Appendix D

BAT Summary – Food, Drink and Milk Industries BREF August 2006

General BAT for the Sector

1 ensure, e.g. by training, that employees are aware of the environmental aspects of the company's operations and their personal responsibilities (see Section 4.1.2)	All employees receive an induction which will be expanded to include awareness of the environmental permit and the developing EMS. All new starters have an individual learning plan which includes all relevant SOP's which will include any relevant to the management of environmental impacts.
2 design/select equipment, which optimises consumption and emission levels and facilitates correct operation and maintenance (see Section 4.1.3.1), e.g. to optimise the pipework system for the capacity to minimise product losses and install pipes at a gradient to promote self-draining	New equipment goes through a capex process which includes siting and assessment of efficiency including energy and water use. Factory Acceptance Testing in place for installation of new equipment.
3 control noise emissions at source by designing, selecting, operating and maintaining equipment, including vehicles to avoid or reduce exposure (see Sections 4.1.2, 4.1.3.1, 4.1.3.2, 4.1.3.3, 4.1.3.4 and 4.1.5) and, where further reductions in noise levels are required, enclosing noisy equipment (see Section 4.1.3.5)	New equipment goes through a capex process which includes H&S sign off to ensure no negative impact on noise exposure for operators. All potentially noisy equipment is located within the building e.g. compressors. All equipment is on the site PPM system. Vehicle movements are limited, with raw material deliveries generally taking place between 6a..m and 2p.m. and product collections about 16 trailers per day. Vehicles switch off engines during loading and unloading.
4 operate regular maintenance programmes (see Section 4.1.5)	The site operates a computerised PPM system, some maintenance is contracted out e.g. boilers and refrigeration equipment.
5 apply and maintain a methodology for preventing and minimising the consumption of water and energy and the production of waste (see Section 4.1.6) incorporating: 5.1 obtaining management commitment, organisation and planning (see Sections 4.1.6.1) 5.2 analysis of production processes, including individual process steps to identify	The operator has a comprehensive Continuous Improvement (CI) governance structure in place which covers manufacturing and supply chain, supported by a data analyst. Opportunities are identified and assessed for added value, and against ability to impact on key site KPI's including H&S, environmental impacts such as water usage and other business/production KPI's. The tracker is

areas of high water and energy consumption and high waste emissions to identify opportunities to minimise these (see Sections 4.1.6.2, 4.1.6.2.1, 4.1.6.2.2 and 4.1.6.2.3), taking into account the water quality requirements for each application, hygiene and food safety 5.3 assessment of objectives, targets and system borders (see Section 4.1.6.3) 5.4 identification of options for minimising water and energy consumption, and waste production (see Section 4.1.6.4), using a systematic approach, such as pinch technology (see Section 4.1.6.4.1) 5.5 carrying out an evaluation and doing a feasibility study (see Section 4.1.6.5) 5.6 implementing a programme for minimising the consumption of water and energy and waste production (see Section 4.1.6.6) and 5.7 ongoing monitoring of water and energy consumption; waste production levels and the effectiveness of control measures (see Section 4.1.6.7). This can involve both measurement and visual inspection	reviewed at Ops period review (monthly). Teams (past, sauce and RTE) do daily reviews on lines as to what could be done better. The operator is aiming for operational excellence, current moving from level 2 (control) to level 3 (improve). Directors set 'Strategy into Reality' targets looking at 5-year business planning/priorities. Bigger spends go forward to Capex/projects. The CI team benchmark against other ABF businesses, and sometimes do visits to other companies or take part in industry forums which help identify best practises which could be brought to the site. Current opportunities on the Tracker include minimising CIP water leaks; behavioural improvements to reduce water usage e.g. hoses; changes to packaging to reduce pack sizes and consequent reduction in transportation; investigating whether or not products can be run on different lines to reduce changeover/running times; challenging chemical use in the DAF plant; re-using fryer oil in drip-trays; adding a transformer to air compressors. The nature of the product and process means that rework opportunities are minimal on sauce in glass due to temperature controls for food safety; paste can be re-worked more easily if needed.
6 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	Manufacturing yield is constantly measured along with utilities and waste which is weighed off some lines. Mass balance of raw materials in/product out can be carried out and is usually part of a first production run for a product. The operator is also looking at value optimisation in terms of combining recipes to reduce changeovers; encouraging review and challenge to the 2 weekly production plan to identify unnecessary changeovers; and monitoring inventory levels more closely to align with production planning and waste minimisation. Chemical use is tracked e.g. for effluent treatment and hygiene use. Accidents and

