DECISIONS

COMMISSION IMPLEMENTING DECISION (EU) 2019/2031

of 12 November 2019

establishing best available techniques (BAT) conclusions for the food, drink and milk industries, under Directive 2010/75/EU of the European Parliament and of the Council

(notified under document C(2019) 7989)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) ([1]), and in particular Article 13(5) thereof,

Whereas:

(1) Best available techniques (BAT) conclusions are the reference for setting permit conditions for installations covered by Chapter II of Directive 2010/75/EU and competent authorities should set emission limit values which ensure that, under normal operating conditions, emissions do not exceed the emission levels associated with the best available techniques as laid down in the BAT conclusions.

(2) The forum composed of representatives of Member States, the industries concerned and non-governmental organisations promoting environmental protection, established by Commission Decision of 16 May 2011 ([2]), provided the Commission on 27 November 2018 with its opinion on the proposed content of the BAT reference document for the food, drink and milk industries. That opinion is publicly available ([3]).

(3) The BAT conclusions set out in the Annex to this Decision are the key element of that BAT reference document.

(4) The measures provided for in this Decision are in accordance with the opinion of the Committee established by Article 75(1) of Directive 2010/75/EU,

HAS ADOPTED THIS DECISION:

Article 1

The best available techniques (BAT) conclusions for the food drink and milk industries, as set out in the Annex, are adopted.

Article 2

This Decision is addressed to the Member States.

Done at Brussels, 12 November 2019.

For the Commission
Karmenu VELLA
Member of the Commission

([1]) OJ L 334, 17.12.2010, p. 17.
([2]) Commission Decision of 16 May 2011 establishing a forum for the exchange of information pursuant to Article 13 of Directive 2010/75/EU on industrial emissions (OJ C 146, 17.5.2011, p. 3).
([3]) https://circabc.europa.eu/ui/group/06f33a94-9829-4eee-b187-21bb783a0fbf/library/d00a6ea2-6a30-46fc-8064-16200f9fe7f6?p=1&n=10&sort=modified_DESC

ANNEX

BEST AVAILABLE TECHNIQUES (BAT) CONCLUSIONS FOR THE FOOD, DRINK AND MILK INDUSTRIES

SCOPE

These BAT conclusions concern the following activities specified in Annex I to Directive 2010/75/EU:

— 6.4 (b) Treatment and processing, other than exclusively packaging, of the following raw materials, whether previously processed or unprocessed, intended for the production of food or feed from:

(i) only animal raw materials (other than exclusively milk) with a finished product production capacity greater than 75 tonnes per day;

(ii) only vegetable raw materials with a finished product production capacity greater than 300 tonnes per day or 600 tonnes per day where the installation operates for a period of no more than 90 consecutive days in any year;

(iii) animal and vegetable raw materials, both in combined and separate products, with a finished product production capacity in tonnes per day greater than:

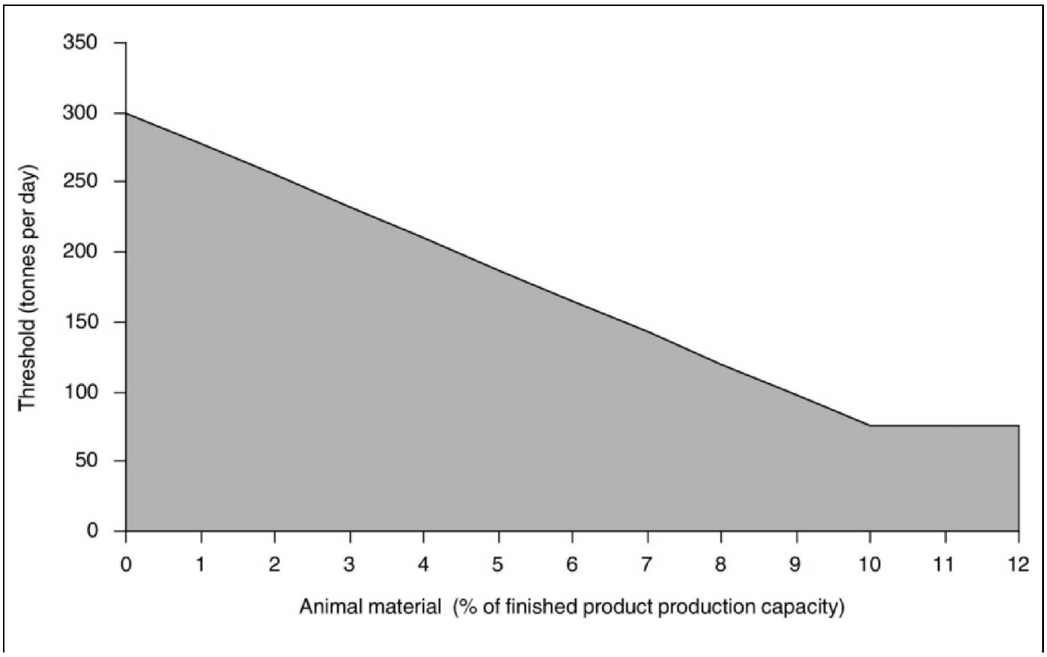
— 75 if A is equal to 10 or more; or,

— [300 – (22,5 × A)] in any other case,

where 'A' is the portion of animal material (in percent of weight) of the finished product production capacity.

Packaging shall not be included in the final weight of the product.

This subsection shall not apply where the raw material is milk only.



— 6.4 (c) Treatment and processing of milk only, the quantity of milk received being greater than 200 tonnes per day (average value on an annual basis).

— 6.11 Independently operated treatment of waste water not covered by Council Directive 91/271/EEC [1] provided that the main pollutant load originates from activities specified in points 6.4 (b) or (c) of Annex I to Directive 2010/75/EU.

(1) Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (OJ L 135, 30.5.1991, p. 40).

These BAT conclusions also cover:

— the combined treatment of waste water from different origins provided that the main pollutant load originates from the activities specified in point 6.4 (b) or 6.4 (c) of Annex I to Directive 2010/75/EU and that the waste water treatment is not covered by Council Directive 91/271/EEC;

— the production of ethanol taking place on an installation covered by the activity description in point 6.4 (b) (ii) of Annex I to Directive 2010/75/EU or as a directly associated activity to such an installation.

These BAT conclusions do not address the following:

— On-site combustion plants generating hot gases that are not used for direct contact heating, drying or any other treatment of objects or materials. This may be covered by the BAT conclusions for Large Combustion Plants (LCP) or by Directive (EU) 2015/2193 of the European Parliament and of the Council ([2]).

— Production of primary products from animal by-products, such as rendering and fat melting, fish-meal and fish oil production, blood processing and gelatine manufacturing. This may be covered by the BAT conclusions for Slaughterhouses and Animal By-products Industries (SA).

— The making of standard cuts for large animals and cuts for poultry. This may be covered by the BAT conclusions for Slaughterhouses and Animal By-products Industries (SA).

Other BAT conclusions and reference documents which could be relevant for the activities covered by these BAT conclusions include the following:

— Large Combustion Plants (LCP);

— Slaughterhouses and Animal By-products Industries (SA);

— Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector (CWW);

— Large Volume Organic Chemical Industry (LVOC);

— Waste Treatment (WT);

— Production of Cement, Lime and Magnesium Oxide (CLM);

— Monitoring of Emissions to Air and Water from IED Installations (ROM);

— Economics and Cross-Media Effects (ECM);

— Emissions from Storage (EFS);

— Energy Efficiency (ENE);

— Industrial Cooling Systems (ICS).

These BAT conclusions apply without prejudice to other relevant legislation, e.g. on hygiene or food/feed safety.

([2]) Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants (OJ L 313, 28.11.2015, p. 1).

