of this document).

4.3.2.5 Concentration by Heat

- Use appropriate abatement technology to reduce the emissions of dust to air from the drying process and reuse particulate materials in the process where practicable
- Employ heat recovery where practicable
- Wash condensate air with condensate instead of with seawater to reduce water consumption (see BREF Section 4.3.4.4).

4.3.2.6 Processing by Removal of Heat

- Employ heat recovery to concentrate stickwater (for example see BREF Section 4.3.4.2).

4.3.2.7 Post Processing Operations

- Recycle packaging waste (e.g. wood, cardboard, paper, plastic) (see Food & Drink BREF Section 4.2.12.3)
- Optimise packaging line efficiency (see Food & Drink BREF Section 4.2.12.4)
- Use appropriate storage and handling techniques to contain emissions, e.g. dust (see Section 4.3.3.1 of this document)
- Apply a control strategy to identify, quantify and select appropriate abatement options for emissions to air (see Food & Drink BREF Section 4.4.1).

4.3.2.8 Cleaning and Sanitation

- Selection of materials/chemicals used in cleaning for minimal impact on the environment (see BREF Section 4.1.42.2)
- Use of pressure cleaning and pressure controlled water via nozzles throughout the installation (see BREF Sections 4.1.8 and 4.1.10)
- Fit cleaning hoses with hand operated triggers (see BREF Section 4.1.9)
- Optimise cleaning procedures to reduce wastewater load and provide training.

4.3.3 Treatment Techniques

4.3.3.1 Treatment of Air Emissions

The following techniques can be used for all fish meal and fish oil manufacturing plants to treat air emissions and odour:

- Use dynamic, filter or electrostatic separators on exhaust air to remove particulates (see Food & Drink BREF Section 4.4.3.5)

- Use of thermal oxidiser to remove odour from concentrated low volume streams (see BREF Section 4.3.3.10)
- Use of biofilters (see BREF Section 4.1.33) and bioscrubbers (see BREF Section 4.3.3.8) on exhaust air to remove odour
- Use of an absorption system such as wet scrubbing with chloride dioxide to remove odour (see BREF Sections 4.3.3.9, 4.3.3.12 and 4.3.3.13)
- Use of an adsorption system such as activated carbon on exhaust air to remove odour (see BREF Section 4.1.34)
- Dispersion of odours through capture of air and exhausting through an appropriately designed stack of sufficient height and configuration (see BREF Section 4.1.35)
- Incineration of malodorous air with heat recovery (see BREF Sections 4.3.3.11 & 4.3.4.3)
- Cover and vent wastewater treatment plants to abate odour (see BREF Section 4.1.43.12).

4.3.3.2 Treatment of Wastewater

The following techniques can be used to treat waste water from all fish meal and fish oil manufacturing plants:

- Select between treatment at source, centralised on site treatment or off site treatment of wastewater (see Food & Drink BREF Section 4.5.1)
- Segregation of process water from uncontaminated storm or other water so that uncontaminated water may be recycled or used to dilute wastewater prior to discharge (see Food & Drink BREF Sections 4.7.9.1 & 4.1.7.8)
- Provision of wastewater holding capacity in excess of routine requirements (see BREF Section 4.1.43.1)
- Use of primary treatment such as screening, sedimentation and flotation (see BREF Sections 4.1.43. and see also Food & Drink BREF Section 4.5.2)
- Prevent stagnant wastewater through the use of sufficient gradients in the collection systems and in the wastewater treatment plant (see BREF Section 4.1.43.3)
- Use of biological treatment systems to biodegrade organic substances, and in certain cases to remove nitrogen (see BREF Section 4.1.43.5 and see also Food & Drink BREF Section 4.5.3)
- Use of tertiary treatment systems to remove phosphorus, such as addition of coagulants and precipitation and for disinfection (see BREF Section 2.3.1.3 and see also Food & Drink BREF Section 4.5.4)

See also the Reference Document on Best Available Techniques in Common Wastewater and Waste Gas Treatment/Management Systems in the Chemical Sector, published by the European Commission in February 2003.

