Best Available Techniques (BAT) Assessment

On Behalf of Wyke Farms Limited

Wyke Farmhouse Cheese, White House Farm, Wyke Champflower, Bruton, Somerset, BA10 0PU

Prepared by:

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ETL606/ 2021

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31st January 2022

QUALITY CONTROL

Document Title:	Best Available Techniques Assessment
Revision:	Version 1.0
Date:	31st January 2022
Document Reference:	ETL606/Wyke Cheese/BAT/V1.0
Prepared For:	Wyke Farms Limited
Project Reference:	ETL606
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Quality control sign off		
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1. Introduction

1.1.1 A Best Available Techniques (BAT) Assessment has been prepared by Earthcare Technical Ltd (ETL) on behalf of Wyke Farms Limited to support an application for a substantial variation to a food and drink sector bespoke installation permit at White House Farm, Wyke Champflower, Bruton, Somerset, BA10 0PU herein termed 'the Site'. The site is operated by Wyke Farms Limited (Wyke).

1.1.2 This report comprises a review of the operation, activities, infrastructure, management systems, etc. for the site, in comparison to the requirements of indicative BAT as stated in the Best Available Techniques (BAT) Reference Document for the Food, Drink and Milk Industries[1] to ensure that all relevant areas are included.

1.1.3 Whilst it is usual for a BAT assessment supporting a permit variation application to only provide an assessment of the elements of the operation that are changing, in this instance a full review against BAT has been undertaken as it is understood that a Regulation 61 Notice requiring further information, namely a full BAT assessment, is to be served by the Environment Agency imminently and this report will therefore additionally serve as a response to that Notice when raised.

1.1.4 The aim of this report is to provide confidence to the Environment Agency that Wyke has both considered the requirements of BAT and operates the site in compliance with the requirements of indicative BAT.

1.1.5 The report is structured in table format in the same order as set out in the Best Available Techniques (BAT) Reference Document for Food, Drink and Milk Industries to ensure a logically sequential review of the requirements of indicative BAT. Next to each relevant requirement there is a summary of the proposals and a comparison against indicative BAT.

1.1.6 The final section comprises conclusions and recommendations, in particular details of any BAT requirements that are not currently met.

[1] Best Available Techniques (BAT) Reference Document for the Food, Drink and Milk Industries, European Commission, 2019

2. BAT Assessment for Wyke Farmhouse Cheese

Environmental Management System

BAT 1	**Implement an EMS that incorporates all of the following features:**	
i)	commitment, leadership, and accountability of the management, including senior management, for the implementation of an effective EMS;	Senior management of Wyke have committed to the establishment and further development of an environmental management system (EMS) which forms part of the wider Integrated Management System (IMS). The IMS is accredited to ISO 14001. The company Environmental Policy is within the IMS and includes a commitment to strive for continual improvement throughout operations. The organisational structure is detailed in the company organogram. The company Environmental Policy is approved and signed by the Production Director within the IMS and includes a commitment to the environment and pollution prevention.
ii)	an analysis that includes the determination of the organisation's context, the identification of the needs and expectations of interested parties, the identification of characteristics of the installation that are associated with possible risks for the environment (or human health) as well as of the applicable legal requirements relating to the environment;	The IMS is accredited to ISO 14001 and therefore the following requirements are met: • Determination of organisations context • Identification of the needs and expectations of interested parties • Identification of aspects and impacts (Bruton Site Environmental Aspects Register) • Identification of compliance obligations
iii)	development of an environmental policy that includes the continuous improvement of the environmental performance of the installation;	The Company Environmental Policy includes a commitment to continual improvement.
iv)	establishing objectives and performance indicators in relation to significant environmental aspects, including safeguarding compliance with applicable legal requirements;	Objectives and Targets as detailed in the IMS, are set in relation to significant environmental aspects e.g. water usage, effluent discharge quality, waste production, electric and gas usage, and are continually measured as appropriate on a daily, weekly and monthly basis. Some objectives and targets are reviewed at weekly KPI meetings, others are reviewed at quarterly management review meetings.
v)	planning and implementing the necessary procedures and actions (including corrective and preventive actions where needed), to achieve the environmental objectives and avoid environmental risks;	The production facility has a range of procedures and work instructions referenced in the IMS to ensure competence, awareness, effective process control and maintenance. All relevant members of staff are trained against the procedures and work instructions that as determined by their job role.

BAT 1	**Implement an EMS that incorporates all of the following features:**	
vi)	determination of structures, roles and responsibilities in relation to environmental aspects and objectives and provision of the financial and human resources needed;	The organisational structure is detailed in the company organogram. Roles and responsibilities are defined within the IMS procedures which have been developed to control environmental aspects. The commitment of senior management to the IMS means that there are relevant financial and human resources in place.
vii)	ensuring the necessary competence and awareness of staff whose work may affect the environmental performance of the installation (e.g. by providing information and training);	All staff training is set out in the Mandatory Training record which details each procedure, management plan and work instruction that the operatives need to be trained against. Everyone has their own training folder and paper records. All documentation is either held electronically on the company secure cloud or in paper files within the relevant departmental office.
viii)	internal and external communication;	*Internal communication* All staff are trained on the parts of the IMS relevant to them and refresher training is carried out as applicable e.g., if procedures change or training expires. There are staff notice boards detailing e.g. current objectives and targets (including progress) and company policies, including the Environmental Policy. There are regular email communications to staff via line managers. Worker Representative meetings are held periodically to allow feedback from employees, and this is then fed back to management (who do not attend). *External communication* Stakeholder communication includes communication with customers, audits by customers and buyer reviews.
ix)	fostering employee involvement in good environmental management practices;	See above for Internal Communication
x)	Establishing and maintaining a management manual and written procedures to control activities with significant environmental impact as well as relevant records;	This is incorporated into the IMS manual and associated procedures.
xi)	effective operational planning and process control;	Operational planning includes quarterly management review meetings, weekly KPI meeting, weekly production meetings and sales meetings. This is key for the main operational processes.

