Creative Foods Europe Ltd

Environmental Permit Variation

EPR Ref: CP3105BD/T001

BAT Assessment – Food, Drink and Milk Industries

Document Ref: Attachment C.3.2

Application Date: 9th January 2020

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Conclusions on BAT from the Food, Drink and Milk Industries BAT Reference Document

The full and complete 2019 Food, Drink and Milk Industries BAT reference document is available at the EIPPC Bureau website:

SCOPE

Assess the operation of the proposed effluent treatment plant (ETP), which come within the scope of the conclusions on BAT from the Food, Drink and Milk Industries BAT reference documents, and is the change being made to the Burton Plant site by the new operator.

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
5.1 General BAT for the whole FDM sector		
BAT 1. BAT is to ensure, e.g. by training, that employees are aware of the environmental aspects of the company's operations and their personal responsibilities.	All relevant staff are trained in the requirements of the site Environmental Management System. All staff will be made aware of and have access to the site environmental policy and performance via notice boards.	
BAT 2. BAT is to design/select equipment, which optimises consumption and emission levels and facilitates correct operation and maintenance, e.g. to optimise the pipework system for the capacity to minimise product losses and install pipes at a gradient to promote self-draining.	All ETP equipment will be designed/selected by the appropriate personnel. Environmental aspects, such as energy consumption, odour and noise generation will be considered	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
	when designing/selecting new equipment.	
BAT3. BAT is to control noise emissions at source by designing, selecting, operating and maintaining equipment, including vehicles to avoid or reduce exposure and, where further reductions in noise levels are required, enclosing noisy equipment.	The site has a noise management plan in place. Weekly noise patrols will be carried out at the site boundary as part of an environmental checksheet. The ETP operator will inspect all equipment on a daily basis.	Updated the NMP once the new ETP is fully operational
BAT 4. BAT is to operate regular maintenance programmes.	All equipment will be included as part of a preventative maintenance programme. All equipment will be inspected daily by the ETP operator. Equipment such as Probe will be calibrated annually by an external body.	
BAT 5. BAT is to apply and maintain a methodology for preventing and minimising the consumption of water and energy and the production of waste incorporating: 5.1 obtaining management commitment, organisation and planning 5.2 analysis of production processes, including individual process steps to identify areas of high water and energy consumption and high waste emissions to	Water and energy consumption form part of the site EMS. Water and energy assessed against tones of finished product.	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
identify opportunities to minimise these, taking into account the water quality requirements for each application, hygiene and food safety 5.3 assessment of objectives, targets and system borders 5.4 identification of options for minimising water and energy consumption, and waste production, using a systematic approach, such as pinch technology 5.5 carrying out an evaluation and doing a feasibility study 5.6 implementing a programme for minimising the consumption of water and energy and waste production 5.7 ongoing monitoring of water and energy consumption; waste production levels and the effectiveness of control measures. This can involve both measurement and visual inspection	Water and energy assessed during annual register of aspects review. Water and energy consumption is continuously monitoring throughout the site. EMS OP10: Energy Management Procedure in place. EMS OP11: Water & Effluent Management Procedure in place. OP07 Green House Keeping Procedure in place to reduce energy consumption.	
BAT 6. BAT is to implement a system for monitoring and reviewing consumption and emission levels for both individual production processes and at site level, to enable actual performance levels to be optimised. Examples of parameters to monitor include: energy consumption; water consumption; waste water volumes; emissions to air and water; solid waste generation; product and by-product yield; consumption of harmful substances and frequency and severity of unplanned releases and spillages. A good knowledge of the process inputs and outputs is required to identify priority areas and options for improving environmental performance. A good monitoring system will include records of operating conditions, sampling and analytical methods and will ensure that measuring equipment is calibrated. Further information is available in the "Reference Document on the General Principles of Monitoring" [96, EC, 2003].	Emissions to atmosphere will be monitored annually as part of the servicing process. Emissions to surfacewater will be monitored annually for Mercury and Cadmium, as per the site env' permit. The following parameters will be recorded in a weekly bases: energy consumption, natural gas consumption, water consumption, refrigerant use, effluent discharge and waste volumes generated.	Assess all recorded parameters should assessed monthly against EMS targets and tonne of finished product.