4.3.3.3 Treatment of Waste

The following techniques can be applied to treat/dispose waste from all fish meal and fish oil manufacturing plants:

- Recycle packaging waste (e.g. cardboard, paper) (see Food & Drink BREF Section 4.2.12.3)
- Reuse wastewater screenings / wastewater sludges in the process if practicable
- Use routes of disposal for sludges as regulated by Animal By-Product Regulations Regulation 1774/2002/EC.

5. BEST AVAILABLE TECHNIQUES FOR THE MANUFACTURE OF FISH MEAL & FISH OIL

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 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 nature or process, plant scale, fuels used, etc.

5.2 BAT – GENERAL PREVENTATIVE MEASURES

For all fish meal and fish oil manufacturing plants, BAT is to do the following:

- Operate an environmental management system (see BREF Sections 4.1.1 & 5.1.1.1), including training (see BREF Section 4.1.2), and where practicable, regular sectoral benchmarking (see BREF Section 5.1.1.1)
- Use a planned maintenance programme (see BREF Sections 4.1.3 and 5.1.1(3)).

5.2.1 Minimisation of Water Consumption

For all fish meal and fish oil manufacturing plants, BAT is to do the following:

- Apply a methodology for reducing water consumption (see Food & Drink BREF Sections 4.1.6.2.1 & 5.1(9))
- Eliminate the use of water where possible (see BREF Section 5.1.4)
- Employ good housekeeping measures
- Apply a dedicated metering of water consumption at the level of unit operations (see BREF Sections 4.1.4 & 5.1.1(4))
- Removal of running water hoses and the repair of dripping taps, etc. (see BREF Sections 4.1.7 & 5.1.1(6))
- Use of pressure cleaning and pressure controlled water via nozzles throughout the installation (see BREF Sections 4.1.8 and 4.1.10). Fit cleaning hoses with hand operated triggers (see BREF Sections 4.1.9 & 5.1.1(8))
- Washing of condensate air with condensate instead of with seawater (see BREF Sections 4.3.4.4 & 5.3.3(4)).

5.2.2 Minimisation of Energy Consumption

For all fish meal and fish oil manufacturing plants, BAT is to do the following:

- Implement the following management systems:
    - An energy management system (see BREF Section 4.1.16)
    - Hot water management and monitoring (see BREF Section 4.2.1.22)
    - Compressed air use management and monitoring (see BREF Section 4.2.1.19)

  - Ventilation use management and monitoring (see BREF Section 4.2.1.20)
  - A lighting management system (see BREF Sections 4.1.26 & 5.1.1(19))
- Recover heat where possible to concentrate stickwater (for example see BREF Section 4.3.4.2)
- Rationalisation and insulation of steam and water pipework (see BREF Section 4.1.24)
- Export any heat and/or power produced which cannot be used on site where feasible (see BREF Section 5.1.1(29))
- Use an energy monitoring system (see Food & Drink BREF Section 5.1(5))
- Employ good housekeeping and process optimisation (see Food & Drink BREF Sections 4.1.7.11 & 5.1(16)).

5.2.3 Minimisation of Emissions to Air

For all fish meal and fish oil manufacturing plants, BAT is to do the following:

- Replace fuel oil with natural gas, where possible (see BREF Section 4.1.40). Otherwise, use low sulphur fuel oil
- Audit odour to identify and characterise sources and determine any action required (see BREF Sections 4.1.28 & 5.1.1(21))
- Use fresh low total volatile nitrogen feedstock (see BREF Section 4.3.4.1)
- Enclose all odour generating process activities using negative pressure extraction units in such processing, handling and storage areas; contain potentially odourous materials in enclosed containers, maintain short storage times, and use cold storage as deemed necessary; clean material storage areas frequently (see BREF Section 4.1.31); and cover WWTP (see BREF Section 4.1.43.12)
- Use appropriate storage and handling techniques to contain emissions, e.g. particulate matter (see BREF Section 5.3(2) and Food & Drink BREF Sections 4.2.1& 3.2.1).