BAT 1	Implement an EMS that incorporates all of the following features:	
		Process control via daily, weekly and monthly monitoring, measurement, inspection and maintenance.
xii)	implementation of appropriate maintenance programmes;	Planned and preventative maintenance is issued to the site engineers through an electronic maintenance system called Emaint which is managed by the Maintenance Manager and Engineering Manager. Critical spares are held onsite and are managed by the Engineering Stores Manager.
xiii)	emergency preparedness and response protocols, including the prevention and/or mitigation of the adverse (environmental) impacts of emergency situations;	The site has a comprehensive Accident Management Plan (Revision 8, February 2021 at the time of writing) which all staff are trained against for emergency preparedness and response. There is a site wide fire alarm system which is tested on a weekly basis and the local fire brigade are familiar with the site including hydrant water supplies and have risk assessed all areas.
xiv)	when (re)designing a (new) installation or a part thereof, consideration of its environmental impacts throughout its life, which includes construction, maintenance, operation and decommissioning;	Linked to Section 6.3.1 of the IMS, there is a Major Capital Projects Installation Form (EG4.12.1) in place which is used to manage change for major capital projects.
xv)	implementation of a monitoring and measurement programme, if necessary, information can be found in the Reference Report on Monitoring of Emissions to Air and Water from IED Installations;	Relevant monitoring is included within the EMS. Monitoring of process parameters of emissions to water is carried out in accordance with BAT 3. Monitoring of emissions to water is carried out in accordance with BAT 4.
xvi)	application of sectoral benchmarking on a regular basis;	Wyke are members of several trade bodies e.g. Provision Trade Federation. Wyke strive for continual improvement. This commitment is also included in the company Environmental Policy.
xvii)	periodic independent (as far as practicable) internal auditing and periodic independent external auditing in order to assess the environmental performance and to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained;	Internal auditing is carried out throughout the year and if there have been any actions identified that are outstanding then they are raised and dealt with between the management team. There are several internal audits every year including an internal audit against MCERTS, an internal audit against the environmental permit, health and safety and hygiene and housekeeping audits. Besides this, there are also external audits by organisations such as the Environment Agency to ensure compliance.

BAT 1	**Implement an EMS that incorporates all of the following features:**	
xviii)	evaluation of causes of nonconformities, implementation of corrective actions in response to nonconformities, review of the effectiveness of corrective actions, and determination of whether similar nonconformities exist or could potentially occur;	A Problem Report System is used by all staff to raise issues to management who in turn determine corrective actions, investigate root cause(s) and ensure that issues are resolved in a timely manner. Paper forms are used to record issues which are tracked to completion using an Access database. Internal auditing system in compliance with the IMS.
xix)	periodic review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness;	Management review is carried out on a quarterly basis and includes consideration of the suitability, adequacy and effectiveness of the IMS.
xx)	following and taking into account the development of cleaner techniques.	Wyke follow research and development within the sector and are committed to using the most efficient market leading technology within the production process.
BAT is also to incorporate the following features in the EMS:		
i)	noise management plan (see BAT 13);	Noise nuisance not present or expected.
ii)	odour management plan (see BAT 15);	Odour nuisance not present or expected.
iii)	inventory of water, energy and raw materials consumption as well as of waste water and waste gas streams (see BAT 2);	Water - Sub-metering across site onto the supervisory control and data acquisition (SCADA) computer system and water usage recorded daily and weekly onto spreadsheets. Annual reporting to the Environment Agency. Energy - Recorded monthly. Import, export and electricity generated from the onsite combined heat and power engine (CHP) running on biogas produced from the anaerobic digestion (AD) plant. Sub-metering is in place for internal monitoring and to inform energy savings where appropriate. Annual reporting to the Environment Agency. Raw materials use is recorded and there are related KPIs. This incorporates all chemical usage, ingredients and packaging materials. Inventory of waste water and waste gas streams (see BAT 2).
iv)	energy efficiency plan (see BAT 6a).	See BAT 6a

Inventory of Waste Water and Waste Gas

<table>
<tr><td>BAT 2</td><td colspan="2">In order to increase resource efficiency and to reduce emissions, BAT is to establish, maintain and regularly review (including when a significant change occurs) an inventory of water, energy and raw materials consumption as well as of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:</td></tr>
<tr><td>i</td><td>Information about the food, drink and milk production processes, including:

a) simplified process flow sheets that show the origin of the emissions;
b) descriptions of process-integrated techniques and waste water/waste gas treatment techniques to prevent or reduce emissions, including their performance.</td><td>Bruton Site Emission Point Schematic (Appendix A) shows the origin of emissions to air and waste water emissions from the dairy effluent treatment process. In normal daily operations, there is no export of waste water for treatment; there has been significant investment in the on-site effluent treatment plant to treat waste effluent into either dischargeable water or potable water for reuse (thus reducing need for abstraction). Some residual waste streams arising are sent to the Wyke Farms AD plant for treatment and recovery.

Bruton Effluent Treatment Process Flow (Appendix B) details effluent and sludge treatment. The waste water treatment process is described in Section 2.1 of the Byrne Looby Treated Dairy Effluent Discharge Risk Assessment Report which accompanies the permit variation application.[2]

There is no treatment of waste gases.

Emission points to air are:
• 2 No. natural gas boilers; and
• Standby generator (used infrequently / operates on diesel).

Fugitive emissions may arise from:
• Refrigerant units losses of gas (losses are recorded).

There is also loss of steam from:
• Pressure relief valves; and
• Cooling towers.</td></tr>
<tr><td>ii</td><td>Information about water consumption and usage (e.g. flow diagrams and water mass balances), and identification of actions to reduce water consumption and waste water volume (see BAT 7).</td><td>Sub-metering is recorded on SCADA across site and water usage recorded daily onto a spreadsheet.</td></tr>
</table>

[2] Treated Dairy Effluent Discharge Risk Assessment Report, White House Farm, Byrne Looby, 14-K6029-R01, January 2022

<table>
<tr><td>BAT 2</td><td colspan="2">In order to increase resource efficiency and to reduce emissions, BAT is to establish, maintain and regularly review (including when a significant change occurs) an inventory of water, energy and raw materials consumption as well as of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:</td></tr>
<tr><td></td><td></td><td>There are a number of available sources for clean water:
Borehole water
Recovered water which comes from three sources:
Effluent treatment plant reverse osmosis
2 No. evaporator condensate streams
Whey polisher reverse osmosis.
There are systems in place to prioritise the use of the recovered water and hence minimise abstraction from the borehole where possible. Washing is carried out mainly at night when there is no production therefore the storage of process water is maximised through the use of the recovered water silo for recovered water streams.