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
BAT 7. BAT is to maintain an accurate inventory of inputs and outputs at all stages of the process from reception of raw materials to dispatch of products and end-of-pipe treatments.	Discharge volume will be recorded continuously. Volume of sludge removed off-site will be recorded daily. Effluent treatment chemical usage will be recorded weekly.	The site should keep a record comparing the total effluent discharge against, tonnes of finished product and water consumption on a monthly bases, as a performance indicator.
BAT 8. BAT is to apply production planning to minimise associated waste production and cleaning frequencies.	Not Applicable.	
BAT 9. BAT is to transport solid FDM raw materials, products, co-products, by-products and waste dry, including avoiding fluming except where washing involving the re-use of water is carried out during fluming and where fluming is necessary to avoid damage to the material being transported	Not Applicable.	
BAT 10. BAT is to minimise storage times for perishable materials	De-watered sludge would be removed off-site daily.	
BAT 11. BAT is to segregate outputs, to optimise use, re-use, recovery, recycling and disposal (and minimise waste water contamination).	De-watered sludge would be removed off-site for further recovery All waste packaging and chemical container would be recycled were appropriate.	
BAT 12. BAT is to prevent materials from falling on the floor, e.g. by using accurately positioned splash protectors, screens, flaps, drip trays and troughs.	Not Applicable.	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
BAT 13. BAT is to optimise the segregation of water streams, to optimise re-use and treatment	Clean surfacewater (i.e. rooftops) is directed to surfacewater drainage network.	Consider the use of uncontaminated water for washing of external areas.
BAT 14. BAT is to collect water streams, such as condensate and cooling water separately to optimise reuse.	Not Applicable.	
BAT 15. BAT is to avoid using more energy than needed for heating and cooling processes, without harming the product.	No temperature adjusting process are to be utilises in the ETP design.	
BAT 16. BAT is to apply good housekeeping.	Good housekeeping will be part of the ETP operators' daily duties.	Include an ETP specific good housekeeping procedure in the site EMS.
BAT 17. BAT is to minimise noise nuisance from vehicles.	The site has a noise management plan in place. All vehicle engines will be switched off when not in use. Forklift will be regularly maintained and serviced annually.	
BAT 18. BAT is to apply storage and handling methods as concluded in the "Storage BREF" [95, EC, 2005]. Further controls may be required to provide and maintain the required hygiene and food safety standards	All ETP chemicals will be appropriately bunded.	Carry out a bund integrity assessment every three years.

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
BAT 19. BAT is to optimise the application and use of process controls to, e.g. prevent and minimise the consumption of water and energy and to minimise the generation of waste and in particular: 19.1 where heat processes are applied and/or materials are stored or transferred at critical temperatures, or within critical temperature ranges, to control the temperature by dedicated measurement and correction, 19.2 where materials are pumped or flow, to control flow and/or level, by dedicated measurement of pressure and/or dedicated measurement of flow and/or dedicated measurement of level and using control devices, such as valves 19.3 where liquids are stored or reacted in tanks or vessels, either during manufacturing or cleaning processes, use level-detecting sensors and level measurement sensors, 19.4 to use analytical measurement and control techniques to reduce waste of material and water and reduce waste water generation in processing and cleaning and in particular to: 19.4.1 measure pH to control additions of acid or alkali and to monitor waste water streams to control mixing and neutralising prior to further treatment or discharge, 19.4.2 measure conductivity to monitor levels of dissolved salts prior to water re-use and detect levels of detergent prior to detergent re-use, 19.4.3 where fluids may be cloudy or opaque due to the presence of suspended matter, measure turbidity to monitor process water quality and to optimise both the recovery of material/product from water and the reuse of cleaning water.	Not applicable to the ETP process.	
BAT 20. BAT is to use automated water start/stop controls to supply process water only when it is required.	Process water is not required for the ETP process, only waste water.	
BAT 21. BAT is to select raw materials and auxiliary materials which minimise the generation of solid waste and harmful emissions to air and water.		

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
	OP08 Sustainable Procurement and Contractor Management Procedure in place.	
BAT 22. BAT is that landspreading is an option for the outlet of materials from the FDM sector, subject to local legislation.	No waste of by-product generated at the site will be landspread. De-watered sludge would be removed off-site for further recovery	
5.1.1 Environmental Management		
BAT 23. BAT is to implement and adhere to an Environmental Management System (EMS) that incorporates, as appropriate to individual circumstances, the following features: • definition of an environmental policy for the installation by top management (commitment of the top management is regarded as a precondition for a successful application of other features of the EMS) • planning and establishing the necessary procedures • implementation of the procedures, paying particular attention to • structure and responsibility • training, awareness and competence • communication • employee involvement • documentation • efficient process control • maintenance programmes • emergency preparedness and response • safeguarding compliance with environmental legislation. • checking performance and taking corrective action, paying particular attention to • monitoring and measurement (see also the "Reference Document on the General Principles of Monitoring")	The site Environmental Management System is the responsibility of the Head of Operations and will be based on the ISO14001 standard, and consists of: • An Environmental Policy • An Environmental Manual • An Environmental Management Plan • An Environmental Procedures Manual • An Environmental Records Manual • A Register of Aspects • Access to a Register of Legislation • Internal Audit Register • Site Effluent Discharge Licence	Include the ETP when assessing the site register of aspects. Include the ETP into the EMS, including standard operating procedures, emergency procedures and operator contact details. Include ETP records as part of the site EMS, including: flow rate, daily discharge volume, daily COD & SS analysis, chemical usage and equipment calibration.