DEFINITIONS

For the purposes of these BAT conclusions, the following definitions apply:

Term used	Definition
Biochemical oxygen demand (BOD_n)	Amount of oxygen needed for the biochemical oxidation of the organic matter to carbon dioxide in *n* days (*n* is typically 5 or 7). BOD is an indicator for the mass concentration of biodegradable organic compounds.
Channelled emissions	Emissions of pollutants into the environment through any kind of duct, pipe, stack, etc.
Chemical oxygen demand (COD)	Amount of oxygen needed for the total chemical oxidation of the organic matter to carbon dioxide using dichromate. COD is an indicator for the mass concentration of organic compounds.
Dust	Total particulate matter (in air).
Existing plant	A plant that is not a new plant.
Hexane	Alkane of six carbon atoms, with the chemical formula C_6H_{14}.
hl	Hectolitre (equal to 100 litres).
New plant	A plant first permitted at the site of the installation following the publication of these BAT conclusions or a complete replacement of a plant following the publication of these BAT conclusions.
NO_X	The sum of nitrogen monoxide (NO) and nitrogen dioxide (NO_2), expressed as NO_2.
Residue	Substance or object generated by the activities covered by the scope of this document, as waste or by-product.
SO_X	The sum of sulphur dioxide (SO_2), sulphur trioxide (SO_3), and sulphuric acid aerosols, expressed as SO_2.
Sensitive receptor	Areas which need special protection, such as: — residential areas; — areas where human activities are carried out (e.g. neighbouring workplaces, schools, day-care centres, recreational areas, hospitals or nursing homes).
Total nitrogen (TN)	Total nitrogen, expressed as N, includes free ammonia and ammonium nitrogen (NH_4-N), nitrite nitrogen (NO_2-N), nitrate nitrogen (NO_3-N) and organically bound nitrogen.
Total organic carbon (TOC)	Total organic carbon, expressed as C (in water), includes all organic compounds.
Total phosphorus (TP)	Total phosphorus, expressed as P, includes all inorganic and organic phosphorus compounds, dissolved or bound to particles.
Total suspended solids (TSS)	Mass concentration of all suspended solids (in water), measured via filtration through glass fibre filters and gravimetry.
Total volatile organic carbon (TVOC)	Total volatile organic carbon, expressed as C (in air).

GENERAL CONSIDERATIONS

Best Available Techniques

The techniques listed and described in these BAT conclusions are neither prescriptive nor exhaustive. Other techniques may be used that ensure at least an equivalent level of environmental protection.

Unless otherwise stated, the BAT conclusions are generally applicable.

Emission levels associated with the best available techniques (BAT-AELs) for emissions to air

Unless otherwise stated, emission levels associated with the best available techniques (BAT-AELs) for emissions to air given in these BAT conclusions refer to concentrations, expressed as mass of emitted substances per volume of waste gas under the following standard conditions: dry gas at a temperature of 273,15 K and a pressure of 101,3 kPa, without correction for oxygen content, and expressed in mg/Nm^3.

The equation for calculating the emission concentration at the reference oxygen level is:

$$E_R = \frac{21 - O_R}{21 - O_M} \times E_M$$

where:

E_R: emission concentration at the reference oxygen level O_R;

O_R: reference oxygen level in vol-%;

E_M: measured emission concentration;

O_M: measured oxygen level in vol-%.

For averaging periods of BAT-AELs for emissions to air, the following definition applies.

Averaging period	Definition
Average over the sampling period	Average value of three consecutive measurements of at least 30 minutes each ([1]).

([1]) For any parameter where, due to sampling or analytical limitations, 30-minute sampling/measurement is inappropriate, a more suitable measurement period may be employed.

When the waste gases of two or more sources (e.g. dryers or kilns) are discharged through a common stack, the BAT-AEL applies to the combined discharge from the stack.

Specific hexane losses

The emission levels associated with the best available techniques (BAT-AELs) related to specific hexane losses refer to yearly averages and are calculated using the following equation:

$$\text{specific hexane losses} = \frac{\text{hexane losses}}{\text{raw materials}}$$

where: hexane losses is the total amount of hexane consumed by the installation for each type of seeds or beans, expressed in kg/year;
raw materials is the total amount of each type of cleaned seeds or beans processed, expressed in tonnes/year.

Emission levels associated with the best available techniques (BAT-AELs) for emissions to water

Unless otherwise stated, emission levels associated with the best available techniques (BAT-AELs) for emissions to water given in these BAT conclusions refer to concentrations (mass of emitted substances per volume of water), expressed in mg/l.

The BAT-AELs expressed as concentrations refer to daily average values, i.e. 24-hour flow-proportional composite samples. Time-proportional composite samples can be used provided that sufficient flow stability is demonstrated. Alternatively, spot samples may be taken, provided that the effluent is appropriately mixed and homogeneous.

In the case of total organic carbon (TOC), chemical oxygen demand (COD), total nitrogen (TN) and total phosphorus (TP), the calculation of the average abatement efficiency referred to in these BAT conclusions (see Table 1) is based on the influent and effluent load of the waste water treatment plant.

Other environmental performance levels

Specific waste water discharge

The indicative environmental performance levels related to specific waste water discharge refer to yearly averages and are calculated using the following equation:

$$\text{specific waste water discharge} = \frac{\text{waste water discharge}}{\text{activity rate}}$$

where: Waste water discharge is the total amount of waste water discharged (as direct discharge, indirect discharge and/or land spreading) by the specific processes concerned during the production period, expressed in m^3/year, excluding any cooling water and run-off water that is discharged separately.
Activity rate is the total amount of products or raw materials processed, depending on the specific sector, expressed in tonnes/year or hl/year. Packaging is not included in the weight of the product. Raw material is any material entering the plant, treated or processed for the production of food or feed.

Specific energy consumption

The indicative environmental performance levels related to specific energy consumption refer to yearly averages and are calculated using the following equation:

$$\text{specific energy consumption} = \frac{\text{final energy consumption}}{\text{activity rate}}$$

where: Final energy consumption is the total amount of energy consumed by the specific processes concerned during the production period (in the form of heat and electricity), expressed in MWh/year.
Activity rate is the total amount of products or raw materials processed, depending on the specific sector, expressed in tonnes/year or hl/year. Packaging is not included in the weight of the product. Raw material is any material entering the plant, treated or processed for the production of food or feed.

1. GENERAL BAT CONCLUSIONS

1.1. Environmental management systems

BAT 1. In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates all of the following features:

(i) commitment, leadership, and accountability of the management, including senior management, for the implementation of an effective EMS;

(ii) an analysis that includes the determination of the organisation's context, the identification of the needs and expectations of interested parties, the identification of characteristics of the installation that are associated with possible risks for the environment (or human health) as well as of the applicable legal requirements relating to the environment;

(iii) development of an environmental policy that includes the continuous improvement of the environmental performance of the installation;

(iv) establishing objectives and performance indicators in relation to significant environmental aspects, including safeguarding compliance with applicable legal requirements;

(v) planning and implementing the necessary procedures and actions (including corrective and preventive actions where needed), to achieve the environmental objectives and avoid environmental risks;

(vi) determination of structures, roles and responsibilities in relation to environmental aspects and objectives and provision of the financial and human resources needed;

(vii) ensuring the necessary competence and awareness of staff whose work may affect the environmental performance of the installation (e.g. by providing information and training);

(viii) internal and external communication;

(ix) fostering employee involvement in good environmental management practices;

(x) Establishing and maintaining a management manual and written procedures to control activities with significant environmental impact as well as relevant records;

(xi) effective operational planning and process control;

(xii) implementation of appropriate maintenance programmes;

(xiii) emergency preparedness and response protocols, including the prevention and/or mitigation of the adverse (environmental) impacts of emergency situations;

(xiv) when (re)designing a (new) installation or a part thereof, consideration of its environmental impacts throughout its life, which includes construction, maintenance, operation and decommissioning;

(xv) implementation of a monitoring and measurement programme, if necessary, information can be found in the Reference Report on Monitoring of Emissions to Air and Water from IED Installations;

(xvi) application of sectoral benchmarking on a regular basis;

(xvii) periodic independent (as far as practicable) internal auditing and periodic independent external auditing in order to assess the environmental performance and to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained;

(xviii) evaluation of causes of nonconformities, implementation of corrective actions in response to nonconformities, review of the effectiveness of corrective actions, and determination of whether similar nonconformities exist or could potentially occur;

(xix) periodic review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness;

(xx) following and taking into account the development of cleaner techniques.

Specifically for the food, drink and milk sector, BAT is to also incorporate the following features in the EMS:

(i) noise management plan (see BAT 13);

(ii) odour management plan (see BAT 15);

(iii) inventory of water, energy and raw materials consumption as well as of waste water and waste gas streams (see BAT 2);

(iv) energy efficiency plan (see BAT 6a).

Note

Regulation (EC) No 1221/2009 of the European Parliament and of the Council ([3]) establishes the Union eco-management and audit scheme (EMAS), which is an example of an EMS consistent with this BAT.

Applicability

The level of detail and the degree of formalisation of the EMS will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.

BAT 2. In order to increase resource efficiency and to reduce emissions, BAT is to establish, maintain and regularly review (including when a significant change occurs) an inventory of water, energy and raw materials consumption as well as of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:

I. Information about the food, drink and milk production processes, including:

(a) simplified process flow sheets that show the origin of the emissions;

(b) descriptions of process-integrated techniques and waste water/waste gas treatment techniques to prevent or reduce emissions, including their performance.