Borehole water usage per tonne of total product is reported to the Environment Agency annually.</td></tr>
<tr><td>iii</td><td>Information about the quantity and characteristics of the waste water streams, such as:

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

(b) average concentration and load values of relevant pollutants/parameters (e.g. TOC or COD, nitrogen species, phosphorus, chloride, conductivity) and their variability.</td><td>a) In light of the plant expansion, there will be no change to the characteristics of the waste water streams however the proposed maximum flows are 1,500m^3 per day and 62.5m^3 per hour in comparison to current maximum limits of 750m^3 per day and 32.25m^3 per hour.

pH and temperature of waste water discharge are not anticipated to change in light of proposed changes.

pH is measured circa every other day and reported on a quarterly basis to the Environment Agency every 3 months. The 2021 data (up to 23/09/2021) shows that the pH of W1 sits between 7.15 and 8.58 with an average value of 8.0.</td></tr>
</table>

BAT 2	**In order to increase resource efficiency and to reduce emissions, BAT is to establish, maintain and regularly review (including when a significant change occurs) an inventory of water, energy and raw materials consumption as well as of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:**	
		The temperature of the discharge is tested every other day. The 2021 data (up to 23/09/2021) shows that the temperature of W1 is related to ambient temperature and varies between 8.3ºC and 29.4ºC with an average temperature of 21.6ºC. b) A phosphate limit was not agreed with the Environment Agency in relation to Improvement Condition 12 in the current permit. However, a limit of 5mg/l of phosphate in the waste water discharge is proposed in accordance with the rationale within the Byrne Looby Treated Dairy Effluent Risk Assessment Report.[2] The 2021 data (to 23/09/2021) shows that the level of PO_4 at W1 sits between 0.00mg/l and 4.58mg/l with an average value of 1.0mg/l. There is no COD limit currently applied however COD is measured once every 4 days. Data for 2021 (up to 23/09/21) ranges from 29.6mg/l to 142mg/l with an average of 72mg/l over the dataset. The permitted limit for suspended solids is 30mg/l. Monitoring results for 2021 (up to 23/09/2021) are all within the limit; all results are less than or equal to 7mg/l with the exception of one outlier at 24mg/l. There is no limit specified for Total Nitrogen (TN) in the current permit. TN is not currently tested at W1 however it is monitored at the UF permeate tank after which there is no further treatment prior to discharge at W1. However, W1 also includes RO reject water when the RO is running so the TN measurements at the UF permeate tank may not be wholly representative of the final discharge. The dataset for 2021 up to 10/11/2021 provides an average of 18.4mg/l TN.
iv	Information about the characteristics of the waste gas streams, such as: (a) average values and variability of flow and temperature;	*Boilers* There are combustion emissions from the two natural gas fired boilers (one duty and one standby) used to generate steam. The boiler operation is a Directly Associated

BAT 2	**In order to increase resource efficiency and to reduce emissions, BAT is to establish, maintain and regularly review (including when a significant change occurs) an inventory of water, energy and raw materials consumption as well as of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the following features:**	
	(b) average concentration and load values of relevant pollutants/parameters (e.g. dust, TVOC, CO, NOX, SOX) and their variability; (c) presence of other substances that may affect the waste gas treatment system or plant safety (e.g. oxygen, water vapour, dust).	Activity. Combined thermal input 18.8 MW. Emissions to air from the boilers are monitored periodically. *Refrigerant gases* Refrigerant gas losses over the site are measured by an external party, Cooltec, who also service the refrigerant gas equipment. Cooltec report on how much of each type of refrigerant gas has been lost over time and this is recorded centrally. Refrigerant usage data is submitted to the Environment Agency every 12 months in accordance with the permit.
v	Information about energy consumption and usage, the quantity of raw materials used, as well as the quantity and characteristics of residues generated, and identification of actions for continuous improvement of resource efficiency (see for example BAT 6 and BAT 10).	Energy - Recorded monthly. Import, export and CHP electric. Sub-metering is in place for internal use and to inform energy savings where appropriate. Reported to the Environment Agency annually; energy consumption per tonne of total product. Raw material use is recorded and there are related KPIs. All chemical usage, ingredients and packaging included. Waste produced recorded and tracked. Annual report to Environment Agency on tonnage of waste per tonne of product.
vi	Identification and implementation of an appropriate monitoring strategy with the aim of increasing resource efficiency, taking into account energy, water and raw materials consumption. Monitoring can include direct measurements, calculations or recording with an appropriate frequency. The monitoring is broken down at the most appropriate level (e.g. at process or plant/installation level).	Energy, water and raw materials consumption is monitored routinely, some of which are compared against production volumes and are subject to KPIs. As above.

Monitoring- process parameters for emissions to water

BAT 3	**Monitor key process parameters at key locations for emissions to water**	
	For relevant emissions to water as identified by the inventory of waste water streams (see BAT 2), BAT is to monitor key process parameters (e.g. continuous monitoring of waste water flow, pH and temperature) at key locations (e.g. at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation).	Continuous monitoring includes: • Flow rates are measured at several locations around the site including at the outflow. • There is an inline continuous turbidity monitor prior to the DAF plant. • pH is monitored continuously at two locations within the DAF plant. • A number of parameters are measured in the Bioreactors; namely temperature, pH, dissolved oxygen, aeration flow rates and air to liquid ratio. • A number of parameters are measured in the Ultra-Filtration banks; namely flow rates, pressures, turbidity and temperature. • A number of parameters are measured in the Reverse Osmosis plant; namely flow rates, conductivity, pressures, pH, temperature. • UV intensity is measured at UV treatment plant.