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
• corrective and preventive action • maintenance of records • independent (where practicable) internal auditing to determine whether or not the environmental management system conforms to planned arrangements and has been properly implemented and maintained. • review by top management.		
5.1.2 Collaboration with upstream and downstream activities		
BAT 24. BAT is to seek collaboration with upstream and downstream partners, to create a chain of environmental responsibility, to minimise pollution and to protect the environment as a whole.	All suppliers will be assessed for environmental performance and accreditation. All waste will be segregated and removed for further processing by an appropriately register waste company and waste haulier.	
5.1.3 Equipment and installation cleaning		
BAT 25. BAT is to do the following: 1. remove raw material residues as soon as possible after processing and clean materials storage areas frequently 2. provide and use catchpots over floor drains and ensure they are inspected and cleaned frequently, to prevent entrainment of materials into waste water 3. optimise the use of dry cleaning (including vacuum systems) of equipment and installations, including after spillages prior to wet cleaning, where wet cleaning is necessary to achieve the required hygiene levels 4. pre-soak floors and open equipment to loosen hardened or burnt-on dirt before wet cleaning 5. manage and minimise the use of water, energy and detergents used 6. fit cleaning hoses used for manual cleaning with hand operated triggers 7. supply pressure-controlled water and do this via nozzles	All equipment have an individual CIC (cleaning instruction card) detailing the cleaning procedure. During the cleaning of any vessels or equipment, residual dry material will be removed as much as is possible prior to wet cleaning. Dry cleaning will be employed to reduce water consumption and the amount of wastewater and solids going to the foul drainage network.	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
8. optimise the application of the re-use of warm open-circuit cooling water, e.g. for cleaning 9. select and use cleaning and disinfection agents which cause minimum harm to the environment and provide effective hygiene control 10. operate a cleaning-in-place (CIP) of closed equipment, and ensure that it is used in an optimal way by, e.g. measuring turbidity , conductivity or pH and automatically dosing chemicals at the correct concentrations 11. use single-use systems for small or rarely used plants or where the cleaning solution becomes highly polluted, such as UHT plants, membrane separation plants, and the preliminary cleaning of evaporators and spray driers 12. where there are suitable variations in the pHs of the waste water streams from CIP and other sources, apply self-neutralisation of alkaline and acidic waste water streams in a neutralisation tank 13. minimise the use of EDTA, by only using it where it is required, with the frequency required and by minimising the quantity used, e.g. by recycling cleaning solutions **When selecting chemicals for disinfecting and sterilising equipment and installations, BAT is to:** 14. avoid the use of halogenated oxidising biocides, except where the alternatives are not effective	The balance tank will be emptied as required. The ETP compound will be maintained regularly. All hose lances and gun triggers will have automatic shut-offs. All cleaning chemicals used on-site will be food grade.	
5.1.4 Additional BAT for some processes and unit operations applied in a number of FDM sectors		
5.1.4.1 Materials reception/despatch		
BAT 26. During the reception and despatch of materials, BAT is to do the following: when vehicles are parked and during loading and unloading, switch off the vehicle engine and the refrigerator unit, if there is one and provide an alternative power supply.	Vehicle operation at the site would be minimal, including daily sludge removal and intermittent forklift activity.	Include as part of Noise Management Plan.
5.1.4.2 Centrifugation/separation		
BAT 27. In all FDM installations carrying out centrifugation, BAT is to do the following:		

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
operate centrifuges to minimise the discharge of product in the waste stream.	No centrifugation processes are to be utilised in the ETP design or carried out on site.	
5.1.4.3 Smoking		
BAT 28. In all FDM installations carrying out smoking, BAT is to do the following: achieve a TOC air emission level of <50 mg/Nm^3.	No smoking processes are to be utilised in the ETP design or carried out on site.	
5.1.4.4 Frying		
BAT 29. In all FDM installations carrying out frying, BAT is to do the following: recirculate and burn exhaust gases.	No frying processes are to be utilised in the ETP design or carried out on site.	
5.1.4.5 Preservation in cans, bottles and jars		
BAT 30. In all FDM installations carrying out preservation in cans bottles and jars, BAT is to do the following: 1 apply automated can, bottle and jar seasoning filling systems incorporating closed circuit recycling of spilled liquids 2 use can, bottle and jar cleaning tanks with floating oil recovery when preserving oil, foods canned in vegetable oils or oily foods.	No cans, bottles or jars processes are to be utilised in the ETP design or carried out on site	
5.1.4.6 Evaporation		
BAT 31. In all FDM installations carrying out evaporation, BAT is to do the following: use multi-effect evaporators optimising vapour recompression related to heat and power availability in the installation, to concentrate liquids.	No evaporation processes are to be utilised in the ETP design or carried out on site.	
5.1.4.7 Freezing and refrigeration		
BAT 32. In all FDM installations carrying out freezing and refrigeration, BAT is to do the following:	No temperature adjusting processes are to be utilised in the ETP design.	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
1 prevent emissions of substances that deplete the ozone layer by, e.g. not using halogenated substances as refrigerants 2 avoid keeping air conditioned and refrigerated areas colder than necessary 3 optimise the condensation pressure 4 regularly defrost the entire system 5 keep the condensers clean 6 make sure that the air entering the condensers is as cold as possible 7 optimise the condensation temperature 8 use automatic defrosting of cooling evaporators 9 operate without automatic defrosting during short production stops 10 minimise transmission and ventilation losses from cooled rooms and cold stores		
5.1.4.8 Cooling		
BAT 33. In all FDM installations carrying out cooling, BAT is to do the following: 1 optimise the operation of cooling water systems to avoid excessive blowdown of the cooling tower 2 install a plate heat-exchanger for precooling ice-water with ammonia, prior to final cooling in an accumulating ice-water tank with a coil evaporator 3 recover heat from cooling equipment. Water temperatures of 50 – 60 °C can be achieved	No temperature adjusting processes are to be utilised in the ETP design.	
5.1.4.9 Packing		
BAT 34. In all FDM installations carrying out packing, BAT is to do the following: 1 optimise the design of packaging, including the weight and volume of material and the recycled content, to reduce the quantity used and to minimise waste 2 purchase materials in bulk 3 collect packaging material separately 4 minimise overflowing during packing	No packing processes are to be utilised in the ETP design.	
5.1.4.10 Energy generation and use		
BAT 35.		