II. Information about water consumption and usage (e.g. flow diagrams and water mass balances), and identification of actions to reduce water consumption and waste water volume (see BAT 7).

III. Information about the quantity and characteristics of the waste water streams, such as:

(a) average values and variability of flow, pH and temperature;

(b) average concentration and load values of relevant pollutants/parameters (e.g. TOC or COD, nitrogen species, phosphorus, chloride, conductivity) and their variability.

IV. Information about the characteristics of the waste gas streams, such as:

(a) average values and variability of flow and temperature;

(b) average concentration and load values of relevant pollutants/parameters (e.g. dust, TVOC, CO, NO_X, SO_X) and their variability;

(c) presence of other substances that may affect the waste gas treatment system or plant safety (e.g. oxygen, water vapour, dust).

V. Information about energy consumption and usage, the quantity of raw materials used, as well as the quantity and characteristics of residues generated, and identification of actions for continuous improvement of resource efficiency (see for example BAT 6 and BAT 10).

VI. Identification and implementation of an appropriate monitoring strategy with the aim of increasing resource efficiency, taking into account energy, water and raw materials consumption. Monitoring can include direct measurements, calculations or recording with an appropriate frequency. The monitoring is broken down at the most appropriate level (e.g. at process or plant/installation level).

Applicability

The level of detail of the inventory will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.

1.2. **Monitoring**

BAT 3. For relevant emissions to water as identified by the inventory of waste water streams (see BAT 2), BAT is to monitor key process parameters (e.g. continuous monitoring of waste water flow, pH and temperature) at key locations (e.g. at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation).

([3]) Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC (OJ L 342, 22.12.2009, p. 1).

BAT 4. BAT is to monitor emissions to water with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

Substance/parameter	Standard(s)	Minimum monitoring frequency (1)	Monitoring associated with
Chemical oxygen demand (COD) (2) (3)	No EN standard available	Once every day (4)	BAT 12
Total nitrogen (TN) (2)	Various EN standards available (e.g. EN 12260, EN ISO 11905-1)		
Total organic carbon (TOC) (2) (3)	EN 1484		
Total phosphorus (TP) (2)	Various EN standards available (e.g. EN ISO 6878, EN ISO 15681-1 and -2, EN ISO 11885)		
Total suspended solids (TSS) (2)	EN 872		
Biochemical oxygen demand (BOD_n) (2)	EN 1899-1	Once every month	
Chloride (Cl^-)	Various EN standards available (e.g. EN ISO 10304-1, EN ISO 15682)	Once every month	—

(1) The monitoring only applies when the substance concerned is identified as relevant in the waste water stream based on the inventory mentioned in BAT 2.
(2) The monitoring only applies in the case of a direct discharge to a receiving water body.
(3) TOC monitoring and COD monitoring are alternatives. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds.
(4) If the emission levels are proven to be sufficiently stable, a lower monitoring frequency can be adopted but in any case at least once every month.

BAT 5. BAT is to monitor channelled emissions to air with at least the frequency given below and in accordance with EN standards.

Substance/ Parameter	Sector	Specific process	Standard(s)	Minimum monitoring frequency (1)	Monitoring associated with
Dust	Animal feed	Drying of green fodder	EN 13284-1	Once every three months (2)	BAT 17
		Grinding and pellet cooling in compound feed manufacture		Once every year	BAT 17
		Extrusion of dry pet food		Once every year	BAT 17
	Brewing	Handling and processing of malt and adjuncts		Once every year	BAT 20
	Dairies	Drying processes		Once every year	BAT 23
	Grain milling	Grain cleaning and milling		Once every year	BAT 28

Substance/ Parameter	Sector	Specific process	Standard(s)	Minimum monitoring frequency (1)	Monitoring associated with
	Oilseed processing and vegetable oil refining	Handling and preparation of seeds, drying and cooling of meal		Once every year	BAT 31
	Starch production	Drying of starch, protein and fibre			BAT 34
	Sugar manufacturing	Drying of beet pulp		Once every month (2)	BAT 36
$PM_{2.5}$ and PM_{10}	Sugar manufacturing	Drying of beet pulp	EN ISO 23210	Once every year	BAT 36
TVOC	Fish and shellfish processing	Smoke chambers	EN 12619	Once every year	BAT 26
	Meat processing	Smoke chambers			BAT 29
	Oilseed processing and vegetable oil refining (3)	—			—
	Sugar manufacturing	High-temperature drying of beet pulp		Once every year	—
NO_X	Meat processing (4)	Smoke chambers	EN 14792	Once every year	—
	Sugar manufacturing	High-temperature drying of beet pulp			
CO	Meat processing (4)	Smoke chambers	EN 15058		
	Sugar manufacturing	High-temperature drying of beet pulp			
SO_X	Sugar manufacturing	Drying of beet pulp when natural gas is not used	EN 14791	Twice every year (2)	BAT 37

(1) The measurements are carried out at the highest expected emission state under normal operating conditions.
(2) If the emission levels are proven to be sufficiently stable, a lower monitoring frequency can be adopted but in any case at least once every year.
(3) The measurement is carried out during a campaign of two days.
(4) The monitoring only applies when a thermal oxidiser is used.

1.3. **Energy efficiency**

BAT 6. In order to increase energy efficiency, BAT is to use BAT 6a and an appropriate combination of the common techniques listed in technique b below.

Technique		Description
(a)	Energy efficiency plan	An energy efficiency plan, as part of the environmental management system (see BAT 1), entails defining and calculating the specific energy consumption of the activity (or activities), setting key performance indicators on an annual basis (for example for the specific energy consumption) and planning periodic improvement targets and related actions. The plan is adapted to the specificities of the installation.
(b)	Use of common techniques	Common techniques include techniques such as: — burner regulation and control; — cogeneration; — energy-efficient motors; — heat recovery with heat exchangers and/or heat pumps (including mechanical vapour recompression); — lighting; — minimising blowdown from the boiler; — optimising steam distribution systems; — preheating feed water (including the use of economisers); — process control systems; — reducing compressed air system leaks; — reducing heat losses by insulation; — variable speed drives; — multiple-effect evaporation; — use of solar energy.

Further sector-specific techniques to increase energy efficiency are given in Sections 2 to 13 of these BAT conclusions.

1.4. **Water consumption and waste water discharge**

BAT 7. In order to reduce water consumption and the volume of waste water discharged, BAT is to use BAT 7a and one or a combination of the techniques b to k given below.

Technique		Description	Applicability
Common techniques			
(a)	Water recycling and/or re-use	Recycling and/or reuse of water streams (preceded or not by water treatment), e.g. for cleaning, washing, cooling or for the process itself.	May not be applicable due to hygiene and food safety requirements.
(b)	Optimisation of water flow	Use of control devices, e.g. photocells, flow valves, thermostatic valves, to automatically adjust the water flow.	
(c)	Optimisation of water nozzles and hoses	Use of correct number and position of nozzles; adjustment of water pressure.	

Technique		Description	Applicability
(d)	Segregation of water streams	Water streams that do not need treatment (e.g. uncontaminated cooling water or uncontaminated run-off water) are segregated from waste water that has to undergo treatment, thus enabling uncontaminated water recycling.	The segregation of uncontaminated rainwater may not be applicable in the case of existing waste water collection systems.

Techniques related to cleaning operations

(e)	Dry cleaning	Removal of as much residual material as possible from raw materials and equipment before they are cleaned with liquids, e.g. by using compressed air, vacuum systems or catchpots with a mesh cover.	Generally applicable.
(f)	Pigging system for pipes	Use of a system made of launchers, catchers, compressed air equipment, and a projectile (also referred to as a 'pig', e.g. made of plastic or ice slurry) to clean out pipes. In-line valves are in place to allow the pig to pass through the pipeline system and to separate the product and the rinsing water.	
(g)	High-pressure cleaning	Spraying of water onto the surface to be cleaned at pressures ranging from 15 bar to 150 bar.	May not be applicable due to health and safety requirements.
(h)	Optimisation of chemical dosing and water use in cleaning-in-place (CIP)	Optimising the design of CIP and measuring turbidity, conductivity, temperature and/or pH to dose hot water and chemicals in optimised quantities.	Generally applicable.
(i)	Low-pressure foam and/or gel cleaning	Use of low-pressure foam and/or gel to clean walls, floors and/or equipment surfaces.	
(j)	Optimised design and construction of equipment and process areas	The equipment and process areas are designed and constructed in a way that facilitates cleaning. When optimising the design and construction, hygiene requirements are taken into account.	
(k)	Cleaning of equipment as soon as possible	Cleaning is applied as soon as possible after use of equipment to prevent wastes hardening.	