Monitoring - emissions to water

BAT 4	**Monitor emissions to water to the required frequencies and standards**	
	BAT is to monitor emissions to water with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Monthly UKAS laboratory testing is carried out at Emission Point W1 for: • Biochemical Oxygen Demand • Suspended solids • Ammonia • Orthophosphate • Chemical Oxygen Demand • Iron In-house testing at Emission Point W1 (not UKAS accredited) for: • Ammonia daily • Phosphate (PO_4) daily • Suspended Solids and Chemical Oxygen Demand (COD) once every 4 days • pH every other day • Temperature every other day Monitoring of COD and suspended solids is carried out every 4 days; BAT stipulates every day unless, in accordance with BAT (note 4 under the table), the emission levels are stable, in which case a lower monitoring frequency can be adopted. See Section 3 – Conclusions and recommendations where a lower monitoring frequency of every 4 days for COD and suspended solids is requested with supporting information. There is no Total Nitrogen (TN) monitoring data for W1 however TN monitoring is carried out on UF permeate prior to outflow (every 2 / 3 day). There is no further treatment following the monitoring prior to discharge at W1. However, W1 also includes RO reject water when the RO is running so the TN measurements at the UF permeate tank may not be wholly representative of the final discharge. There is currently no chloride monitoring at W1 however, there is chloride monitoring on DAF outflow.

Monitoring - air emissions

<table>
<tr><th>BAT 5</th><th colspan="2">Monitor channelled emissions to air to the required frequencies and standards</th></tr>
<tr><td></td><td>BAT is to monitor channelled emissions to air with at least the frequency given below and in accordance with EN standards.

The table below shows the monitoring required for the dairy sector only:
<table>
<tr><th>Substance / parameter</th><th>Specific process</th><th>Standard</th><th>Minimum monitoring frequency</th><th>Monitoring associated with</th></tr>
<tr><td>Dust</td><td>Drying processes</td><td>EN 13284-1</td><td>Once every year</td><td>BAT 23</td></tr>
</table>
</td><td>Not applicable no drying.</td></tr>
</table>

Energy Efficiency

BAT 6	**In order to increase energy efficiency, BAT is to use BAT 6a and an appropriate combination of the common techniques listed in technique b below.**		
a	Energy efficiency plan	An energy efficiency plan, as part of the environmental management system (see BAT 1), entails defining and calculating the specific energy consumption of the activity (or activities), setting key performance indicators on an annual basis (for example for the specific energy consumption) and planning periodic improvement targets and related actions. The plan is adapted to the specificities of the installation.	There is an 'Energy statement' for whole business which supports the Environmental Policy and IMS. Energy KPIs are in place which are reviewed weekly and at quarterly management review meetings. There is also a permit requirement to report annually the energy consumption per tonne of total product (MWh energy / tonne product). Objectives and targets for energy are benchmarked against the requirement per 1,000 litres of milk processed. The current target for reduction in energy consumption is to reduce electricity usage to <37kWh per 1,000 litres milk processed.
b	Use of common techniques	Common techniques include techniques such as: • burner regulation and control; • cogeneration; • energy-efficient motors; • heat recovery with heat exchangers and/or heat pumps (including mechanical vapour recompression); • lighting; • minimising blowdown from the boiler; • optimising steam distribution systems; • preheating feed water (including the use of economisers); • process control systems; • reducing compressed air system leaks; • reducing heat losses by insulation; • variable speed drives; • multiple-effect evaporation; • use of solar energy.	The following techniques are employed to increase energy efficiency: • Renewable energy from CHP electricity – cogeneration • Circa 50% of the electricity requirement for the dairy is provided by the on-site CHP engine utilising biogas from the nearby Wyke AD Plant . • Variable speed motors and pumps • Variable speed inverters • Heat exchange throughout process • LED lighting • Leak tagging programme for compressed air systems, water and steam (and product). • Insulation of all pipework transferring heat / cold • Multiple effect evaporator • Timed processes e.g. agitator use reduced

Water consumption and waste water discharge

BAT 7		**In order to reduce water consumption and the volume of waste water discharged, BAT is to use BAT 7a and one or a combination of the techniques b to k given below.**	
Technique		**Description**	**Site specific information**
Common techniques			
a	Water recycling and/or reuse	Recycling and/or reuse of water streams (preceded or not by water treatment), e.g. for cleaning, washing, cooling or for the process itself.	Recovered water is used where possible instead of abstracted water. For example, for cleaning and washing of plant. Sources of recovered water are: a) Effluent treatment plant reverse osmosis b) 2 No. evaporator condensate streams c) Whey polisher reverse osmosis.
b	Optimisation of water flow	Use of control devices, e.g. photocells, flow valves, thermostatic valves, to automatically adjust the water flow.	• Key water streams are sub-metered. • Automated processes ensure optimum flow control using valves. • All hoses have spray guns and trigger controls.
c	Optimisation of water nozzles and hoses	Optimisation of water nozzles and hoses	As above
d	Segregation of water streams	Water streams that do not need treatment (e.g. uncontaminated cooling water or uncontaminated run-off water) are segregated from waste water that has to undergo treatment, thus enabling uncontaminated water recycling.	Segregated clean and dirty drainage systems. Clean roof water is segregated where possible. However, if there is pipework on the roof, then it is designated dirty in case of cross contamination.
Techniques related to cleaning operations			
e	Dry cleaning	Removal of as much residual material as possible from raw materials and equipment before they are cleaned with liquids, e.g. by using compressed air, vacuum systems or catch pots with a mesh cover.	This technique is not used.

BAT 7		**In order to reduce water consumption and the volume of waste water discharged, BAT is to use BAT 7a and one or a combination of the techniques b to k given below.**	
f	Pigging system for pipes	Use of a system made of launchers, catchers, compressed air equipment, and a projectile (also referred to as a 'pig', e.g. made of plastic or ice slurry) to clean out pipes. In-line valves are in place to allow the pig to pass through the pipeline system and to separate the product and the rinsing water.	This technique is not used. Product pipework cleaning via CIP set on either a caustic or acid wash. This is dependent on product and the piece of plant that is being cleaned along with the wash schedule.
g	High-pressure cleaning	Spraying of water onto the surface to be cleaned at pressures ranging from 15 bar to 150 bar.	When silos and tanks are cleaned, spray balls are used to increase the water spraying pressure to the contact surface.
h	Optimisation of chemical dosing and water use in cleaning-in-place (CIP)	Optimising the design of CIP and measuring turbidity, conductivity, temperature and/or pH to dose hot water and chemicals in optimised quantities	Process monitoring of CIP sets is as follows: • Raw milk CIP set – conductivity and temperature. Caustic and acid strength measured as a percentage. • Main CIP set (cheese dairy) - conductivity, temperature, flow rate and pressure. Caustic and acid strength measured as a percentage and conductivity. • Separator CIP set (liquid processing) - temperature, flow rate, Caustic and acid strength measured as a percentage. • Butter dairy CIP set – temperature. • All parameters are recorded on SCADA. • Manual chemical strength checks undertaken at every CIP if not automatically logged. • All CIP’s undergo quarterly validation to check they are working effectively. • Zone 1 (product contact) swabs undertaken quarterly. • CIPs are scheduled at certain intervals depending on production runs.