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
BAT is to do the following: 1. for installations where there is a use for the heat and power produced, e.g. in sugar manufacturing, milk powder production, whey drying, instant coffee production, brewing and distilling, use combined heat and power generation in new or substantially altered installations or those renewing their energy systems 2. use heat pumps for heat recovery from various sources 3. switch equipment off when it is not needed 4. minimise the loads on motors 5. minimise motor losses 6. use variable speed drives to reduce the load on fans and pumps 7. apply thermal insulation, e.g. of pipes, vessels and equipment used to carry, store or treat substances above or below ambient temperature and to equipment used for processes involving heating and cooling 8. apply frequency controllers on motors	No energy generation processes are to be utilised in the ETP design.	
5.1.4.11 Water use		
BAT 36. If groundwater is used, BAT is to do the following: only pump up the quantities of water that are actually required	No groundwater abstraction occurs on-site.	
5.1.4.12 Compressed air systems		
BAT 37. For compressed air generation, BAT is to do the following: 1 review the pressure level and reduce it if possible 2 optimise the air inlet temperature 3 fit silencers at air inlets and exhausts, to reduce noise levels	Air used in the DAF would not be compressed, but generated by a motor Air flow rate would be adjusted depending on effluent quality.	
5.1.4.13 Steam systems		
BAT 38. For steam systems, BAT is to do the following: 1 maximise condensate return		

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
2 avoid losses of flash steam from condensate return 3 isolate unused pipework 4 improve steam trapping 5 repair steam leaks 6 minimise boiler blowdown	No steam relater processes are to be utilised in the ETP design.	
5.1.5 Minimisation of air emissions		
BAT 39. To prevent air emissions from FDM installations, BAT is to do the following: 1. apply and maintain an air emissions control strategy incorporating: 1.1. definition of the problem 1.2. an inventory of site emissions, including, e.g. abnormal operation 1.3. measuring the major emissions 1.4. assessing and selecting the air emission control techniques 2. collect waste gases, odours and dusts at source and duct them to the treatment or abatement equipment 3. optimise the start-up and shut-down procedures for the air emission abatement equipment to ensure that it is always operating effectively at all of the times when abatement is required 4. unless specified otherwise, where process-integrated BAT which minimise air emissions by the selection and use of substances and the application of techniques do not achieve emission levels of 5 – 20 mg/Nm^3 for dry dust, 35 – 60 mg/Nm^3 for wet/sticky dust and <50 mg/Nm^3 TOC, to achieve these levels by applying abatement techniques. This document does not specifically consider emissions from combustion power plants in FDM installations and these levels are, therefore, not intended to represent BAT associated emission levels from those combustion plants. 5. where process-integrated BAT do not eliminate odour nuisance, apply abatement techniques.	The Balance tank and Sludge tank will be sealed. Emissions from the Balance tank and Sludge tank will pass through a carbon scrubber before release to air. There is an Odour Management Plan in place at the site. Odour checks are included as part of the weekly environmental patrol.	
5.1.6 Waste water treatment		
BAT 40. For the treatment of waste water from FDM installations, BAT is to use a suitable combination of the following:		