5.2.4 Minimisation of Emissions to Water

For all fish meal and fish oil manufacturing plants, BAT is to do the following:

- Implement a methodology for reducing water consumption (see Food & Drink BREF Sections 4.1.6.2.1 & 5.1(9))
- Ensure the regular maintenance of utility systems (see BREF Section 5.1.1(3))
- Use screens and/or traps on floor drains (see BREF Sections 4.1.11 & 5.1.1(7))
- Separate process and non-process waste water (see BREF Sections 4.1.5 & 5.1.1(5))
- 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 and 4.1.43.13)
- Selection of materials/chemicals used in cleaning for minimal impact on the environment (see BREF Section 4.1.42.2). Optimise cleaning procedures and provide training (see BREF Section 5.1.4)
- Washing of condensate air with condensate instead of with seawater (see BREF Sections 4.3.4.4 & 5.3.3(4)).

5.2.5 Protection of Surface and Groundwater

For all fish meal and fish oil manufacturing plants, BAT is to do the following:

- Apply overfill protection on bulk storage tanks (see BREF Section 4.1.13)
- Use bunds or double skinned tanks for bulk storage tanks (see BREF Sections 4.1.14 and 4.1.15)
- Seal the base and sides of WWTP tanks (see BREF Section 4.1.43.12).

5.2.6 Prevention of Noise Emissions

For all fish meal and fish oil manufacturing plants, BAT is to do the following:

- Implement a noise management system (see BREF Sections 4.1.36 & 5.1.1(24))
- Reduce noise at source, e.g. roof extract fans (see BREF Sections 4.1.3, 4.1.36, 4.1.37, 4.1.38 & 4.1.39 and see also Food & Drink BREF Sections 5.1(3) & 5.1(17)).

5.3 BAT – Preventative Measures For Specific Unit Operations

The following preventative techniques can be applied to the stated specific unit operations in fish meal and fish oil manufacturing plants.

5.3.1 Raw Materials Reception and Preparation

- Enclose raw materials during transport, loading / unloading and storage to reduce odour (see BREF Section 5.3.3(1)) and enclose all odour generating activities using negative pressure extraction units such as in storage, handling and processing areas (see BREF Section 4.3.1.2)
- Use fresh low total volatile nitrogen feedstock to reduce the potential for malodorous emissions to air. Employ a “check” system to ensure quality of materials accepted is to standard (see BREF Section 4.3.4.1)
- Use submersible fish pumps to reduce noise emissions during offloading, although this will lead to greater water consumption and emissions to wastewater (see BREF Section 3.2.3)
- Overfill protection and bunding or double skin tank protection for bulk storage tanks (see BREF Sections 4.1.13, 4.1.14 & 4.1.15). Reduce odour through frequent cleaning of materials storage areas (see BREF Section 4.1.31)
- Short term and possibly cold storage of raw materials before processing (see BREF Sections 4.1.27 & 5.3(3)).

5.3.2 Size Reduction, Mixing, Forming

- Particulate matter (dust) is often generated and should be recovered in extracted air and reused in the process where practicable
- Noise can be an issue with size reduction techniques such as grinding. Insulate and enclose noisy equipment in insulated buildings where possible.

5.3.3 Separation

- Use high efficiency separation techniques to maximise recovery of fish meal cake.

5.3.4 Heat Processing

- Remove the organic odour components by condensing the vapour from boiling vessels combined with energy recovery
- Reuse condensate where practicable

- Use appropriate abatement technology to reduce malodorous emissions from the cooking and drying processes. See Section 4.3.3.1 of this document.

5.3.5 Concentration by Heat

- Use appropriate abatement technology to reduce the emissions of dust to air from the drying process and reuse particulate materials in the process where practicable
- Employ heat recovery where practicable
- Wash condensate air with condensate instead of with seawater to reduce water consumption (see BREF Sections 4.3.4.4 & 5.5.3(4)).

5.3.6 Processing by Removal of Heat

- Employ heat recovery to concentrate stickwater (for example see BREF Section 4.3.4.2).