BAT 7		**In order to reduce water consumption and the volume of waste water discharged, BAT is to use BAT 7a and one or a combination of the techniques b to k given below.**	
			• Every product run is also undergoes microbiological testing to ensure that CIPs are effective.
i	Low-pressure foam and/or gel cleaning	Use of low-pressure foam and/or gel to clean walls, floors and/or equipment surfaces.	Cleaning chemical fogging of rooms is used in some departments after production.
j	Optimised design and construction of equipment and process areas	The equipment and process areas are designed and constructed in a way that facilitates cleaning. When optimising the design and construction, hygiene requirements are taken into account.	The design and construction of equipment and process areas is optimised to assist cleaning where possible.
k	Cleaning of equipment as soon as possible	Cleaning is applied as soon as possible after use of equipment to prevent wastes hardening.	There is a cleaning schedule in place. Equipment is washed when off production, ready for next production run.

Harmful Substances

BAT 8	**In order to prevent or reduce the use of harmful substances, e.g. in cleaning and disinfection, BAT is to use one or a combination of the techniques given below.**	
a	Proper selection of cleaning chemicals and/or disinfectants Avoidance or minimisation of the use of cleaning chemicals and/or disinfectants that are harmful to the aquatic environment, in particular priority substances considered under the Water Framework Directive 2000/60/EC of the European Parliament and of the Council. When selecting the substances, hygiene and food safety requirements are taken into account.	The selection of cleaning chemicals is process specific and ensures optimum cleaning of plant. The types of chemicals used are determined through working with chemical suppliers to meet onsite requirements. Insite software (Christeyns) is used to monitor and review aspects of automated CIP cleaning including valve positions, flow rates and chemical usage. It is used to optimise aspects of each CIP such as water and chemical usage. The chemicals are essential to ensure cleanliness of the plant for food safety. Less harmful substances are used where possible. Chemical suppliers advise what chemicals to use in regard to effluent compatibility and we ensure that they have a Certificate of Authenticity to certify them as food grade.
b	Reuse of cleaning chemicals in cleaning-in-place (CIP). Collection and reuse of cleaning chemicals in CIP. When reusing cleaning chemicals, hygiene and food safety requirements are taken into account.	Each CIP set has recirculation steps so that where possible chemical is returned for reuse. Process monitoring within the CIP set determines if additional chemical is required for example, to increase the strength, through a make-up process. CIP systems are tested on each run for chemical strength, temperature and duration, which are all recorded on SCADA. Following this, microbiological sample results confirm if hygiene has been maintained.
c	Dry cleaning	Not applicable.
d	Optimised design and construction of equipment and process	See BAT 7j

<table>
<tr><td>BAT 9</td><td colspan="2">In order to prevent emissions of ozone-depleting substances and of substances with a high global warming potential from cooling and freezing, BAT is to use refrigerants without ozone depletion potential and with a low global warming potential.</td></tr>
<tr><td></td><td>Suitable refrigerants include water, carbon dioxide or ammonia</td><td>The refrigerants used on site and their Global Warming Potential are shown in Table 1 below:

Table 1 – Refrigerant type and Global Warming Potential

<table><tr><th>Refrigerant type</th><th>Global Warming Potential (GWP)</th></tr><tr><td>R134a</td><td>1,430</td></tr><tr><td>R410</td><td>2,088</td></tr><tr><td>R448a</td><td>1,386</td></tr></table>
Previously used refrigerants with a higher GWP greater than 2,500 have been replaced with lower GWP refrigerants as above.

Glycol circuits are used to keep raw materials and products cold to mitigate risk of freezing. Glycol is cooled by the refrigerants in the chillers. There is no other viable option for the production process.</td></tr>
</table>

Resource Efficiency

BAT 10	**In order to increase resource efficiency, BAT is to use one or a combination of the techniques given below**	
a	Anaerobic digestion	Anaerobic digestion is utilised for the treatment and recovery of the following waste streams: • high strength waste from the dairy processes; • residue whey permeate; and • sludges from the effluent treatment plant. The AD plant is operated by Wyke under a separate environmental permit. Renewable CHP Electricity and waste heat from biogas generated by the AD plant are used in the production processes. Circa 50% of the electricity requirement for the dairy is provided by the on-site CHP engine utilising biogas from the nearby Wyke AD Plant . In addition, any cheese and butter food wastes are sent to a local AD plant representing the best-case scenario for these waste streams in line with the waste hierarchy. The Wyke Farms AD plant is not suitable for this waste stream with respect to compliance with Animal By-product regulations.
b	Use of residues	As detailed above, the residues are used as feedstocks in the Wyke Farms anaerobic digestion plant. • Permeate – sent to Wyke Farms AD Plant • High Strength Waste – sent to Wyke Farms AD Plant • Effluent Treatment Plant Sludges – sent to Wyke Farms AD Plant
c	Separation of residues e.g. using accurately positioned splash protectors, screens, flaps, catchpots, drip trays and troughs	High Strength Waste is separated from multiple sources around the dairy. These include the separation of high strength dairy wastes from CIP pre-rinses, separator de-sludges any rejected waste product from the production process.

d	Recovery and reuse of residues from the pasteuriser. Residues from the pasteuriser are fed back to the blending unit and are thereby reused as raw materials.	N/A
e	Phosphorus recovery as struvite (see BAT 12g)	Not applicable as phosphorus content below 5mg/l
f	Use of waste water for land spreading	Waste water is not routinely land spread However, as part of contingency plan in case of issues with the effluent treatment plant, Wyke do have a SR2010No4 mobile plant landspreading permit and deployments in place for spreading of liquid dairy effluent waste and effluent sludge to land for agricultural benefit.