<table>
<tr><th>CONCLUSIONS ON BAT</th><th>APPLICABILITY ASSESSMENT</th><th>ACTION GOING FORWARD</th></tr>
<tr>
<td>1 apply an initial screening of solids at the FDM installation
2 remove fat using a fat trap at the FDM installation, if the waste water contains animal or vegetable FOG
3 apply flow and load equalisation
4 apply neutralisation to strongly acid or alkaline waste water
5 apply sedimentation to waste water containing SS
6 apply dissolved air flotation
7 apply biological treatment. Aerobic and anaerobic techniques applied in the FDM sector
8 use CH_4 gas produced during anaerobic treatment for the production of heat and/or power
Unless otherwise stated in this chapter, the emission levels given in Table 5.1 are indicative of the emission levels that would be achieved with those techniques generally considered to represent BAT. They do not necessarily represent levels currently achieved within the industry but are based on the expert judgement of the TWG.
<table>
<tr><th>Parameter</th><th>Concentration (mg/l)</th></tr>
<tr><td>BOD_5</td><td><25</td></tr>
<tr><td>COD</td><td><125</td></tr>
<tr><td>TSS</td><td><50</td></tr>
<tr><td>pH</td><td>6 – 9</td></tr>
<tr><td>Oil and grease</td><td><10</td></tr>
<tr><td>Total nitrogen</td><td><10</td></tr>
<tr><td>Total phosphorus</td><td>0.4 – 5</td></tr>
<tr><td colspan="2">Better levels of BOD_5 and COD can be obtained. It is not always possible or cost effective to achieve the total nitrogen and phosphorus levels shown, in view of local conditions.</td></tr>
</table>
Table 5.1: Typical FDM waste water quality after treatment

When further treatment is required to either achieve these levels or to meet special discharge limits, the following techniques are available:
9 remove nitrogen biologically</td>
<td>Before treatment, effluent will pass through a drum screen, to remove coarse solids.

Foul drains contains fat-traps and interceptors.

Equalisation achieved by mixing in the balance tank.

ETP will contain a DAF unit to remove sludge.

Primary treated effluent will be discharged to sewer.

Secondary biological treatment to be carried out at the Severn Trent Water Sewage Plant.

Discharge parameter limits to be site by Severn Trent discharge licence.

Effluent will be dosed with a polymer and polyaluminium chloride (coagulant) to promote flocculation.

The effluent circulated in the DAF will be further dosed to adjust pH levels.</td>
<td></td>
</tr>
</table>