Further sector-specific techniques to reduce water consumption are given in Section 6.1 of these BAT conclusions.

1.5. **Harmful substances**

BAT 8. In order to prevent or reduce the use of harmful substances, e.g. in cleaning and disinfection, BAT is to use one or a combination of the techniques given below.

Technique		Description
(a)	Proper selection of cleaning chemicals and/or disinfectants	Avoidance or minimisation of the use of cleaning chemicals and/or disinfectants that are harmful to the aquatic environment, in particular priority substances considered under the Water Framework Directive 2000/60/EC of the European Parliament and of the Council ([1]) When selecting the substances, hygiene and food safety requirements are taken into account.
(b)	Reuse of cleaning chemicals in cleaning-in-place (CIP)	Collection and reuse of cleaning chemicals in CIP. When reusing cleaning chemicals, hygiene and food safety requirements are taken into account.
(c)	Dry cleaning	See BAT 7e.
(d)	Optimised design and construction of equipment and process areas	See BAT 7j.

([1]) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L327, 22.12.2000, p. 1).

BAT 9. In order to prevent emissions of ozone-depleting substances and of substances with a high global warming potential from cooling and freezing, BAT is to use refrigerants without ozone depletion potential and with a low global warming potential.

Description

Suitable refrigerants include water, carbon dioxide or ammonia.

1.6. **Resource efficiency**

BAT 10. In order to increase resource efficiency, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
(a)	Anaerobic digestion	Treatment of biodegradable residues by microorganisms in the absence of oxygen, resulting in biogas and digestate. The biogas is used as a fuel, e.g. in a gas engine or in a boiler. The digestate may be used, e.g. as a soil improver.	May not be applicable due to the quantity and/or nature of the residues.
(b)	Use of residues	Residues are used, e.g. as animal feed.	May not be applicable due to legal requirements.
(c)	Separation of residues	Separation of residues, e.g. using accurately positioned splash protectors, screens, flaps, catchpots, drip trays and troughs.	Generally applicable.
(d)	Recovery and reuse of residues from the pasteuriser	Residues from the pasteuriser are fed back to the blending unit and are thereby reused as raw materials.	Only applicable to liquid food products.
(e)	Phosphorus recovery as struvite	See BAT 12g.	Only applicable to waste water streams with a high total phosphorus content (e.g. above 50 mg/l) and a significant flow.

Technique		Description	Applicability
(f)	Use of waste water for land spreading	After appropriate treatment, waste water is used for land spreading in order to take advantage of the nutrient content and/or to use the water.	Only applicable in the case of a proven agronomic benefit, a proven low level of contamination and no negative impact on the environment (e.g. on the soil, the groundwater and surface water). The applicability may be restricted due to the limited availability of suitable land adjacent to the installation. The applicability may be restricted by the soil and local climatic conditions (e.g. in the case of wet or frozen fields) or by legislation.

Further sector-specific techniques to reduce waste sent for disposal are given in Sections 3.3, 4.3 and 5.1 of these BAT conclusions.

1.7. **Emissions to water**

BAT 11. In order to prevent uncontrolled emissions to water, BAT is to provide an appropriate buffer storage capacity for waste water.

Description

The appropriate buffer storage capacity is determined by a risk assessment (taking into account the nature of the pollutant(s), the effects of these pollutants on further waste water treatment, the receiving environment, etc.).

The waste water from this buffer storage is discharged after appropriate measures are taken (e.g. monitoring, treatment, reuse).

Applicability

For existing plants, the technique may not be applicable due to lack of space and/or due to the layout of the waste water collection system.

BAT 12. In order to reduce emissions to water, BAT is to use an appropriate combination of the techniques given below.

	Technique [1]	Typical pollutants targeted	Applicability
Preliminary, primary and general treatment			
(a)	Equalisation	All pollutants	Generally applicable.
(b)	Neutralisation	Acids, alkalis	
(c)	Physical separation, e.g. screens, sieves, grit separators, oil/fat separators, or primary settlement tanks	Gross solids, suspended solids, oil/grease	

	Technique (1)	Typical pollutants targeted	Applicability
Aerobic and/or anaerobic treatment (secondary treatment)			
(d)	Aerobic and/or anaerobic treatment (secondary treatment), e.g. activated sludge process, aerobic lagoon, upflow anaerobic sludge blanket (UASB) process, anaerobic contact process, membrane bioreactor	Biodegradable organic compounds	Generally applicable.
Nitrogen removal			
(e)	Nitrification and/or denitrification	Total nitrogen, ammonium/ammonia	Nitrification may not be applicable in the case of high chloride concentrations (e.g. above 10 g/l). Nitrification may not be applicable when the temperature of the waste water is low (e.g. below 12 ° C).
(f)	Partial nitritation — Anaerobic ammonium oxidation		May not be applicable when the temperature of the waste water is low.
Phosphorus recovery and/or removal			
(g)	Phosphorus recovery as struvite	Total phosphorus	Only applicable to waste water streams with a high total phosphorus content (e.g. above 50 mg/l) and a significant flow.
(h)	Precipitation		Generally applicable.
(i)	Enhanced biological phosphorus removal		
Final solids removal			
(j)	Coagulation and flocculation	Suspended solids	Generally applicable.
(k)	Sedimentation		
(l)	Filtration (e.g. sand filtration, microfiltration, ultrafiltration)		
(m)	Flotation		

(1) The descriptions of the techniques are given in Section 14.1.

The BAT-associated emission levels (BAT-AELs) for emissions to water given in Table 1 apply to direct emissions to a receiving water body.

The BAT-AELs apply at the point where the emission leaves the installation.

Table 1

BAT-associated emission levels (BAT-AELs) for direct emissions to a receiving water body

Parameter	BAT-AEL (1) (2) (daily average)
Chemical oxygen demand (COD) (3) (4)	25-100 mg/l (5)
Total suspended solids (TSS)	4-50 mg/l (6)
Total nitrogen (TN)	2-20 mg/l (7) (8)
Total phosphorus (TP)	0,2-2 mg/l (9)

(1) The BAT-AELs do not apply to emissions from grain milling, green fodder processing, and the production of dry pet food and compound feed.
(2) The BAT-AELs may not apply to the production of citric acid or yeast.
(3) No BAT-AEL applies for biochemical oxygen demand (BOD). As an indication, the yearly average BOD_5 level in the effluent from a biological waste water treatment plant will generally be ≤ 20 mg/l.
(4) The BAT-AEL for COD may be replaced by a BAT-AEL for TOC. The correlation between COD and TOC is determined on a case-by-case basis. The BAT-AEL for TOC is the preferred option because TOC monitoring does not rely on the use of very toxic compounds.
(5) The upper end of the range is:
— 125 mg/l for dairies;
— 120 mg/l for fruit and vegetable installations;
— 200 mg/l for oilseed processing and vegetable oil refining installations;
— 185 mg/l for starch production installations;
— 155 mg/l for sugar manufacturing installations;as daily averages only if the abatement efficiency is ≥ 95 % as a yearly average or as an average over the production period.
(6) The lower end of the range is typically achieved when using filtration (e.g. sand filtration, microfiltration, membrane bioreactor), while the upper end of the range is typically achieved when using sedimentation only.
(7) The upper end of the range is 30 mg/l as a daily average only if the abatement efficiency is ≥ 80 % as a yearly average or as an average over the production period.
(8) The BAT-AEL may not apply when the temperature of the waste water is low (e.g. below 12 °C) for prolonged periods.
(9) The upper end of the range is:
— 4 mg/l for dairies and starch installations producing modified and/or hydrolysed starch;
— 5 mg/l for fruit and vegetable installations;
— 10 mg/l for oilseed processing and vegetable oil refining installations carrying out soap-stock splitting;as daily averages only if the abatement efficiency is ≥ 95 % as a yearly average or as an average over the production period.

The associated monitoring is given in BAT 4.

1.8. Noise

BAT 13. In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to set up, implement and regularly review a noise management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:

— a protocol containing actions and timelines;

— a protocol for conducting noise emissions monitoring;

— a protocol for response to identified noise events, e.g. complaints;

— a noise reduction programme designed to identify the source(s), to measure/estimate noise and vibration exposure, to characterise the contributions of the sources and to implement prevention and/or reduction measures.