Emissions to Water

BAT 11	**In order to prevent uncontrolled emissions to water, BAT is to provide an appropriate buffer storage capacity for waste water.**	
	The appropriate buffer storage capacity is determined by a risk assessment (taking into account the nature of the pollutant(s), the effects of these pollutants on further waste water treatment, the receiving environment, etc.). The waste water from this buffer storage is discharged after appropriate measures are taken (e.g. monitoring, treatment, reuse).	Raw effluent from the dairy is stored in the concrete ring balance tank prior to treatment where it is aerated and mixed. The capacity of the balance tank (2,400m^3) is such that there is sufficient storage including contingency. Production of raw effluent is in the region of 750m^3 per day and therefore the balance tank represents between 3 and 4 days of waste water production. Under normal operating conditions the balance tank operates at less than 50% working capacity. The effluent treatment process is sized appropriately. In order to treat effluent arising from planned production increases and higher strength effluent wastes, a new bioreactor has been commissioned. There is a contingency plan in place which forms part of the management system, specifically covering the storage and treatment of liquid waste.

BAT 12	In order to reduce emissions to water, BAT is to use an appropriate combination of the techniques given below.	
Preliminary, primary and general treatment		
a	Equalisation	All waste water is collected in the balance tank where it is mixed and aerated. The bioreactors are also mixed and aerated via jets.
b	Neutralisation	In the DAF plant, pH correction is carried out and wastewater is dosed accordingly with caustic or acid to neutralise it. Caustic is predominantly required to lower the pH.
c	Physical separate (e.g. screens, sieves, primary settlement tanks etc.)	• Fat traps prior to the balance tanks. • Strainers on pumps between main balance tank and DAF balance tank. • Scrapers on the DAF separate sludge from the effluent • Strainers on pumps between bioreactors and the UF banks
Aerobic and/or anaerobic treatment (secondary treatment)		
d	Aerobic and/or anaerobic treatment (e.g. activated sludge, aerobic lagoon, upflow anaerobic sludge blanket (UASB) process, anaerobic contact process, membrane bioreactor.)	DAF plant and the Bioreactors utilise aerobic treatment processes.
e	Nitrification and/or denitrification	Nitrification of ammonia takes place in the bioreactor
f	Partial nitration - anaerobic ammonium oxidation	Not applicable
Phosphorus recovery and/or removal		
g	Phosphorus recovery as struvite	Not applicable, relatively low phosphorus
h	Precipitation	Not applicable
i	Enhanced biological phosphorus removal	Not applicable
Final solids removal		
j	Coagulation and flocculation	This occurs in the DAF plant through addition of poly-aluminium chloride and a polymer. Aeration causes flocculation- sludge is then removed from top of DAF plant by scrappers.
k	Sedimentation	Not applicable
l	Filtration (e.g. sand filtration, microfiltration, ultrafiltration)	Ultrafiltration plant – membrane filtration of water from sludge.

m	Flotation	Relevant to DAF plant see j) above
	[for detail of each technique, refer BAT 12 table 1 in BATCs, copied in to col J]	

BAT 12	**Associated emission levels (BAT-AELs) for direct emissions to a receiving water body**		
	Parameter	**BAT-AEL (daily average) (mg/l)**	**Comment**
	Chemical oxygen demand[1]	25-100[2]	No COD limit is currently applied however COD is measured once every 4 days. Data for 2021 (up to 23/09/2021) ranges from 29.6mg/l to 142mg/l with an average of 72mg/l over the dataset.
	Total suspended solids	4-50[3]	The permitted limit is 30mg/l. Monitoring results for 2021 (up to 23/09/2021) are all within the limit; all results are less than or equal to 7mg/l with the exception of one outlier at 24mg/l.
	Total nitrogen	2-20[4 5]	There is no limit specified for Total Nitrogen in the current permit. Total Nitrogen is not currently tested at W1 however it is monitored at the outflow from the UF permeate tank after which there is no further treatment prior to discharge at W1. However, W1 also includes RO reject water when the RO is running so the TN measurements at the UF permeate tank may not be wholly representative of the final discharge. The dataset for 2021 up to 10/11/2021 provides an average of 18.4mg/l and a maximum of 72.9mg/l. These are results of spot samples and not daily averages.
	Total phosphorus	0.2-2[6]	No limit currently applied. Proposed limit of 5mg/l based on a site-specific risk assessment.[2] The 2021 data (to 23/09/2021) shows that the level of PO_4 at W1 sits between 0.00mg/l and 4.58mg/l with an average value of 1.0mg/l.
([1]) The BAT-AEL for COD may be replaced by a BAT-AEL for TOC. The correlation between COD and TOC is determined on a case-by-case basis. The BAT-AEL for TOC is the preferred option because TOC monitoring does not rely on the use of very toxic compounds.			
([2]) The upper end of the range is 125mg/l for dairies as daily averages only if the abatement efficiency is ≥ 95 % as a yearly average or as an average over the production period.			
([3]) The lower end of the range is typically achieved when using filtration (e.g. sand filtration, microfiltration, membrane bioreactor), while the upper end of the range is typically achieved when using sedimentation only.			
([4]) The upper end of the range is 30 mg/l as a daily average only if the abatement efficiency is ≥ 80 % as a yearly average or as an average over the production period.			
([5]) The BAT-AEL may not apply when the temperature of the waste water is low (e.g. below 12 °C) for prolonged periods.			
([6]) The upper end of the range is 4 mg/l for dairies and starch installations producing modified and/or hydrolysed starch;			

Noise

BAT 13	**In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to set up, implement and regularly review a noise management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:**	
	A protocol containing appropriate actions and timelines;	Noise nuisance at sensitive receptors is not expected, has not been substantiated and there is no history of complaints.
	A protocol for conducting noise emissions monitoring;	Noise nuisance at sensitive receptors is not expected, has not been substantiated and there is no history of complaints.
	A protocol for response to identified noise events, e.g. complaints;	Noise nuisance at sensitive receptors is not expected, has not been substantiated and there is no history of complaints.
	A noise reduction programme designed to identify the source(s), to measure/estimate noise and vibration exposure, to characterise the contributions of the sources and to implement prevention and/or reduction measures.	Noise nuisance at sensitive receptors is not expected, has not been substantiated and there is no history of complaints.