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
10 apply precipitation to remove phosphorus, simultaneously with the activated sludge treatment, where applied 11 use filtration for waste water polishing 12 remove dangerous and priority hazardous substances 13 apply membrane filtration		
BAT 41. When the quality of the waste water is suitable for re-use in FDM processing, BAT is to do the following: 14 re-use water after it has been sterilised and disinfected, avoiding the use of active chlorine and which meets the standard of Council Directive 98/83/EC [66, EC, 1998].	Waste water will not be suitable for reuse as the primary treatment will be utilized only.	
BAT 42. BAT is to treat waste water sludge using one or a combination of the following techniques: 15 stabilisation 16 thickening 17 dewatering 18 drying, if natural heat or heat recovered from processes in the installation can be used.	Sludge would be de-watered using a screw press. Resultant water will be pumped back into the ETP for further processing.	
5.1.7 Accidental releases		
BAT 43. In general, to prevent accidents and minimise their harm to the environment as a whole, BAT is to do the following: 1. identify potential sources of incidents/accidental releases that could harm the environment 2. assess the probability of the identified potential incidents/accidental releases occurring and their severity if they do occur, i.e. to carry out a risk assessment 3. identify those potential incidents/accidental releases for which additional controls are required to prevent them from occurring 4. identify and implement the control measures needed to prevent accidents and minimise their harm to the environment 5. develop, implement and regularly test an emergency plan 6. investigate all accidents and near misses and keep records.	The site has the following operational procedures in place at address all potential risk to the environment: OP01 Waste Management OP02 Bulk Storage and Filling OP03 Spillage Procedure OP04 Site Inspection Procedure OP06 Pipework, Bunds and Tank Inspection Procedure OP07 Green House Keeping OP09 Refrigerant Management	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
	OP11 Water & Effluent Management OP12 Spill-Kit Inspection A BCP is in place at the site to assist in the speedy and efficient return to normal operations should a major incident occur which directly impinges on our business activities. An environmental patrol is carried out weekly.	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
5.2 Additional BAT for some individual FDM sectors		
5.2.1 Additional BAT for the meat and poultry sector		
BAT 44. In addition to the BAT, for meat and poultry processing installations, BAT is to do the following: 1. thaw meat in air 2. avoid the use of flake ice by using a suitable mixture of chilled and frozen raw materials 3. dose spices and other solid ingredients from a bulk container rather than from plastic bags 4. stop the water supply automatically when sausage fillers and similar equipment are not used at breaks or at production stops	Not Applicable	
5.2.2 Additional BAT for the fish and shellfish sector		
BAT 45. In addition to the BAT, for fish and shellfish processing installations, BAT is to do the following: 1 maintain the quality of fish for optimal use by minimising storage times 2 use high quality fish by ensuring collaboration with upstream suppliers 3 operate regular maintenance programmes to, e.g. ensure efficient skinning 4 thaw mackerel, by immersing them in containers filled with water which is mixed by bubbling air through it. The level of the water is maintained by recirculation and using level-actuated switches, achieving a water consumption of <2 m^3/t of raw fish 5 thaw whitefish, by immersing them in containers filled with water which is mixed by bubbling air through it. The level of the water is maintained by using level-actuated switches, achieving a water consumption of 1.8 – 2.2 m^3/t of raw fish 6 thaw shrimps and prawns by immersing them in containers filled with filtered peeling water, if available. The water is mixed by bubbling air through it. The level of the water is maintained by recirculation and using level-actuated switches, or by using level-actuated switches 7 avoid scaling if the fish is subsequently skinned 8 where scaling is undertaken, i.e. where fish is not subsequently skinned, use filtered	Not Applicable	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
recirculated scaling waste water for preliminary fish rinsing and properly adjust the scaler operation by weighing the right amount of scales for a specific water flow 9 remove and transport skin and fat from the skinning drum using vacuum suction 10 remove and transport fat and viscera from mackerel by vacuum suction 11 use fine mesh conveyor belts to transport solid products, by-products and wastes, to enable their separation from water 12 when filleting: 12.1 remove the frames from fish fillets by two sets of rotating knives 12.2 where water nozzles or spray cleaning systems are required, install them with presence-activated sensors (i.e. intermittent operation) 12.3 a 60 - 75 % reduction in water consumption can be obtained by: 12.3.1 removing unnecessary nozzles so that water is only added where required 12.3.2 replacing those nozzles that take the fish from the tail cut with a mechanical device 12.3.3 replacing the nozzles for cleaning the driving wheels on the filleting part with mechanical devices 12.3.4 replacing existing nozzles by nozzles with a lower water consumption 12.3.5 using pulsating water nozzles, i.e. alternating the opening and closing of the water supply using an automatic valve 12.3.6 replacing the waste drain by drain-belts and closing the nozzles in the waste drain. The waste will be separated from the process water directly near the filleting machine, resulting in shorter contact time 12.4 reduce both the number and size of spray nozzles (water saving of about 75 %)		
5.2.3 Additional BAT for the fruit and vegetables sector		
BAT 46. In addition to the BAT, for fruit and vegetable processing installations, BAT is to do the following: 1 where storage cannot be avoided, minimise storage times, and where weather conditions do not increase the speed of degradation and/or harm the quality, avoid	Not Applicable	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
refrigeration by storing fruit and vegetables and their by-products which are intended for use as animal feed, outdoors in a clean covered area or in containers 2 apply dry separation of rejected raw material from the sorting step and solid residues (e.g. in sorting, trimming, extraction, filtration steps) 3 collect soil in sedimentation and/or filtration steps instead of washing into the WWTP 4 peel fruit and vegetables using a batch steam process or a continuous steam process not using cold water to condense the steam and, if for technological reasons steam peeling cannot be applied, use dry caustic peeling, unless the recipe requirements cannot be met if either of these techniques is used 5 after blanching, cool fruit and vegetables before freezing them by passing them through cold water 6 optimise the re-use of water with or without treatment, depending on the unit operations which require water and the quality of water these require, ensuring that adequate hygiene and food quality standards are maintained.		
5.2.4 Additional BAT for the vegetable oils and fats sector		
BAT 47. In addition to the BAT, for vegetable oil processing installations, BAT is to do the following: 1 use a counter current flow desolventiser-toaster in vegetable oil extraction 2 in vegetable oil processing, use the vapour generated in the desolventiser-toaster in the first step of the miscella distillation pre-evaporator 3 use the exothermic reaction heat from the hydrogenation of vegetable oil to heat the product to the desired reaction temperature and to generate steam later in the reaction. The achievable energy (steam) generation is 25 – 125 kWh/t (90 - 450 MJ/t) (40 – 200 kg/t) unrefined oil 4 use water ring pumps to generate an auxiliary vacuum for oil drying, oil degassing or minimising oxidation of oil 5 recover hexane from condensable vapours from meal desolventising-toasting, miscella distillation and from the stripping column of the mineral oil system, using a hexanewater gravity separator and a reboiler	Not Applicable	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
6 use a mineral oil scrubber to recover hexane from uncondensable vapours from meal desolventising-toasting, miscella distillation, the reboiler and from the stripping column of the mineral oil system 7 use cyclones, to reduce wet dust emissions arising from vegetable oil extraction, to achieve a wet dust emission level of <50 mg/Nm3 8 refine crude oils by physical refining, or if they have an ffa content <2 %, by chemical refining 9 deodorise vegetable oils using a double scrubber in combination with a once-through cooling system		
5.2.5 Additional BAT for dairies		
BAT 48. In addition to the BAT, for dairies, BAT is to do the following: 1 partially homogenise milk 2 replace batch pasteurisers with continuous ones 3 use regenerative heat exchange in pasteurisation 4 reduce the required frequency of cleaning of centrifugal separators by improving the preliminary milk filtration and clarification 5 use just-in-time "component filling" to avoid losses and minimise water pollution 6 maximise the recovery of diluted, but otherwise uncontaminated, product from CIP initial rinses, HTST start-up, shut-down and change-over and from the rinsing of other equipment and pipework by online detection of transition points between the product and the water phase. This can be done by, e.g. measuring the volume using flow or density transmitters; measuring the density using conductivity transmitters and using scattered light turbidity sensors to differentiate water from the product 7 for large dairies with highly branched tubing, use several small CIP systems instead of a centralised CIP system 8 re-use cooling water, used cleaning water, condensates from drying and evaporation, permeates generated in membrane separation processes and final rinse-water after the treatment, if any required, to ensure the level of hygiene necessary for the re-use application 9 achieve the levels given in Table 5.2, Table 5.3 and Table 5.4.	Not Applicable	