Applicability

BAT 13 is only applicable to cases where a noise nuisance at sensitive receptors is expected and/or has been substantiated.

BAT 14. In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
(a)	Appropriate location of equipment and buildings	Noise levels can be reduced by increasing the distance between the emitter and the receiver, by using buildings as noise screens and by relocating buildings' exits or entrances.	For existing plants, the relocation of equipment and buildings' exits or entrances may not be applicable due to lack of space and/or excessive costs.

Technique		Description	Applicability
(b)	Operational measures	These include: (i) improved inspection and maintenance of equipment; (ii) closing of doors and windows of enclosed areas, if possible; (iii) equipment operation by experienced staff; (iv) avoidance of noisy activities at night, if possible; (v) provisions for noise control, e.g. during maintenance activities.	Generally applicable.
(c)	Low-noise equipment	This includes low-noise compressors, pumps and fans.	
(d)	Noise control equipment	This includes: (i) noise reducers; (ii) insulation of equipment; (iii) enclosure of noisy equipment; (iv) soundproofing of buildings.	May not be applicable to existing plants due to lack of space.
(e)	Noise abatement	Inserting obstacles between emitters and receivers (e.g. protection walls, embankments and buildings).	Applicable only to existing plants, as the design of new plants should make this technique unnecessary. For existing plants, the insertion of obstacles may not be applicable due to lack of space.

1.9. **Odour**

BAT 15. In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:

— A protocol containing actions and timelines.

— A protocol for conducting odour monitoring. It may be complemented by measurement/estimation of odour exposure or estimation of odour impact.

— A protocol for response to identified odour incidents, e.g. complaints.

— An odour prevention and reduction programme designed to identify the source(s); to measure/estimate odour exposure; to characterise the contributions of the sources; and to implement prevention and/or reduction measures.

Applicability

BAT 15 is only applicable to cases where an odour nuisance at sensitive receptors is expected and/or has been substantiated.

2. BAT CONCLUSIONS FOR ANIMAL FEED

The BAT conclusions presented in this section apply to animal feed. They apply in addition to the general BAT conclusions given in Section 1.

2.1. **Energy efficiency**

2.1.1. *Compound feed/Pet food*

General techniques to increase energy efficiency are given in Section 1.3 of these BAT conclusions. Indicative environmental performance levels are presented in the table below.

Table 2

Indicative environmental performance levels for specific energy consumption

Product	Unit	Specific energy consumption (yearly average)
Compound feed	MWh/tonne of products	0,01-0,10 (1) (2) (3)
Dry pet food		0,39-0,50
Wet pet food		0,33-0,85

(1) The lower end of the range can be achieved when pelleting is not applied.
(2) The specific energy consumption level may not apply when fish and other aquatic animals are used as raw material.
(3) The upper end of the range is 0,12 MWh/tonne of products for installations located in cold climates and/or when heat treatment is used for Salmonella decontamination.

2.1.2. *Green fodder*

BAT 16. In order to increase energy efficiency in green fodder processing, BAT is to use an appropriate combination of the techniques specified in BAT 6 and of the techniques given below.

Technique		Description	Applicability
(a)	Use of predried fodder	Use of fodder that has been predried (e.g. by flat pre-wilting).	Not applicable in the case of the wet process.
(b)	Recycling of waste gas from the dryer	Injection of the waste gas from the cyclone into the burner of the dryer.	Generally applicable.
(c)	Use of waste heat for pre-drying	The heat of the outlet steam from the high-temperature dryers is used for predrying part or all of the green fodder.	

2.2. **Water consumption and waste water discharge**

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. The indicative environmental performance level is presented in the table below.

Table 3

Indicative environmental performance level for specific waste water discharge

Product	Unit	Specific waste water discharge (yearly average)
Wet pet food	m^3/tonne of products	1.3-2.4

2.3. **Emissions to air**

BAT 17. In order to reduce channelled dust emissions to air, BAT is to use one of the techniques given below.

Technique		Description	Applicability
a	Bag filter	See Section 14.2.	May not be applicable to the abatement of sticky dust.
b	Cyclone		Generally applicable.

Table 4

BAT-associated emission levels (BAT-AELs) for channelled dust emissions to air from grinding and pellet cooling in compound feed manufacture

Parameter	Specific process	Unit	BAT-AEL (average over the sampling period)	
			New plants	Existing plants
Dust	Grinding	mg/Nm^3	< 2-5	< 2-10
	Pellet cooling		< 2-20	

The associated monitoring is given in BAT 5.

3. BAT CONCLUSIONS FOR BREWING

The BAT conclusions presented in this section apply to brewing. They apply in addition to the general BAT conclusions given in Section 1.

3.1. Energy efficiency

BAT 18. In order to increase energy efficiency, BAT is to use an appropriate combination of the techniques specified in BAT 6 and of the techniques given below.

Technique		Description	Applicability
(a)	Mashing-in at higher temperatures	The mashing-in of the grain is carried out at temperatures of approximately 60 °C, which reduces the use of cold water.	May not be applicable due to the product specifications.
(b)	Decrease of the evaporation rate during wort boiling	The evaporation rate can be reduced from 10 % down to approximately 4 % per hour (e.g. by two-phase boiling systems, dynamic low-pressure boiling).	
(c)	Increase of the degree of high-gravity brewing	Production of concentrated wort, which reduces its volume and thereby saves energy.	

Table 5

Indicative environmental performance level for specific energy consumption

Unit	Specific energy consumption (yearly average)
MWh/hl of products	0,02-0,05

3.2. Water consumption and waste water discharge

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. The indicative environmental performance level is presented in the table below.

Table 6

Indicative environmental performance level for specific waste water discharge

Unit	Specific waste water discharge (yearly average)
m^3/hl of products	0,15-0,50

3.3. **Waste**

BAT 19. In order to reduce the quantity of waste sent for disposal, BAT is to use one or both of the techniques given below.

Technique		Description
(a)	Recovery and (re)use of yeast after fermentation	After fermentation, yeast is collected and can be partially reused in the fermentation process and/or may be further used for multiple purposes, e.g. as animal feed, in the pharmaceutical industry, as a food ingredient, in an anaerobic waste water treatment plant for biogas production.
(b)	Recovery and (re)use of natural filter material	After chemical, enzymatic or thermal treatment, natural filter material (e.g. diatomaceous earth) may be partially reused in the filtration process. Natural filter material can also be used, e.g. as a soil improver.

3.4. **Emissions to air**

BAT 20. In order to reduce channelled dust emissions to air, BAT is to use a bag filter or both a cyclone and a bag filter.

Description

See Section 14.2.

Table 7

BAT-associated emission levels (BAT-AELs) for channelled dust emissions to air from handling and processing of malt and adjuncts

Parameter	Unit	BAT-AEL (average over the sampling period)	
		New plants	Existing plants
Dust	mg/Nm³	< 2-5	< 2-10

The associated monitoring is given in BAT 5.

4. BAT CONCLUSIONS FOR DAIRIES

The BAT conclusions presented in this section apply to dairies. They apply in addition to the general BAT conclusions given in Section 1.

4.1. **Energy efficiency**

BAT 21. In order to increase energy efficiency, BAT is to use an appropriate combination of the techniques specified in BAT 6 and of the techniques given below.

Technique		Description
(a)	Partial milk homogenisation	The cream is homogenised together with a small proportion of skimmed milk. The size of the homogeniser can be significantly reduced, leading to energy savings.
(b)	Energy-efficient homogeniser	The homogeniser's working pressure is reduced through optimised design and thus the associated electrical energy needed to drive the system is also reduced.
(c)	Use of continuous pasteurisers	Flow-through heat exchangers are used (e.g. tubular, plate and frame). The pasteurisation time is much shorter than that of batch systems.
(d)	Regenerative heat exchange in pasteurisation	The incoming milk is preheated by the hot milk leaving the pasteurisation section.
(e)	Ultra-high-temperature (UHT) processing of milk without intermediate pasteurisation	UHT milk is produced in one step from raw milk, thus avoiding the energy needed for pasteurisation.
(f)	Multi-stage drying in powder production	A spray-drying process is used in combination with a downstream dryer, e.g. fluidised bed dryer.
(g)	Precooling of ice-water	When ice-water is used, the returning ice-water is precooled (e.g. with a plate heat exchanger), prior to final cooling in an accumulating ice-water tank with a coil evaporator.