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

BAT 14	**In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques given below.**	
a	Appropriate location of equipment and buildings. Noise levels can be reduced by increasing the distance between the emitter and the receiver, by using buildings as noise screens and by relocating building exits or entrances.	The cooling towers are located at rear of site with fans projected away from sensitive receptors (which lie to the north). The natural gas boilers and the standby generator are situated within a building which acts to reduce noise emissions.
b	Operational measures. This includes techniques such as: • improved inspection and maintenance of equipment; • closing of doors and windows of enclosed areas, if possible; • equipment operation by experienced staff; • avoidance of noisy activities at night, if possible; • provisions for noise control during maintenance, traffic, handling and treatment activities.	Operational measures to reduce noise emissions include: • Planned preventative maintenance of plant and equipment. • Only trained staff are able to operate equipment. • There is a 5mph speed limit on site. • Doors are kept closed on rooms with higher noise levels during normal operations to reduce external noise emissions.
c	Low-noise equipment. This may include low-noise compressors, pumps and fans.	This technique is not currently employed.
d	Noise and vibration control equipment. This includes techniques such as: • noise reducers; • acoustic and vibrational insulation of equipment; • enclosure of noisy equipment; • soundproofing of buildings.	The main production processes are entirely within buildings. Noisy equipment such as vacuum pumps and evaporating plant are located inside the production building.
e	Noise abatement. Inserting obstacles between emitters and receivers (e.g. protection walls, embankments and buildings).	This technique is not currently employed.

Odour

BAT 15	**In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:**	
	A protocol containing appropriate actions and timelines;	Odour nuisance at sensitive receptors is not expected, has not been substantiated and there is no history of complaints.
	A protocol for conducting odour monitoring. It may be complemented by measurement/estimation of odour exposure or estimation of odour impact.	Odour nuisance at sensitive receptors is not expected, has not been substantiated and there is no history of complaints.
	A protocol for response to identified odour incidents, e.g. complaints;	Odour nuisance at sensitive receptors is not expected, has not been substantiated and there is no history of complaints.
	An odour prevention and reduction programme designed to identify the source(s); to measure/estimate odour exposure; to characterise the contributions of the sources; and to implement prevention and/or reduction measures.	Odour nuisance at sensitive receptors is not expected, has not been substantiated and there is no history of complaints.

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

Energy Efficiency

<table>
<tr><td>BAT 21</td><td colspan="2">In order to increase energy efficiency, BAT is to use an appropriate combination of the techniques specified in BAT 6 and of the techniques given below.</td></tr>
<tr><td>a</td><td>Partial milk homogenisation</td><td>N/A</td></tr>
<tr><td>b</td><td>Energy-efficient homogeniser</td><td>N/A</td></tr>
<tr><td>c</td><td>Use of continuous pasteurisers</td><td>All pasteurisers are continuous.</td></tr>
<tr><td>d</td><td>Regenerative heat exchange in pasteurisation</td><td>All pasteurisers use regenerative heat when heating and cooling product.</td></tr>
<tr><td>e</td><td>Ultra-high-temperature (UHT) processing of milk without intermediate pasteurisation</td><td>UHT milk is not produced on site.</td></tr>
<tr><td>f</td><td>Multi-stage drying in powder production</td><td>There is no powder production.</td></tr>
<tr><td>g</td><td>Precooling of ice-water</td><td>N/A</td></tr>
<tr><td colspan="2">Table 8
Indicative environmental performance levels for specific energy consumption
<table>
<tr><th>Main product (at least 80 % of the production)</th><th>Unit</th><th>Specific energy consumption (yearly average)</th></tr>
<tr><td>Market milk</td><td rowspan="4">MWh/tonne of raw materials</td><td>0,1-0,6</td></tr>
<tr><td>Cheese</td><td>0,10-0,22 (1)</td></tr>
<tr><td>Powder</td><td>0,2-0,5</td></tr>
<tr><td>Fermented milk</td><td>0,2-1,6</td></tr>
</table>
(1) The specific energy consumption level may not apply when raw materials other than milk are used.</td><td>Under permit condition 4.1.3, Table S4.2 of the current permit Wyke are required to report annually the energy consumption per tonne of total product expressed as MWh energy / tonne product.

Total product includes cheese, skim concentrate, whey protein concentrate, butter and cream and the figure for 2021 was 0.92MWh/tonne of product. It is felt that the current performance indicator of MWh/tonne of product is a better indicator of performance due to the fact that a number of products are made from the raw materials used, primarily milk.</td></tr>
</table>

Waste

BAT 22	**In order to reduce the quantity of waste sent for disposal, BAT is to use one or a combination of the techniques given below.**	
a	Techniques related to the use of centrifuges. Optimised operation of centrifuges	Separator de-sludges are pumped to the High Strength Waste Tank. These are minimised through wastage audits of these processes.
b	Rinsing of the cream heater with skimmed milk or water (Technique related to butter production)	The cream heater is rinsed with water to recover the cream. This is sent to the butter dairy meltdown tank for recovery. When the cream heater is cleaned, the first pre-rinse is sent for recovery to the high strength waste silo.
c	Continuous freezing of ice cream (Technique related to ice cream production)	Not applicable
d	Minimisation of the generation of acid whey (Techniques related to cheese production)	Not applicable
e	Recovery and use of whey (Techniques related to cheese production)	Whey is recovered through evaporation and membrane filtration. Whey cream is separated out for butter manufacture. Whey undergoes ultrafiltration to produce whey protein concentrate. Whey permeate from the ultrafiltration process is sent for energy recovery at our AD Plant. The evaporation of products such as whey and whey protein concentrate also takes place.

Emissions to air

BAT 23	**In order to reduce channelled dust emissions to air from drying, BAT is to use one or a combination of the techniques given below.**	
a	Bag filter	Not applicable
b	Cyclone	Not applicable
c	Wet scrubber	Not applicable

Table 10

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

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

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

3. Conclusions and recommendations

3.1.1 The Best Available Techniques review has highlighted that the current and proposed operation at Wyke Farmhouse Cheese Dairy is generally compliant with indicative BAT as stated Best Available Techniques (BAT) Reference Document for the Food, Drink and Milk Industries[1]. However, there are four deviations from BAT related to BAT 4 Monitoring of emissions to water; monitoring parameters and frequencies, as detailed below.