<table>
<tr><th>CONCLUSIONS ON BAT</th><th>APPLICABILITY ASSESSMENT</th><th>ACTION GOING FORWARD</th></tr>
<tr><td>These are indicative of the levels that can be achieved by applying in-process BAT. They are based on achieved levels reported by the TWG. The ranges reported reflect a variety of conditions under which installations operate. Energy consumption levels may vary due to, e.g. production volumes. Warm climates may use more energy for cooling and vice versa. Water consumption and waste water emission levels may vary due to, e.g. different product portfolios, batch sizes and cleaning. The waste water emission level may be lower compared to the water consumption level because many dairies measure the intake of cooling water, often from their own wells, but then discharge it unmeasured. In warm climates water may be lost due to evaporation.</td><td></td><td></td></tr>
<tr><td colspan="3">5.2.5.1 Additional BAT for the production of market milk</td></tr>
<tr><td>BAT 50.
In addition to the BAT, for the production of market milk, BAT is to do the following:
1 achieve the consumption and emission levels shown in Table 5.2

<table><tr><th>Energy consumption (kWh/l)</th><th>Water consumption (l/l)</th><th>Waste water (l/l)</th></tr><tr><td>0.07 – 0.2</td><td>0.6 – 1.8</td><td>0.8 – 1.7</td></tr></table>Table 5.2: Consumption and emission levels associated with the production of market milk from 1 litre of received milk</td><td>Not Applicable</td><td></td></tr>
<tr><td colspan="3">5.2.5.2 Additional BAT for milk powder production</td></tr>
<tr><td>BAT 51.
In addition to the BAT, for milk powder production, BAT is to do the following:
1 to produce powdered milk use multi-effect evaporators, optimising vapour recompression related to heat and power availability in the installation, to concentrate liquid milk before spray drying, followed by FBD, e.g. integrated FDB
2 apply an early warning fire alarm, e.g. CO detector, to reduce the risks of explosion in spray driers
3 achieve the consumption and emission levels shown in Table 5.3</td><td>Not Applicable</td><td></td></tr>
</table>

<table>
<tr><th>CONCLUSIONS ON BAT</th><th>APPLICABILITY ASSESSMENT</th><th>ACTION GOING FORWARD</th></tr>
<tr><td>
<table>
<tr><th>Energy consumption (kWh/l)</th><th>Water consumption (l/l)</th><th>Waste water (l/l)</th></tr>
<tr><td>0.3 – 0.4</td><td>0.8 – 1.7</td><td>0.8 – 1.5</td></tr>
</table>
Table 5.3: Consumption and emission levels associated with the production of milk powder from 1 litre of received milk
</td><td></td><td></td></tr>
<tr><td colspan="3">5.2.5.3 Additional BAT for buttermaking</td></tr>
<tr><td>BAT 52.
In addition to the BAT, for buttermaking, BAT is to do the following:
1 remove residual butter from pipework using a cooled butter block pushed by compressed air
2 rinse the cream heater with skimmed milk before cleaning it</td><td>Not Applicable</td><td></td></tr>
<tr><td colspan="3">5.2.5.4 Additional BAT for cheesemaking</td></tr>
<tr><td>BAT 53.
In addition to the BAT, for cheesemaking, BAT is to do the following:
1 use the heat from warm whey for preheating cheese milk
2 maximise whey recovery and use
3 segregate salt whey (not to be mixed with sweet or acid whey)
4 reduce fat and cheese fines in whey and screen liquid streams to collect fines
5 minimise the occurrence of acid whey and drain the top or platform of the salting vats to avoid brine spillage to the WWTP
6 to produce whey powder use multi-effect evaporators, optimising vapour recompression related to heat and power availability in the installation, to concentrate whey before spray drying, followed by FBD, e.g. integrated FDB.</td><td>Not Applicable</td><td></td></tr>
<tr><td colspan="3">5.2.5.5 Additional BAT for ice-cream manufacturing</td></tr>
<tr><td>BAT 54.
In addition to the BAT, for ice-cream manufacturing, BAT is to do the following:</td><td>Not Applicable</td><td></td></tr>
</table>