Table 8

Indicative environmental performance levels for specific energy consumption

Main product (at least 80 % of the production)	Unit	Specific energy consumption (yearly average)
Market milk	MWh/tonne of raw materials	0,1-0,6
Cheese		0,10-0,22 (1)
Powder		0,2-0,5
Fermented milk		0,2-1,6

(1) The specific energy consumption level may not apply when raw materials other than milk are used.

4.2. Water consumption and waste water discharge

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. Indicative environmental performance levels are presented in the table below.

Table 9

Indicative environmental performance levels for specific waste water discharge

Main product (at least 80 % of the production)	Unit	Specific waste water discharge (yearly average)
Market milk	m^3/tonne of raw materials	0,3-3,0
Cheese		0,75-2,5
Powder		1,2-2,7

4.3. **Waste**

BAT 22. In order to reduce the quantity of waste sent for disposal, BAT is to use one or a combination of the techniques given below.

	Technique	Description
Techniques related to the use of centrifuges		
(a)	Optimised operation of centrifuges	Operation of centrifuges according to their specifications to minimise the rejection of product.
Techniques related to butter production		
(b)	Rinsing of the cream heater with skimmed milk or water	Rinsing of the cream heater with skimmed milk or water which is then recovered and reused, before the cleaning operations.
Techniques related to ice cream production		
(c)	Continuous freezing of ice cream	Continuous freezing of ice cream using optimised start-up procedures and control loops that reduce the frequency of stoppages.
Techniques related to cheese production		
(d)	Minimisation of the generation of acid whey	Whey from the manufacture of acid-type cheeses (e.g. cottage cheese, quark and mozzarella) is processed as quickly as possible to reduce the formation of lactic acid.
(e)	Recovery and use of whey	Whey is recovered (if necessary using techniques such as evaporation or membrane filtration) and used, e.g. to produce whey powder, demineralised whey powder, whey protein concentrates or lactose. Whey and whey concentrates can also be used as animal feed or as a carbon source in a biogas plant.

4.4. **Emissions to air**

BAT 23. In order to reduce channelled dust emissions to air from drying, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
(a)	Bag filter	See Section 14.2.	May not be applicable to the abatement of sticky dust.
(b)	Cyclone		Generally applicable.
(c)	Wet scrubber		

Table 10

BAT-associated emission level (BAT-AEL) for channelled dust emissions to air from drying

Parameter	Unit	BAT-AEL (average over the sampling period)
Dust	mg/Nm^3	< 2-10 (1)

(1) The upper end of the range is 20 mg/Nm^3 for drying of demineralised whey powder, casein and lactose.

The associated monitoring is given in BAT 5.

5. BAT CONCLUSIONS FOR ETHANOL PRODUCTION

The BAT conclusion presented in this section applies to ethanol production. It applies in addition to the general BAT conclusions given in Section 1.

5.1. **Waste**

BAT 24. In order to reduce the quantity of waste sent for disposal, BAT is to recover and (re)use yeast after fermentation.

Description

See BAT 19a. The yeast may not be recovered when the stillage is used as animal feed.

6. BAT CONCLUSIONS FOR FISH AND SHELLFISH PROCESSING

The BAT conclusions presented in this section apply to fish and shellfish processing. They apply in addition to the general BAT conclusions given in Section 1.

6.1. **Water consumption and waste water discharge**

BAT 25. In order to reduce water consumption and the volume of waste water discharged, BAT is to use an appropriate combination of the techniques specified in BAT 7 and of the techniques given below.

Technique		Description
(a)	Removal of fat and viscera by vacuum	Use of vacuum suction instead of water to remove fat and viscera from the fish.
(b)	Dry transport of fat, viscera, skin and fillets	Use of conveyors instead of water.

6.2. **Emissions to air**

BAT 26. In order to reduce channelled emissions of organic compounds to air from fish smoking, BAT is to use one or a combination of the techniques given below.

Technique		Description
(a)	Biofilter	The waste gas stream is passed through a bed of organic material (such as peat, heather, root, tree bark, compost, softwood and different kinds of combinations) or some inert material (such as clay, activated carbon, and polyurethane), where organic (and some inorganic) components are transformed by naturally occurring microorganisms into carbon dioxide, water, other metabolites and biomass.
(b)	Thermal oxidation	See Section 14.2.
(c)	Non-thermal plasma treatment	
(d)	Wet scrubber	See Section 14.2. An electrostatic precipitator is commonly used as a pre-treatment step.
(e)	Use of purified smoke	Smoke generated from purified primary smoke condensates is used to smoke the product in a smoke chamber.

Table 11

BAT-associated emission level (BAT-AEL) for channelled TVOC emissions to air from a smoke chamber

Parameter	Unit	BAT-AEL (average over the sampling period)
TVOC	mg/Nm^3	15–50 (1) (2)

(1) The lower end of the range is typically achieved when using thermal oxidation.
(2) The BAT-AEL does not apply when the TVOC emission load is below 500 g/h.

The associated monitoring is given in BAT 5.

7. BAT CONCLUSIONS FOR THE FRUIT AND VEGETABLE SECTOR

The BAT conclusions presented in this section apply to the fruit and vegetable sector. They apply in addition to the general BAT conclusions given in Section 1.

7.1. Energy efficiency

BAT 27. In order to increase energy efficiency, BAT is to use an appropriate combination of the techniques specified in BAT 6 and to cool fruit and vegetables before deep freezing.

Description

The temperature of the fruit and vegetables is lowered to around 4 °C before they enter the freezing tunnel by bringing them into direct or indirect contact with cold water or cooling air. Water can be removed from the food and then collected for reuse in the cooling process.

Table 12

Indicative environmental performance levels for specific energy consumption

Specific process	Unit	Specific energy consumption (yearly average)
Potato processing (excluding starch production)	MWh/tonne of products	1,0-2,1 (1)
Tomato processing		0,15-2,4 (2) (3)

(1) The specific energy consumption level may not apply to the production of potato flakes and powder.
(2) The lower end of the range is typically associated with the production of peeled tomatoes.
(3) The upper end of the range is typically associated with the production of tomato powder or concentrate.

7.2. Water consumption and waste water discharge

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. Indicative environmental performance levels are presented in the table below.

Table 13

Indicative environmental performance levels for specific waste water discharge

Specific process	Unit	Specific waste water discharge (yearly average)
Potato processing (excluding starch production)	m^3/tonne of products	4,0-6,0 (1)
Tomato processing when water recycling is possible		8,0-10,0 (2)

(1) The specific waste water discharge level may not apply to the production of potato flakes and powder.
(2) The specific waste water discharge level may not apply to the production of tomato powder.

8. BAT CONCLUSIONS FOR GRAIN MILLING

The BAT conclusions presented in this section apply to grain milling. They apply in addition to the general BAT conclusions given in Section 1.

8.1. **Energy efficiency**

General techniques to increase energy efficiency are given in Section 1.3 of these BAT conclusions. The indicative environmental performance level is presented in the table below.

Table 14

Indicative environmental performance level for specific energy consumption

Unit	Specific energy consumption (yearly average)
MWh/tonne of products	0,05-0,13

8.2. **Emissions to air**

BAT 28. In order to reduce channelled dust emissions to air, BAT is to use a bag filter.

Description

See Section 14.2.

Table 15

BAT-associated emission level (BAT-AEL) for channelled dust emissions to air from grain milling

Parameter	Unit	BAT-AEL (average over the sampling period)
Dust	mg/Nm^3	< 2-5

The associated monitoring is given in BAT 5.

9. BAT CONCLUSIONS FOR MEAT PROCESSING

The BAT conclusions presented in this section apply to meat processing. They apply in addition to the general BAT conclusions given in Section 1.

9.1. **Energy efficiency**

General techniques to increase energy efficiency are given in Section 1.3 of these BAT conclusions. The indicative environmental performance level is presented in the table below.

Table 16

Indicative environmental performance level for specific energy consumption

Unit	Specific energy consumption (yearly average)
MWh/tonne of raw materials	0,25-2,6 (1) (2)

(1) The specific energy consumption level does not apply to the production of ready meals and soups.
(2) The upper end of the range may not apply in the case of a high percentage of cooked products.

9.2. **Water consumption and waste water discharge**

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. The indicative environmental performance level is presented in the table below.

Table 17

Indicative environmental performance level for specific waste water discharge

Unit	Specific waste water discharge(yearly average)
m^3/tonne of raw materials	1,5-8,0 (1)

(1) The specific waste water discharge level does not apply to processes using direct water cooling and to the production of ready meals and soups.