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]	incidents are recorded, this will move on to the new Alcumus system which is being implemented alongside the EMS system which can be used to report incidents.
7 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 (see Section 4.1.6.2)	Mass balance is used for example when introducing a new product, or for an event. This has included measuring pipework to identify where losses are. Work ongoing to analyse inventory levels of raw materials to ensure alignment with production planning and efficient use of ingredients.
8 apply production planning to minimise associated waste production and cleaning frequencies (see Section 4.1.7.1)	Production team review production plan every week and challenge batch sizes/ changes. The high number of different products produced means that there are a high number of changeovers, however the operator is constantly looking for ways to minimise these, for example by combining recipes.
9 transport solid FDM raw materials, products, co-products, by-products and waste dry (see Section 4.1.7.4), 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	Solid raw materials are transported in big bags or bins/tubs. There is no fluming.
10 minimise storage times for perishable materials (see Section 4.1.7.3)	Fresh and frozen ingredients are delivered on a just in time basis. Ambient items have a longer shelf life.
11 segregate outputs, to optimise use, re-use, recovery, recycling and disposal (and minimise waste water contamination) (see Sections 4.1.7.6, 4.1.6, 4.1.7.7, 4.7.1.1, 4.7.2.1, 4.7.5.1 and 4.7.9.1)	Wastes are segregated e.g. food wastes, wastes for animal feed, plastic, cardboard, metal etc.
12 prevent materials from falling on the floor, e.g. by using accurately positioned splash protectors, screens, flaps, drip trays and troughs (see Section 4.1.7.6)	Catch trays are used in the cook house where ingredients are transferred to the cooking and mixing vessels. Wastage from the pappadum lines is contained in trays/bins. Oil from catch trays in RTE is reclaimed Waste is measured/weighed off lines.
13 optimise the segregation of water streams (see Section 4.1.7.8), to optimise re-use and treatment	Cooling water for the pasteurisers is returned to the cooling tower hotwell for reuse. Wastewater from the weekly fryer caustic clean is saved in an IBC for use in the effluent treatment plant to balance acidic wastewater streams.

14 collect water streams, such as condensate and cooling water separately to optimise reuse (see Section 4.1.7.8)	Condensate from cooking vessels and boilers is returned to the boiler hotwell. Cooling water for the pasteurisers is returned to the cooling tower hotwell for reuse.
15 avoid using more energy than needed for heating and cooling processes, without harming the product (see Section 4.1.7.9)	Start-up/shut down procedures on all lines to ensure equipment not left on. Site wide energy monitoring system creates 'spark reports' to challenge energy use such as equipment being left on. Temperature set points for coldstores are set at legal/food safety limits, as are set points for pasteurisers to ensure product is heated to the correct temperature for the correct amount of time.
16 apply good housekeeping (see Section 4.1.7.11)	Teams are trained and asked to operate to 'Clean as you Go' principles to minimise waste to drain and employ dry clean up where possible. SOP's are in place for all processing activities which specify procedures around use of equipment, waste segregation and storage, use of chemicals etc. GMP audits and H&S walk rounds take place which identify poor housekeeping practises.
17 minimise noise nuisance from vehicles (see Section 4.1.7.12)	Vehicle movements are limited, with raw material deliveries generally taking place between 6a..m and 2p.m. and product collections about 16 trailers per day. Vehicles switch off engines during loading and unloading.
18 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	A list of bulk storage tanks is included in the application. All external bulk tanks are bunded, and IBC's stored on mobile bunds or within dedicated self-bunded storage containers.
19 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 (see Section 4.1.8) 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 set points for coldstores are set at legal/food safety limits, as are set points for pasteurisers to ensure product is heated to the correct temperature for the correct amount of time. Filling lines are automated and optimised via CI processes and ongoing yield analysis.

temperature by dedicated measurement and correction (see Section 4.1.8.1) 19.2 where materials are pumped or flow, to control flow and/or level, by dedicated measurement of pressure (see Sections 4.1.8.2) and/or dedicated measurement of flow (see Section 4.1.8.4) and/or dedicated measurement of level (see Section 4.1.8.3) and using control devices, such as valves (see Section 4.1.8.7) 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 (see Section 4.1.8.3) 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 (see Section 4.1.8.5.1) 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 (see Section 4.1.8.5.2) and 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 (see Section 4.1.8.5.3)	Ingredients are mostly auto-dispensed or metered in to vessels. Pigs used on filling lines to flush through prior to change overs and maximise yields. Value optimisation – looking at what recipes could be combined to minimise change overs. Scrapers are used within mixing vessels to ensure maximum yield, similarly paste tubs are scraped out prior to washing. Water used for rinsing out of ingredients tubs, is included in the recipe formulation. Continuous pH monitoring is in place on effluent release. Wastewater from the weekly fryer caustic clean is saved in an IBC for use in the effluent treatment plant to balance acidic wastewater streams.
20 use automated water start/stop controls to supply process water only when it is required (see Section 4.1.8.6)	Water in product is metered into cooking vessels.
21 select raw materials and auxiliary materials which minimise the generation of solid waste and harmful emissions to air and water (see Sections 4.1.9.1 and 4.1.9.2)	Raw materials/ingredients are selected on the basis of the recipe requirements, operator can minimise waste by ordering correct pack sizes etc. and scheduling production to ensure all ingredients are used up.
22 landspreading is an option for the outlet of materials from the FDM sector, subject to local legislation, as discussed in Section 4.1.6.	N/A

Environmental Management System

BAT is to implement and adhere to an Environmental Management System (EMS) that incorporates, as appropriate to individual circumstances, the following features: (see Chapter 3) □ 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)	The operator has an Environmental Policy in place which commits the site to legal compliance and environmentally efficient operation. The Policy is owned by the Supply Chain Director.
□ planning and establishing the necessary procedures	The operator is currently developing a Safety, Health and Environment (SHE) Management System aligned to the requirements of ISO14001:2015 and ISO45001:2018.
□ 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.	The developing SHE Management System includes a manual and documented procedures setting out roles and responsibilities, procedures for training, communications and consultation, documentation and emergency response. SOP's are in place for all manufacturing processes and cleaning tasks. The site operates a computerised PPM system. A compliance register is in place which documents all applicable 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") _ 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.	The developing SHE Management System includes a manual and documented procedures setting out the monitoring and measurement programme and internal/external audit process. The site already receives external environmental audits from the ABF Group. Various corrective and preventive action procedures are in place in different areas for example GMP audit actions, SHE incidents and action reporting. The operator is moving to a new system for incident reporting called Alcumus which will be used for the reporting, recording and investigation of all SHE incidents and non-conformances.