Chloride

3.1.2 BAT requires monthly chloride monitoring. There is currently no chloride monitoring at Emission Point W1 however there is chloride monitoring on the DAF outflow.

Chemical Oxygen Demand

3.1.3 BAT requires monitoring of chemical oxygen demand (COD) every day unless a reduced frequency can be agreed based on monitoring results. COD is currently monitored every 4 days.

3.1.4 A BAT-AEL of up to 125mg/l (daily average) for COD is proposed for dairies. There is currently no permitted limit. Data for 2021 (up to 23/09/21) ranges from COD of 29.6mg/l to 142mg/l with an average COD of 72mg/l over the dataset. A derogation from BAT is therefore requested such that the monitoring frequency for COD remains at every 4 days and does not need to be increased to every day.

Suspended Solids

3.1.5 BAT requires monitoring of suspended solids every day unless a reduced frequency can be agreed based on monitoring results. Suspended solids are currently monitored every 4 days.

3.1.6 The permitted limit for suspended solids is 30mg/l. Monitoring results for 2021 (up to 23/09/2021) are all within the limit; all results are less than or equal to 7mg/l with the exception of one outlier at 24mg/l. A derogation from BAT is therefore requested such that the monitoring frequency for suspended solids remains at every 4 days and does not need to be increased to every day.

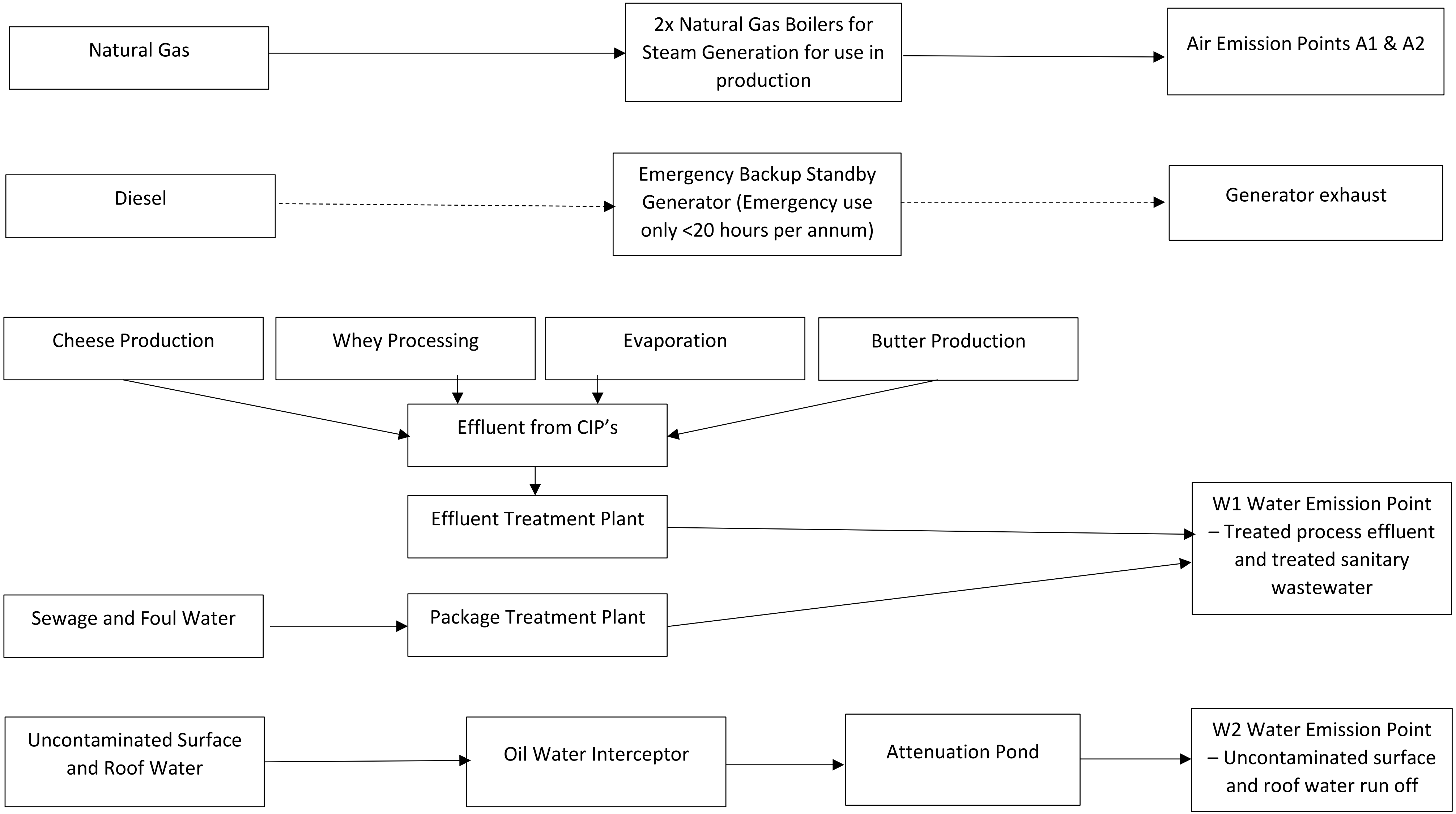
Total Nitrogen

3.1.7 BAT requires monitoring of total nitrogen (TN) every day. There is currently no TN monitoring at W1 however it is carried out on the UF permeate prior to outflow (every 2 / 3 day). There is no further treatment after this sample point. However, W1 also includes RO reject water when the RO is running so the TN measurements at the UF permeate tank may not be wholly representative of the final discharge.

3.1.8 The BAT-AEL for TN is 20mg/l with a possibility of an upper end limit of 30mg/l if abatement is in place and is greater than 80% efficient as a yearly average or over a production period. There is currently no permitted limit. TN results for 2021 up to 10/11/2021 provides an average of 18.4mg/l TN and a maximum of 72.9mg/l.

Appendix A – Bruton Site Emission Point Schematic

Bruton Site Emission Point Schematic



Appendix B – Bruton Effluent Treatment Process Flow Diagram

Bruton Effluent Treatment Process Flow Diagram January 2022