9.3. Emissions to air

BAT 29. In order to reduce channelled emissions of organic compounds to air from meat smoking, BAT is to use one or a combination of the techniques given below.

Technique		Description
(a)	Adsorption	Organic compounds are removed from a waste gas stream by retention on a solid surface (typically activated carbon).
(b)	Thermal oxidation	See Section 14.2.
(c)	Wet scrubber	See Section 14.2. An electrostatic precipitator is commonly used as a pretreatment step.
(d)	Use of purified smoke	Smoke generated from purified primary smoke condensates is used to smoke the product in a smoke chamber.

Table 18

BAT-associated emission level (BAT-AEL) for channelled TVOC emissions to air from a smoke chamber

Parameter	Unit	BAT-AEL (average over the sampling period)
TVOC	mg/Nm^3	3-50 (1) (2)

(1) The lower end of the range is typically achieved when using adsorption or thermal oxidation.
(2) The BAT-AEL does not apply when the TVOC emission load is below 500 g/h.

The associated monitoring is given in BAT 5.

10. BAT CONCLUSIONS FOR OILSEED PROCESSING AND VEGETABLE OIL REFINING

The BAT conclusions presented in this section apply to oilseed processing and vegetable oil refining. They apply in addition to the general BAT conclusions given in Section 1.

10.1. Energy efficiency

BAT 30. In order to increase energy efficiency, BAT is to use an appropriate combination of the techniques specified in BAT 6 and to generate an auxiliary vacuum.

Description

The auxiliary vacuum used for oil drying, oil degassing or minimisation **of** oil oxidation is generated by pumps, steam injectors, etc. The vacuum reduces the amount of thermal energy needed for these process steps.

Table 19

Indicative environmental performance levels for specific energy consumption

Specific process	Unit	Specific energy consumption (yearly average)
Integrated crushing and refining of rapeseeds and/or sunflower seeds	MWh/tonne of oil produced	0,45-1,05
Integrated crushing and refining of soybeans		0,65-1,65
Stand-alone refining		0,1-0,45

10.2. **Water consumption and waste water discharge**

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. Indicative environmental performance levels are presented in the table below.

Table 20

Indicative environmental performance levels for specific waste water discharge

Specific process	Unit	Specific waste water discharge (yearly average)
Integrated crushing and refining of rapeseeds and/or sunflower seeds	m^3/tonne of oil produced	0,15-0,75
Integrated crushing and refining of soybeans		0,8-1,9
Stand-alone refining		0,15-0,9

10.3. **Emissions to air**

BAT 31. In order to reduce channelled dust emissions to air, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
(a)	Bag filter	See Section 14.2.	May not be applicable to the abatement of sticky dust.
(b)	Cyclone		Generally applicable.
(c)	Wet scrubber		

Table 21

BAT-associated emission levels (BAT-AELs) for channelled dust emissions to air from handling and preparation of seeds as well as drying and cooling of meal

Parameter	Unit	BAT-AEL (average over the sampling period)	
		New plants	Existing plants
Dust	mg/Nm^3	< 2-5 [1]	< 2-10 [1]

[1] The upper end of the range is 20 mg/Nm^3 for drying and cooling of meal.

The associated monitoring is given in BAT 5.

10.4. **Hexane losses**

BAT 32. In order to reduce the hexane losses from oilseed processing and refining, BAT is to use all of the techniques given below.

Technique		Description
(a)	Countercurrent flow of meal and steam in the desolventiser-toaster	Hexane is removed from the hexane-laden meal in a desolventiser-toaster, involving a countercurrent flow of steam and meal.
(b)	Evaporation from the oil/hexane mixture	Hexane is removed from the oil/hexane mixture using evaporators. The vapours from the desolventiser-toaster (steam/hexane mixture) are used to provide thermal energy in the first stage of the evaporation.
(c)	Condensation in combination with a mineral oil wet scrubber	Hexane vapours are cooled to below their dew point so that they condense. Uncondensed hexane is absorbed in a scrubber using mineral oil as a scrubbing liquid for subsequent recovery.
(d)	Gravitational phase separation in combination with distillation	Undissolved hexane is separated from the aqueous phase by means of a gravitational phase separator. Any residual hexane is distilled off by heating the aqueous phase to approximately 80-95 °C.

Table 22

BAT-associated emission levels (BAT-AELs) for hexane losses from oilseed processing and refining

Parameter	Type of seeds or beans processed	Unit	BAT-AEL (yearly average)
Hexane losses	Soybeans	kg/tonne of seeds or beans processed	0,3-0,55
	Rapeseeds and sunflower seeds		0,2-0,7

11. BAT CONCLUSIONS FOR SOFT DRINKS AND NECTAR/JUICE MADE FROM PROCESSED FRUIT AND VEGETABLES

The BAT conclusions presented in this section apply to soft drinks and nectar/juice made from processed fruit and vegetables. They apply in addition to the general BAT conclusions given in Section 1.

11.1. **Energy efficiency**

BAT 33. In order to increase energy efficiency, BAT is to use an appropriate combination of the techniques specified in BAT 6 and of the techniques given below.

Technique		Description	Applicability
(a)	Single pasteuriser for nectar/juice production	Use of one pasteuriser for both the juice and the pulp instead of using two separate pasteurisers.	May not be applicable due to the pulp particle size.
(b)	Hydraulic sugar transportation	Sugar is transported to the production process with water. As some of the sugar is already dissolved during the transportation, less energy is needed in the process for dissolving sugar.	Generally applicable.
(c)	Energy-efficient homogeniser for nectar/juice production	See BAT 21b.	

Table 23

Indicative environmental performance level for specific energy consumption

Unit	Specific energy consumption (yearly average)
MWh/hl of products	0,01-0,035

11.2. **Water consumption and waste water discharge**

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. The indicative environmental performance level is presented in the table below.

Table 24

Indicative environmental performance level for specific waste water discharge

Unit	Specific waste water discharge (yearly average)
m^3/hl of products	0,08-0,20

12. BAT CONCLUSIONS FOR STARCH PRODUCTION

The BAT conclusions presented in this section apply to starch production. They apply in addition to the general BAT conclusions given in Section 1.

12.1. **Energy efficiency**

General techniques to increase energy efficiency are given in Section 1.3 of these BAT conclusions. Indicative environmental performance levels are presented in the table below.

Table 25

Indicative environmental performance levels for specific energy consumption

Specific process	Unit	Specific energy consumption (yearly average)
Potato processing for the production of native starch only	MWh/tonne of raw materials (1)	0,08-0,14
Maize and/or wheat processing for the production of native starch in combination with modified and/or hydrolysed starch		0,65-1,25 (2)

(1) The amount of raw materials refers to gross tonnage.
(2) The specific energy consumption level does not apply to the production of polyols.

12.2. **Water consumption and waste water discharge**

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. Indicative environmental performance levels are presented in the table below.

Table 26

Indicative environmental performance levels for specific waste water discharge

Specific process	Unit	Specific waste water discharge (yearly average)
Potato processing for the production of native starch only	m^3/tonne of raw materials (1)	0,4-1,15
Maize and/or wheat processing for the production of native starch in combination with modified and/or hydrolysed starch		1,1-3,9 (2)

(1) The amount of raw materials refers to gross tonnage.
(2) The specific waste water discharge level does not apply to the production of polyols.

12.3. **Emissions to air**

BAT 34. In order to reduce channelled dust emissions to air from starch, protein and fibre drying, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
(a)	Bag filter	See Section 14.2.	May not be applicable to the abatement of sticky dust.
(b)	Cyclone		Generally applicable.
(c)	Wet scrubber		

Table 27

BAT-associated emission levels (BAT-AELs) for channelled dust emissions to air from starch, protein and fibre drying

Parameter	Unit	BAT-AEL (average over the sampling period)	
		New plants	Existing plants
Dust	mg/Nm^3	< 2-5 (1)	< 2-10 (1)

(1) When a bag filter is not applicable, the upper end of the range is 20 mg/Nm^3.

The associated monitoring is given in BAT 5.

13. BAT CONCLUSIONS FOR SUGAR MANUFACTURING

The BAT conclusions presented in this section apply to sugar manufacturing. They apply in addition to the general BAT conclusions given in Section 1.

13.1. **Energy efficiency**

BAT 35. In order to increase the energy efficiency, BAT is to use an appropriate combination of the techniques specified in BAT 6 and one or a combination of the techniques given below.