<table>
<tr><th>CONCLUSIONS ON BAT</th><th>APPLICABILITY ASSESSMENT</th><th>ACTION GOING FORWARD</th></tr>
<tr><td>1 achieve the consumption and emission levels shown in Table 5.4
<table><tr><th>Energy consumption (kWh/kg)</th><th>Water consumption (l/kg)</th><th>Waste water (l/kg)</th></tr><tr><td>0.6 – 2.8</td><td>4.0 – 5.0</td><td>2.7 – 4.0</td></tr></table>Table 5.4: Consumption and emission levels associated with the production of 1 kg of ice cream</td><td></td><td></td></tr>
<tr><td colspan="3">5.2.6 Additional BAT for starch manufacturing</td></tr>
<tr><td>BAT 55.
In addition to the BAT, for the starch sector, BAT is to do the following:
1 optimise the re-use of process water and/or potato fruit juice in the potato starch making process
2 use gluten process water (in the protein separation step) for germ and fibre washing and steeping processes in maize starch processing
3 wash starch slurry, using a counter current flow, before it is dewatered and dried</td><td>Not Applicable</td><td></td></tr>
<tr><td colspan="3">5.2.7 Additional BAT for the sugar sector</td></tr>
<tr><td>BAT 56.
In addition to the BAT, for the sugar beet sector, BAT is to do the following:
1 recycle transport water
2 use evaporator condensate for sugar extraction from sugar beets
3 avoid drying sugar beet pulp if an outlet is available for pressed sugar beet pulp, e.g. animal feed; otherwise dry sugar beet pulp using steam driers or using high temperature driers, combined with measures to reduce emissions to air. In HTD possible measures to reduce emissions to air include, e.g. minimising the quantity of small beet particles dried, drying to a maximum dry matter content of 91 %, mechanical pressing of pulp prior to drying, minimising the quantity of added mollases before drying and optimising the operation of cyclones and spray scrubbers</td><td>Not Applicable</td><td></td></tr>
<tr><td colspan="3">5.2.8 Additional BAT for the coffee sector</td></tr>
<tr><td>BAT 57.
In addition to the BAT, for the coffee sector, BAT is to do the following:
1. when roasting coffee, recirculate air from the roaster back into the roaster
2. when roasting coffee, where process-integrated BAT which minimise air emissions by the selection and use of substances and the application of techniques do not achieve</td><td>Not Applicable</td><td></td></tr>
</table>

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
emission levels of 5 – 20 mg/Nm^3 for dry dust; <50 mg/Nm^3 TOC for light roasted coffee (this level is more difficult to achieve as the darkness of roasting is increased; to achieve these levels by applying abatement techniques. Emission levels for NOx were provided too late for full verification by the TWG. 3. in instant coffee manufacturing, use the waste heat from the hot liquid coffee extract to heat the process water prior to extraction and use counter current heat-exchange to use the heat from spray drying within the roasting sector 4. during instant coffee manufacturing, after drying, agglomerate the dust to make granules then recycle the remaining dust and apply air abatement.		
5.2.9 Additional BAT for drinks manufacturing		
BAT 58. In addition to the BAT, for drinks processing installations, BAT is to do the following: 1 if CO_2 is used in the installation, use CO_2 which is either recovered from the fermentation process or as a by-product of another process, to avoid the production of CO_2 directly derived from fossil fuels especially for use in the installation 2 recover yeast after fermentation 3 where diatomaceous earth is used as a filter, collect the spent filter material to optimise re-use and/or disposal 4 use multistage bottle cleaning systems 5 optimise water consumption of the rinsing zone in the bottle cleaning machine, by controlling the rinsing water flow, installing an automatic valve to interrupt the water supply in case the line stops and using fresh water for the two last rows of rinsing nozzles 6 re-use bottle cleaning overflows after sedimentation and filtration	Not Applicable	
5.2.9.1 Additional BAT for brewing		
BAT 59. In addition to the BAT, for breweries, BAT is to do the following: 1 optimise the re-use of hot water from wort cooling and recover heat from wort boiling 2 re-use bottle pasteurising overflow water 3 achieve a water consumption level of 0.35 – 1 m^3/hl of beer produced	Not Applicable	

CONCLUSIONS ON BAT	APPLICABILITY ASSESSMENT	ACTION GOING FORWARD
5.2.9.2 Additional BAT for winemaking		
BAT 60. In addition to the BAT, for winemaking, BAT is to do the following: 1 after the cold stabilisation of wine, re-use the alkaline cleaning solution and when the spent alkaline solution can no longer be re-used and the pH is still high enough to disrupt the operation of the WWTP, apply self-neutralisation or if the pH levels and the flowrate will not disrupt the operation of the WWTP, gradually release the cleaning solution to the WWTP.	Not Applicable	