□ review by top management.	The developing SHE Management System includes a manual and documented procedures setting out the management review process.
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	The operator uses Sedex and a supplier management tool to understand impacts in their supply chain. The operator also participates in customer forums as required and complies with customer requirements on environmental issues.

Equipment and installation cleaning

1 remove raw material residues as soon as possible after processing and clean materials storage areas frequently (see Section 4.3.10)	Mixing vessels have scrapers in them to maximise yield. Tubs/bins are scraped out prior to cleaning.
2 provide and use catchpots over floor drains and ensure they are inspected and cleaned frequently, to prevent entrainment of materials into waste water (see Section 4.3.1.1)	Yes, floor drains have catch pots in them.
3 optimise the use of dry cleaning (including vacuum systems) of equipment and installations, including after spillages (see Sections 4.3.1, 4.7.1.2, 4.7.2.2, 4.7.5.2 and 4.7.9.2) prior to wet cleaning, where wet cleaning is necessary to achieve the required hygiene levels	Teams are trained and asked to operate to 'Clean as you Go' principles to minimise waste to drain and employ dry clean up where possible. Tubs/bins are scraped out prior to cleaning; sauce tubs rinse can go in to the vessel as water in product.
4 pre-soak floors and open equipment to loosen hardened or burnt-on dirt before wet cleaning (see Section 4.3.2)	N/A
5 manage and minimise the use of water, energy and detergents used (see Section 4.3.5)	Water is metered in the cookhouse to closely monitor use of hoses. Detergents are auto-dosed. CI programme includes challenging use of cleaning chemicals e.g. in effluent plant.
6 fit cleaning hoses used for manual cleaning with hand operated triggers (see Section 4.3.6)	Cookhouse hoses have restrictors on the spray to enable it to be adjusted.
7 supply pressure-controlled water and do this via nozzles (see Section 4.3.7.1)	Cookhouse hoses are mostly high-pressure hoses with restrictors.

8 optimise the application of the re-use of warm open-circuit cooling water, e.g. for cleaning (e.g. see Section 4.7.5.17)	N/A
9 select and use cleaning and disinfection agents which cause minimum harm to the environment (see Sections 4.3.8, 4.3.8.1 and 4.3.8.2) and provide effective hygiene control	Some cleaning and disinfection agents are used which carry an environmental hazard code. E.g. chlorofoam is only used once per week for certain tasks.
10 operate a cleaning-in-place (CIP) of closed equipment (see Section 4.3.9), and ensure that it is used in an optimal way by, e.g. measuring turbidity (see Section 4.1.8.5.3), conductivity (see Section 4.1.8.5.2) or pH (see Section 4.1.8.5.1) and automatically dosing chemicals at the correct concentrations (see Section 4.3.9)	CIP systems are in place for cleaning of fryers, cooking vessels and filling lines. The operator has reviewed CIP operation procedures to ensure consistency. At present there is a routine review of CIP processes. Addressing leaks from the CIP systems is a current project on the CI opportunities tracker.
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 (see Section 4.3.9)	N/A
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 (see Section 4.5.2.4)	Wastewater from the weekly fryer caustic clean is saved in an IBC for use in the effluent treatment plant to balance acidic wastewater streams.
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 (see Sections 4.3.8, 4.3.8.2, 4.3.8.2.2, 4.3.8.2.3 and 4.3.8.2.5).	N/A
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 (see Sections 4.3.8.1, 4.5.4.8, 4.5.4.8.1 and 4.5.4.8.2).	N/A

Additional BAT for some processes and unit operations applied in a number of FDM sectors

Materials reception/despatch

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 (see Section 4.2.1.1).	Some ingredients arrive in refrigerated vehicles. Site policy is for vehicles to switch engines off during loading/unloading.

Centrifugation/Separation

operate centrifuges to minimise the discharge of product in the waste stream (see Section 4.2.3.1).	N/A

Frying

recirculate and burn exhaust gases (see Section 4.2.7.1).	Not at present.

Preservation in Cans, Bottles and Jars

1 apply automated can, bottle and jar seasoning filling systems incorporating closed circuit recycling of spilled liquids (see Section 4.2.8.2) 2 use can, bottle and jar cleaning tanks with floating oil recovery when preserving oil, foods canned in vegetable oils or oily foods (see Section 4.2.8.3).	Filling lines are automated. N/A

Evaporation

1 use multi-effect evaporators (see Section 4.2.9.1) optimising vapour recompression (see Section 4.2.9.2) related to heat and power availability in the installation, to concentrate liquids.	N/A