Technique		Description	Applicability
(a)	Pressing of beet pulp	The beet pulp is pressed to a dry matter content of typically 25-32 wt-%.	Generally applicable.
(b)	Indirect drying (steam drying) of beet pulp	Drying of beet pulp by the use of superheated steam.	May not be applicable to existing plants due to the need for a complete reconstruction of the energy facilities.
(c)	Solar drying of beet pulp	Use of solar energy to dry beet pulp.	May not be applicable due to local climatic conditions and/or lack of space.
(d)	Recycling of hot gases	Recycling of hot gases (e.g. waste gases from the dryer, boiler or combined heat and power plant).	Generally applicable.
(e)	Low-temperature (pre)drying of beet pulp	Direct (pre)drying of beet pulp using drying gas, e.g. air or hot gas.	

Table 28

Indicative environmental performance level for specific energy consumption

Specific process	Unit	Specific energy consumption (yearly average)
Sugar beet processing	MWh/tonne of beets	0,15-0,40 (1)

(1) The upper end of the range may include the energy consumption of the lime kilns and dryers.

13.2. Water consumption and waste water discharge

General techniques to reduce water consumption and the volume of waste water discharged are given in Section 1.4 of these BAT conclusions. The indicative environmental performance level is presented in the table below.

Table 29

Indicative environmental performance level for specific waste water discharge

Specific process	Unit	Specific waste water discharge (yearly average)
Sugar beet processing	m^3/tonne of beets	0,5-1,0

13.3. Emissions to air

BAT 36. In order to prevent or reduce channelled dust emissions to air from beet pulp drying, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
(a)	Use of gaseous fuels	See Section 14.2.	May not be applicable due to the constraints associated with the availability of gaseous fuels.
(b)	Cyclone		Generally applicable.
(c)	Wet scrubber		
(d)	Indirect drying (steam drying) of beet pulp	See BAT 35b.	May not be applicable to existing plants due to the need for a complete reconstruction of the energy facilities.
(e)	Solar drying of beet pulp	See BAT 35c.	May not be applicable due to local climatic conditions and/or lack of space.
(f)	Low-temperature (pre)drying of beet pulp	See BAT 35e.	Generally applicable.

Table 30

BAT-associated emission level (BAT-AEL) for channelled dust emissions to air from beet pulp drying in the case of high-temperature drying (above 500 °C)

Parameter	Unit	BAT-AEL (average over the sampling period)	Reference oxygen level (O_R)	Reference gas condition
Dust	mg/Nm³	5-100	16 vol-%	No correction for water content

The associated monitoring is given in BAT 5.

BAT 37. In order to reduce channelled SO_X emissions to air from high-temperature beet pulp drying (above 500 °C), BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
(a)	Use of natural gas	—	May not be applicable due to the constraints associated with the availability of natural gas.
(b)	Wet scrubber	See Section 14.2.	Generally applicable.
(c)	Use of fuels with low sulphur content	—	Only applicable when natural gas is not available.

Table 31

BAT-associated emission level (BAT-AEL) for channelled SO_X emissions to air from beet pulp drying in the case of high-temperature drying (above 500 °C) when natural gas is not used

Parameter	Unit	BAT-AEL (average over the sampling period) (1)	Reference oxygen level (O_R)	Reference gas condition
SO_X	mg/Nm³	30-100	16 vol-%	No correction for water content

(1) When using exclusively biomass as a fuel, emission levels are expected to be at the lower end of the range.

The associated monitoring is given in BAT 5.

14. DESCRIPTION OF TECHNIQUES

14.1. **Emissions to water**

Technique	Description
Activated sludge process	A biological process in which the microorganisms are maintained in suspension in the waste water and the whole mixture is mechanically aerated. The activated sludge mixture is sent to a separation facility from where the sludge is recycled to the aeration tank.
Aerobic lagoon	Shallow earthen basins for the biological treatment of waste water, the content of which is periodically mixed to allow oxygen to enter the liquid through atmospheric diffusion.
Anaerobic contact process	An anaerobic process in which waste water is mixed with recycled sludge and then digested in a sealed reactor. The water/sludge mixture is separated externally.
Precipitation	The conversion of dissolved pollutants into insoluble compounds by adding chemical precipitants. The solid precipitates formed are subsequently separated by sedimentation, air flotation, or filtration. Multivalent metal ions (e.g. calcium, aluminium, iron) are used for phosphorus precipitation.
Coagulation and flocculation	Coagulation and flocculation are used to separate suspended solids from waste water and are often carried out in successive steps. Coagulation is carried out by adding coagulants with charges opposite to those of the suspended solids. Flocculation is carried out by adding polymers, so that collisions of microfloc particles cause them to bond to produce larger flocs.
Equalisation	Balancing of flows and pollutant loads by using tanks or other management techniques.
Enhanced biological phosphorus removal	A combination of aerobic and anaerobic treatment to selectively enrich polyphosphate-accumulating microorganisms in the bacterial community within the activated sludge. These microorganisms take up more phosphorus than is required for normal growth.
Filtration	The separation of solids from waste water by passing it through a porous medium, e.g. sand filtration, microfiltration and ultrafiltration.
Flotation	The separation of solid or liquid particles from waste water by attaching them to fine gas bubbles, usually air. The buoyant particles accumulate at the water surface and are collected with skimmers.
Membrane bioreactor	A combination of activated sludge treatment and membrane filtration. Two variants are used: a) an external recirculation loop between the activated sludge tank and the membrane module; and b) immersion of the membrane module in the aerated activated sludge tank, where the effluent is filtered through a hollow fibre membrane, with the biomass remaining in the tank.
Neutralisation	The adjustment of the pH of waste water to a neutral level (approximately 7) by the addition of chemicals. Sodium hydroxide (NaOH) or calcium hydroxide ($Ca(OH)_2$) is generally used to increase the pH, whereas sulphuric acid (H_2SO_4), hydrochloric acid (HCl) or carbon dioxide (CO_2) is generally used to decrease the pH. The precipitation of some substances may occur during neutralisation.
Nitrification and/or denitrification	A two-step process that is typically incorporated into biological waste water treatment plants. The first step is the aerobic nitrification where microorganisms oxidise ammonium (NH_4^+) to the intermediate nitrite (NO_2^-), which is then further oxidised to nitrate (NO_3^-). In the subsequent anoxic denitrification step, microorganisms chemically reduce nitrate to nitrogen gas.

Technique	Description
Partial nitritation — Anaerobic ammonium oxidation	A biological process that converts ammonium and nitrite into nitrogen gas under anaerobic conditions. In waste water treatment, anaerobic ammonium oxidation is preceded by a partial nitrification (i.e. nitritation) that converts about half of the ammonium (NH_4^+) into nitrite (NO_2^-).
Phosphorus recovery as struvite	Phosphorus is recovered by precipitation in the form of struvite (magnesium ammonium phosphate).
Sedimentation	The separation of suspended particles by gravitational settling.
Upflow anaerobic sludge blanket (UASB) process	An anaerobic process in which waste water is introduced at the bottom of the reactor from where it flows upward through a sludge blanket composed of biologically formed granules or particles. The waste water phase passes into a settling chamber where the solid content is separated; the gases are collected in domes at the top of the reactor.

14.2. **Emissions to air**

Technique	Description
Bag filter	Bag filters, often referred to as fabric filters, are constructed from porous woven or felted fabric through which gases are passed to remove particles. The use of a bag filter requires the selection of a fabric suitable for the characteristics of the waste gas and the maximum operating temperature.
Cyclone	Dust control system based on centrifugal force, whereby heavier particles are separated from the carrier gas.
Non-thermal plasma treatment	Abatement technique based on creating a plasma (i.e. an ionised gas consisting of positive ions and free electrons in proportions resulting in more or less no overall electric charge) in the waste gas by using a strong electrical field. The plasma oxidises organic and inorganic compounds.
Thermal oxidation	The oxidation of combustible gases and odorants in a waste gas stream by heating the mixture of contaminants with air or oxygen to above its auto-ignition point in a combustion chamber and maintaining it at a high temperature long enough to complete its combustion to carbon dioxide and water.
Use of gaseous fuels	Switching from the combustion of a solid fuel (e.g. coal) to the combustion of a gaseous fuel (e.g. natural gas, biogas) that is less harmful in terms of emissions (e.g. low sulphur content, low ash content or better ash quality).
Wet scrubber	The removal of gaseous or particulate pollutants from a gas stream via mass transfer to a liquid solvent, often water or an aqueous solution. It may involve a chemical reaction (e.g. in an acid or alkaline scrubber). In some cases, the compounds may be recovered from the solvent.