5.3.7 Post Processing Operations

- Recycle packaging waste (e.g. wood, cardboard, paper, plastic) (see Food & Drink BREF Section 5.1.4.9(1))
- Optimise line efficiency (see Food & Drink BREF Sections 4.2.12.4 & 5.1.4.9(4))
- Use appropriate storage and handling techniques to contain emissions, e.g. dust (see Section 4.3.3.1 of this document)
- Apply a control strategy to identify, quantify and select appropriate abatement options for emissions to air (see Food & Drink BREF Section 4.4.1).

5.3.8 Cleaning and Sanitation

- Selection of materials/chemicals used in cleaning for minimal impact on the environment (see BREF Sections 4.1.42 & 5.1.4)
- Use of pressure cleaning and pressure controlled water via nozzles throughout the installation (see BREF Sections 4.1.8, 4.1.10 & 5.1.1(8))
- Fit cleaning hoses with hand operated triggers (see BREF Sections 4.1.9 & 5.1.1(8))
- Optimise cleaning procedures (e.g. CIP) to reduce water consumption and wastewater load (see Food & Drink BREF Section 5.1.3(10)).

5.4 BAT – Measures for Treatment, Abatement and Disposal

5.4.1 Treatment of Air Emissions

For all fish meal and fish oil manufacturing plants, BAT is to minimise the formation of air emissions and odours using the measures outlined in section 5.2 and 5.3 of this document, and then, if necessary, use:

- A thermal oxidiser (see BREF Section 4.3.3.10)
- A biofilter (see BREF Section 4.1.33)
- A bioscrubber (see BREF Section 4.3.3.8)
- An absorption system such as wet scrubbing with chloride dioxide to remove odour (see BREF Sections 4.3.3.9, 4.3.3.12 and 4.3.3.13)
- An activated carbon filter (see BREF Section 4.1.34)

- A dynamic, wet, filter or electrostatic separators on exhaust air to remove particulates/dust in meal milling and packaging areas (see Food & Drink BREF Sections 4.4.3.5 & 5.1.5(2)).

5.4.2 Treatment of Wastewater

For all fish meal and fish oil manufacturing plants, BAT is to minimise the quality and load of wastewater generated using the measures outlined in section 5.2 and 5.3 of this document, then treat waste water as follows:

- Prevent wastewater stagnation (see BREF Sections 4.1.43.3 & 5.1.5(1))
- Provide wastewater holding capacity in excess of routine requirements (see BREF Sections 4.1.43.1 & 5.1.5(6))
- Use of primary treatment such as screening, equalisation and flotation (see BREF Sections 4.1.43 and also see Food & Drink BREF Sections 4.5.4)
- Prevent odour emissions from wastewater treatment tanks by aerating and covering them (see BREF Sections 4.1.43.12 and 4.1.43.13 & 5.1.5(7))
- Use appropriate biological treatment (see BREF Sections 4.1.43.14, 4.1.43.15 and 4.2.6.3 & 5.1.5(8))
- Remove nitrogen and phosphorus compounds (see BREF Sections 2.3.1.2, 4.1.43.15 & 5.1.5(9) and see also Food & Drink BREF Section 4.5.4)
- Subject the effluent from biological treatment to tertiary treatment, where required (see BREF Section 2.3.1.3)
- Regularly conduct laboratory analysis of the effluent composition and maintain records (see BREF Section 5.1.5(13)).

5.4.3 Treatment and Disposal of Waste

For all fish meal and fish oil manufacturing plants, BAT is to minimise the quantity and load of waste generated using the measures outlined in section 5.2 and 5.3 of this document, then treat/dispose of waste generated as follows:

- Recycle packaging waste (e.g. cardboard, paper) (see Food & Drink BREF Section 4.2.12.3)
- Reuse wastewater screenings/ wastewater sludges in the process if practicable
- Remove sludges produced and subject them to further animal by-product uses. These routes and their conditions of application are regulated by Animal By-Product Regulations 1774/2002/EC (see BREF Section 5.1.5(10)).