Freezing and refrigeration

1 prevent emissions of substances that deplete the ozone layer by, e.g. not using halogenated substances as refrigerants (see Section 4.1.9.3)	Various F-gases are used as refrigerants on site including R407c, R410a, R404a, R407c.
2 avoid keeping air conditioned and refrigerated areas colder than necessary (see Section 4.2.15.1) 3 optimise the condensation pressure (see Section 4.2.11.2)	Temperature set points for coldstores are set at legal/food safety limits and monitored regularly by security – particularly during out of hours. Temperature set points consider food safety limits and Health & Safety measures, to not create an additional safety risk (e.g. reduce slip, fall risk and cold environments)
4 regularly defrost the entire system (see Section 4.2.15.3)	A defrost timer is in place on the freezer and chillers.
5 keep the condensers clean (see Section 4.2.11.3)	External contractor carries out regular maintenance and optimisation of the refrigeration systems.
6 make sure that the air entering the condensers is as cold as possible (see Section 4.2.11.3)	External contractor carries out regular maintenance and optimisation of the refrigeration systems.
7 optimise the condensation temperature (see Section 4.2.11.3)	External contractor carries out regular maintenance and optimisation of the refrigeration systems.
8 use automatic defrosting of cooling evaporators (see Section 4.2.15.5)	A defrost timer is in place on the freezer and chillers.
9 operate without automatic defrosting during short production stops (see Section 4.2.11.7)	A defrost timer is in place on the freezer and chillers.
10 minimise transmission and ventilation losses from cooled rooms and coldstores (see Section 4.2.15.2).	burner

Cooling

1 optimise the operation of cooling water systems to avoid excessive blowdown of the cooling tower (see Section 4.1.5)	A conductivity probe is in place to allow auto-dosing of chemicals and avoid excessive blowdown. An external contractor regularly carries our cooling water testing.

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 (see Section 4.2.10.1)	N/A
3 recover heat from cooling equipment. Water temperatures of 50 – 60 °C can be achieved (see Section 4.2.13.5).	Not currently. The operator could look at CIP using heat from cooling towers.

Packing

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 (see Section 4.2.12.2)	Current opportunity on the CI Tracker to adapt RTE cardboard flute to make packs thinner. This would represent a saving on pallets and weights. Packaging design efficiencies part of NPD process.
2 purchase materials in bulk (see Section 4.1.7.2)	Packaging materials are purchased in bulk.
3 collect packaging material separately (see Section 4.2.12.3)	Glass, plastic, cardboard, metal and wood are collected separately.
4 minimise overflowing during packing (see Section 4.2.12.6).	Filling lines are automated to prevent overfilling. One of the Sites monitored KPIs is Giveaway which is a main determinant of yield and so is closely monitored and reviewed.

Energy generation and use

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 (see Section 4.2.13.1)	N/A – operator has future plans to install CHP.
2 use heat pumps for heat recovery from various sources (see Section 4.2.13.4)	Not currently.
3 switch equipment off when it is not needed (see Section 4.2.13.6)	Yes, start-up and shut-down procedures in place for all lines and hibernation settings are in place.

4 minimise the loads on motors (see Section 4.2.13.7)	Measured and defined by Crowley Carbon monitoring system. This system provides 'sparks alerts' when energy use is higher than expected.
5 minimise motor losses (see Section 4.2.13.8)	As above.
6 use variable speed drives to reduce the load on fans and pumps (see Section 4.2.13.10)	This opportunity has been highlighted by an external contractor site survey and is being addressed by the operator e.g. on air handling units.
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 (see Section 4.2.13.3)	All steam pipes are insulated.
8 apply frequency controllers on motors (see Section 4.2.13.9).	In place and operation in RTE, inverters are applied widespread throughout the facility wherever appropriate.

Water use

If groundwater is used, BAT is to do the following: 1 only pump up the quantities of water that are actually required (see Section 4.2.14.1).	N/A

Compressed air systems

1 review the pressure level and reduce it if possible (see Section 4.2.16.1)	A leak survey or compressed air systems has been completed and leaks addressed. Pressure levels variable across site, not currently reviewed.
2 optimise the air inlet temperature (see Section 4.2.16.2)	Compressed air systems on PPM system.
3 fit silencers at air inlets and exhausts, to reduce noise levels (see Section 4.2.16.3).	N/A

Steam systems

1 maximise condensate return (see Section 4.2.17.1)	Yes, condensate from boilers and cooking vessels returned to boiler hotwell.

2 avoid losses of flash steam from condensate return (see Section 4.2.17.2)	Steam traps on the condensate return stop/reduce the losses of steam flash.
3 isolate unused pipework (see Section 4.2.17.3)	Any pipework that is unused is isolated and then removed, currently no known redundant steam legs still in the system.
4 improve steam trapping (see Section 4.1.5)	Site has a steam trap contract with Spirax Sarco who come in twice a year to test all the steam traps. Any traps that are found to be either failed open or failed closed are replaced as part of the contract.
5 repair steam leaks (see Section 4.1.5)	Ongoing PPM programme would address this.
6 minimise boiler blowdown (see Section 4.2.17.4).	Auto blow down in place.

Minimisation of air emissions

Air emissions arise from various sources during processing and cleaning and from the drying of FDM materials.

Process-integrated BAT which minimise air emissions by the selection and use of substances and techniques should be applied. The selection of air emission abatement techniques can then be made, if further control is required.

1 apply and maintain an air emissions control strategy (see Section 4.4.1) incorporating: 1.1 definition of the problem (see Sections 4.4.1.1 and 4.4.1.1.1) 1.2 an inventory of site emissions, including, e.g. abnormal operation (see Sections 4.4.1.2 and 4.4.1.2.1) 1.3 measuring the major emissions (see Sections 4.4.1.3 and 4.4.1.3.1) 1.4 assessing and selecting the air emission control techniques (see Section 4.4.1.4)	Emissions to air from the site consist of products of combustion from 2 x natural gas fired steam boilers and 2 x gas fired thermal oil boilers, plus emission from the fryers which are directed through an odour abatement plant. Emissions monitoring has been carried out as part of this application.
2 collect waste gases, odours and dusts at source (see Section 4.4.3.2) and duct them to the treatment or abatement equipment (see Section 4.4.3.3)	Waste gases from fryers are collected and ducted to the odour abatement plant. LEV is in place to collect dust from the grinding room which is collected in an external enclosed hopper.
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 (see Sections 4.4.3.1)	Odour abatement plant and LEV runs constantly during processing.

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. Some air abatement techniques are described in Sections 4.4 to 4.4.3.12	N/A
5 where process-integrated BAT do not eliminate odour nuisance, apply abatement techniques. Many of the techniques described in Section 4.4 are applicable to odour abatement.	Odour abatement in place (activated carbon).

Wastewater

For the treatment of waste water from FDM installations, BAT is to use a suitable combination of the following:

1 apply an initial screening of solids (see Section 4.5.2.1) at the FDM installation	Screen in place to remove solids prior to oil skimming.
2 remove fat using a fat trap (see Section 4.5.2.2) at the FDM installation, if the waste water contains animal or vegetable FOG	Oil skimmer in place.
3 apply flow and load equalisation (see Section 4.5.2.3)	Balance tank in place.
4 apply neutralisation (see Section 4.5.2.4) to strongly acid or alkaline waste water	Effluent is dosed with acid or caustic to correct pH.
5 apply sedimentation (see Section 4.5.2.5) to waste water containing SS	N/A
6 apply dissolved air flotation (see Section 4.5.2.6)	DAF plant in place.
7 apply biological treatment. Aerobic and anaerobic techniques applied in the FDM sector	N/A

are described in Sections 4.5.3.1 to 4.5.3.3.2	
8 use CH_4 gas produced during anaerobic treatment for the production of heat and/or power (see Section 4.5.3.2).	N/A
BAT is to treat waste water sludge using one or a combination of the following techniques: 15 stabilisation (see Section 4.5.6.1.2) 16 thickening (see Section 4.5.6.1.3) 17 dewatering (see Section 4.5.6.1.4) 18 drying (see Section 4.5.6.1.5), if natural heat or heat recovered from processes in the installation can be used.	Sludge is removed off-site to an anaerobic digestion plant.

Accidental releases

1 identify potential sources of incidents/accidental releases that could harm the environment (see Section 4.6.1)	Potential accident scenarios are identified in the main application and will be part of the developing SHE management system within the Aspects Register and within emergency response procedures. The site also has a risk register which includes potential emergency scenarios such as major spills.
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 (see Section 4.6.2)	Potential scenarios identified in the application, risk register and aspects register are all assessed for likelihood and severity.
3 identify those potential incidents/accidental releases for which additional controls are required to prevent them from occurring (see Section 4.6.3)	Required controls to manage identified risks are identified within the application, risk register and aspects register.
4 identify and implement the control measures needed to prevent accidents and minimise their harm to the environment (see Section 4.6.4)	Required controls to manage identified risks are identified within the application, risk register and aspects register.
5 develop, implement and regularly test an emergency plan (see Section 4.6.5)	The site has a Crisis Manual and emergency plans to address identified scenarios such as fire. There are also emergency 'battle boxes' in place containing equipment and plans for use in the event of an emergency. Exercises are carried out twice per year to practise the response to identified scenarios.
6 investigate all accidents and near misses and keep records (see Section 4.6.6).	All incidents and accidents are reported and investigated using the H&S database at present. The operator is moving to a new system for incident reporting called Alcumus which will be used for the reporting, recording and

	investigation of all SHE incidents and non-conformances.

BAT Summary – Food and Drink Sector Guidance EPR 6.10

BAT for Operating Techniques And Emissions

2.2 Process Control

1. Assess your product loss against the benchmarks.	Product yield and losses are constantly monitored via the CI process.
2. Set up effluent monitoring to provide baseline information on wastewater loadings (kgCOD and volume)	Effluent sampling in place to generate composite samples for analysis to ensure compliance with discharge consent. Continuous pH monitoring in place.
3. Investigate high loss areas. Using the baseline information you should set improvement targets – this could be a reduction in daily kgCOD or volume, or any other specific objective.	Manufacturing yield is constantly measured along with utilities and waste which is weighed off some lines. Mass balance of raw materials in/product out can be carried out and is usually part of a first production run for a product.
4. Continue monitoring and review your performance regularly.	As above – daily/weekly/monthly reviews of KPI's.
5. Carry out any appropriate measurements listed in Table 3:	
Temperature measurement	
Pressure measurement	
Level measurement	Level measurement in place on bulk tanks e.g. oil and acetic acid.
Flow measurement and control	Flow control in place on cooking and mixing vessels to ensure correct recipe additions.

2.3 Raw Materials Preparation

e.g is there cleaning, sorting, screening, grading or peeling.

No

2.4 Heat Processing using Steam or Water

Is there any blanching, evaporation, pasteurisation, Sterilisation, UHT, baking, roasting, drying or dehydration in the process?

Pasteurisation is used in the process – see below.

Frying

The main control issues are emissions to air, removal of entrained oil from exhaust gases, exhaust gas recirculation to the burner, odour, energy efficiency and recovery of heat in off gases.

Emissions from the fryers are directed to the odour abatement plant for treatment prior to release to atmosphere. There is currently no recirculation of exhaust gas from fryers. There is an economiser on Steam Boiler 2 that takes heat from the exhaust gases for efficiency purposes.

The operator receives Certificates of Analysis for the fryer oil which covers FFA checks; oil is monitored in the fryers during production and any sign of deterioration, such as 'soapy appearance' which would indicate the presence of FFAs would prompt an oil change.