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 Emission to Air

Constituent Group or Parameter	**Emission Levels (mg/m^3)**	**Mass Thresholds (g/hr) Note 1**
Ammonia	30	150
Amines and amides	5	-
Total hydrogen sulphide, sulphides and mercaptans (expressed as S)	5	15
Total Organic Carbon (as C)	50	500
Total Particulate Matter (including emissions from material handling)	5 - 50 150	>200 At mass flow up to 200
Other	--	Note 2

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.

Note 2: Any relevant polluting substances as specified in Schedule to S.I. No. 394 of 2004: EPA (Licensing)(Amendment) Regulations, 2004.

6.1.1 Odour Emission

Activities at the installation shall be carried out in a manner such that emissions of odours do not result in significant impairment of, and/or significant interference with amenities or the environment beyond the installation boundary. Reference shall be made to the Environmental Protection Agency's publication Odour Impacts and Odour Emission Control Measures for Intensive Agriculture (2001).

6.2 EMISSION LEVELS FOR DISCHARGES TO WATER

The following table sets out emission level values 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*

Constituent Group or Parameter	Emission Level	Notes
pH	6 - 9	
Number of Toxicity Units (TU)	5	1
BOD5	>90% removal Note 3, or 20 - 40mg/l	
COD	>75% removal Note 3, or 125 - 250mg/l	
Suspended Solids	50mg/l	
Total Ammonia (as N)	10mg/l	
Total Nitrogen (as N)	>80% removal Note 3, or 5 - 25mg/l	2,4
Total Phosphorus (as P)	>80% removal Note 3, or 2 - 5mg/l	4
Oils, Fat and Grease	10 - 15mg/l	
Mineral Oil (from interceptor)	20mg/l	
Mineral Oil (from biological treatment)	1.0mg/l	
Other	--	5

* 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^{o}C in salmonid waters and 3^{o}C in cyprinid waters (Freshwater Fish Directive 79/659/EEC).

Note 1: 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, 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.

Note 5: Any relevant polluting substances as specified in Schedule to S.I. No. 394 of 2004: EPA (Licensing)(Amendment) Regulations, 2004.

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 processed for monitoring the emissions from the sector 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 emissions for SOx, NOx, CO and particulates, as required by the licence, 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 instruction at a frequency determined by the Agency.
- Periodic monitoring of air emissions from odour abatement equipment for ammonia, total amines and hydrogen sulphide and mercaptans, or as determined by the Agency.
- Periodic monitoring for other parameters as 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.

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 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 Food, Drink and Milk Industry (January 2006).

1.2 Reference Document on Best Available Techniques in the Slaughterhouse and Animal By-Products Industries (May 2005).

1.3 Council Directive 96/61/EC of 24 September 1996 concerning Integrated Pollution Prevention and Control.

2. Ireland

2.1 Integrated Pollution Control Licensing BATNEEC Guidance Note for the Fish Meal and Fish Oil (Draft 3).

2.2 Environmental Protection Agency Guidance Note For Noise in Relation to Scheduled Activities - 2ND Edition (2006).

Appendix 2

GLOSSARY OF TERMS AND ABBREVIATIONS

BAT	Best Available Technique
BOD	Biochemical Oxygen Demand
BREF	Reference document on Best Available Techniques in the Slaughterhouse and Animal By-Products Industries, published by the European Commission, May 2005.
^0C	Degree Celsius
CO	Carbon monoxide
COD	Chemical Oxygen Demand
CO_2	Carbon dioxide
ELV	Emission Limit Value
Kg	Kilogramme
K	Degree Kelvin (0^oC = 273.15K)
m^3	Cubic metre
mg	Milligramme
MJ	Megajoule (1 MJ = 1000 kj = 106 joule)
N_2	Nitrogen
Nm^3	Normal cubic metre (101.3 kPa, 273 K)
NH_3	Ammonia
NH_4	Ammonium
NO	Nitrogen monoxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
O_2	Oxygen
SO_2	Sulphur dioxide
SOx	Sulphur oxides
t	Tonne (metric)
VOC	Volatile Organic Compounds
WWTP	Waste Water Treatment Plants