Pasteurisation, Sterilisation, UHT 1. Use recirculating systems to recycle water. (Once through cooling systems should not be used.)	Cooling water for the pasteurisers is returned to the cooling tower hotwell for reuse.
2. Use energy efficiency techniques including regenerative heat exchangers.	Not currently.

2.5 Cooling, chilling, freezing and freeze drying

1. Use re-circulating systems to recycle water (once through cooling systems should not be used)	Cooling water for the pasteurisers is returned to the cooling tower hotwell for reuse.
2. Use detailed drainage plans to ensure that ammonia leaks cannot be discharged to surface waters.	Drainage plan in place (see Appendix A)
3. Energy efficient techniques should be applied.	Refrigeration equipment maintained by external contractor and optimised via regular maintenance.

2.6 Separation and concentration of food components – extraction

Is there separation or concentration of food components in the process?

No

2.7 Cleaning and sanitation

You should ensure that appropriate cleaning procedures are in place. These should include measures such as the following:	
1. Wherever possible raw materials and product should be kept out of the wastewater system.	Teams are trained and asked to operate to 'Clean as you Go' principles to minimise waste to drain and employ dry clean up where possible. Tubs/bins are scraped out prior to cleaning; sauce tubs pre-rinse can go in to the vessel as water in product. Mixers have scrapers in to maximise yield and minimise solids to drain. Catchpots in place on factory drains to prevent large solids reaching effluent plant.
2. Equipment design:	

• When ordering new equipment consider ease of cleaning • Wherever practicable, process lines and operations that cause excessive spillage of material onto the floor should be modified to eliminate or reduce the problem • Dry clean-up procedures should remove as much residual material as possible from vessels and equipment before they are washed • Drains should be equipped with catchpots • Catchpots should be in place during cleaning (for example by installing lockable catchpots) • You should optimise water pressure at jets, nozzles and orifices • Trigger operated spray guns or hoses should have an automatic water supply shut off	New equipment goes through a capex process which includes siting and assessment of efficiency including energy and water use. Factory Acceptance Testing in place for installation of new equipment. Pigs used on filling lines to flush through prior to cleaning/changeover. Catch trays are used in the cook house where ingredients are transferred to the cooking and mixing vessels. Wastage from the pappadum lines is contained in trays/bins. Teams are trained and asked to operate to 'Clean as you Go' principles to minimise waste to drain and employ dry clean up where possible. Tubs/bins are scraped out prior to cleaning; sauce tubs pre-rinse can go in to the vessel as water in product. Mixers have scrapers in to maximise yield and minimise solids to drain. Catchpots in place on factory drains to prevent large solids reaching effluent plant. Cookhouse hoses are mostly high-pressure hoses with restrictors.
3. Good Housekeeping: • You should install trays to collect waste to prevent it falling onto the floor • Spilt material should be swept, shovelled or vacuumed rather than hosed down the drain • You should make sure that suitable dry clean up equipment is always readily available • You should provide convenient, secure receptacles for collected waste • Cleaning schedules should be optimised • Cleaning cycle durations should be matched to the vessel size • You should schedule product manufacture to minimise numbers of product changes and subsequent cleaning between products.	Teams are trained and asked to operate to 'Clean as you Go' principles to minimise waste to drain and employ dry clean up where possible. Dry clean up equipment is available in all manufacturing areas. SOP's are in place for all processing activities which specify procedures around use of equipment, waste segregation and storage, use of chemicals etc. GMP audits and H&S walk rounds take place which identify poor housekeeping practises. Production team review production plan every week and challenge batch sizes/ changes. The high number of different products produced means that there are a high number of changeovers, however the operator is

	constantly looking for ways to minimise these, for example by combining recipes.
4. Manual cleaning: • Procedures should ensure that hoses are only used after dry clean up • Trigger controls should be used on hand held hoses and water lances to minimise the use of washdown water • High pressure/low-volume systems should be used wherever practicable	See above on Clean as you Go. Cookhouse hoses are mostly high-pressure hoses with restrictors.
5. Cleaning chemicals usage: • You should ensure that staff (and contract cleaners) are trained in the handling, making up and application of working solutions. In particular, the correct concentration of chemical agent should be used. Overuse of chemicals should be avoided, particularly where manual dosing is used.	Cleaning chemicals are auto-dosed. All cleaning staff are trained in the handling of chemicals and task cards are in place for each cleaning task.
6. CIP • dry product should be removed before the start of the wash cycle by gravity draining, pigging or air blowdown • pre-rinsing should be used to enable remaining product to be recovered for re-use or disposal • the use of turbidity detector to maximise product recovery • optimal CIP programme for the size of plant/vessel and type of soiling • optimising frequency and duration of rinses to reduce water use • automatic dosing of chemicals at correct concentrations • internal recycling of water and chemicals • recycle control on conductivity rather than time • continuous cleaning of recirculated solutions • water-efficient spray devices	Pigging is used to clean through lines prior to changeovers. Some cookhouse vessels, pre-rinse is used in the recipe. CIP systems are in place for cleaning of fryers, cooking vessels and filling lines. The operator has reviewed CIP operation procedures to ensure consistency. At present there is minimal optimisation of CIP processes. Addressing leaks from the CIP systems is a current project on the CI opportunities tracker.
7. Use dry clean-up techniques where practicable to reduce wastewater strength.	As above.
8. Sanitisation: • You should justify the use of organohalogen-based oxidising biocides	N/A

over the alternatives (e.g. ozone and UV light) • Recycling of water and recovery of cleaning chemicals.	

3. Emissions and monitoring

3.1 Point source emissions to air

1. Meet the benchmark values for point source emissions to air listed in Annex 1 or justify otherwise.	Emissions to air from the site consist of products of combustion from 2 x natural gas fired steam boilers and 2 x gas fired thermal oil boilers, plus emission from the fryers which are directed through an odour abatement plant. Emissions monitoring and air dispersion modelling has been carried out as part of this application.
2. Use heat recovery systems.	Not currently.
3. Recycle exhaust gases where practicable for pre-heat purposes.	There is currently no recirculation of exhaust gas from fryers. There is an economiser on Steam Boiler 2 that takes heat from the exhaust gases for efficiency purposes.

3.1 Point source emission to water

1. As a minimum, control all emissions to avoid a breach of water quality standards but where another technique can deliver better results at reasonable cost it will be considered BAT and should be used. Unless self-evident, you should provide calculations and/or modelling to demonstrate this as part of your application.	There are no direct releases to surface water from the process, only run-off of clean rainwater. Process effluent is discharged to foul sewer in accordance with a trade effluent discharge consent.
2. Keep raw materials and product out of the wastewater system wherever possible. The following techniques should be used: • dry clean-up • installation of drain catchpots and screens • where gross FOG is found in wastewater, drainage systems should have grease traps and gratings to prevent sewer blockage. These must be frequently inspected, emptied and maintained • use a balancing tank or pond (equalisation or balancing), with a hydraulic retention time of 6 – 12 hours,	See above re. Dry clean up and catchpots in place. Effluent treatment plant includes initial screen, oil skimmer, balance tank, and DAF plant. Effluent is dosed with caustic or acid to correct pH. Wastewater from the weekly fryer caustic clean is saved in an IBC for use in the effluent treatment plant to balance acidic wastewater streams.

which can improve treatment in the following ways: - by allowing waste streams to be combined e.g. acid and alkali streams from the regeneration of deionisers; or high BOD and low BOD waste streams. This can reduce consumption of reagents - by making the flow rate less variable. This can reduce the size of the treatment plant needed, as it only has to handle the average flow and not the peak flow.	
3. Provide contingency measures to prevent accidental discharges from overloading or damaging the treatment plant. These will often include providing a diversion tank into which potentially damaging wastewater can be diverted. This should typically have a capacity of 2 – 3 hours at peak flow rate. The wastewater should be monitored upstream of the treatment plant to allow automatic diversion to the tank. The contents of the diversion tank may be gradually re-introduced into the wastewater stream, or removed for off-site disposal. If you do not provide a diversion tank, you must tell us what equivalent measures you use to protect your treatment plant.	Effluent reception pit and balance tank which have a combined capacity of 215m^3. If there was a known problem with effluent then it could be held back prior to the DAF plant and tankered off if capacity was reached, or a pump could be used to pump effluent back round to the reception pit. However, out of consent effluent does not automatically recirculate if detected prior to release after treatment.

3.2 Fugitive Emissions

1. Regularly inspect pipe joints, shaft seals and gaskets in the refrigeration plant using proprietary leak detection equipment.	Refrigeration equipment maintained by external contractor and optimised via regular maintenance.
2. Ensure that a system log book is kept which records: - Quantity of refrigerant and oil added to or removed from the system - Leakage testing results - Location and details of specific leakage incidents	Refrigeration equipment maintained by external contractor who are responsible for generating the required records.

3.3 Odour

1. Ensure that effluent treatment plant is adequately sized and maintained, and check that site waste water drains do not become blocked. Where present, aeration tanks should be kept aerated and mixed at all times except where maintenance necessitates shut-down of the	Effluent plant is maintained under contract and the various parts of the system undergo periodic deep clean. DAF plant runs constantly.

aeration system. Alternative operational arrangements should be implemented during shut-down to avoid odour nuisance.	
2. Design and operate abatement plant to cope with maximum loadings and volumes.	Odour plant operated to original installers specification.
3. Design extraction from odorous activities to minimise air flows to the abatement plant.	All fumes from the fryers are ducted to the odour abatement plant.

3.4 Monitoring

Table 4 B Monitoring of emissions to sewer

Flow rate – continuous and integrated daily flow rate	Yes
pH – continuous	Yes
Temperature – continuous monitoring is appropriate if the temperature of the discharge is above 25°C	N/A
COD/BOD – flow weighted sample or composite samples, weekly analysis, reported as flow weighted monthly averages	Composite sample
TOC - continuous	N/A

1.1 Accident Management

1. Use automatic process controls backed-up by manual supervision, both to minimise the frequency of emergency situations and to maintain control during emergency situations. Instrumentation will include, where appropriate, microprocessor control, trips and process interlocks, coupled with independent level, temperature, flow and pressure metering and high or low alarms.	Filling lines are automated. Bulk tanks (new oil, used oil and acetic acid) have level indicators and the new oil tanks to be installed will have high-level alarms.
2. Use techniques and procedures to prevent overfilling of tanks - liquid or powder- (*eg*. level measurement displayed both locally and at the central control point, independent high-level alarms, high-level cut-off, and batch metering).	Batch metering in place – ingredients are weighed or metered in to cooking and mixing vessels.
3. Use measures to detect variation in effluent composition *eg* in-line TOC measurement (see monitoring section)	Not currently. Weekly composite samples taken.
4. Ensure that gross fat, oil and grease (FOG) does not block drains.	Drains periodically cleaned.

5. Identify the major risks associated with the effluent treatment plant (ETP) and have procedures in place to minimise them.	Main risks include out of consent pH, COD or suspended solids. Site currently has continuous monitoring of pH and has the ability to recirculate effluent if identified as out of consent using a pump, however out of consent effluent is not automatically diverted.
6. Provide adequate effluent buffer storage so that you can stop spills reaching the ETP or controlled water, especially those spills with high organic strength.	Spills could potentially be held in the initial effluent reception pit or pumped to a bunded area. Bunding is in place for all bulk tanks and IBC's to prevent spills reaching surface water drains, as well as spill response kits. Operator investigating potential options for blocking final release points to surface water from the site.
7. Protect against spillages and leaks of refrigerants, especially ammonia.	Refrigeration equipment maintained by external contractor and optimised via regular maintenance.

1.2 Energy Efficiency

1. Recover heat from, for example, ovens, dryers, fryers, evaporators, pasteurisers and sterilisers, where a plate heat exchanger has a regeneration capacity up to 94%.	Not currently.
2. For in-tunnel and tray ovens, fit heat exchangers to the exhaust flues to remove heat from exhaust gases and to heat inlet air.	N/A
3. Recover heat from condensed steam, for example, blanching and steam peeling.	Condensate recovered from the steam system.
4. Use multi-effect evaporators in large scale evaporator applications.	N/A
5. Minimise water use and use recirculating water systems.	Cooling water for the pasteurisers is returned to the cooling tower hotwell for reuse. Production team review production plan every week and challenge batch sizes/ changes. The high number of different products produced means that there are a high number of changeovers, however the operator is constantly looking for ways to minimise these and thereby save water, for example by combining recipes.

6. Ensure efficient operation of the refrigeration system – consider heat recovery from refrigeration system, reducing heat load, efficient operation on part load and fast closing doors/alarms on chilled storage areas.	Not currently.
7. Use spent cooling water (which is raised in temperature) in order to recover the heat.	Cooling water for the pasteurisers is returned to the cooling tower hotwell for reuse.
8. Optimise efficiency measures for combustion plant, *e.g.* air/feedwater pre-heating, and use of excess air.	Yes, coil in boiler hotwell and economisers.

1.3 Efficient use of raw materials and water

• Identify and evaluate opportunities for the recycling or reuse of water, taking into consideration hygiene issues and practical constraints. An optimal scheme is likely to include a combination of: • sequential reuse (water stream used for two or more processes or operations before disposal) • counter-flow reuse, in which the water flows counter-current to the product so that the final product only comes into contact with clean water • recycling within a unit process or group of processes without treatment. Recirculating systems should be used to recycle water. (Once through cooling systems should not be used.) • the recycling of condensate as boiler feed water (where it is of suitable quality). Contaminated condensate should be used for lower grade cleaning activities e.g. yard washing • recycling following treatment - this may include tertiary treatment such as membrane technology.	Cooling water for the pasteurisers is returned to the cooling tower hotwell for reuse. Condensate from boilers and cooking vessels is returned to the boiler hotwell. Production team review production plan every week and challenge batch sizes/ changes. The high number of different products produced means that there are a high number of changeovers, however the operator is constantly looking for ways to minimise these and thereby save water, for example by combining recipes.
2. Assess the potential environmental impact of raw materials and make substitutions where appropriate. Consider their degradation products when choosing cleaning materials. If caustic is used low mercury sodium hydroxide should be selected. Supercritical carbon dioxide	Raw materials/ingredients are selected on the basis of the recipe requirements, operator can minimise waste by ordering correct pack sizes etc. and scheduling production to ensure all ingredients are used up.

is a suitable alternative to organic solvent useage for extraction of caffeine.	The operator uses Sedex and a supplier management tool to understand impacts in their supply chain. All chemicals used have a current COSHH risk assessment in place.

1.4 Avoidance, recovery and disposal of wastes

1. Demonstrate that the chosen routes for recovery or disposal represent the best environmental option considering, but not limited to, the following: • all avenues for recycling back into the process or reworking for another process • composting • animal feed • other commercial uses, as tabulated in table 2 below • landspreading, but only under the following circumstances - you can demonstrate that it represents a genuine agricultural benefit or ecological improvement - you have identified all the pollutants likely to be present. These may substances from the process, from the materials of which your plant is constructed (e.g. reaching the waste by corrosion/erosion mechanisms), from materials related to maintenance (e.g. detergent). You should consider all these possibilities, for both normal and abnormal operation of the plant. You should validate your conclusions by chemical analysis of the waste. - you have identified the ultimate fate of the substances in soil.	Pastes can sometimes be reworked but pasteurised sauces cannot be due to food safety requirements. Food waste and effluent sludge is mainly sent for anaerobic digestion, with some landspreading and pappadum waste going for animal feed. Other waste streams such as cardboard, plastic, wood and metal are recycled with remaining general waste incinerated with energy recovery.
2. Schedule production to minimise product changeovers and clean downs.	Production team review production plan every week and challenge batch sizes/ changes. The high number of different products produced means that there are a high number of changeovers, however the operator is constantly looking for ways to minimise these and thereby save water, for example by combining recipes.

3. Consider whether your packing line efficiency can be improved.	Current opportunity on the CI Tracker to adapt RTE cardboard flute to make packs thinner. This would represent a saving on pallets and weights. Packing lines also subject to CI programme e.g. investigating whether or not products can be run on different lines to reduce changeover/running times.